TRANSMITTAL MEMORANDUM

To:	Distribution	**Date:**	December 10, 2014

Subject: Draft Final, Quality Assurance Project Plan, Superfund Response Actions, Former Fort Ord, California, Volume I, Appendix D, Operable Unit 2 Landfills

DCN: 07202.2001.259

Enclosed for your review is the Draft Final, Quality Assurance Project Plan, Superfund Response Actions, Former Fort Ord, California, Volume I, Appendix D, Operable Unit 2 Landfills. This Quality Assurance Project Plan (QAPP) describes the planning, implementation, acquisition, and assessment of data using effective methodologies and thorough quality assurance (QA) and quality control (QC) activities that Gilbane Company, directed by the United States Army Corps of Engineers (USACE), will use during sampling of the thermal treatment unit (TTU) at Operable Unit 2 (OU2) Landfills at the Former Fort Ord, California. This document is intended for use by field operators, supervisors, and data processing and managers responsible for implementing and coordinating field activities for the project.

Should you have comments on this version of the document, please forward them in writing by January 12, 2014, to:

William K. Collins
BRAC Environmental Coordinator
U.S. Army Fort Ord BRAC Field Office
P.O. Box 5008
Monterey, CA 93944-5008
Fax: 831-393-9188

Comments may be submitted in electronic format or by fax; however, they must be followed up with a hard copy sent through the U.S. Postal Service or hand delivered to the Fort Ord Administrative Record. All hardcopy comments must be received by close of business on the designated comment period deadline.

Should you have any questions, please contact the U.S. Army, Fort Ord BRAC Community Relations Office, at (831) 393-1284 or by e-mail at melissa.m.broadston.ctr@mail.mil.

Distribution List: Draft Final, Quality Assurance Project Plan, Superfund Response Actions, Former Fort Ord, California, Volume I, Appendix D, Operable Unit 2 Landfills

CD	Paper	Name	Organization	Address	City, State	Zip
1	1*	Ms. Teresa Rodgers	Department of the Army USACE	1325 J Street	Sacramento, CA	95814
1		Mr. Alexander Kan	Department of the Army USACE	1325 J Street	Sacramento, CA	95814
1		Mr. James Specht	Department of the Army USACE	1325 J Street	Sacramento, CA	95814
1		Ms. Bonnie McNeill	Department of the Army USACE	1325 J Street	Sacramento, CA	95814
1	1	Mr. William Collins	Department of the Army, Fort Ord BRAC Field Office	4463 Gigling Road	Seaside, CA	93955
1		Mr. Tom Ghigliotto	Chenega	4463 Gigling Road	Seaside, CA	93955
1	1	Mr. Lewis Mitani	U.S. Environmental Protection Agency (EPA), Region IX	75 Hawthorne Street (Mail Code: SFD-8-3)	San Francisco, CA	94105
1		Mr. Terry Zdon	TechLaw, Inc.	7 Shore Point Road	North Little Rock, AR	94105
1	1	Mr. Min Wu	California Department of Toxic Substance Control (DTSC)	8800 Cal Center Drive	Sacramento, CA	95826-3200
1		Mr. Steve Crane	Gilbane	2934 Gold Pan Court, Suite 12	Rancho Cordova, CA	95670
1		Mr. Chuck Clyde	Gilbane	PO Box 1860	Marina, CA	93933
1		Mr. Eric Schmidt	Chicago Bridge and Iron	PO Box 1860	Marina, CA	93933
1		Mr. Mick Williams	Chicago Bridge and Iron	1230 Columbia Street, Suite 1200	San Diego, CA	92101

Distribution List: Draft Final, Quality Assurance Project Plan, Superfund Response Actions, Former Fort Ord, California, Volume I, Appendix D, Operable Unit 2 Landfills

CD	Paper	Name	Organization	Address	City, State	Zip
1		Mr. Peter Kelsall	Chicago Bridge and Iron	6380 S. Fiddlers Green Circle, Suite 300	Greenwood Village, CO	80111
1		Mr. Dan Amadeo	Chicago Bridge and Iron	PO Box 1641	Marina, CA	93933-1641
	1	Mr. Mike Weaver	Fort Ord Community Advisory Group (FOCAG)	52 Corral De Tierra Road	Salinas, CA	93908
1	1	Ms. LeVonne Stone	Fort Ord Environmental Justice Network	P.O. Box 361	Marina, CA	93933-0361
1	1	Ms. Lindsay Alexander	Fort Ord Cleanup, Fort Ord BRAC	4463 Gigling Road, Room 101	Seaside, CA	93955
1	1	Ms. Audrey Johnson	Gilbane	P.O. Box 1860	Marina, CA	93933-1860

* Hardcopies of 11 x 17 only

RODGERS.TERESA.MARIE.1218053854

Digitally signed by RODGERS.TERESA.MARIE.1218053854
DN: c=US, o=U.S. Government, ou=DoD, ou=PKI, ou=USA, cn=RODGERS.TERESA.MARIE.1218053854
Date: 2014.12.10 12:58:26 -08'00'

USACE Sacramento HTW Project Technical Team Lead
Teresa Rodgers

Draft Final
Quality Assurance Project Plan
Former Fort Ord, California, Volume I
Appendix D
Operable Unit 2 Landfill

Worldwide Environmental Remediation Services Contract
Contract No. W912DY-10-D-0024
Task Order No. CM01

Prepared for:
U.S. Army Corps of Engineers
Sacramento District
1325 J Street
Sacramento, California 95814

Prepared by:
Gilbane Company
2730 Shadelands Drive
Walnut Creek, California 94598

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF ATTACHMENTS

ABBREVIATIONS AND ACRONYMS

◦C	degrees Celsius
◦F	degrees Fahrenheit
%	percent
%D	percent difference
%R	percent recovery
%v	percent [by] volume
ADR	Automated Data Review
ARAR	applicable or relevant and appropriate requirement
Army	US Department of the Army
BCT	BRAC Cleanup Team
bgs	below ground surface
BRAC	Base Realignment and Closure
Btu	British thermal unit(s)
BTU/hr	Btu per hour
CA	corrective action
CAMU	Corrective Action Management Unit
CAS	Chemical Abstracts Service
CB&I	Chicago Bridge & Iron Company
CCR	California Code of Regulations
CCV	continuing calibration verification
CDFR	Chemical Data Final Report
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CH_4	methane
CMQ/OE	Certified Manager of Quality/Organizational Excellence
CO	carbon monoxide
COC	Chain of custody
CQA	Certified Quality Auditor
DL	detection limit
DoD	Department of Defense
DQCR	Daily Quality Control Report
DQI	data quality indicator
DQO	data quality objective
DTSC	Department of Toxic Substances Control
EDD	electronic data deliverable
ELAP	Environmental Laboratory Accreditation Program
EP	extraction point
EPA	United States Environmental Protection Agency
ESD	Explanation of Significant Differences
Eurofins	Eurofins Air Toxics, Inc.
EW	extraction well

FID	flame ionization detector
FODIS	Fort Ord Data Integration System
FTL	Field Team Lead
FWV	field work variance
GAC	granular activated carbon
GC	gas chromatograph
GCMS	gas chromatograph(y)/mass spectroscop(e/y)
HAZWOPER	Occupational Safety and Health Administration Hazardous Waste Operations and Emergency Response Standard
HHRA	human health risk assessment
ICAL	initial calibration
ICV	initial calibration verification
IDQTF	Intergovernmental Data Quality Task Force
IT	IT Corporation
Gilbane	Gilbane Company
lb/MMBtu	pounds per million British thermal units
LCS	laboratory control sample
LCSD	Laboratory control sample duplicate
LDC	Laboratory Data Consultants
LEL	lower explosive limit
LFG	landfill gas
LOD	limit of detection
LOQ	limit of quantitation
MBUAPCD	Monterey Bay Unified Air Pollution Control District
mg/L	milligrams per liter
N_2	nitrogen
NA	not applicable
NELAP	National Environmental Laboratory Accreditation Program
NMOC	non-methane organic compounds
NO	nitrogen oxide
NOx	nitrogen oxides
O_2	oxygen
O&M	operations and maintenance
PARCCS	precision, accuracy, representativeness, comparability, completeness, and sensitivity
PDL	project decision limit
PM	Project Manager
ppb	parts per billion
ppbv	parts per billion by volume
ppmv	parts per million by volume
PQL	practical quantitation limit
PRG	preliminary remediation goal
QA	quality assurance

QAPP	Quality Assurance Project Plan
QC	quality control
QSM	Quality Systems Manual
RI	remedial investigation
ROD	Record of Decision
RRT	Relative retention time
RPD	relative percent difference
RSD	relative standard deviation
RT	retention time
SAP	Sampling and Analysis Plan
SC	site closure
scfm	standard cubic feet per minute
SDG	sample delivery group
SOP	Standard Operating Procedure
SQP	Standard Quality Procedure
SSHO	Site Safety and Health Officer
SVA	Salinas Valley Aquiclude
TBD	to be determined
THC	total hydrocarbons
TTU	thermal treatment unit
UFP	Uniform Federal Policy
USACE	US Army Corps of Engineers
VF	Passive Vent in Area F
VOC	volatile organic compound
WERS	Worldwide Environmental Remediation Services

EXECUTIVE SUMMARY

This Quality Assurance Project Plan (QAPP) describes the planning, implementation, acquisition, and assessment of data using effective methodologies and thorough quality assurance (QA) and quality control (QC) activities that Gilbane Company (Gilbane), directed by the United States Army Corps of Engineers (USACE), will use during sampling of the thermal treatment unit (TTU) at Operable Unit 2 (OU2) Landfills (**Figure 1)** at the Former Fort Ord, California. This QAPP also includes information for laboratory analysis, QA/QC activities, and data management and analysis in support of the samples collected for operations and maintenance (O&M) procedures of the TTU. The, O&M activities, designed to mitigate landfill gas, 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 processing and managers responsible for implementing and coordinating field activities for the project. The distribution of this document is listed in Section 2.2.

This QAPP adheres to United States Environmental Protection Agency (EPA) requirements for such documents, and includes all 24 elements of a QAPP as outlined in EPA Requirements for Quality Assurance Project Plans (EPA QA/R-5; 2001). This document is divided into the following six major sections:

- Project Management explains project management, including the purpose and structure of the QAPP and the ITSI/USACE organization;
- Project Quality Objects explains the conceptual site model, project objectives and background, data quality objectives, and documentation;
- Sample Design explains the sampling approach;
- Sampling Requirements describes sampling references;
- Analytical Requirements describes the data generation and acquisition activities; and
- Data Management and Data Review describe the assessment and oversight procedures to ensure high quality data.

Crosswalk: Uniform Federal Policy (UFP)-QAPP to 2106-G-05

Optimized UFP-QAPP Worksheets		**2106-G-05 QAPP Guidance Section**	
Project Management			
1 & 2	Title and Approval Page	2.2.1	Title, Version, and Approval/Sign-Off
3 & 5	Project Organization and QAPP Distribution	2.2.3	Distribution List
		2.2.4	Project Organization and Schedule
4, 7 & 8	Personnel Qualifications and Sign-off Sheet	2.2.1	Title, Version, and Approval/Sign-Off
		2.2.7	Special Training Requirements and Certification
6	Communication Pathways	2.2.4	Project Organization and Schedule
9	Project Planning Session Summary	2.2.5	Project Background, Overview, and Intended Use of Data
Project Quality Objectives			
10	Conceptual Site Model	2.2.5	Project Background, Overview, and Intended Use of Data
11	Project/Data Quality Objectives	2.2.6	Data/Project Quality Objectives and Measurement Performance Criteria
12	Measurement Performance Criteria	2.2.6	Data/Project Quality Objectives and Measurement Performance Criteria
13	Secondary Data Uses and Limitations	Chapter 3	QAPP Elements for Evaluation Existing Data
14 & 16	Project Tasks & Schedule	2.2.4	Project Organization and Schedule
15	Project Action Limits and Laboratory-Specific Detection / Quantitation Limits	2.2.6	Data/Project Quality Objectives and Measurement Performance Criteria
Sample Design			
17	Sampling Design and Rationale	2.3.1	Sample Collection Procedure, Experimental Design, and Sampling Tasks
18	Sampling Locations and Methods	2.3.1	Sample Collection Procedure , Experimental Design, and Sampling Tasks
		2.3.2	Sampling Procedures and Requirements
Sampling Requirements			
19 & 30	Sample Containers, Preservation, and Hold Times	2.3.2	Sampling Procedures and Requirements
20	Field QC	2.3.5	Quality Control Requirements
21	Field SOPs	2.3.2	Sampling Procedures and Requirements
22	Field Equipment Calibration, Maintenance, Testing, and Inspection	2.3.6	Instrument/Equipment Testing, Calibration and Maintenance Requirements, Supplies and Consumables
Analytical Requirements			
23	Analytical SOPs	2.3.4	Analytical Methods Requirements and Task Description
24	Analytical Instrument Calibration	2.3.6	Instrument/Equipment Testing, Calibration and Maintenance Requirements, Supplies and Consumables

Optimized UFP-QAPP Worksheets		**2106-G-05 QAPP Guidance Section**	
25	Analytical Instrument and Equipment Maintenance, Testing, and Inspection	2.3.6	Instrument/Equipment Testing, Calibration and Maintenance Requirements, Supplies and Consumables
26 & 27	Sample Handling, Custody, and Disposal	2.3.3	Sample Handling, Custody Procedures, and Documentation
28	Analytical Quality Control and Corrective Action	2.3.5	Quality Control Requirements
Data Management and Data Review			
29	Project Documents and Records	2.2.8	Documentation and Records Requirements
31, 32 & 33	Assessments and Corrective Action	2.4	Assessments and Data Review (Check)
		2.5.5	Reports to Management
34	Data Verification and Validation Inputs	2.5.1	Data Verification and Validation Targets and Methods
35	Data Verification Procedures	2.5.1	Data Verification and Validation Targets and Methods
36	Data Validation Procedures	2.5.1	Data Verification and Validation Targets and Methods
37	Data Usability Assessment	2.5.2	Quantitative and Qualitative Evaluations of Usability
		2.5.3	Potential Limitations on Data Interpretation
		2.5.4	Reconciliation with Project Requirements

1.0 PROJECT MANAGEMENT

1.1 Title and Approval Page (QAPP Worksheets #1 & 2)

Site Name: Operable Unit 2 Landfills
Site Location: Former Fort Ord, California
Document Title: Preliminary Draft, Quality Assurance Project Plan, Remedial Design, Operable Unit 2 Landfills, Former Fort Ord, California
Contract Number: W912DY-10-D-0024

REVIEW SIGNATURES

Investigative Organization

_____ Date: _____
Erin Caruso, PE, PMP
Gilbane Deputy Project Manager

_____ Date: _____
Cheryl Prince
Gilbane Quality Control Manager

_____ Date: _____
Evelyn Dawson, CHMM
Gilbane Program Chemist

Contracting Organization

_____ Date: _____
Bonnie McNeil
USACE Project Chemist

APPROVAL SIGNATURES

Base Representative

_____ Date: _____

William K. Collins
Fort Ord BRAC Environmental Coordinator

Federal Regulatory Agency

_____ Date: _____

Lewis Mitani
US EPA, Region IX

State Regulatory Agency

_____ Date: _____

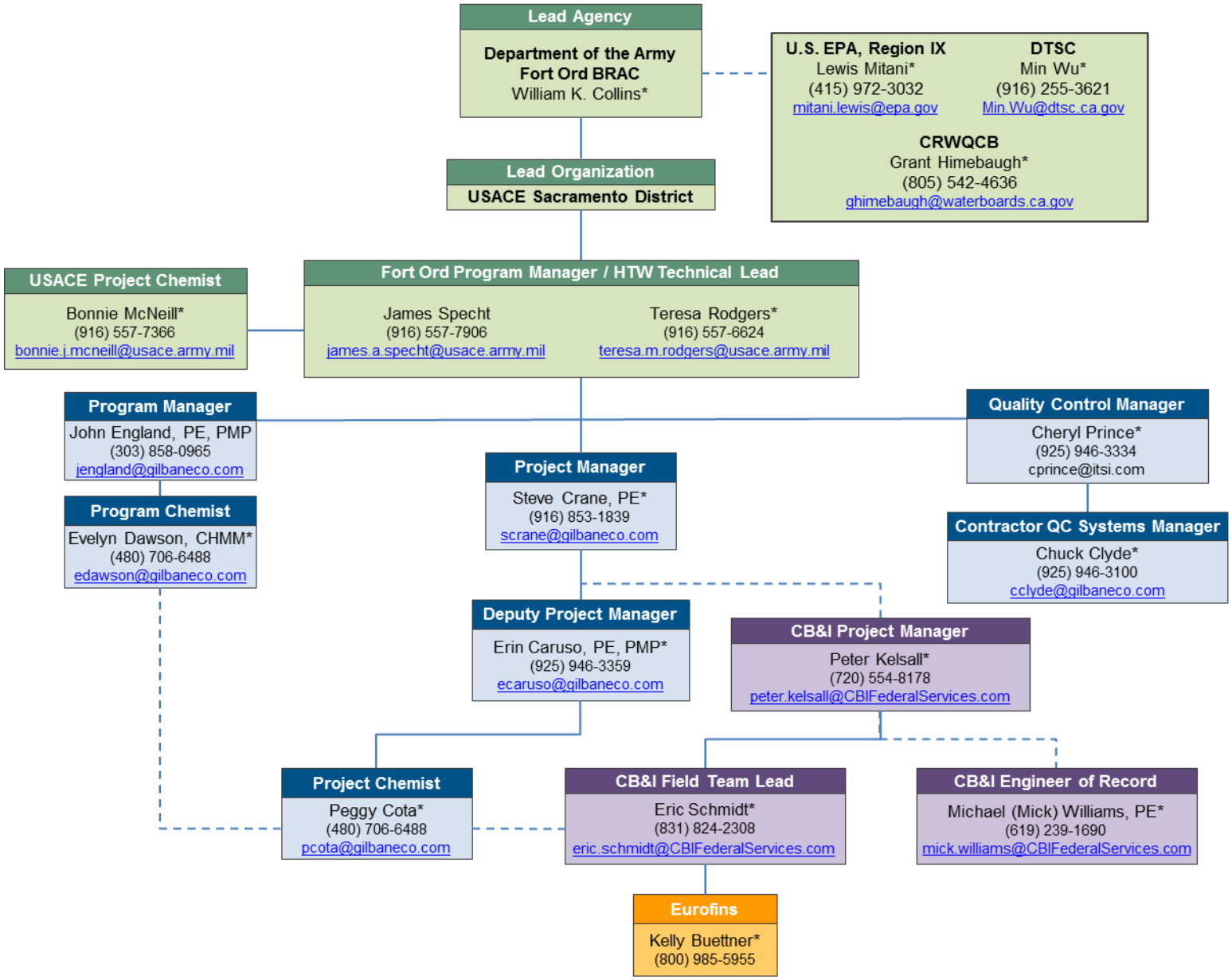
Min Wu
California Department of Toxic Substances Control

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	US 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.	09/08

1.2 Project Organization and QAPP Distribution (QAPP Worksheets #3 & 5)

*QAPP recipient Lines of authority _____ Lines of Communication ----------



1.3 Personnel Qualifications and Sign-off Sheet (QAPP Worksheets #4, 7, & 8)

Gilbane

Name	Project Title/Role	Education/Experience	Specialized Training/Certifications	Signature/Date
Steve Crane	Gilbane Project Manager	MS Engineering 34 years of experience	PE	
Peggy Cota	Gilbane Project Chemist	BS Biology 20-plus yrs.' experience QA and laboratory	Validation; QA/QC; Occupational Safety and Health Administration Hazardous Waste Operations and Emergency Response Standard (HAZWOPER)	
Erin Caruso	Gilbane Deputy Project Manager	MS Engineering 14 years of experience	PE, PMP HAZWOPER	
Chuck Clyde	Gilbane Construction Superintendent	29 years in Construction 16 years as Superintendent	HAZWOPER 30 Hour HSO Construction QC	
Cheryl Prince	Gilbane Quality Control Manager	Certified Quality Auditor (CQA), Certified Manager of Quality/Organizational Excellence (CMQ/OE) 24 years of experience	CQA, CMQ/OE, HAZWOPER	
Chuck Clyde	Gilbane Fort Ord Quality Control Manager	24 years of Environmental experience – 18 years as Quality Control Manager	HAZWOPER, 10 Hour Supervisor, Construction QC	

Chicago Bridge and Iron (CBI) Federal Services

Name	Project Title/Role	Education/Experience	Specialized Training/Certifications	Signature/Date
Peter Kelsall	Project Manager	MS Engineering Geology BS Geology PMP #1037 38 years of experience	HAZWOPER Project Manager Training	
Michael Williams	Engineer of Record	BS Engineering	PE, HAZWOPER	
Eric Schmidt	Senior Environmental Scientist / Field Team Lead	MS Environmental Science & Engineering BS Biochemistry 27 years of experience	QA/QC Validation Data Management Field Sampling TTU Operations ArcGIS HAZWOPER	

Laboratory: Eurofins

Name	Project Title/Role	Education/Experience	Specialized Training/Certifications	Signature/Date
Kelly Buettner	Project Manager	B.S. Natural Science		
Bahar Amiri	QA Manager	B.S. Nutrition Science and Biochemistry 15 years total environmental lab experience 6 years QA experience	ISO 17025 Training (2013)	

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

1.4 Communication Pathways (QAPP Worksheet #6)

Communication Driver	Organization	Name	Contact Information	Procedure (timing, pathway, documentation, etc.)
Manage all project phases	Gilbane	Steve Crane	916-853-1839	Oversees and reviews all materials and information about the project.
Point of Contact with USACE and Ft. Ord BRAC	Gilbane	Erin Caruso	916-853-1839	All materials and information about the project will be forwarded to USACE and Fort Ord staff.
QC Oversight	Gilbane	Cheryl Prince	925-946-3100	Reviews Project Plans. Assures Gilbane compliance with Worldwide Environmental Remediation Services (WERS) requirements.
QA Oversight	Gilbane	Evelyn Dawson	480-706-6488	Prepares QAPP and QAPP Amendments. Assures Gilbane compliance with WERS requirements.
QAPP variances in the field	CB&I Federal Services	Eric Schmidt	831-824-2308	Notify Peggy Cota and/or Evelyn Dawson by phone and e-mail of variances to QAPP made in the field and the reasons within 24 hours.
Project Status Reports	Gilbane	Steve Crane	916-853-1839	Steve Crane will e-mail or fax weekly status reports to USACE and/or Fort Ord staff.
Analytical contact with the field staff and laboratory.	CB&I Federal Services	Eric Schmidt	831-824-2308	Oversees and reviews all analytical materials generated from the field and by the laboratory.
Reporting lab data quality issues	Laboratory	Bahar Amiri or Kelly Buettner	800-985-5955	All QA/QC issues with project field samples will be reported by the laboratory to Eric Schmidt within 2 business days. Identify required variances from QAPP.
Field and analytical corrective actions and QAPP modifications.	Gilbane	Evelyn Dawson	480-706-6488	The need for corrective action for analytical issues will be determined by Evelyn Dawson. Identify and initiate QAPP amendments. Issue valid QAPP variances with input from Project Manager and Sampling Team Lead.

Communication Driver	Organization	Name	Contact Information	Procedure (timing, pathway, documentation, etc.)
Hazardous or unsafe conditions that raise question of stopping work	CB&I Federal Services	Eric Schmidt	CB&I Federal Services	Confer with Steve Crane and/or the ITSI Site Safety and Health Officer (SSHO) to determine whether work needs to be stopped; the ITSI SSHO will report stop-work decision to the ITSI Project Manager (PM).
Perform field QC checks to ensure that proper samples and sample containers are being collected and that proper sampling methods, custody procedures, packaging, and shipment are performed	Gilbane	Chuck Clyde	831-212-2122	Report result of field checks to Steve Crane.
Prepare initial write-up of field generated data to be included in final reports.	CB&I Federal Services	Eric Schmidt	831-824-2308	Confer with Steve Crane on questions and resolutions.
Database setup and data management planning	CB&I Federal Services	Eric Schmidt	831-824-2308	Provides information on sample and analytical reporting groups, and types of report tables required for project.
Data verification/data validation	CB&I Federal Services / Laboratory Data Consultants	Eric Schmidt	831-824-2308	Report result of analytical QA/QC checks to Evelyn Dawson
Data review issues and corrective actions	CB&I Federal Services	Eric Schmidt	831-824-2308	Report result of analytical QA/QC corrective action to Evelyn Dawson and Erin Caruso

1.5 Project Planning Session Summary (QAPP Worksheet #9)

There was no planning session held for the preparation of the OU2 Landfill QAPP. The OU2 Landfill is discussed in monthly BCT project meetings.

2.0 PROJECT QUALITY OBJECTIVES

2.1 Conceptual Site Model (QAPP Worksheet #10)

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 cells, one cell north and five cells south of Imjin Road, covering approximately 150 acres, including the immediate surrounding area (**Figure 1**). The Area A Landfill was an irregularly shaped area of approximately 33 acres separated from the main landfill to the south by Imjin Road. The landfill south of Imjin Road (Areas B through F) encompasses approximately 120 acres of land that was undeveloped other than for the use as landfill. The six landfill areas were used for residential and on-base waste disposal. 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, effectively terminating waste disposal activities at the OU2 Landfills (Shaw, 2008a). 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 for soil presented in the OU2 Landfills ROD involved 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 *Explanation of Significant Differences, Consolidation of Remediation Waste in a Corrective Action Management Unit (CAMU), Operable Unit 2 Landfill* (CAMU ESD; Army, 1997a) designates the existing boundaries of the main landfill area as a CAMU. Designation as a CAMU generally allows remediation waste to be placed there 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. The soil and debris are managed, incorporated within the landfill foundation layer, and capped as part of the landfill. 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) clarified that the CAMU ESD is intended to designate CAMU regulations as ARARS for the landfills but not to designate the landfills as a CAMU.

The 1997 RI Sites ROD also presents the selected remedial actions and describes the methods and procedures to execute and accomplish the soil remedies at Fort Ord Remediation Sites 2, 12, 16, 17, 31, and 39. The remedial actions for the debris and soil at the OU2 landfill include a cover system; institutional controls; and a groundwater extraction and treatment system for volatile organic compounds (VOCs) using granular activated carbon (GAC). The Army completed construction of an engineered cover over Areas B through F from 1997 to 2002 (Shaw, 2005a). In 2001 the Army installed a pilot extraction and treatment system to mitigate landfill gas (LFG) migration along the eastern perimeter of Area F where housing is located closest to the landfill (Shaw, 2005b). The system began operation on June 4, 2001. The extraction and treatment system included a line of extraction wells (EWs) with the LFG treated with GAC to remove VOCs, and potassium permanganate to remove vinyl chloride. Two 8-inch-diameter, near-surface, perforated collector pipes, approximately 800 feet in total length, were installed in Area E during construction in 2002 for possible future methane extraction. The perforated collector pipes, installed in the foundation layer at Area E, collectively are referred to as extraction point (EP)-36.

Based on the results of the pilot study, the extraction and treatment system was expanded by adding vertical EWs along the perimeter and within the interior of Area F and replacing the existing treatment system with a TTU. The TTU, unlike the GAC/potassium permanganate treatment system, has removed and treated both VOCs and methane. Full-time operation of the TTU started on August 2, 2006.

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 established as part of the LFG treatment system expansion (Shaw, 2008b). In April 2009, EP-36 was brought on line 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 passive vent 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).

To optimize the TTU, the system is monitored during operation. System monitoring includes all extraction points, 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, 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 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). To accommodate the remediation at the Site 39 Inland Ranges, additional capacity in the form of a vertical expansion was required at the OU2 Landfills. Additional capacity was available by placing remediation waste within the confines of the existing Area E footprint. Construction of the vertical expansion involved placing additional remediation waste above the existing geomembrane and providing a new 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. The additional remediation waste is to be sealed above and below by a geomembrane. Phase 1 was completed by Gilbane in 2013 with approximately

150,000 cubic yards placed in the vertical expansion at Area E. It is anticipated that remediation of Site 39 and placement of soil in the Area E vertical expansion may continue in future years.

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. 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 carved 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. The southeastern portion of Fort Ord is characterized by relatively well-defined, eastward flowing drainage channels within narrow, moderately to steeply sloping canyons. Runoff is into the Salinas Valley.

Potential receptors and exposure pathways

The Army performed ambient air monitoring in 2000, 2001, and 2002 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 HHRA later was updated with data from 2003. The updated HHRA indicated that the Fort Ord Landfills were not a significant contributor of VOCs in ambient air or a significant risk to downwind receptors (Army, 2006)

Geology and Hydrogeology

Remedial investigation at the landfills indicated that the landfill materials were buried in relatively uniform sand dune deposits in shallow trenches approximately 30 feet wide that extend from ground surface to 10 to 12 feet below ground surface (bgs). Soil samples collected below the landfills do not contain chemicals associated with the landfills. Chemicals associated with landfilled materials, however, 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).

Water in the A-aquifer flows toward the west and the Pacific Ocean. Due to extensive local and regional pumping of water from the upper 180-foot aquifer for agricultural and domestic use, the natural flow toward the west is reversed, and water in the upper 180-foot aquifer is separated from the A-aquifer by an impermeable layer, or aquiclude, known as the Salinas Valley Aquiclude (SVA). Near the Pacific Ocean, however, the two aquifers are connected because the aquiclude pinches out in this area. Therefore, chemicals in the A-aquifer can or may migrate into the upper 180-foot aquifer (Army, 1995).

Known or Suspected Contaminants

Groundwater contamination at OU 2 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 OU 2, 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. None of these three aquifers within OU 2 is used as a direct source for drinking water, although the Lower 180-Foot Aquifer outside of OU 2 is a significant source of potable water for the former Fort Ord and the City of Marina (Army, 2008). The COCs and ACLs for OU 2 are listed in Table 5. The primary indicator chemical for the distribution of COCs has been TCE.

The Human Health Risk Assessment conducted based on ambient air monitoring concluded that the OU2 Landfill is not a significant contributor of VOCs in ambient air or risk to downwind receptors (Shaw, 2005c). Landfill gas is collected and treated for VOCs and vinyl chloride. Since the onset of TTU operations, the methane concentrations in perimeter monitoring probes have remained below remediation criteria (Shaw, 2011 and 2012).

2.2 Project/Data Quality Objectives (QAPP Worksheet #11)

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 goal 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

DQOs have been developed by the planning team for the OU2 landfill. The planning team consists of project and technical staff from Gilbane Company (Gilbane); Chicago Bridge and Iron (CBI); the U.S. Army Corps of Engineers (USACE); and Base Realignment and Closure (BRAC) Cleanup Team (BCT). Initial technical decisions will be made by Gilbane and CBI personnel, and will be submitted to the USACE technical team leader for approval.

There are DQOs for the three types of testing at the thermal treatment units (TTUs): (1) source testing, (2) operational influent landfill gas testing, and (3) landfill perimeter monitoring. The data quality objectives for the OU2 landfill are listed below. .

DQO #1: Source Testing

State the Problem. Even though the Monterey Bay Unified Air Pollution Control District (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 Landfill, are listed below:

- Minimum destruction efficiency of total hydrocarbons (THC) shall be 98 percent 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 percent oxygen.
- Combustion temperature shall be maintained at a minimum of 1400 degrees Fahrenheit (°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 (SO_2) emissions shall not exceed 0.2 %v (2000 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 percent 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 the constituents of concern and the mass emission factors for secondary pollutants that result from the combustion process.

Identify the goal of the study. 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. Additionally, the system may require optimization in order to meet regulatory standards.

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

Stack Emissions (Effluent)
Gas stream volumetric flow rate
Oxygen (O_2)
NMOCs
CO
Nitrogen oxides (NOx)
SO_2
Methane (CH_4)
VOCs by EPA Compendium Method TO-15
Flare temperature

Influent LFG
Heating value (calculated based on hydrocarbon content; caloric content of gas)
O_2, CO_2, nitrogen (N_2)
CH_4
VOCs
NMOCs
Reduced sulfur compounds
LFG flow rate

A certified mobile laboratory 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). Section 6.0 provides details of the analytical methods to be employed. The landfill gas 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.

Define the boundaries of the study. 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.

The only potential constraint to data collection will be inclement weather that could inhibit sample collection (health and safety considerations).

Develop the analytical approach. The planning team is interested in measuring TTU stack emissions and the influent LFG concentrations for specific gases in order 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 will require adjustments to increase its efficiency in order to meet target operating conditions.
- If stack emission data show that the system does not achieve regulatory standards, then the TTU will require optimization in order to be able achieve the regulatory standards.
- If stack emission data show that the system meets regulatory standards, then the TTU will not require further optimization.

Specify 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 in order to obtain the most reliable data, decision errors will be minimized and should not be a factor in making sound decisions.

Develop the 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. The field test methods, parameters, numbers of tests, and durations of tests are as follows for the stack emission testing:

Sample Parameter	Test Method	Number of Runs/ Samples	Test Duration
Gas Stream Volumetric Flow Rate	EPA Method 19	3	Concurrent
Oxygen, Carbon Dioxide	EPA Method 3A	3	40 minutes
NMOC	EPA Method 25A	3	40 minutes
CO	EPA Method 10	3	40 minutes
NOx	EPA Method 7E	3	40 minutes
Methane	Portable LFG Analyzer	1	NA
VOCs	EPA Method TO-15	1	NA

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, and numbers of tests for influent LFG are as follows:

Sample Parameter	Test Method	Number of Samples
Heating Value (calculated) Oxygen, CO_2, NMOC	ASTM 1945	1
VOCs	EPA Method TO-15	1
Reduced sulfur compounds	ASTM D5504	1
LFG rate	Flow meter	Continuous
Flare temperature	Thermocouple	Continuous

Stack emission testing will be performed annually in order demonstrate that the TTU is operating efficiently and is in compliance with the optimum operating conditions.

DQO #2: Operational Influent LFG Testing

State the Problem. 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 the extraction well (EWs) on the eastern side of Area F, where the landfill is closest to the property boundary, need to maintain compliance with 5 %v standard. VOC mass extraction rates may need to be adjusted to maximize removal.

Identify the goal of the study. 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 (LEL) of five percent volume (%v); and to determine the composition and characteristics of the influent from the extraction wells (EWs) on the eastern side of Area F and other wells and probes to prevent adverse acute and chronic exposure to toxic and/or carcinogenic compounds.

Identify information inputs.

To determine trends in composition and characteristics present in the operational influent LFG and the extraction wells, the following inputs are required using a portable LFG analyzer:

<u>Influent LFG</u>
Methane
Carbon dioxide
Oxygen
Balance gas
Temperature
Flow
Vacuum

In addition, input will come from the analysis of VOCs by EPA Method TO-15 from a fixed-base laboratory.

Define the boundaries of the study. The boundaries of the study are the frequency and the locations of monitoring points for the TTU. The constraint to potential data collection is system down-time due to maintenance. A high concern is given to the compliance perimeter probes and EWs on the Eastern side of Area F, where the landfill is closest to the property boundary.

Develop the analytical approach. The composition of gases from the perimeter and interior extraction wells 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., extraction well 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 probes are less than 10 %v, then these leg(s) may be shut down.
- If methane concentrations in individual interior extraction wells at Area F are below 40 %v, then the individual wells may be shut down.
- If methane concentrations in individual interior extraction wells at Area D are below 30 %v, then the individual wells may be shut down.
- If methane concentrations in the interior legs of Area F or D are below 50 %v, then operation of the TTU will be intermittent rather than continuous.
- If extraction well temperatures are greater than 120 °F, then the individual well(s) or the leg will be shut down.

Specify 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 in order to obtain the most reliable data, decision errors will be minimized and should not be a factor in making sound decisions.

Develop the 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
Methane, oxygen, carbon dioxide, balance gas, temperature, flow rate, vacuum	Pre-TTU	TTU analyzer	Continuous
	Perimeter and/or Interior Legs in operation	portable LFG analyzer	Weekly
	Extraction Wells	portable LFG analyzer	As needed
VOCs	Pre-TTU	EPA Method TO-15	Annual

DQO #3: Perimeter Monitoring

State the Problem. 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 need to be measured to determine whether concentrations are in compliance with the regulatory requirements or whether corrective actions need to be implemented.

Identify the goal of the study. The primary decision is whether the concentrations of methane in the compliance perimeter probes meet the regulatory requirement. Secondarily, there is a decision as to 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 housing is located closest to the landfill, 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, the planning team will obtain measurements of methane and VOCs from the perimeter probes at the landfill.

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

Sixty-seven perimeter probes will be monitored quarterly for methane except for the perimeter probes along the eastern perimeter of Area F, which will be monitored more frequently as part of TTU operations. In addition to the perimeter probes, two shallow probes installed in the utility trench located within the OU2 landfills also will be monitored quarterly. A portable LFG analyzer will be used in the field to measure methane, oxygen, carbon dioxide, and balance gas.

The 14 passive vents installed along the center ridgeline of each landfill cell also will be monitored quarterly. 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.

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.

Define the boundaries of the study. To determine the concentrations of methane and trace gases at the perimeter, compliance probes installed along the perimeter of the landfill will be monitored.

Develop the analytical approach. The planning team is interested in the concentrations of the methane and trace gases at the landfill perimeter.

The following decision rules apply to methane in the 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 housing is located closest to the landfill, 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 housing is located closest to the landfill, are greater than 5%v, then LFG migration is not being controlled by operations of the TTU and the operational schedule of the TTU (Section 4.0) needs to be modified.

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.

The following decision rules relate to volatile organic compounds 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 probes with previous measured detections greater than 100 times the 2004 EPA Region IX Ambient Air preliminary remediation goal (PRG) for vinyl chloride in gas (100 x PRG = 4.1 parts per billion by volume [ppbv]): if the concentration of vinyl chloride exceeds the previous maximum recorded value, the probe will be sampled quarterly until two successive measurements show declining or constant concentrations.
- For compliance probes with no previous measured detections greater than 100 times the 2004 EPA Region IX PRG for vinyl chloride in gas: if the concentration remains less than 100 times the PRG, then no action is required.

- For compliance probes with no previous measured detections greater than 100 times the 2004 EPA Region IX PRG for vinyl chloride in gas: if the concentration exceeds 100 times the PRG, then the probe will be sampled quarterly until two successive measurements show declining or constant concentrations.

The 2004 EPA Region IX PRG for vinyl chloride is more conservative than the current EPA Region IX Ambient Air Regional Screen Level for vinyl chloride; therefore, this value will continue to be used in the decision rules.

Specify 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 in order to obtain the most reliable data, decision errors will be minimized and should not be a factor in making sound decisions.

Develop the plan for obtaining data. The perimeter probes were installed at a maximum separation of 1,000 feet except for five locations along the outer perimeter of Area F. 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 to provide more samples.

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.

2.3 Measurement Performance Criteria (QAPP Worksheet #12)

Measurement performance criteria are taken from Tables 7-4, 7-7, 7-12, and 7-13 of the O&M Plan, Appendix F of the *Landfill Gas Sampling and Analysis Plan* (Shaw, 2008a). The criteria are summarized below.

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	< ½ Limit of Quantitation (LOQ)[1]
Completeness	Data Assessment	≥ 90%
Comparability	Data Review: compare results to previous sampling events.	Similar units and LOQs meet project decision limit (PDLs)[1]

Analytical Group/Method: Sulfur Gases/ASTM D5504
Estimated Concentration Level: Low
Matrix: Gas (ppbv)

Data Quality Indicators (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	< ½ LOQ[1]
Completeness	Data Assessment	≥ 90%
Comparability	Data Review: compare results to previous sampling events.	Similar units and LOQs meet PDLs[1]

[1]See Worksheet 15 for LOQs and project decision limits (PDLs) values

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

Estimated Concentration Level: Low

Matrix: Gas (ppbv)

Data Quality Indicators (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 %
Accuracy		Toluene-d8	70-130 %
Accuracy		4-Bromofluorobenzene	70-130 %
Accuracy	Laboratory Control Sample (LCS)[1,2]	Vinyl chloride	70-130 %
Accuracy		1,1-Dichloroethene	70-130 %
Accuracy		Methylene chloride	70-130 %
Accuracy		1,1-Dichloroethane	70-130 %
Accuracy		Chloroform	70-130 %
Accuracy		1,1,1-Trichloroethane	70-130 %
Accuracy		Carbon tetrachloride	70-130 %
Accuracy		Benzene	70-130 %
Accuracy		1,2-Dichloroethane	70-130 %
Accuracy		Trichloroethene	70-130 %
Accuracy		Tetrachloroethene	70-130 %
Accuracy		1,2-Dibromoethane (EDB)	70-130 %
Accuracy		1,4-Dioxane	70-130 %
Bias/Sensitivity	Method Blanks	< ½ LOQ[3]	
Completeness	Data Assessment	≥ 90%	
Comparability	Data Review: compare results to previous sampling events.	Similar units and LOQs meet PDLs[3]	

[1]Samples will be spiked for all compounds on the TO-15 list; however, only the compounds presented will be controlled.

[2]The 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%

[3]See Worksheet 15 for LOQs and project decision limit (PDL) values

2.4 Secondary Data Uses and Limitations (QAPP Worksheet #13)

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	Shaw Environmental, Inc. Annual Report, 2010, Operations and Maintenance, Operable Unit 2 Landfills June 2011, Revision 0	Trend analysis, design optimization	None
Soil Gas, Inspection Reports, Figures, Analytical Data	Shaw Environmental, Inc. Annual Report, 2012, Operations and Maintenance, Operable Unit 2 Landfills January 2014, Revision 0	Trend analysis, design optimization	None

2.5 Project Tasks & Schedule (QAPP Worksheets #14 & 16 [Uniform Federal Policy (UFP)-QAPP Manual Section 2.8.1])

Sixty-seven monitoring probes and 2 utility trench probes are located around Areas B through F (**Figure 2**). All the monitoring probes installed around the OU2 Landfills are included in quarterly monitoring to establish trends. **Figure 2** also shows the locations of the probes designated as compliance probes for quarterly methane monitoring and annual VOC monitoring.

Quarterly and 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	CB&I Federal Services	Biweekly or during TTU operation	Annual Report
Landfill O&M	CB&I Federal Services	Monthly	Annual Report
TTU Inspection / maintenance	CB&I Federal Services	During operation, Quarterly	Annual Report
Landfill methane monitoring	CB&I Federal Services	Quarterly	Annual Report
Landfill Inspections	Monterey County Department of Health	Quarterly	Annual Report
Landfill Inspections	Registered California civil engineer	Annually	Annual Report
VOC Monitoring	CB&I Federal Services	Annually	Annual Report

2.6 Project Action Limits and Laboratory-Specific Detection/Quantitation Limits (QAPP Worksheet #15)

The OU2 Landfill ROD (Army, 1994) chemicals of concern, aquifer cleanup levels, and discharge limits for treated water as stated in Table 1 are as follows:

Chemical of Concern	Aquifer Cleanup Level (micrograms per liter [ug/L])	Discharge Limit for Treated Water (ug/L)
Benzene	1.0	0.5
Carbon Tetrachloride	0.5	0.5
Chloroform	2.0	0.5
1,1-Dichloroethane	5.0	0.5
1,2-Dichloroethane	0.5	0.5
Cis-1,2-Dichloroethene	6.0	0.5
1,2-Dichloropropane	1.0	0.5
Dichloromethane	5.0	0.5
Tetrachloroethene	3.0	0.5
Trichloroethene	5.0	0.5
Vinyl chloride	0.1	0.1

In accordance with Section 4.1.5 of Appendix F in the O&M Plan (Shaw, 2008a), the following decision rules were evaluated as they relate to VOCs. These rules are based on comparison of current analytical data with historical data since start-up of the pilot LFG extraction and treatment system:

> For compliance probes with previous measured detections greater than 100 times the 2004 EPA Region IX PRG for vinyl chloride in gas (100 x PRG = 4.1 parts per billion by volume [ppbv]): if the concentration of vinyl chloride exceeds the previous maximum recorded value, sample quarterly until two successive measurements show declining or constant concentrations.

One hundred times the current (2014) EPA Region IX Regional Screening Level (RSL) for vinyl chloride is 6.7 ppbv. Therefore, the requirements presented in the O&M Plan (actions triggered at 4.1 ppbv) are more conservative than the current RSL. The only regulatory requirement for VOCs on the perimeter probes is 27 California Code of Regulations (CCR), Section 20921(a)(3), which states: “Trace gases shall be controlled to prevent adverse acute and chronic exposure to toxic and/or carcinogenic compounds”. Since this applies to all trace gases, all VOCs (as measured by TO-15) have been quantified on probes, both historically and in the present.

The full lists of compounds for ASTM D1945 and D5504 methods are required under the current annual source test plan for the TTU. The full list of VOCs for TO-15 is required during the

source test in order to measure the destruction efficiency of the TTU, a parameter that is calculated for a standard source test of a TTU.

Practical quantitation limits (PQLs) are taken from tables 7-2, 7-5, and 7-8 of the O&M Plan, Appendix F, *Landfill Gas Sampling and Analysis Plan* (Shaw, 2008a). The criteria are summarized below.

Analytical Group/Method: Fixed Gases/ASTM D1945
Estimated Concentration Level: Low
Matrix: Gas (ppmv)

Method	Analyte	CAS Number	PQL	Laboratory LOD	Laboratory LOQ
ASTM D1945	Acetylene	74-86-2	10	0.59	10
ASTM D1945	Butane	106-97-8	10	0.59	10
ASTM D1945	NMOC (C6+)	NA	100	0.59	100
ASTM D1945	Carbon dioxide	124-38-9	100	85.67	100
ASTM D1945	Ethane	74-84-0	10	0.59	10
ASTM D1945	Ethene	74-85-1	10	0.59	10
ASTM D1945	Isobutane	75-28-5	10	0.59	10
ASTM D1945	Isopentane	78-78-4	10	0.59	10
ASTM D1945	Methane	74-82-8	100	0.18	1
ASTM D1945	Neopentane	463-82-1	10	0.59	10
ASTM D1945	Pentane	109-66-0	10	0.59	10
ASTM D1945	Propane	74-98-6	10	0.59	10
ASTM D1945	Oxygen	7782-44-7	1,000	26.31	1,000
ASTM D1945	Nitrogen	7727-37-9	1,000	113.2	1,000
ASTM D1945	Carbon monoxide	630-08-0	100	50	100
ASTM D1945	Hydrogen	1333-74-0	100	60	100

Notes:
LOD = limit of detection
LOQ = limit of quantitation
NMOC = non-methane organic compound (reference to methane [MW=16])

Analytical Group/Method: Sulfur Gases/ASTM D5504

Estimated Concentration Level: Low

Matrix: Gas (ppbv)

Method	Analyte	CAS Number	Detection Limits	Molecular Weight	Laboratory LOQ
ASTM D5504	Hydrogen sulfide	7783-06-4	4	34.081	4.0
ASTM D5504	Carbonyl sulfide	463-58-1	4	60.075	4.0
ASTM D5504	Methyl mercaptan	74-93-1	4	48.107	4.0
ASTM D5504	Ethyl mercaptan	75-08-1	4	62.134	4.0
ASTM D5504	Dimethyl sulfide	75-18-3	4	62.134	4.0
ASTM D5504	Carbon disulfide	75-15-0	4	76.141	4.0
ASTM D5504	Isopropyl mercaptan	75-33-2	4	76.161	4.0
ASTM D5504	tert-Butyl mercaptan	75-66-1	4	90.187	4.0
ASTM D5504	n-Propyl mercaptan	107-03-9	4	76.161	4.0
ASTM D5504	Ethyl methyl sulfide	624-89-5	4	76.161	4.0
ASTM D5504	Thiophene	110-02-1	4	84.140	4.0
ASTM D5504	Isobutyl mercaptan	513-44-0	4	90.187	4.0
ASTM D5504	Diethyl sulfide	352-93-2	4	90.187	4.0
ASTM D5504	n-Butyl mercaptan	109-79-5	4	90.187	4.0
ASTM D5504	Dimethyl disulfide	624-92-0	4	94.199	4.0
ASTM D5504	3-Methylthiophene	616-44-4	4	98.166	4.0
ASTM D5504	Tetrahydrothiophene	110-01-0	4	88.171	4.0
ASTM D5504	2-Ethylthiophene	872-55-9	4	112.193	4.0
ASTM D5504	2,5-Dimethylthiophene	638-02-8	4	112.193	4.0
ASTM D5504	Diethyl disulfide	110-81-6	4	122.252	4.0

CAS = Chemical Abstracts Service

Analytical Group/Method: VOC/TO-15
Estimated Concentration Level: Low
Matrix: Gas (ppbv)

Method	Analyte	CAS Number	Detection Limits	Laboratory LOD	Laboratory LOQ
TO-15	Ethyl benzene	100-41-4	0.5	0.14	0.5
TO-15	Styrene	100-42-5	0.5	0.14	0.5
TO-15	alpha-Chlorotoluene	100-44-7	0.5	0.14	0.5
TO-15	cis-1,3-Dichloropropene	10061-01-5	0.5	0.14	0.5
TO-15	trans-1,3-Dichloropropene	10061-02-6	0.5	0.14	0.5
TO-15	1,4-Dichlorobenzene	106-46-7	0.5	0.14	0.5
TO-15	1,2-Dibromoethane (EDB)	106-93-4	0.5	0.14	0.5
TO-15	1,3-Butadiene	106-99-0	2	0.14	0.5
TO-15	1,2-Dichloroethane	107-06-2	0.5	0.14	0.5
TO-15	4-Methyl-2-pentanone	108-10-1	2	0.14	0.5
TO-15	1,3,5-Trimethylbenzene	108-67-8	0.5	0.14	0.5
TO-15	Toluene	108-88-3	0.5	0.14	0.5
TO-15	Chlorobenzene	108-90-7	0.5	0.14	0.5
TO-15	Tetrahydrofuran	109-99-9	2	0.14	0.5
TO-15	Hexane	110-54-3	2	0.14	0.5
TO-15	Cyclohexane	110-82-7	2	0.14	0.5
TO-15	1,2,4-Trichlorobenzene	120-82-1	2	0.62	2
TO-15	1,4-Dioxane	123-91-1	2	0.68	2
TO-15	Dibromochloromethane	124-48-1	2	0.14	0.5
TO-15	Tetrachloroethene	127-18-4	0.5	0.14	0.5
TO-15	Heptane	142-82-5	2	0.14	0.5
TO-15	cis-1,2-Dichloroethene	156-59-2	0.5	0.14	0.5
TO-15	trans-1,2-Dichloroethene	156-60-5	2	0.14	0.5
TO-15	Methyl tert-butyl ether	1634-04-4	2	0.14	0.5
TO-15	1,3-Dichlorobenzene	541-73-1	0.5	0.14	0.5
TO-15	Carbon tetrachloride	56-23-5	0.5	0.14	0.5
TO-15	2-Hexanone	591-78-6	2	0.53	2
TO-15	4-Ethyltoluene	622-96-8	2	0.14	0.5
TO-15	Ethanol	64-17-5	2	1	2
TO-15	2-Propanol	67-63-0	2	0.67	2
TO-15	Acetone	67-64-1	2	0.65	5
TO-15	Chloroform	67-66-3	0.5	0.14	0.5
TO-15	Benzene	71-43-2	0.5	0.14	0.5
TO-15	1,1,1-Trichloroethane	71-55-6	0.5	0.14	0.5

Method	Analyte	CAS Number	Detection Limits	Laboratory LOD	Laboratory LOQ
TO-15	Bromomethane	74-83-9	0.5	0.25	5
TO-15	Chloromethane	74-87-3	2	0.62	5
TO-15	Chloroethane	75-00-3	0.5	0.76	2
TO-15	Vinyl chloride	75-01-4	0.5	0.14	0.5
TO-15	Methylene chloride	75-09-2	0.5	0.25	5
TO-15	Carbon disulfide	75-15-0	2	0.65	2
TO-15	Bromoform	75-25-2	2	0.14	0.5
TO-15	Bromodichloromethane	75-27-4	2	0.14	0.5
TO-15	1,1-Dichloroethane	75-34-3	0.5	0.14	0.5
TO-15	1,1-Dichloroethene	75-35-4	0.5	0.14	0.5
TO-15	Freon 11	75-69-4	0.5	0.14	0.5
TO-15	Freon 12	75-71-8	0.5	0.14	0.5
TO-15	Freon 113	76-13-1	0.5	0.14	0.5
TO-15	Freon 114	76-14-2	0.5	0.14	0.5
TO-15	1,2-Dichloropropane	78-87-5	0.5	0.14	0.5
TO-15	2-Butanone	78-93-3	2	0.51	2
TO-15	1,1,2-Trichloroethane	79-00-5	0.5	0.14	0.5
TO-15	Trichloroethene	79-01-6	0.5	0.14	0.5
TO-15	1,1,2,2-Tetrachloroethane	79-34-5	0.5	0.14	0.5
TO-15	Hexachlorobutadiene	87-68-3	2	0.59	2
TO-15	m,p-Xylene	108-38-3	1	0.14	0.5
TO-15	o-Xylene	95-47-6	0.5	0.14	0.5
TO-15	1,2-Dichlorobenzene	95-50-1	0.5	0.14	0.5
TO-15	1,2,4-Trimethylbenzene	95-63-6	0.5	0.14	0.5

3.0 SAMPLE DESIGN

3.1 Sampling Design and Rationale (QAPP Worksheet #17)

Final closure is being completed as a remedial action in accordance with the OU2 Landfills ROD (Army, 1994). The selected remedial action for soil presented in the OU2 Landfills ROD involved placing an engineered cover system over buried refuse at the Landfills. The O&M Plan (Shaw, 2008) provides procedures for monitoring the operation of the TTU, including vents, probes, and extraction wells.

Section 5.0 of the O&M Plan (Shaw, 2008) describes the perimeter monitoring system that is used to test the operational influent and effluent landfill gas.

Passive vents were installed through the vegetative cover at 19 locations to minimize the potential for gas buildup beneath the geomembrane. Five vents have been converted to extraction points, to provide supplemental methane to the TTU. The other vents were capped in 2001 for health and safety reasons (potential fire hazard). The TTU system prevents gas buildup beneath the geomembrane. The fourteen capped passive vents are not monitored for compliance, but are sampled quarterly for methane using a portable landfill gas analyzer. The vents that were converted to extraction points 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 (a subset of the monitoring 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 collect methane, oxygen, carbon dioxide, and balance gas, collectively termed LFG, measurements using a portable landfill gas analyzer LFG at depths below surface ranging from 12 to 32 feet. The utility trench probes are 4 feet deep. All the monitoring probes installed around the OU2 Landfills are included in quarterly monitoring to establish trends. Samples collected from the 21 compliance probes are sent to an off-site laboratory annually for analysis of VOCs by EPA Method TO-15.

Monitoring probes and passive vents along the center ridgelines of each area were first monitored in June 2000.

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
NOx, CO, O_2, and CO_2	EPA Methods 7E, 10, and 3A
Outlet Total Hydrocarbons, Methane, 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 landfills.

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

3.2 Sampling Locations and Methods (QAPP Worksheet #18)

Operable Unit 2

Area	Probe ID	Matrix	Type	Depth (feet)	Analytical Group	Sampling SOP Reference[1]	Frequency	Rationale
OU2 B	SGP-1B	Soil Gas	Sample Port	12	LFG	5	Quarterly	Monitoring Point
OU2 B	SGP-2B	Soil Gas	Sample Port	12	LFG	5	Quarterly	Monitoring Point
OU2 B	SGP-3B	Soil Gas	Sample Port	12	LFG	5	Q/A - VOC Fixed Lab	Compliance
OU2 B	SGP-4B	Soil Gas	Sample Port	12	LFG	5	Q/A - VOC Fixed Lab	Compliance
OU2 B	SGP-5B	Soil Gas	Sample Port	12	LFG	5	Quarterly	Monitoring Point
OU2 C	SGP-1C	Soil Gas	Sample Port	12	LFG	5	Quarterly	Monitoring Point
OU2 C	SGP-2C	Soil Gas	Sample Port	12	LFG	5	Q/A - VOC Fixed Lab	Compliance
OU2 C	SGP-3C	Soil Gas	Sample Port	12	LFG	5	Q/A - VOC Fixed Lab	Compliance
OU2 D	SGP-1D	Soil Gas	Sample Port	12	LFG	5	Quarterly	Monitoring Point
OU2 D	SGP-1D	Soil Gas	Sample Port	22	LFG	5	Quarterly	Monitoring Point
OU2 D	SGP-2D	Soil Gas	Sample Port	12	LFG	5	Quarterly	Monitoring Point
OU2 D	SGP-2D	Soil Gas	Sample Port	22	LFG	5	Quarterly	Monitoring Point
OU2 D	SGP-3D	Soil Gas	Sample Port	12	LFG	5	Quarterly	Monitoring Point

Area	Probe ID	Matrix	Type	Depth (feet)	Analytical Group	Sampling SOP Reference[1]	Frequency	Rationale
OU2 D	SGP-3D	Soil Gas	Sample Port	22	LFG	5	Quarterly	Monitoring Point
OU2 D	SGP-4D	Soil Gas	Sample Port	12	LFG	5	Q/A - VOC Fixed Lab	Compliance
OU2 D	SGP-4D	Soil Gas	Sample Port	22	LFG	5	Q/A - VOC Fixed Lab	Compliance
OU2 D	SGP-5D	Soil Gas	Sample Port	12	LFG	5	Quarterly	Monitoring Point
OU2 D	SGP-6D	Soil Gas	Sample Port	12	LFG	5	Q/A - VOC Fixed Lab	Compliance
OU2 D	SGP-6D	Soil Gas	Sample Port	22	LFG	5	Q/A - VOC Fixed Lab	Compliance
OU2 E	SGP-1E	Soil Gas	Sample Port	12	LFG	5	Quarterly	Monitoring Point
OU2 E	SGP-2E	Soil Gas	Sample Port	12	LFG	5	Quarterly	Monitoring Point
OU2 E	SGP-3E	Soil Gas	Sample Port	12	LFG	5	Quarterly	Monitoring Point
OU2 E	SGP-4E	Soil Gas	Sample Port	12	LFG	5	Quarterly	Monitoring Point
OU2 E	SGP-5E	Soil Gas	Sample Port	12	LFG	5	Quarterly	Monitoring Point
OU2 E	SGP-6E	Soil Gas	Sample Port	12	LFG	5	Quarterly	Monitoring Point
OU2 E	SGP-7E	Soil Gas	Sample Port	12	LFG	5	Q/A - VOC Fixed Lab	Compliance
OU2 E	SGP-8E	Soil Gas	Sample Port	12	LFG	5	Q/A - VOC Fixed Lab	Compliance
OU2 E	SGP-9E	Soil Gas	Sample Port	12	LFG	5	Q/A - VOC Fixed Lab	Compliance
OU2 F	SGP-1F	Soil Gas	Sample Port	12	LFG	5	Quarterly	Monitoring Point

Area	Probe ID	Matrix	Type	Depth (feet)	Analytical Group	Sampling SOP Reference[1]	Frequency	Rationale
OU2 F	SGP-1F	Soil Gas	Sample Port	22	LFG	5	Quarterly	Monitoring Point
OU2 F	SGP-2F	Soil Gas	Sample Port	32	LFG	5	Quarterly	Monitoring Point
OU2 F	SGP-2F	Soil Gas	Sample Port	12	LFG	5	Quarterly	Monitoring Point
OU2 F	SGP-3F	Soil Gas	Sample Port	12	LFG	5	Quarterly	Monitoring Point
OU2 F	SGP-3F	Soil Gas	Sample Port	32	LFG	5	Quarterly	Monitoring Point
OU2 F	SGP-4F	Soil Gas	Sample Port	12	LFG	5	Quarterly	Monitoring Point
OU2 F	SGP-4F	Soil Gas	Sample Port	32	LFG	5	Quarterly	Monitoring Point
OU2 F	SGP-5F	Soil Gas	Sample Port	12	LFG	5	Quarterly	Monitoring Point
OU2 F	SGP-5F	Soil Gas	Sample Port	32	LFG	5	Quarterly	Monitoring Point
OU2 F	SGP-6F	Soil Gas	Sample Port	12	LFG	5	Quarterly	Monitoring Point
OU2 F	SGP-6F	Soil Gas	Sample Port	32	LFG	5	Quarterly	Monitoring Point
OU2 F	SGP-7F	Soil Gas	Sample Port	12	LFG	5	Quarterly	Monitoring Point

Area	Probe ID	Matrix	Type	Depth (feet)	Analytical Group	Sampling SOP Reference[1]	Frequency	Rationale
OU2 F	SGP-7F	Soil Gas	Sample Port	32	LFG	5	Quarterly	Monitoring Point
OU2 F	SGP-8F	Soil Gas	Sample Port	12	LFG	5	Q/A - VOC Fixed Lab	Compliance
OU2 F	SGP-8F	Soil Gas	Sample Port	22	LFG	5	Q/A - VOC Fixed Lab	Compliance
OU2 F	SGP-9F	Soil Gas	Sample Port	12	LFG	5	Quarterly	Monitoring Point
OU2 F	SGP-10F	Soil Gas	Sample Port	12	LFG	5	Quarterly	Monitoring Point
OU2 F	SGP-10F	Soil Gas	Sample Port	22	LFG	5	Quarterly	Monitoring Point
OU2 F	SGP-11F	Soil Gas	Sample Port	12	LFG	5	Quarterly	Monitoring Point
OU2 F	SGP-11F	Soil Gas	Sample Port	32	LFG	5	Quarterly	Monitoring Point
OU2 F	SGP-12F	Soil Gas	Sample Port	32	LFG	5	Quarterly	Monitoring Point
OU2 F	SGP-13F	Soil Gas	Sample Port	12	LFG	5	Q/A - VOC Fixed Lab	Compliance
OU2 F	SGP-13F	Soil Gas	Sample Port	32	LFG	5	Q/A - VOC Fixed Lab	Compliance
OU2 F	SGP-14F	Soil Gas	Sample Port	12	LFG	5	Quarterly	Monitoring Point
OU2 F	SGP-14F	Soil Gas	Sample Port	32	LFG	5	Quarterly	Monitoring Point
OU2 F	SGP-15F	Soil Gas	Sample Port	12	LFG	5	Q/A - VOC Fixed Lab	Compliance
OU2 F	SGP-15F	Soil Gas	Sample Port	32	LFG	5	Q/A - VOC Fixed Lab	Compliance

Area	Probe ID	Matrix	Type	Depth (feet)	Analytical Group	Sampling SOP Reference[1]	Frequency	Rationale
OU2 F	SGP-16F	Soil Gas	Sample Port	4	LFG	5	Quarterly	Monitoring Point
OU2 F	SGP-17F	Soil Gas	Sample Port	12	LFG	5	Q/A - VOC Fixed Lab	Compliance
OU2 F	SGP-17F	Soil Gas	Sample Port	32	LFG	5	Q/A - VOC Fixed Lab	Compliance
OU2 F	SGP-18F	Soil Gas	Sample Port	12	LFG	5	Quarterly	Monitoring Point
OU2 F	SGP-18F	Soil Gas	Sample Port	32	LFG	5	Quarterly	Monitoring Point
OU2 F	SGP-19F	Soil Gas	Sample Port	12	LFG	5	Quarterly	Monitoring Point
OU2 F	SGP-19F	Soil Gas	Sample Port	22	LFG	5	Quarterly	Monitoring Point
OU2 F	SGP-20F	Soil Gas	Sample Port	12	LFG	5	Quarterly	Monitoring Point
OU2 F	SGP-20F	Soil Gas	Sample Port	32	LFG	5	Quarterly	Monitoring Point
OU2 F	SGP-21F	Soil Gas	Sample Port	12	LFG	5	Quarterly	Monitoring Point
OU2 F	SGP-21F	Soil Gas	Sample Port	22	LFG	5	Quarterly	Monitoring Point
OU2 F	SGP-22F	Soil Gas	Sample Port	12	LFG	5	Q/A - VOC Fixed Lab	Compliance
OU2 F	SGP-22F	Soil Gas	Sample Port	32	LFG	5	Q/A - VOC Fixed Lab	Compliance

Thermal Treatment Unit

Area	TTU Location	Matrix	Type	Depth (feet)	Analytical Group	Sampling SOP Reference	Frequency	Rationale
TTU	Mixed	Soil Gas	Sample Port	NA	LFG	5	A – VOC, Fixed Gases and Sulfur Fixed Lab	Documentation
TTU	Stack Outlet	Soil Gas	Sample Port	NA	LFG	5	A - VOC Fixed Lab	
TTU	Area D Vents	Soil Gas	Sample Port	NA	LFG	5	A - VOC Fixed Lab	
TTU	Area F Extraction Wells	Soil Gas	Sample Port	NA	LFG	5	A - VOC Fixed Lab	
TTU	Area E Header	Soil Gas	Sample Port	NA	LFG	5	A - VOC Fixed Lab	
TTU	Area F Vents	Soil Gas	Sample Port	NA	LFG	5	A - VOC Fixed Lab	

Notes:
[1]SOPs are listed on Worksheet #21.

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.

A = Annually
LFG = landfill gas
OU = operable unit
Q/A = Quarterly/Annually
SGP = soil gas probe
TTU = thermal treatment unit

4.0 SAMPLING REQUIREMENTS

4.1 Sample Containers, Preservation, and Holding Times (QAPP Worksheets #19 & 30)

Laboratory: Eurofins Air Toxics, Inc. (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	Containers (number, size, and type)	Preservation	Analytical Holding Time	Data Package Turnaround
Fixed Gases	Soil Gas	ASTM D1945	NELAP: 10-17-14 DoD ELAP: 07-27-14	Tedlar™ Bag	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	NELAP: 10-17-14	Tedlar™ Bag	None	24 hours	21 days

Notes:
DoD = Department of Defense
ELAP = Environmental Laboratory Accreditation Program
NELAP = National ELAP

4.2 Field Quality Control Summary (QAPP Worksheet #20)

Matrix	Analytical Group	Preparation/ Analysis Reference	Approximate Number of Primary Sampling Locations[1]	No. of Field Duplicates	No. of LCS/LCSDs	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/LCSD = Laboratory control sample/laboratory control sample duplicate
NA = Not applicable

4.3 Field SOPs/Methods (QAPP Worksheet #21)

This worksheet documents specific field procedures and methods that will be implemented for work conducted at the OU2 Landfills. Applicable field SOPs will be readily available to all field personnel responsible for their implementation. The SOPs listed below are included in **Attachment 2.**

SOP Reference No.	Title, Revision, Date	Equipment Type	Modified for Project Work? (Y/N)	Comments
1	Chain-of-Custody Procedures for Environmental Samples, PR-TC-01.04.05.00 v2, 13 August 2013	NA	N	Method and responsibilities associated with the maintenance and custody of samples.
2	Sample Handling, Packaging and Shipping, PR-TC-02.04.01.01 v2 14 June 2013	NA	N	Methods and responsibilities for field personnel to use in the packaging and shipping of environmental samples for chemical and physical analysis
3	Field Documentation, PR-TC-01.04.01.00 v2, 14 May 2013	NA	N	Guidelines and procedures for sample numbering
4	Creating a Sample Identification System, PR-TC-01.04.04.00 In revision*	NA	N	Guidelines and procedures for sample numbering
5	Soil Gas Sampling, PR-TC-02.02.03.02, In revision*	Summa Canister or Tedlar™ Bag	N	Methods for sampling soil gas.

NA = Not applicable
*SOP will be submitted with final version of QAPP.

4.4 Field Equipment Calibration, Maintenance, Testing, and Inspection Table (QAPP Worksheet #22)

Instrument specifications can be found in Table 7-1 of Appendix F, Landfill Gas Sampling and Analysis Plan. (Shaw, 2008)

Field Equipment	Activity	SOP/ Method Reference	Responsible Person	Frequency	Acceptance Criteria	Corrective Action
Gas Analyzer	Calibration	Operations Manual	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	

5.0 ANALYTICAL REQUIREMENTS

5.1 Analytical SOP's (QAPP Worksheet #23)

The SOPs referenced below are the laboratory-specific procedures for the tests for which the laboratory are certified under DoD ELAC and NELAC programs. A copy of both certifications including the specifically referenced method is included in **Attachment 1**.

SOP Reference Number	**Title, Revision Date, and / or Number**	**Definitive or Screening Data**	**Matrix/ Analytical Group**	**Equipment Type**	**Modified for Project Work?** (Y/N)
SOP #6	Analysis of Volatile Organic Compounds in Summa Polished Canisters by Modified EPA Methods TO-14A/TO-15, 04/30/13, Revision 30	Definitive	VOCs	Mass Spectrometer	N
SOP #54	Analysis of Natural Gases by Modified ASTM Method D-1945 12/27/13, Revision 18	Definitive	Fixed Gases	Gas Chromatograph	N
SOP #13	ASTM D5504 – Sulfur Compounds 12/27/13, Revision 17	Definitive	Sulfur Gases	Sulfur Chemiluminescence Detector	N
SOP #24	Storage and Disposal of Hazardous Wastes 10/23/12, Revision 7	Definitive	Sample Handling	NA	N
SOP #50	Sample Receiving/Login Procedures 04/17/2013, Revision 16	Definitive	Sample Handling	NA	N
SOP #63	Internal Sample Tracking, Transmittal and Custody Procedures 10/1/2012, Revision 15	Definitive	Sample Handling	NA	N

5.2 Analytical Instrument Calibration (QAPP Worksheet #24)

Instrument	Calibration Procedure	Calibration Frequency	Acceptance Criteria	Corrective Action (CA)	Person Responsible for CA	Method Reference
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	D1945
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	D1945
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	D1945
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	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	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	D5504

Instrument	Calibration Procedure	Calibration Frequency	Acceptance Criteria	Corrective Action (CA)	Person Responsible for CA	Method Reference
Gas Chromatograph/ Mass Spectrometer (GCMS)	Tuning Criteria	Every 24 hours	TO-15 ion abundance criteria	Correct problem then repeat tune.	Laboratory Analyst/Section Manager	TO-15
GCMS	Minimum 5-Point ICAL	Prior to sample analysis	% RSD ≤ 30 with two compounds allowed out to ≤ 40% RSD	Correct problem then repeat Initial Calibration Curve.	Laboratory Analyst/Section Manager	TO-15
GCMS	ICV	After each initial calibration curve, and daily prior to sample analysis	%D ±30 percent	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	TO-15
GCMS	CCV	Prior to the analysis of samples and blanks, but after tuning criteria have been met	%D ±30 percent	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	TO-15

5.3 Analytical Instrument and Equipment Maintenance, Testing, and Inspection Table (QAPP Worksheet #25)

All 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	Lab SOP Reference[1]
GC/MS	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 (FID)	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 Wipe test annually	Calibration and QC criteria met	Evaluate system	Laboratory Analyst/ Section Manager	13

[1]SOPs are listed on Worksheet #23.

5.4 Sample Handling, Custody, and Disposal (QAPP Worksheets #26 & 27)

Sampling Organization: CB&I
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]
Sample labeling	Gilbane/Field Team Leader	Field SOP #s 3 and 4
Chain-of-custody (COC) form completion		Field SOP #1
Packaging		Field SOP #2
Shipping coordination		Field SOP #2
Sample receipt, inspection, and log-in	Eurofins/Sample Custodian	SOP #50
Sample custody and storage	Eurofins/Sample Custodian	SOP # 63 and SOP #24
Sample disposal	Eurofins/Sample Custodian	SOP #24

[1]Sampling SOPs are listed in Worksheet #21; Laboratory SOPs are listed on Worksheet #23.

5.5 Analytical Quality Control and Corrective Action (QAPP Worksheet #28)

The following tables provide guidance for the evaluation of QC analyses and the implementation of corrective action for out-of-control situations. 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	Person(s) Responsible for Corrective Action	Project Measurement Performance Criteria
Method Blank	1 per extraction batch	Target analytes not detected >½ 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 (and Precision)
Laboratory Duplicate	1 per batch	Analyte-specific RPD acceptance criteria	Evaluate system; reanalyze	Laboratory Analyst/Section Manager	Precision
Relative Retention Time (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

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

QC Sample:	Frequency/ Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Measurement Performance Criteria
Method Blank	1 per extraction batch	Target analytes not detected >½ 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 (and Precision)
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	Person(s) Responsible for Corrective Action	Measurement Performance Criteria
Method Blank	1 per extraction batch	Target analytes not detected >½ 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/LCSD (Lab QC)	1 per batch	Analyte-specific %R acceptance criteria	Evaluate system; reanalyze	Laboratory Analyst/Section Manager	Accuracy/Bias (and Precision)
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 ±30 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

6.0 DATA MANAGEMENT AND DATA REVIEW

6.1 Project Documents and Records (QAPP Worksheet #29)

Sample Collection and Field Records			
Record	Generation	Verification	Storage location/archival
Field notes/logbook	Field Team Lead	Project Manager	Project File
COC forms	Field Team Lead	Project Manager	Project File
Laboratory raw data package	Eurofins Laboratory	Project Chemist	Project File
PDF copy of analytical data	Eurofins Laboratory	Project Chemist	Fort Ord Administrative Records
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 Laboratory	Project Chemist	Project File
Laboratory equipment calibration logs	Eurofins Laboratory	Project Chemist	Project File
Sample preparation logs	Eurofins Laboratory	Project Chemist	Project File
Run logs	Eurofins Laboratory	Project Chemist	Project File
Sample disposal records	Eurofins Laboratory	Project Chemist	Project File
Validated data	Project Chemist	Program Chemist	On-site
Electronic Validated data	Data Validation Subcontractor	Project Chemist	Fort Ord Data Integration System (FODIS), chemistry database
Contractor Quality Assurance Report	Project Chemist	Program Chemist	Project File
Annual Report	Project Manager	USACE Project Manager	Fort Ord Administrative Records

6.2 Assessments and Corrective Action (QAPP Worksheets #31, 32, & 33)

Assessments:

Assessment Type	Responsible Personnel and Organization	Number and Frequency	Assessment Deliverable	Deliverable Due Date
Review of QAPP, SOPs, and Site Safety and Health Plan with Field Staff	Field Team Lead (FTL)	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 basewide and site-specific QAPPs.	FTL	Ongoing during all phases of fieldwork	Daily progress reports	24 hours following conclusion of business day
Logbook and Field Form Review	FTL	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	Prior to sampling mobilization, as new laboratories are contracted	Receipt of copies of certifications. E-mail traffic concerning lab capacity prior to sampling startup. QAPP sign-off sheet received from laboratory.	48 hours following assessment
Tailgate Safety Meeting	HSO	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	Ongoing during all phases of fieldwork	Daily progress reports	24 hours following conclusion of business day

Assessment Type	Responsible Personnel and Organization	Number and Frequency	Assessment Deliverable	Deliverable Due Date
Field Sampling and COC Form Review Against QAPP Requirements	Project Chemist	Daily	Corrections will be made directly to reviewed documents; communication may be in the form of e-mail	24 hours following assessment
Data Validation	DV Chemist	Per Sample Delivery Group (SDG)	Communication may be in the form of e-mail traffic. amendment of the analytical report or CAs due to deficiencies identified in the validation process.	24 hours following assessment
Laboratory Report Deliverables and Analytical Results Against QAPP Requirements	Project Chemist	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 CA	Responsibility for Monitoring CA
Review of QAPP, SOPs, and Site Safety and Health Plan with Field Staff	FTL	Completed acknowledgement signature pages	48 hours following assessment	FTL	FTL
Work performed in accordance with basewide and site-specific QAPPs	PM	Interim CA documented pending final approval	By close of same business day	FTL	PM and QA/QC Manager

Assessment Type	Individual(s) Notified of Findings	Assessment Response Documentation	Time Frame for Response	Responsibility for Implementing CA	Responsibility for Monitoring CA
Logbook and Field Form Review	FTL	Corrections will be made directly to reviewed documents	NA	FTL	FTL
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	Gilbane PM	Corporate H&S Manager
Field Sampling and COC Form Review Against QAPP Requirements	Sample Coordinator	Response to email	48 hours after notification	FTL	FTL
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

6.3 Data Verification and Validation Inputs (QAPP Worksheet #34)

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

6.4 Data Verification Procedures (QAPP Worksheet #35)

Records Reviewed	Requirement Documents	Process Description	Responsible for Validation (Name, Organization)
Methods	QAPP, SOP	Records support implementation of the SOP-sampling and analysis.	Project Chemist
Performance Requirements	QAPP, SOP	Verify laboratory method SOPs are sufficient to satisfy DQOs.	Program Chemist
Sampling Locations, Number of Samples	QAPP, SOP	Verify that sample locations and quantities will be sufficient to satisfy DQOs.	Program Chemist
Daily Quality Control Report (DQCR) and Other Field Documentation	QAPP, SOP	Review daily sampling activity reports including pertinent field sampling data.	Project Chemist
Chain of Custody	QAPP, SOP	Examine traceability of data from sample collection to generation of project reported data.	Project Chemist
Deviations	QAPP, SOP	Determine impacts of any deviations from methods.	Program Chemist
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
Precision	QAPP, SOP	Review data against performance criteria and determine impact of any result out of criteria.	Project Chemist
Accuracy	QAPP, SOP	Review data against performance criteria and determine impact of any result out of criteria.	Project Chemist
QC samples	QAPP, SOP	Ensure that a sufficient number of QC samples are analyzed, as outlined in the QAPP, to meet DQOs.	Project Chemist
Field Change Requests	QAPP, SOP	Review any change request or corrective action documentation. Determine impact to project objectives.	Project/Program Chemist
Electronic Data Deliverables	QAPP	Verify that acceptable Electronic Data Deliverables (EDDs) have been qualified. The Laboratory Data Consultants Automated Data Review (LDC ADR) EDD format files will be submitted to the USACE.	Project Chemist

6.5 Data Validation Procedures (QAPP Worksheet #36)

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

6.6 Data Usability Assessment (QAPP Worksheet #37)

Step 1	**Review the project's objectives and sampling design** 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 (SCs) or advance sites as close to SC as practicable during the Period of Performance in a cost-effective manner. The site-specific QAPPs will indicate the project objects and sampling design. To that end, the usability assessment will incorporate the activities listed below. **Field Certification** Field personnel will generate field forms, maps, and notes describing the daily procedures. The DQCR, generated during sampling, will discuss any successes and/or deviations from the Work Plan. 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 field work variance (FWV). **Data Quality Indicators: Precision, Accuracy, Representativeness, Comparability, Completeness, and Sensitivity (PARCCS)** 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. Laboratory limits used in the sensitivity review consist of the detection limit (DL), 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. **Precision** 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.

The variance between the samples, in terms of RPD, is calculated according to the following equation:

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

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 percent, 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:

$$Percent\ \mathrm{Recovery} = \frac{S-C}{T} \quad x \quad 100$$

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, COC 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 90%.

$$\frac{\text{Number of possible analyte results} - \text{Number of rejected and unreported results}}{\text{Possible number of analyte results}} \times 100$$

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.

Comparability

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.

Sensitivity

The DL, 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.

The DL is the minimum quantity of an analyte that can be distinguished reliably from background noise or from zero for a specific analytical method at a 99 percent confidence level. The DL protects against false positives. The LOD is the minimum quantity of an analyte that can be reliably detected for a specific analytical method at a 99 percent confidence level that the value is not a false negative. The LOD should be equivalent to the

	concentration of the DL verification standard. 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 should be sensitive enough to meet the project decision limits (e.g., cleanup goals). 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 contaminants of concern 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 DL 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 DL 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 Chemical Data Final Report (CDFR). Worksheet #15 presents the laboratory LODs and LOQs for the selected analytical method(s) used to support the project decision limits. The laboratory DLs are presented in Attachment 1.
Step 2	**Review the data verification and data validation outputs** The outputs from the verification and validation process will be used to determine data usability. QA reports, including the data validation reports and DQCRs, 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.
Step 3	**Implement the statistical method** 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 the most recent version of the Department of Defense (DoD) Quality Systems Manual (QSM), as available. For methods where the limits are not available, the project criteria will default to the laboratory criteria based on the laboratory's tracked trending. 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 CDFR. 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.
Step 4	**Document data usability and draw conclusions** 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 report and the CDFR. 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.

7.0 REFERENCES

EPA, 2006. *Guidance on Systematic Planning Using the Data Quality Objectives Process*, EPA QA/G-4. February.

EPA, 2009. *Guidance for Labeling Externally Validated Laboratory Analytical Data for Superfund Use*. EPA 540-R-08-005. January.

EPA, 2012. *Guidance on Quality Assurance Project Plans*, EPA CIO 2106-G-05 QAPP, Final Draft. January.

Intergovernmental Data Quality Task Force (IDQTF), 2012. *Uniform Federal Policy for Quality Assurance Project Plans*, Part 2a (Revised): Optimized UFP-QAPP Worksheets. March.

Shaw Environmental, Inc. (Shaw), 2005a. *Draft Final Remedial Action Construction Completion Report, Operable Unit 2 Landfills, Areas A through F, Former Fort Ord, California.* (AR No. OU2-630B)

Shaw, 2005b. *Draft Final Evaluation Report, Landfill Gas Pilot Test, Operable Unit 2 Landfills, Former Fort Ord, California.* (AR No. OU2-627A)

Shaw, 2005c. *Draft Final Report, 2003 Ambient Air Monitoring and Human Health Risk Assessment, Operable Unit 2 Landfills, Former Fort Ord, California, Revision 0.* (AR No. OU2-647E)

Shaw, 2008a. *Operation and Maintenance Plan, Operable Unit 2 Landfills, Former Fort Ord, California*. Revision 2. September. (AR No. OU2-593F)

Shaw, 2008b. *Final Construction Completion Report, Landfill Gas System Expansion, Operable Unit 2 Landfills, Former Fort Ord, California,* Revision 0. (AR No. OU2-662F)

Shaw, 2010. *Chemical Data Quality Management Plan, Former Fort Ord, California*. Revision 1. July.

Shaw, 2011. *Annual Report, 2010 Operations and Maintenance, Operable Unit 2 Landfills, Former Fort Ord, California*. Revision 0. July.

Shaw, 2012. *Annual Report, 2011 Operations and Maintenance, Operable Unit 2 Landfills, Former Fort Ord, California*. Revision 0. September.

United States Department of the Army (Army), 1994. *Record of Decision, Operable Unit 2, Fort Ord Landfills, Fort Ord, California.* July. (AR No. OU2-480)

Army, 1995. *Explanation of Significant Differences (ESD), Operable Unit 2, Fort Ord Landfills, Fort Ord, California.* (AR No. OU2-406).

Army 1997a**.** *Explanation of Significant Differences Consolidation of Remediation Waste in a Corrective Action Management Unit (CAMU), Operable Unit 2 Landfill.* January.

Army, 1997b. *Record of Decision, Basewide Remedial Investigation Sites, Fort Ord, California.* (AR No. RI-025)

Army, 2003. *Explanation of Significant Differences (ESD), Excavation and Segregation of Spent Ammunition from Soil, Site 39, Former Fort Ord, California*.

Army, 2006. *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), Operable Unit 2, Fort Ord Landfills, Former Fort Ord, California.* August. (AR No. OU2-656)

Army, 2009. *Record of Decision Amendment, Site 39 Inland Ranges, Former Fort Ord, California.* (AR No. RI-041E)

US Army Corps of Engineers, 2005. *Guidance for Evaluating Performance-Based Chemical Data.* EM-200-1-10. June.

FIGURES

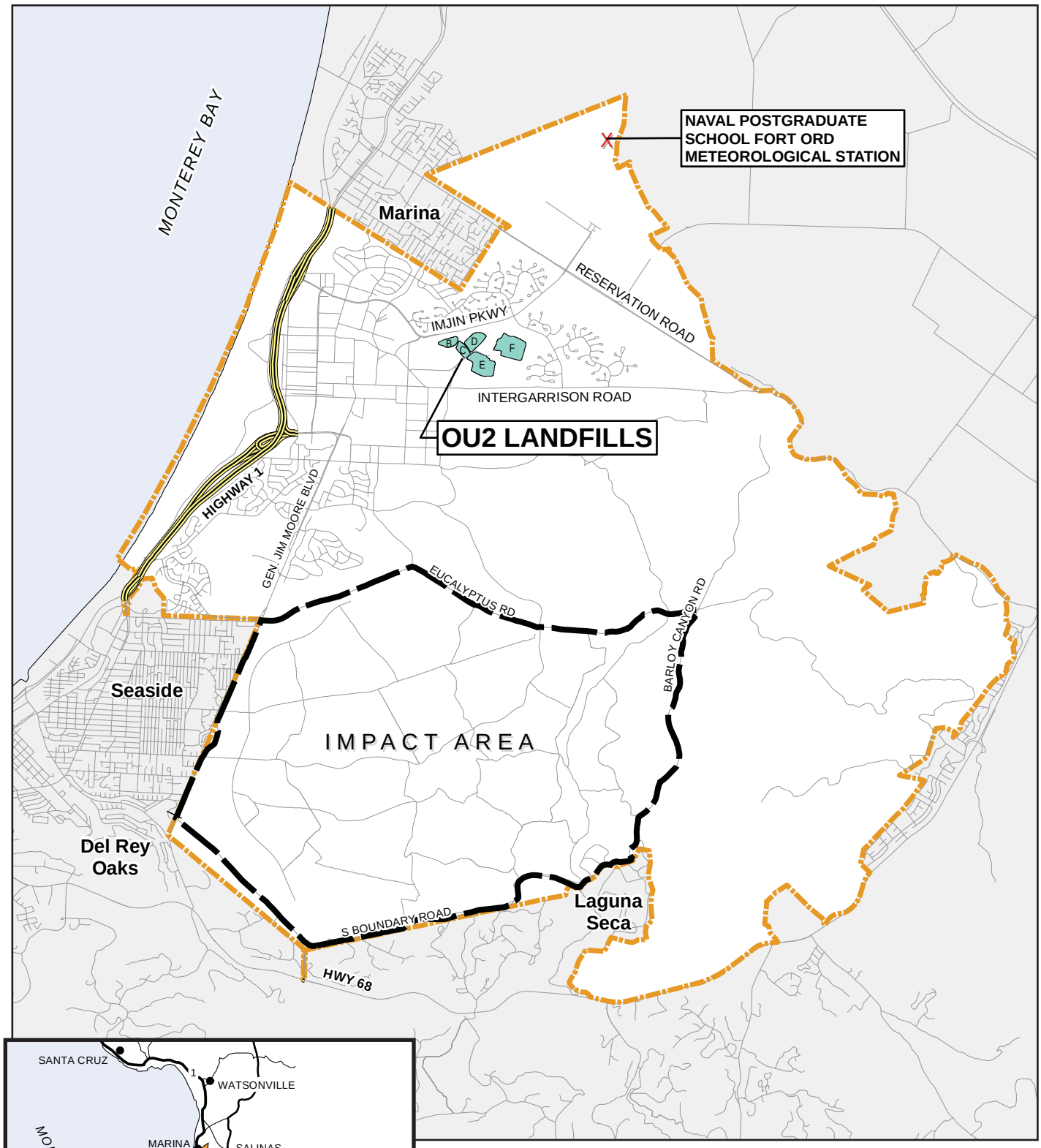
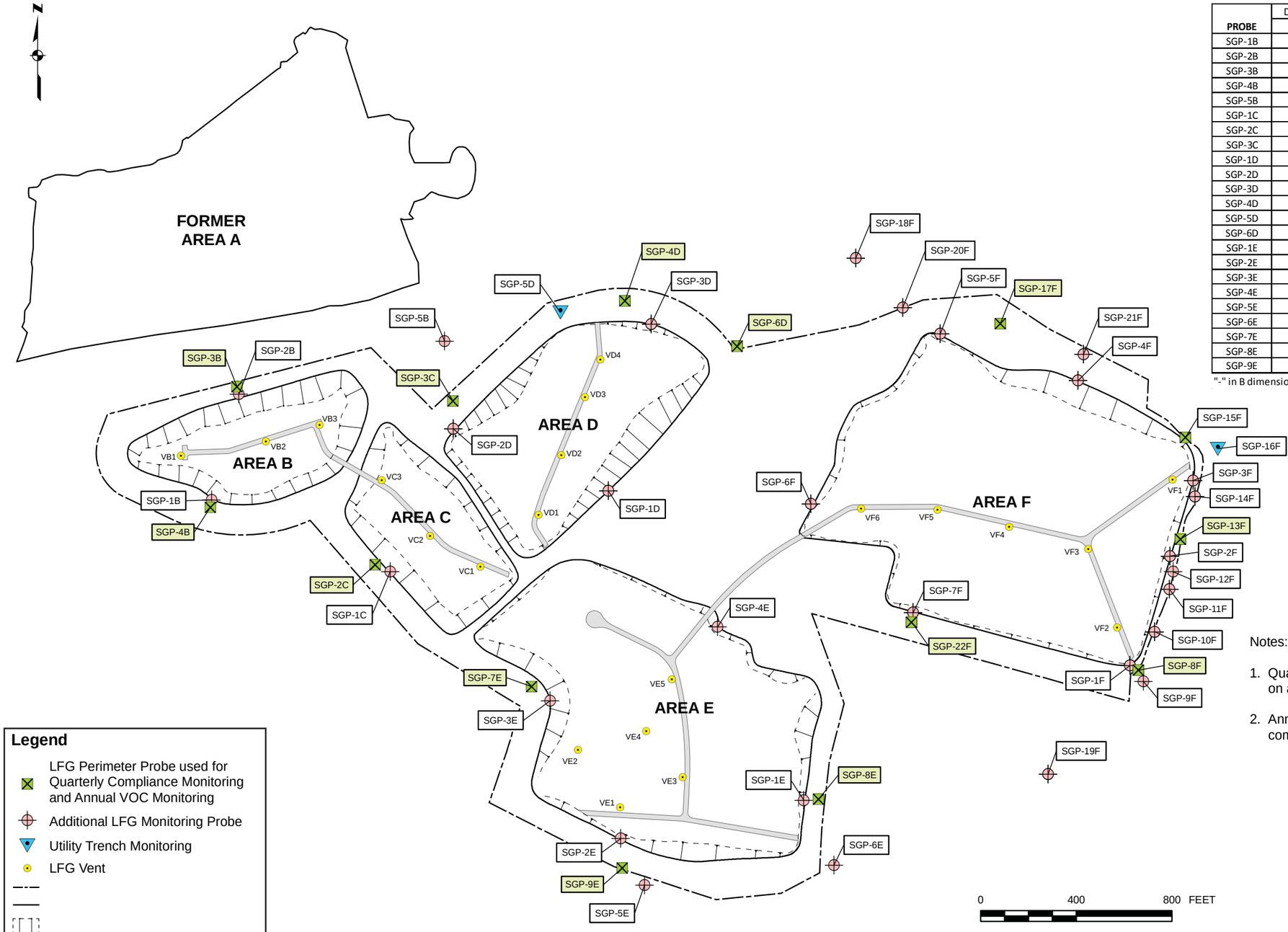


Image courtesy of 2011 Shaw Environmental, Inc. 2011 Annual Operations and Maintenance, Operable Unit 2 Landfills, Former Fort Ord, California.

Gilbane

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	DEPTH (ft bgs) A	DEPTH (ft bgs) B	PROBE	DEPTH (ft bgs) A	DEPTH (ft bgs) 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

Notes:

1. Quarterly methane monitoring conducted on all probes.
2. Annual VOC monitoring conducted on compliance probes.

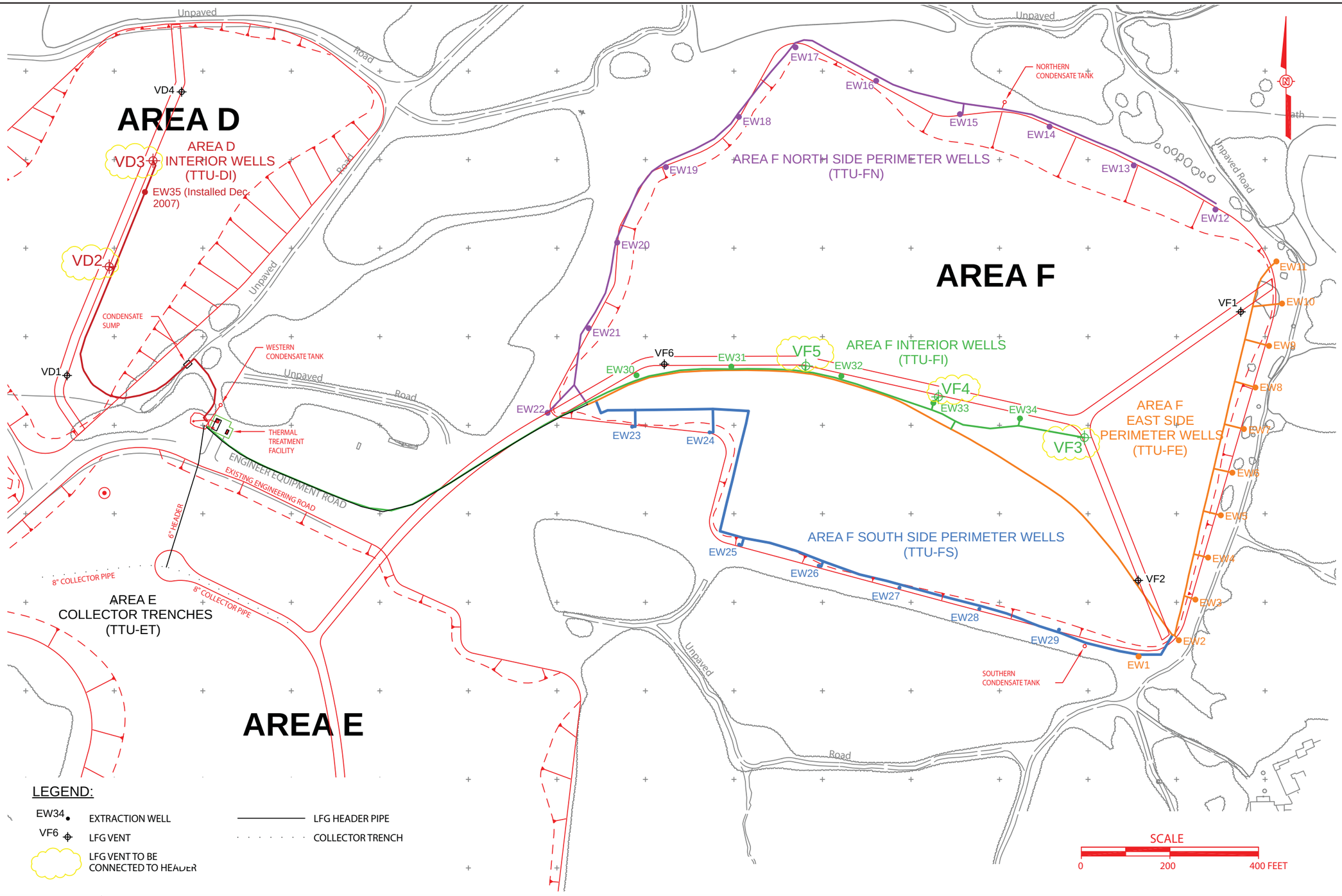
Image courtesy of 2011 Shaw Environmental, Inc. 2011 Annual Operations and Maintenance, Operable Unit 2 Landfills, Former Fort Ord, California. Vent locations updated August 2013.

Gilbane

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

Figure 2
Perimeter Probe Monitoring Locations

Prepared June 2014



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

Figure 3
TTU Extraction Well Locations

Prepared June 2014

ATTACHMENT 1
LABORATORY INFORMATION

LABORATORY QUALITY ASSURANCE MANUAL

(LQAM)

Rev. 26

March 5, 2014

Quality Assurance Manager: Bahar Amiri

The Laboratory Quality Assurance Manual is effective as of the date of the signature of the Quality Assurance Manager

EUROFINS AIR TOXICS, INC.
180 BLUE RAVINE ROAD, SUITE B
FOLSOM, CA 95630
(800) 985-5955
atl@eurofinsus.com

LABORATORY QUALITY ASSURANCE MANUAL

Approvals

Robert Mitzel, President — Date: 3/5/14

Heidi Hayes, Technical Director — Date: 3-5-14

Sepideh Saeed, Laboratory Director — Date: 3-5-14

Bahar Amiri, Quality Assurance Manager — Date: 3-5-14

REVISION LOG

Revision: 23	**Effective Date: 10-05-2012**	
Section	**Justification**	**Changes**
Entire Document	Initial Version	
Revision: 24	**Effective Date: 11-28-2012**	
Section	**Justification**	**Changes**
Cover page; Appendices Table of Contents; Section 1.3; Section 2.1; Section 2.6.2; table added to Section 6.3; Appendices numbering arrangement	NELAP Concordance, Quality Systems Internal Audit, and minor transcription errors	Added address, phone number to cover page, and appendices to Table of Contents. Statements added to the sections cited to be in compliance with NELAP requirements.
Revision: 25	**Effective Date: 02-22-2013**	
Section	**Justification**	**Changes**
Section 1.1; Section 2.1 Organizational Chart; Section 2.6 Qualifications and Responsibilities; Section 5.5 Sample Return/Disposal; Section 6.3 Equipment and Instrumentation; Section 8.1 Scope of Testing; Appendices A,D, and F	ISO 17025 Concordance and product testing methods – Chambers addition.	Updates made throughout document regarding product testing and Chambers information. Specified sections include the required information.
Revision: 26	**Effective Date: 03-05-2014**	
Section	**Justification**	**Changes**
Cover page; Appendices including Method Manuals, Organizational Chart, terms and definitions, and references.	Appendices were updated to correspond to the most current SOPs, methods, DoD, and TNI definitions.	General formatting and spelling errors corrected throughout the entire document.

TABLE OF CONTENTS

10. ASSURING QUALITY OF TEST RESULTS

11. AUDITS AND INSPECTIONS

12. CORRECTIVE AND PREVENTIVE ACTION

13. SERVICE TO CLIENTS

APPENDICES

1. INTRODUCTION

The purpose of the Laboratory Quality Assurance Manual is to provide a framework to outline the quality systems at Eurofins Air Toxics, Inc.

1.1 Our Unique Promise of Value

Eurofins Air Toxics is the global leader in the The NELAC Institute (TNI) National Environmental Laboratory Accreditation Program (NELAP) for accredited vapor-phase environmental analytical laboratory services, and is also ISO/IEC 17025:2005 accredited for environmental chamber chemical emissions testing and associated analytical laboratory services.

Eurofins Air Toxics supports public and private sectors, including engineering and consulting firms, manufacturers, industry, government, retailers and others by offering a wide variety of certified air methods as well as emissions testing of consumer and building products and materials. Eurofins Air Toxics provides unmatched quality, capacity, and technical expertise to deliver an outstanding service experience to clients worldwide.

1.2 Mission Statement

Eurofins Air Toxics, Inc. is an analytical and environmental laboratory specializing in the analysis of vapor-phase contaminants and air quality parameters. Our business is guided by four key principles:

1) Providing unmatched data integrity
2) Establishing long-term relationships
3) Delivering quality client service
4) Exceeding client expectations

1.3 Quality Policy

The Executive Management Group recognizes quality as a key element of the laboratory's standard of service. This group supports the laboratory's commitment to quality as defined by NELAP and ISO 17025.

The Quality Policy Statement gives employees clear requirements for producing analytical data that is scientifically valid, legally defensible, accurate, impartial, and of known and documented quality, through strict adherence to the Quality Policy Statement. The Quality Assurance Officer wrote the Quality Policy Statement with final approval from the Technical Director. The policy cannot be

revised without the Technical Director and Quality Assurance Officer's approvals. Employees are trained on the components of the Quality Policy Statement during their orientation. All employees sign the statement as agreement to implement the policy in all aspects of their work. The statement is as follows:

We strive to provide the highest quality data achievable by:

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

We each take personal responsibility to provide this quality product while meeting the company's high standards of integrity and ethics, understanding that improprieties, such as failure to conduct the required test, manipulation of test

procedures or data, or inaccurate documentation, will not be tolerated. Intentional misrepresentation of activities performed is considered fraud and is grounds for termination.

1.4 Statement of Values

At Eurofins Air Toxics, we strive to be the BEST in everything that we do. Our very existence is based on our continued ability to provide innovative, dependable, and cost-effective environmental services to our clients. We CARE about our clients as well as our co-workers and manage our daily activities to build relationships based on mutual TRUST, HONESTY, and RESPECT. We are LEADERS in our field and accept the risks associated with building new frontiers in our professional lives. Our strength comes from our TEAMS for through them we can achieve our goals.

1.5 Certifications, Accreditations, and Registration

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

Appendix C lists accreditations held by Eurofins Air Toxics, Inc. in support of environmental and product testing work. Current copies of all scopes of accreditation are kept on file in the Quality Assurance Department.

2. ORGANIZATION AND PERSONNEL

2.1 Organizational Structure

Eurofins Air Toxics' management organization includes six core areas: Operations, Information Technology (IT), Client Services, Research, Sales and Marketing, and Finance and Administration. The management staff includes executives, directors, managers, and group leaders. Each operating area is lead by a manager and/or a group leader. In the absence of a member of the laboratory and operational management team, deputies are appointed as follows:

Position	Deputy
President	Technical Director or appointee
Technical Director	Quality Assurance Manager or appointee
Quality Assurance Manager	Technical Director or appointee
Laboratory Director	Technical Director or appointee
Vice President of VOC Materials Testing	Technical Director or appointee
Managers/Group Leaders	Laboratory Director

Eurofins Air Toxics' senior executives and managers are committed to following and assuring compliance with the TNI Standard as defined in this Laboratory Quality Assurance Manual (LQAM). Each manager is responsible for implementing and maintaining systems as they affect their teams and for participating in their respective role in the management systems as outlined in the LQAM.

An Organizational Chart is presented in Appendix D of this manual. This organizational structure is created in a way to avoid any potential for conflicts of interest or undue pressure that might influence the technical judgment of analytical personnel.

2.2 Management Responsibilities

Management and/or supervisor is defined as group leaders, managers, and directors, and positions above those. The following is a list of management responsibilities:

- Personnel hiring and training
- Supervision of personnel
- Ensuring quality of data produced
- Resources allocation
- Directing daily work operations, including scheduling of work
- Maintaining awareness of technical development and regulatory requirements
- Assessing laboratory capacity and workload
- Contributing to the continuous improvement of the laboratory operation
- Providing resources to ensure a safe work environment

- Providing resources to ensure a work environment free of undue pressures
- Communicating problems and concerns to senior and executive management to enlist a higher level of support for corrections and continuous improvement, ensuring compliance with the requirements of NELAP and ISO 17025
- Ensuring that corrective actions are carried out in an appropriate and agreed upon time frame

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

2.3 Overview of the Quality Assurance Program

The Quality Assurance (QA) Department is responsible for developing planned activities the purpose of which is to provide assurance to all levels of management that a quality program is in place within the laboratory, and that it is functioning in an effective manner that is consistent with the requirements of NELAP and ISO 17025. Although Eurofins Air Toxics is a wholly owned subsidiary of Eurofins Scientific, the Quality Assurance and quality systems described in this manual are specific to Eurofins Air Toxics.

2.3.1 Quality Assurance Manager

The Quality Assurance Manager ensures that the quality system is followed at all times. The QA Manager reports directly to the Technical Director in order to maintain independence from business operating units and facilitate communications regarding quality-related issues. The QA Manager has no direct supervisory responsibility for the generation of technical data to avoid any conflict of interest in administrating the QA program. The QA Manager has the final authority to stop work that compromises the laboratory's integrity or data quality. The situation must be investigated and appropriate corrective action must be put in place before the QA Manager will authorize the resumption of work. The specific duties of the QA Manager are communicated in job description format.

2.4 Quality Assurance Responsibilities

The Quality Assurance team is responsible for implementing and maintaining Quality Assurance procedures throughout the laboratory. This is accomplished

via coordination and dissemination of internal and external assessment information, review of Standard Operating Procedures (SOPs) to document variances taken to published methods, monitoring of the Quality Assurance Manual to ensure consistency with actual practices, maintenance of an ongoing Corrective Action Program with quarterly reports to the senior management team, a leadership role in employee training, data review, and other quality control-related programs.

The QA team is free from any commercial, financial, or production pressures when making assessments or decisions regarding the quality of work produced or effectiveness of the quality systems.

2.5 Communication of Quality Issues to Management

Communication between the Quality Assurance (QA) team and other management teams occurs on a regular basis (typically via bi-weekly status meetings). Information regarding outstanding corrective action items, upcoming assessments, assessment results, and/or general observations are discussed and documented via a database of agenda notes. The QA databases along with the Laboratory Information Management System (LIMS) database are used to compile a Quarterly Quality Assurance Status Report, which is distributed to the senior management team for review.

2.6 Personnel Qualifications and Responsibilities

Full resumes and specific position descriptions for all personnel are located in Human Resources (HR) Department files. In addition, department managers have copies of position descriptions for their staff.

2.6.1 Executive Team

President: Provides leadership that ensures the founding mission and core values of the company are put into practice. The President leads programs relating to the development of long-range strategy, quality systems, financial infrastructure and sales. The President also provides day-to-day leadership and management of programs for overseeing the processes and resources necessary for establishing long-range service objectives, plans, and policies in cooperation with the Board of Directors. The President is responsible for the measurement and effectiveness of both internal and external processes by providing accurate and timely feedback on the operating condition of the company. In addition, the President directs the definition and operation of the laboratory production

by fostering a success-oriented and accountable environment within the company.

Technical Director: Provides oversight for the quality systems and technical performance of the laboratory, and manages technical support, the project management team, and the QA Manager. The Technical Director is responsible for developing products and solutions to meet client and industry needs, and also oversees the validation process of current and new products to ensure quality objectives are met and documented as defined.

Laboratory Director: Responsible for managing the operations of the laboratory, profit/loss relating to operations, laboratory efficiency improvement in software and instrument automation, and serves as the primary interface between finance, HR, IT, and sales/marketing. The Laboratory Director has the overall responsibility of ensuring customer satisfaction goals are met while elevating the skill and training of key technical staff as well as assuring that state-of-the-art instrumentation and capital assets are in place to meet global customer needs.

Vice President of VOC Materials Testing: Responsible for the promotion and demonstration of expertise in chamber testing, product emissions, and indoor air quality (IAQ), providing scientific leadership in these areas. Represents Eurofins Air Toxics on technical committees and at technical conferences and trade shows as they relate to the promotion and demonstration of expertise in chamber emissions testing and IAQ. Has the overall responsibility for establishing and maintaining a strategy and business plan for the emissions and product testing markets in the U.S.

2.6.2 Management Team:

Laboratory management and personnel are free from any commercial, financial, or production pressures when making technical judgments or decisions regarding the quality of work produced.

Information Technology Manager: Oversees all aspects of software engineering and development, database administration, and network administration. The IT manager is instrumental in designing and implementing model work-flow processes, defining user requirements, and proposing software design and implementation to satisfy long-term company business goals. This role provides established policies and

procedures to ensure continuous database and server environment integrity and reliability.

Quality Assurance Manager: Responsible for overseeing the quality systems in the laboratory. Key to the Quality Assurance role is a focus on continuous improvement through effective monitoring of systems and evaluation of non-compliance and corrective actions. To support the quality systems, the Quality Assurance Manager leads the internal and external audit programs, negotiates audit resolution, and oversees the effectiveness of the Corrective Action Report (CAR) program. The QA Manager is tasked with providing timely feedback to front-line managers and bench staff regarding quality programs and also a big-picture assessment to senior management. Additionally, the QA Manager ensures required documentation and certifications are current and accurate, including regulatory accreditations, the LQAM, and SOPs.

Managers/Group Leaders: Responsible for day-to-day operations of the laboratory or specific departments. The Group Leaders oversee technical operations, sample analysis, data entry, report generation, provision of resources, and other related areas. In addition, they are responsible for employee management and review. Group Leaders report directly to the Laboratory Director. Managerial decisions are made by the Laboratory Director in their absence.

2.6.3 Laboratory Staff and Responsibilities

It is the primary responsibility of laboratory staff to produce quality data within the framework of each individual method and within the parameters of the laboratory's quality control guidelines. It is also the responsibility of staff to identify existing problems or inefficiencies, and to improve the processes of the laboratory whenever possible. Duties for these personnel typically include:

- Sample preparations
- Performance of analytical tests
- Calibrations, operation, and maintenance of instruments
- Standard and reagent preparation
- Sample storage
- Data entry
- Data package preparation

2.7 Training

The experience and training received by personnel is of great importance to Eurofins Air Toxics' clients and regulatory agencies. Accurate training documentation is the responsibility of both employees and their supervisors. On a routine basis, the supervisor reviews and signs training documentation to verify that it is complete and current.

Each laboratory analyst being trained to perform a new analysis is required to perform an initial Demonstration of Capability (DOC) and meet the requirements for accuracy and precision before working independently on the test methods. Typically this is accomplished by the successful analysis of at least four aliquots of a laboratory quality control sample. However, there are certain tests that are not required by the mandated test method or regulation to perform the above procedure (e.g., PM10). In this case, the analyst's proficiency demonstration is satisfied by documentation of having read, understood, and agreed to follow the SOP, specific department or method forms and procedures, and observation by scientist or senior analyst.

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

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

2.7.1 New Hire Training

New employees learn about personnel and safety policies as well as business strategies through a formal process administered by our Human Resources Department and the Safety Committee. All new employees are also required to attend the Quality Assurance Orientation course. Completion of this course is documented in the employee's Training Record. The course outline includes:

- Introduction to QA
- Definitions of SOPs and LQAM
- How to use CARS
- Logbook protocol
- Chain-of-custody procedures

- Training Documentation
- Overview of Eurofins Air Toxics classes including Ethics and Integrity courses
- Overall Training Record organization and upkeep

New employee training continues with review and signing of the Eurofins Air Toxics Ethics Policy (Form F1.56), a review of the Quality Assurance Manual, and signing of the Quality Policy. Upon completion of those, employees move on to analytical method training if required for their position. Other non-testing training materials may be required by the departments.

In general, the laboratory staff reviews the department's SOPs and/or the regulatory method as well as the instrument manual. The employee will then observe while an experienced analyst prepares samples and operates the instrument. Training includes sample handling and preparation, documentation protocols, calibration procedures, QC requirements, data management, data reporting and troubleshooting.

2.7.2 Ongoing Training

After successful completion of the initial Demonstration of Capability, all laboratory staff must demonstrate continued proficiency. Whenever there is a change in test method, instrument method type, and/or personnel a new DOC must be performed. At least once per year, each analyst must demonstrate continued proficiency on assigned technical methods. The QA Department notifies personnel via e-mail whenever a new SOP is generated or a current SOP is updated. Employees responsible for that method or procedure must read the new or updated SOP within 30 days and document the review in the LIMS SOP Tracker module. In addition, the Laboratory Quality Assurance Manual and the Chemical Hygiene Plan must be annually reviewed by all employees.

Employees are re-trained if an issue or investigation warrants that it is a necessary corrective action. Management provides direction as to when employee re-training is required, and to the extent of the re-training.

2.8 Employee Safety

Laboratory staff may, on occasion, be exposed to handling of solvents, compressed gases, calibration standards, or other hazards. Eurofins Air Toxics designates an assigned Safety Officer and several staff members who comprise

the Safety Committee. Some members are 40-hour OSHA-trained and respirator-fitted.

Employee education in the safe handling and disposal of these materials is accomplished as follows:

- Each new employee is given a safety tour of the facility within the first two days of employment. Documentation of this orientation appears in the employee's Training Record.
- The Safety Committee meets frequently to discuss safety concerns and ways of improving safety in the work place.
- The Safety Committee schedules ongoing safety training throughout the year.
- If special precautions must be taken to perform a method, a safety section is included in the method SOP or in a stand-alone SOP which discusses protocols and other measures for risk reduction through exposure prevention.
- Safety Data Sheets (SDSs), formerly Material Safety Data Sheets (MSDS), are maintained for each chemical used on-site. The SDSs are accessible to personnel in the library area immediately outside the standards room and/or electronically through the chemical inventory database (CISpro) at all times. SDSs are also accessible on the Internet from product vendors.
- The Safety Committee members are assigned to duties that include hazardous waste disposal, incident or spill management, scheduling staff training, safety site assessments, Chemical Hygiene Plan review, and the overall leadership of the Safety Program.

2.9 Client Services/Project Management Responsibilities

The Project Management group is responsible for organizing and managing client projects. Clients are assigned a Project Manager who serves as their primary contact. It is the Project Manager's responsibility to act as client advocate by communicating client requirements to laboratory personnel and ensuring that clients provide complete information needed by the laboratory to meet those requirements. All client verbal and electronic communications are documented by the project managers in the LIMS Contacts module. In addition to information management, project management responsibilities include:

- Coordinating and preparing proposals in conjunction with technical staff, including review of project-specific documents and negotiations of variance requests

- Documentation of project requirements
- Coordinating and communicating turnaround-time (TAT) requirements
- Scheduling sample submissions, sample containers, and sample pickup via Eurofins Air Toxics courier service
- Informing clients of deviation from their contract

2.10 Confidentiality

Strict confidentiality is maintained in all of Eurofins Air Toxics dealings with clients. All employees are required to protect company data, including client names and/or test results from disclosure to any third party. This policy is presented to employees in SOP #99 and during their orientation period.

Clients are promptly notified if their data is subpoenaed or requested by a regulatory or legal body.

In order to ensure the confidentiality of our systems and procedures within the laboratory, it is Eurofins Air Toxics' policy to restrict the distribution of our internal procedures to clients. Clients are, however, permitted to review the laboratory's procedures while on-site as part of an audit or visit. Based on this policy, the laboratory requests that any document viewed is not shared or made available to any third parties without the permission of Eurofins Air Toxics.

2.11 Operational Integrity

All employees sign an Employee Ethics Statement on their first day of employment. Employees responsible for generating, handling, or reviewing laboratory data understand that Eurofins Air Toxics' mission is to perform all work with the highest level of integrity. Shortcuts or generating results to suit a client's purpose, rather than adhering to good scientific practices, is not considered acceptable under any circumstances. Any violation of the laboratory ethics policy results in a detailed investigation that could lead to termination. Examples of violations of data integrity are listed below:

- Knowingly recording inaccurate data
- Fabrication of data without performing the work needed to generate the information; this includes creating any type of fictitious data or documentation
- Time travel or adjusting clocks on computerized systems to make it appear that data was acquired at some time other than the actual time

- Manipulation of data for the express purpose of passing systems suitability or quality control criteria
- Selective use of data generated, or not using data that was legitimately generated to impact the outcome of a test
- Executing significant deviations from approved test methods and procedures without prior approval from Eurofins Air Toxics management and/or the client

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

- Clearly document the situation and maintain all data generated. There is a big difference between poor judgment and fraud. Fraud usually involves intent to conceal an action taken. Therefore, the more documentation that is maintained the less likely an action is considered fraudulent if further scrutinized. All documentation of the inquiry and subsequent disciplinary actions will be maintained by both the Technical Director and the Human Resources Department for at least five years.
- When out-of-specification results or quality control-type issues are detected, all supporting data and relative background information must be documented and presented for management review. Problem resolution and client contact, as applicable, must also be documented.
- Any questionable situations and decisions must be reviewed with a supervisor.
- Questionable or uncomfortable issues are brought directly to QA Manager or a member of the QA Department as part the QA “open door” policy. If an employee desires to remain anonymous, he or she is encouraged to report to the designated laboratory staff ombudsman. The designated ombudsman will meet separately with management and the employee involved, ensuring anonymity.

3. BUILDINGS AND FACILITIES

3.1 Facility

The Eurofins Air Toxics laboratory occupies approximately 35,000 square feet of space in Folsom, California, including 7,000 square feet of office space. The single-story building is custom-designed to suit the specifications of an air laboratory. Design criteria included floor plans to accommodate segregation of conflicting tests and provide an environment that is conducive for cross-functional work teams. The main instrumentation laboratory is based on an “open” concept

in which walls were removed to promote a sense of community and teamwork. Wide hallways with alcoves were designed to encourage congregation and discussion. The number of private offices was minimized so that barriers between management and staff are absent. Elements of the quality system are evident throughout the facility design. The facility's map is provided in Appendix F.

3.2 Security

Security at Eurofins Air Toxics is maintained through a controlled access system. Representatives of State, Federal, and private entities have access to the laboratory facility and records during normal business hours. Guests and employees must enter/exit through Sample Receiving or the reception area. All visitors must sign in and out upon arrival and departure. After work hours, the building is secured and linked to a commercial security agency. The security system is equipped with perimeter alarms, motion sensors, and speakers that monitor background sounds. Heat-activated fire alarms are monitored by an outside agency. A fire alarm also activates the security system. Security and controlled access protocols are described in SOP #30.

4. DOCUMENT CONTROL

4.1 Controlled Documents at Eurofins Air Toxics

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

4.1.1 Quality Policy Manual and Company Policies

Eurofins Air Toxics' Quality policies and Quality Systems must comply with all State and Federal requirements for those programs for which the laboratory maintains accreditation.

All Eurofins Air Toxics employees are required to read the Quality Assurance Manual within 30 days of release of the latest version and maintain current documentation in their Training Record binders. The Quality Assurance Manual is available to all employees electronically on a shared server located at O:\QA\LQAM. A hard copy is also available in the QA department.

4.1.2 Laboratory Standard Operating Procedures (SOPs)

The SOPs at Eurofins Air Toxics detail the work processes used on a regular basis that are to be conducted and followed within the organization. They document the way activities are to be performed to facilitate consistent conformance to technical and quality system requirements and to support data quality. These SOPs can be administrative or technical. All employees should maintain a record of review of the most current SOPs.

4.1.3 Work Instructions (at the department level)

The intent of these procedures or documents is to define in greater detail the specific "how to". The level of detail in these documents must be sufficient so any appropriately trained person can perform the task accurately.

4.1.4 Logbooks, Forms, and Instructions

The intent of these documents is to provide documented evidence to support Eurofins Air Toxics quality systems and operations. They are used as part of regular laboratory operations to record necessary information.

4.2 Document Approval, Issue, Control, and Maintenance

The Quality Assurance Department is responsible for the approval, issue, control, and maintenance of all documents that are part of the laboratory's quality systems including, but not limited to, the Quality Assurance Manual (LQAM), Standard Operating Procedures (SOPs), Logbooks, Forms and Instructions, Certificates of Analysis (C of As), and calibration and training documents.

All documents issued to personnel in the laboratory as part of the quality system shall be reviewed and approved for use by Technical Director, Laboratory Director, and Quality Assurance Manager prior to use.

The LQAM and SOPs are reviewed to ensure they remain accurate and current. The frequency of review is either annual at the least or as needed, depending on the procedure. Upon generation of new or updated documents, all copies of obsolete documents are removed from the laboratory and its computer network, then archived or destroyed as appropriate. Pertinent staff members are notified of the updates. A new revision number is assigned to the LQAM or SOP at every review.

All technical changes must have the approval of the Technical Director, the Laboratory Director or Vice President of VOC Materials Testing, and the Quality Assurance Manager.

Detailed instructions regarding document control and how to write SOPs are available in SOPs #46 and #119.

4.3 Laboratory Logbooks and Forms

Procedures are in place to ensure that all data is traceable, authentic, complete, and retrievable. Logbooks, forms, and instructions are created and distributed by the Quality Assurance Department as needed. Used logbooks are returned to QA for archival. The QA Department maintains a master index to uniquely number and identify each logbook and form distributed. Logbooks can contain blank or preformatted pages. They are bound and uniquely identified, and have sequentially pre-numbered pages.

4.4 Archival and Storage of Documents

The majority of documents at Eurofins Air Toxics are stored electronically. Documents which remain in hard-copy format include chain-of-custody forms (COCs), Data Review Checklists, scanned packets (run logs, spectral defenses, manual integrations, etc.), FedEx/UPS air and freight bills, and most logbooks. All other hard-copy documentation is stored in its specific workorder folder. The hard-copy workorder folder is placed in a bar-coded storage box for long-term storage. Bar codes are maintained in an inventory log. An off-site company archives the boxes using the bar-coding system. The storage company provides one-day retrieval service upon request.

Used logbooks are returned to Quality Assurance for archival and remain in the QA Department for no less than five years.

5. SAMPLE HANDLING

5.1 Sample Collection

It is the responsibility of the client to submit representative and/or homogeneous and properly preserved samples of the system from which they are collected. In all cases, field sampling personnel are ultimately responsible for having expertise and knowledge in air sampling methodology or product/materials collection protocols sufficient to ensure that the defensibility of the data will not be compromised due to deficiencies in the field sampling, handling, or transportation. General information regarding the proper use of sampling media

provided by Eurofins Air Toxics is available as a resource for field personnel. The laboratory provides sample containers, chain-of-custody forms, sampling labels, chemical ice packs (if appropriate), shipping containers, custody seals (per client request), and a copy of the Sample Acceptance Policy.

Air sampling media provided by a qualified vendor or prepared by the laboratory for field use is certified for cleanliness. The laboratory's media cleaning process is typically verified using batch certification protocols. Individually certified canisters are also available per specific client request.

5.2 Sample Receipt and Entry

5.2.1 Sample Receipt

Samples can be received at the laboratory during normal laboratory operating hours. Receipt occurs in one of three ways:

- Commercial courier
- Eurofins Air Toxics courier service
- Personal delivery

Upon arrival at the laboratory, samples are received and inspected following Eurofins Air Toxics' Sample Acceptance Policy as outlined in SOP #50. This SOP establishes specific guidelines for sample acceptance, which are generally accepted practices under U.S. Environmental Protection Agency (USEPA), Department of Defense (DoD), ISO, and NELAP protocols.

5.2.2 Sample Entry

As soon as is practical after sample receipt, the samples are entered into LIMS. Samples awaiting log-in are stored in temporary holding areas, at appropriate storage conditions to maintain sample integrity.

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

A sample acknowledgment in the form of a Sample Receipt Confirmation prints from LIMS for each sample delivery group (SDG), which is the same number as the workorder. This notification is sent to the client to confirm sample receipt and entry.

5.2.3 Sample Rejection Policy

Any time a sample is received in a condition that does not meet the method requirements, if there is doubt about the suitability of items received, if items do not conform to the description provided, or the testing required is not clear or specified, the condition of the sample is clearly documented on a Sample Discrepancy Report (SDR). The SDR is delivered to the Project Manager for review and communicated to the client as needed. Directions on next steps, which may include canceling the sample or proceeding with qualifiers and/or narrative, are documented on the SDR. Details are outlined in SOP#50.

5.3 Sample Identification and Tracking

A sample label is generated for each sample, and in addition to the assigned Eurofins Air Toxics' sample number the following information is printed on the label: workorder number, laboratory sample ID, and, if needed, a sample release date. For canister analysis, the label is not affixed directly to the canister but attached with a tag.

To ensure traceability of results, the unique sample number assigned is used to identify the sample in all laboratory data documentation, including logbooks, instrument printouts, and final reports.

5.4 Sample Storage

After entry into LIMS, samples are placed in an assigned and identified storage location until needed for analysis. Room temperature, refrigerated, and freezer storage are available, and samples are stored in accordance with regulatory, method, or client directions. The LIMS system is used to assign storage locations for bar-coded media, which promotes orderly storage of samples. Sample storage locations for sorbent and condensate samples requiring refrigeration are monitored for accurate temperature control.

When a canister, bag, or product sample is scheduled for analysis, the analyst obtains custody of the sample by scanning the canister tag or sticker bar code as well as the bar-coded destination location of each individual sample. The scanned information is electronically transmitted to LIMS to reflect the custody of canister and bag samples at all times. All other media samples are logged into the Internal Extractable Sample Tracking Logbook and the pertinent storage area.

5.5 Sample Return/Disposal

Samples are released for disposal upon satisfactory completion of analysis unless prior contractual arrangements have been made. Product samples are held for a minimum of 30 days after satisfactory completion of the analysis, unless otherwise specified by the customer. The release of samples is electronically documented in the LIMS tracking system via scanning of the canisters and bags. This ensures verification of completion of all analyses including all samples in each workorder. Samples are released following the procedures outlined in SOP #63.

Sample disposal varies based on the sampling media. Whole air samples are vented through a charcoal scrubber, while liquid samples are disposed of according to procedures noted in SOP #24.

5.6 Chain of Custody

Samples received by the laboratory must be documented using a chain-of-custody (COC) form and relinquished following standard EPA-approved guidelines, including the following:

- Unique sample name or number
- Location, date, and time of collection
- Canister number (if applicable)
- Collector's name
- Preservation type (if applicable)
- Matrix or product type
- Any special remarks

Additional information may be required depending on the requested analysis.

A copy of the signed COC will be e-mailed to the client in conjunction with the Sample Receipt Confirmation.

Once a sample is received by the laboratory, the internal chain-of-custody procedure is followed.

Disclaimer: *Eurofins Air Toxics assumes no real or implied responsibility or liability for client-related field sampling and shipping activities. It is the responsibility of the individual client to ensure that referenced methodologies are followed with respect to sample collection and shipment to the laboratory. Air sampling media and equipment should only*

be used by experienced field engineers. It is the ultimate responsibility of the client to be knowledgeable both in sample preservation requirements as well as relevant State, Federal, and international shipping requirements. Any time a chemical substance is collected using Eurofins Air Toxics media, the client bears sole responsibility for understanding and abiding by the laws involving shipment of potentially hazardous substances by common carrier.

6. TECHNICAL REQUIREMENTS – TRACEABILITY OF MEASUREMENTS

6.1 Reagents and Solvents

The reliability of Eurofins Air Toxics' analytical results can be directly affected by the quality of reagents used in the laboratory. Procedures are in place to control labeling, storing, and evaluation of these materials. All purchased supplies, reagents, solvents, and standards are verified as acceptable and meeting criteria for analysis prior to use. The Eurofins Air Toxics' Chemical Hygiene Plan (CHP) provides safety information in regard to the storage and handling of laboratory chemicals. All reagent certificates and Safety Data Sheets (SDSs) are retained by the laboratory (see section 2.8).

6.2 Calibration Standards

Written calibration procedures are required, where applicable, for all instruments and equipment used in the laboratory. The source and accuracy of standards used for calibration purposes are integral to obtaining quality data. Requirements for calibration are provided in each analytical method including specifications for the standard used. Calibration measurements made by the laboratory must be traceable to national standard of measurement (e.g., NIST) where available. Certificates of Analysis are maintained for each material, as applicable.

Standards are usually purchased from commercial suppliers either as neat (pure) compounds or as solutions with certified concentrations. The accuracy and quality of these purchased standards are documented on the C of A, and hard-copy certificates are maintained on file in the laboratory. Upon receipt at Eurofins Air Toxics, material is labeled with a date of receipt and stored appropriately.

Stock standard solutions are recorded in the proper standard logbook and are assigned a unique standard code number. When a working standard is prepared, the compound(s), standard code number, date prepared, analyst, expiration date, and solvent are noted in the working standard logbook. All working standards are kept in containers and at temperatures that will not alter their integrity. All containers are clearly labeled with concentrations, unique standard code number,

and expiration date. Standards are not to be used in the laboratory past their expiration date.

6.3 Equipment and Instrumentation

The laboratory is equipped with all equipment and instrumentation required for testing the scope of work it supports. All equipment and instrumentation is maintained in proper working order. Eurofins Air Toxics' major equipment capabilities are summarized in the table below:

Major Instrumentation

Number	Instrumentation
24	GC-MS
7	Gas Chromatographs with various detectors (TCD, PID, FID, SCD, ECD)
2	HPLC-UV
11	Air Concentrators
7	Automated Thermal Desorption Units
3	Liquid Auto-samplers
1	Extractors
60	119 L Dynamic Environmental Chambers
1	Micro-chamber/Thermal Extractor
1	Air Generator
1	Industrial Air Compressor
1	Air Humidification System

6.3.1 General Requirements

- Equipment and instrumentation are assigned a unique identifier designation to identify them within the data documentation.
- An equipment logbook is established in conjunction with installation and is readily available to document all incidents that pertain to the equipment and instruments as they occur.
- All test, measuring, and inspection of laboratory systems, equipment, and instruments used at Eurofins Air Toxics are routinely calibrated and maintained in accordance with applicable Standard Operating Procedures.
- A member of the technical group, or another designated individual, performs routinely scheduled maintenance and calibration of laboratory equipment as required by laboratory procedures. These activities are documented.

- If appropriate standards or expertise for calibration or maintenance are not available in-house, the operation is conducted by an outside service firm.
- All equipment taken out of service is tagged accordingly.

6.3.2 Standard Operating Procedures

Information regarding operation, maintenance, and calibration of equipment and instrumentation are found in respective SOPs. The procedures include a routine schedule for preventative maintenance and calibration as applicable, along with acceptance criteria and remedial action to be taken in the event of failure. These procedures are maintained in the document control system and reviewed on a regular basis to verify they remain current and accurate. Equipment manuals are also available to provide additional information with regard to operations and maintenance.

6.3.3 Maintenance

- Equipment maintenance is performed as either a preventative or corrective operation.
- Preventative maintenance procedures and schedules for each piece of equipment are assigned where applicable. Preventative maintenance operations are performed by an analyst, scientist, senior scientist, or contracted manufacturer's representative or service firm personnel. Documentation is maintained for the procedures performed as part of the preventative maintenance operation. It is the responsibility of Group Leaders to ensure that a preventative maintenance schedule is addressed by a procedure where appropriate and is followed.
- A supply of commonly needed replacement parts is maintained by the laboratory.

6.3.4 Calibration

- Calibration is the establishment of, under specified conditions, the relationship between the values/response indicated by a measuring instrument or system and the corresponding known/certified values associated with the standard used. Some types of calibrations are performed within a set of frequency (e.g., daily), while others provide intermediate checks to ensure that the instrument response has not changed significantly.

- All measuring and testing equipment having an effect on the accuracy, precision, or validity of calibrations and tests are calibrated and/or verified on an ongoing and routine basis. Methods for calibration of instruments and equipment vary widely with the nature of the device and the direction given by analytical procedures, department procedures, or manufacturer recommendations. Frequency of calibration can also depend on additional factors, including robustness of the instrument or equipment and the frequency of use.
- Calibration information is recorded in a logbook that is associated with the instrument/equipment and/or a calibration certificate is maintained and/or data printouts are generated to document the activity.
- Calibration measurements are traceable to national standard of measurement (e.g., NIST) where available. Physical standards, such as NIST-certified weights or thermometers are re-certified on a routine basis. Calibration certificates are maintained on file, where applicable, to indicate the traceability to national standard of measurement.
- Calibration failures are documented in the logbook for the instrument and/or within the data printouts from the instrument.
- After repair, adjustments, or relocation that could affect instrument response, calibration/verification activities are performed, as applicable, before the unit is returned to service.
- Analytical data is not reported from instrumentation or equipment that fails to meet calibration requirements.

6.4 Computerized Systems and Computer Software

6.4.1 Computer Usage

Eurofins Air Toxics provides computer equipment for employees to use as a tool in performing their work. Computer equipment is the property of Eurofins Air Toxics and is to be used in accordance with defined terms and conditions. The laboratory's goal is to provide standard hardware and software that meets the needs of the user.

6.4.1.1 Physical security of computer systems: It is company policy to protect computer hardware, software, and data documentation from misuse, theft, unauthorized access, and environmental hazards. All of the laboratory servers are housed in a locked office, which maintains favorable environmental conditions to allow for optimal server performance. Access to the laboratory's networks is granted by the Systems Administrator or Information Technology (IT) Manager. Network access is tightly controlled for the entire company. Users maintain individual network accounts and are allowed to access specific areas of the network based on the privileges assigned to them. A user is granted access to only those areas needed to fulfill his or her job function.

6.4.1.2 Passwords: All software used to reduce sample data or generate sample reports is password-protected; users are granted rights to these systems based on a "read/write/none" privilege system. The following procedures apply regardless of what system(s) is being utilized:

- Passwords must be kept confidential.
- Users must log-out of a system when not in use to prevent unauthorized access.
- Forgotten passwords can only be reset by the IT Department or by an appropriate System Administrator.
- Network passwords automatically expire every 90 days. The computer prompts a user to change the password when the expiration date nears.

6.4.1.3 Computer viruses: Eurofins Air Toxics continuously monitors its computer network for computer viruses. Anti-virus software is employed to detect viruses on the Windows network. Employees must report any virus concerns to the IT department as soon as possible. Employees who share files between their home computer and the laboratory should install anti-virus software on their home computer. If an employee does not have such software, the laboratory can suggest various no-cost anti-virus software products.

6.4.1.4 Internet and e-mail System: The e-mail system is used primarily for Eurofins Air Toxics business purposes. The Employee Handbook provides additional information in regard to system usage. Employee access to the Internet is restricted to those employees who have a business need for it. All employees have access to e-mail. All Internet and e-mail activity is subject to monitoring. All messages created, sent, or received over the Internet are property of Eurofins Air Toxics and can be regarded as public information. E-mail and Website filtering software is utilized.

6.4.1.5 Software Policy:

Eurofins Air Toxics' Software Policy is as follows:

- Copyright laws protect software, and Eurofins Air Toxics' intent is to abide by all software agreements.
- Software purchases must be formally requested and approved by management, IT Department, and/or validation personnel, as necessary.
- All software is used in accordance with applicable license agreements.
- Employees are not to install any software on computer(s) unless authorized by the IT Department.
- Employees must not give software to outsiders (e.g., clients, contractors, etc.), unless approval is granted by management.
- Users must not make copies of any licensed software or related documentation without permission. Any user that illegally reproduces software is subject to civil and criminal penalties including fines and imprisonment.

6.4.1.6 Computer system backup, data restoration, and data archival: All data systems are backed up on a daily, weekly, and monthly basis using a modified "grandfather-father-son" (GFS) rotation protocol. Specifically, these backups are conducted on the servers responsible for all laboratory production data files and databases (i.e., Project Management files, analytical data, audit trails, Quality Assurance documents, etc.). A daily incremental backup is scheduled to run each night Monday through Saturday. The daily incremental backup is limited to files modified the same day. On Sunday, a weekly full backup of all files on each server is completed. At the end of each month, a

full backup of each data system is conducted. This monthly backup tape is then placed in permanent storage. The permanent historical backup tapes are stored in an off-site data storage facility. Data is not removed from the server until at least three permanent monthly backup tapes have been created. This ensures that no archived data will be lost due to corruption of the magnetic tape. A more comprehensive description of the laboratory's electronic data archiving system can be found in SOP #55.

6.4.1.8 Remote access to computer systems: With special permissions, employees are able to remotely connect to the laboratory computer network through a VPN system. When logging in, users are authenticated with their Windows account and password.

6.4.2 System and software verification: Before each new computer system or significant modification of an existing system is implemented in the laboratory, the following requirements must be met:

- Required documents – Describe the required system functionality and specification (e.g., Software Development Change Control, Change Control Log, IT Logic New Rule or Rule Update)
- Design documents – System overview, screen design, report layout, data description, system configuration, file structure, and module design
- Testing documentation for system development/verification – structural testing of the internal mechanisms and user testing of the installation and system qualification.

7. PURCHASING EQUIPMENT AND SUPPLIES

7.1 Procurement

The primary materials procured by the laboratory are analytical instrumentation and software, media and reagents including standards, carrier gases and cryogens, miscellaneous laboratory supplies, computer hardware and software, and service contracts.

Control of the purchase of these items and services is maintained using a standard purchase order system described in SOP #105 and outlined below:

- Purchase requests must be approved by a director or manager.
- An assigned purchase order (PO) number is entered along with the date, vendor, and requester.
- An evaluation of the supplier is conducted to determine whether it has been deemed a qualified vendor.
- Requires that upon receipt or delivery of services the product is inspected by the purchasing agent and compared to the packing slip and/or request for services.
- Each PO is matched with invoices prior to payment to insure that purchased items or services were delivered as expected.

Purchasing documents are maintained by the Accounting Department, calibration certificates are maintained by the Quality Assurance Department, and Certificates of Analysis for reagents and media are maintained by laboratory personnel.

7.2 Supplier Evaluation

Suppliers and vendors are evaluated in accordance with SOP #105 to assure that the quality of the products purchased meet the quality expectations of Eurofins Air Toxics, Inc. and do not interfere in the quality of testing. A laboratory database is maintained with a list of approved vendors.

8. ANALYTICAL METHODS

8.1 SCOPE OF TESTING

Soil vapor, landfill gas, indoor and outdoor ambient air, source (stack) emissions, and other types of air-phase samples are analyzed in accordance with official published methods or validated in-house methods. Method modifications made by Eurofins Air Toxics, Inc. are detailed in a summary of modifications table in the method SOP. Measurement and analysis of volatile organic compound (VOC) emissions from products using environmental chambers are performed in accordance with the relevant ASTM, EPA, and ISO methods. Specific operational and assessment parameters required for product compliance to voluntary and regulatory labels and testing are outlined in documents such as CDPH/EHLB SM V1.1 (CA 01350), ANSI/BIFMA M7.1, and AgBB.

The methods used by Eurofins Air Toxics are approved by a broad range of regulatory agencies.

A list of methods covered under the laboratory's NELAP accreditation can be found in the table in section 8.2.

Eurofins Air Toxics specializes in and has expertise with the following types of projects:

- Vapor Intrusion investigations
- Environmental assessments
- Remediation system monitoring (soil vapor extraction)
- Landfill gas characterization
- Source emissions testing
- Soil vapor surveys
- Ambient air monitoring
- Indoor air quality (IAQ)
- Material emissions using environmental chambers

Appendix E contains summaries for each commonly performed analytical procedure in the laboratory. Each summary contains the following information:

- A brief method description
- Laboratory variances to method compendium or other regulatory reference methodologies
- Tables containing analyte lists, Reporting Limits (RLs), Limits of Quantitation (LOQs), and quality control (QC) acceptance criteria
- A table of calibration and QC procedures

This Quality Assurance Manual references methods in a general manner; specific procedures used by the laboratory can be found in the method-specific SOPs.

8.2 Analytical Test Methods

Eurofins Air Toxics' NELAP-certified analytical methods, parameters, instrumentation, sampling media, holding times, and SOP numbers are summarized in the table below:

Method	Parameter	Type	Sampling Container	Holding Time in days	Eurofins Air Toxics SOP #
TO-14A/TO-3	BTEX/TPH	GC/FID/PID	Summa Canister Tedlar Bag	30 3	43
TO-4A/TO-10A	Pesticides/PCBs	GC/ECD	PUF	7	26
TO-11A	Aldehydes/ Ketones	HPLC/UV	DNPH Cartridge	14	11
TO-12	Non-methane Organic Carbon (NMOC)	GC/FID	Summa Canister Tedlar Bag	30 3	36
TO-13A	PAHs/ Semi-volatiles	GC/MS	XAD/PUF	7	3/10
TO-14A/TO-15	VOCs	GC/MS	Summa Canister Tedlar Bag	30 3	6/38/83/114
TO-17	VOCs	GC/MS	Sorbent Tube	30	5/109/110/ 112/122
ASTM D-1946	Fixed Gases, CH_4, C_2+	GC/TCD/FID	Summa Canister Tedlar Bag	30 3	08
ASTM D-1945	Fixed & Natural Gases	GC/TCD/FID	Summa Canister Tedlar Bag	30 3	54
ASTM D-5504	Sulfur Gases	GC/SCD	Tedlar Bag	24 hours	13
PM10/TSP	Particulate Matter	Mass	Quartz Filter	14	66

8.3 Method Validation

As part of the initial test method evaluation for new standard methods, analytical runs must be performed the same way an analyst would perform an initial Demonstration of Capability (DOC) to evaluate precision and bias along with a Method Detection Limit (MDL) study as applicable.

Non-standard methods, including laboratory-developed methods, standard methods outside their intended scope or application, and requested changes to existing instrumentation will follow a planned process explained in detail in SOP #107 and outlined below:

- Measurement Quality Objectives (MQOs) – should be clearly outlined prior to validation.

- Development of Test Plan – Technical Director and assigned personnel are responsible for the development of such plan.
- Validation – Implementation of the test plan with documentation of all results will be reviewed by the Technical Director.
- Review and Approval – Review of performance against the MQOs, supporting documents, and written procedures is performed by the Technical Director. After approval, the QA Manager reviews for completeness and finalizes the method for production.

8.4 Procedural Deviations

Eurofins Air Toxics communicates and addresses procedural deviations in the following ways:

- Modifications to standard methods made by Eurofins Air Toxics are detailed in a summary of modifications table in the analytical method SOP. The modification table is also included in the laboratory narrative of the final data report.
- Differences between a project request and laboratory standard protocol are documented in a variance table created by the laboratory's project chemist for submission with the proposal to the client. Agreement is documented by the client's initials and date in the approval column or with written documentation from the client that all variances have been approved.
- If a sample received did not meet the established criteria for quality testing, the Sample Receiving Department will issue a Sample Discrepancy Report (SDR), and the Project Manager will communicate the discrepancy to the client. If the client still wants the sample to be processed, the discrepancy will be narrated in the final report.
- Other analytical procedural deviations that are within allowable variations established for every method and listed in the method SOPs are discussed with the client, and if accepted the sample results will be reported with a narrative of the deviation and the affected result will be flagged accordingly.
- Analytical procedural deviations that are not within allowable variations and directly affect the sample result will require the initiation of a Corrective Action Report request.

The Corrective Action Program is explained in detail in section 12 of this Quality Manual.

9. INTERNAL QUALITY CONTROL CHECKS

9.1 Laboratory Quality Control Samples and Acceptance Criteria

9.1.1 Blanks: For the whole air methods for which no sample preparation step is required, a blank is a designated sample designed to monitor for contamination originating from the analytical system. The Laboratory Blank is comprised of clean, humidified air or nitrogen. A Laboratory Blank is analyzed after any applicable standards and prior to the analysis of project samples. A blank is also analyzed in the event saturation-level concentrations are incurred to demonstrate that contamination does not exist. The blank and the field samples are treated with the same internal standards and surrogate standards and carried through the entire analytical procedure. For methods requiring a sample preparation step (e.g., TO-11A and TO-13A), a Laboratory Blank is prepared using un-sampled media and extracted alongside the batch of field samples. Ideally, blanks demonstrate that no artifacts were introduced during the preparation and/or analysis process. The specific acceptance criterion for each test is given in the analytical method and is usually based on the required Reporting Limit (RL).

9.1.2 Surrogates: Surrogates are organic compounds that are chemically similar to the analytes of interest but are not naturally occurring in environmental samples. For GC-MS methods and some GC methods, the recovery of the surrogate standard is used to monitor for unusual matrix effects and gross sample processing errors, and to provide a measure of recovery for every sample matrix. When required by the analytical method, surrogates are spiked into all the field and QC samples to monitor analytical efficiency by measuring recovery on an individual sample basis. The percent recovery is determined and compared to the acceptance criteria. Acceptance criteria limits are set as required by the method or based on a statistical determination from laboratory data.

9.1.3 Matrix Spikes: Matrix spikes are not required QC for whole air samples collected in Summa canisters. Accurately spiking target compounds into an evacuated canister prior to deployment in the field for sample collection or post-sample collection is neither practical nor technically appropriate. Therefore, matrix spiking is performed only on samples submitted as part of a sampling train, such as condensates, or on extractable samples, provided they are submitted in duplicate for matrix spike and in triplicate for the matrix spike duplicate. It is the responsibility of the client to provide additional samples to fulfill any method

requirements regarding matrix spikes. When applicable, matrix and matrix duplicate spiking is performed using a subset of target analytes. Recoveries and demonstrated reproducibility values that do not meet the acceptance criteria are flagged and explained in the laboratory narrative.

9.1.4 Laboratory Control Samples: Laboratory control samples (LCS) are samples of known composition that are analyzed with each batch of samples to demonstrate laboratory accuracy. The LCS is prepared by fortifying clean matrix with known target concentrations. In the case of non-extracted batches, the LCS is generally analyzed daily prior to sample analysis, but could also serve as an end check standard. Percent recovery is calculated and compared to acceptance criteria, which are set as required by the method or based on a statistical determination from laboratory data.

9.1.5 Sample Duplicates and Laboratory Control Sample Duplicates: A duplicate is a second aliquot of a sample that is treated identically to the original to determine precision of the test. To compare the values for each compound, the relative percent difference (RPD) is calculated by dividing the difference between the numbers by their average. Precision for analytes that are not typically found in environmental samples is determined by analyzing a pair of Laboratory Control Samples (LCS), and comparing the RPD for the spiked compounds. The acceptance criteria are described as a maximum for the RPD value as required by the method or based on a statistical determination from laboratory data.

9.1.6 Internal Standards: Internal standards (IS) are organic compounds that are chemically similar to the analytes of interest but are not naturally occurring in environmental samples. For extractable methods and when required by the method, IS are added to every field and QC sample typically after extractions but prior to analysis. For all GC-MS methods an IS blend is introduced into each standard and blank to monitor the stability of the analytical system. Comparison of the peak area of the IS is used for quantitation of target analytes. The IS peak area and retention time also provide a check for changes in the instrument response and chromatographic performance. The acceptance criteria are stipulated in the analytical method.

9.1.7 Second Source Check: A second source check is analyzed using either the Laboratory Control Sample (LCS) and/or an Initial Calibration Verification (ICV). The second source is a standard that is made from a solution or neat compound purchased from a different vendor than that

used for the calibration standards. For some organic custom mixes, the same vendor but a different lot and preparation is used. This ensures that potential problems with a vendor supply would be evident in the analysis. Some areas of the laboratory use continuing calibration verification standards as a second source from the initial calibration.

9.2 Quality Control Sample Frequency and Corrective Action

Each analytical method defines the frequency for required quality control (QC) samples. A summary is provided in Appendix E. The corrective action required when a QC result fails to meet acceptance criteria is also given. If the method reference requires the use of specific limits, the laboratory uses the published limits that are documented as part of the analytical method. Many methods require that each laboratory determine their own acceptance criteria based on statistics from performance of the method. In these cases, the limits are available to the analyst and are entered into the laboratory computerized QC system described in SOP #48. Statistically determined acceptance criteria are frequently subject to change as the laboratory recalculates its control limits. Due to their dynamic nature, acceptance criteria are not included in this manual.

9.3 Quality Control Charts

Quality control (QC) results entered into the computer are used to generate control charts that are plotted via computer and can be accessed at any time by all analysts and by the Quality Assurance Department. The system charts results from surrogates and laboratory control samples. These charts provide a graphical method for monitoring precision and bias over time. The computerized quality control system is used to report QC data to clients and to collect data for assessment of precision and accuracy statistical limits.

9.4 Measurement Uncertainty

As stated in ISO 17025, “All uncertainty components which are of importance in a given situation shall be taken into account using appropriate methods of analysis” (5.4.6.3).

This means the laboratory must determine the uncertainty contribution of all steps in the testing process such as equipment, calibration, standards, reagents, preparation, etc. Since, in most methods, the laboratory control sample (LCS) goes through the entire process of preparation to analysis, all factors that would contribute to uncertainty is evident through the LCS results. As such, LCSs are performed with every batch of samples where appropriate for the method.

Measurement uncertainty is calculated as two times the standard deviation of the LCS recoveries for the group and date range of data points selected for all applicable methods. This is reported as a percentage. Reports for uncertainty shall be generated and submitted to the Quality Assurance Department for review on an annual basis. At this point, it is not necessary to apply or report the uncertainty determination with sample results. When a client requests the measurement uncertainty it is applied by multiplying the determined analyte concentration by the uncertainty percentage.

10. ASSURING QUALITY OF TEST RESULTS

10.1 Data Management

At a minimum, data management is initiated when Eurofins Air Toxics receives samples from the client. More often, the process begins with client communication of their needs and requirements for a specific project and/or testing. The Project Managers are responsible for entering this information into the client services modules of LIMS. Upon receipt of the samples, a unique tracking number is generated based on this information in the project profile. At this point, computer technology becomes an integral part of tracking the samples through laboratory operations.

10.2 Data documentation

Analytical data generated in the laboratory is collected through the associated data system or is manually documented in bound logbooks. Analysts review data as it is generated to determine that the instruments and systems are performing within specifications. If any problems are observed during an analytical run or the testing process, corrective action is taken and documented.

Procedures are in place to ensure that all data is traceable, authentic, and complete. The following general requirements outline the Eurofins Air Toxics' system for logbooks, notebooks, and documentation recording:

- Observations, data, and calculations are recorded at the time they are made and are identifiable to the specific task.
- Entries are legible, signed, and dated.
- Errors are corrected in a manner that does not obliterate the original entry, initialed, and dated.
- Blank pages or substantial portions of pages which are left blank are crossed out to eliminate the possibility of data entry at a later date.

- Logbook pages and instrument printouts are signed and dated to indicate completion.
- At periodic intervals the Quality Assurance Department checks equipment/instrument logbook entries and temperature recordings for completeness, legibility, and conformance to procedures.
- At a minimum, the following is recorded as part of data documentation:
    - Date of analysis/operation
    - Initials/date of analyst performing test/operation
    - Identification of client sample(s) and material(s) analyzed
    - Materials, reagents, and standards used to perform the test/operation
    - Method used to perform test/operation
    - Equipment/instrumentation used to perform test/operation
    - Deviations, planned or unplanned, from the analytical method
    - Signature/date of person reviewing data documentation
- For computer-generated data, the following information is recorded:
    - Samples(s) analyzed/operations performed
    - Date of analysis/operation
    - Unique instrument identification
    - Name or initial/date of person operating the instrument
    - Name or initial/date of person reviewing data
    - Any manual notation, interpretations, or integrations made on instrument printouts are signed, dated, and reviewed.

10.3 Data Calculations

Most instruments either include or are connected to a data system programmed to perform calculations needed to reduce the raw data to a reportable form. All calculations are maintained in the instrument manuals and/or as part of the analytical method.

In many cases, data from the local instrument system are uploaded directly to LIMS for review and reporting. This direct upload eliminates the need to re-type data and any associated source of transcription errors from the analytical scheme.

Some instruments report data that require application of additional factors before the data is in final form. Analysts input these additional factors into the laboratory sample management system, where final calculations are performed.

10.4 Reporting Limits

It is important to ascertain the Limit of Quantitation (LOQ) that can be achieved by a given method, particularly when the method is commonly used to determine trace levels of analyte. The USEPA has established one method for determining Method Detection Limits (MDLs) from which LOQs can be extrapolated, which is summarized in the laboratory procedures.

MDLs are verified or determined annually on each instrument and are the basis for the LOQ used in the default reporting format. Because MDLs change each time they are re-evaluated, they are not included in this manual but are available at the laboratory and available to clients upon request.

For DoD-certified methods and compounds, quarterly evaluation of the LOQ and determination of Limit of Detection (LOD) is performed. The LOQ evaluation entails the calculation of precision and accuracy at the LOQ or Reporting Limit. The LOD for each compound is determined by analyzing a calibration standard or set of standards between the MDL and LOQ. The LOD is assigned the concentration at which the peak meets the signal-to-noise criteria.

The Reporting Limit used to determine whether a result is significant and reported as detectable is dependent upon agency and client requirements. A variety of formats are available and include use of the MDL, LOD, LOQ, method-specified limits, and project-specific limits.

10.5 Data Review

Final review and verification of the data is performed by a trained analyst or scientist using the sample results and quality control information entered into the laboratory sample management system. Another tool used for data review involves the use of proprietary in-house data validation software to review every data point generated and to alert the reviewer when manual integrations occur. The software is also programmed to report each analyte that does not meet acceptance criteria in the quality control and/or sample(s).

After determining that all necessary requirements for valid data are met, the reviewer electronically approves the data by updating the “Report Approved By” status with their initials. This action applies the electronic signature of the Technical Director. The computer is programmed with a list of approved reviewers for each test, and the system is password-protected to ensure that only qualified individuals verify the data.

10.6 Data Qualification

Data qualifiers are used to provide additional information about the results reported. The most typical use for data qualifiers is for results that fall below the quantitation limit. The data systems used to generate and report results are programmed to flag values in this range as estimated.

Other qualifiers are applied to advise data users of any validation issues associated with the data. The laboratory makes every effort to meet all of the requirements for generation of data. Occasionally, data is generated that does not meet all the method requirements due to sample matrix or other analytical problems. If the test cannot be repeated, or re-analysis would not yield more useable data, qualified data is reported. Qualifiers can be in the form of comments on the analytical report or flags applied to the results.

10.7 Data Reporting

When each analysis is completed, reviewed, and verified, a report is generated. The client receives a copy of the report containing the results of the analysis, plus comments added by the analyst when necessary. The report contains the electronic signature of the Technical Director. Copies of the reports and associated supporting raw data are retained in the Eurofins Air Toxics' archives.

Eurofins Air Toxics offers a variety of data levels and formats, from a basic report of sample and QC results only (Level II) to a comprehensive data package including all supporting quality control information and raw sample data (Level IV). The client directs the selection of report type. Various electronic formats are also available, formatted to client-specific file structure and sent via e-mail, direct upload, Website access, or commercial courier.

Client confidentiality of Eurofins Air Toxics' Web data is ensured by the use of a secured firewall Internet environment coupled with the use of a user ID and password to gain log-in access to the system.

If amendments to a final report are required due to omissions, errors, or additional requests, a workorder reissue is initiated. All reissues receive a unique workorder number to distinguish them from the original issue. Reissued reports require a reason for the reissue and date of the reissue in the laboratory narrative. The laboratory maintains all supporting documentation for the revision including corrections, additions, or deletions relative to the original report.

10.7.1 Reporting the Results

Analytical reports are printed with a cover page that summarizes all samples in that group. This page lists the Eurofins Air Toxics' assigned sample number and the corresponding client description. The cover page identifies the laboratory contact person's name and the laboratory's phone number in case there is a question about the report. Within this package, each page is uniquely identified and paginated. Analytical test results which meet all the requirements of NELAP and ISO 17025 are noted as so in the footer of the summary cover page.

10.8 Data Storage, Security, and Archival

Eurofins Air Toxics has documented procedures and instructions for the identification, collection, access, filing, storage, maintenance, and disposal of data records. Records are in the form of hard-copy paper records, electronic data files, magnetic tape, and CD-ROMs.

Eurofins Air Toxics maintains records to demonstrate conformance to specified requirements and the effective operation of its quality systems. Records are stored and maintained in such a way that they are readily retrievable in facilities that provide a suitable environment to minimize deterioration or damage and prevent loss. Retention time for the records is in accordance with NELAP's minimum five-year requirement and/or specific procedures or instructions.

The laboratory maintains all documentation necessary for historical reconstruction of data, as follows:

- Analysis reports
- Data logbooks
- Instrument printouts
- Correspondence and client files
- Instrument and equipment logbooks
- Quality Assurance records
- Corporate documents
- Electronic records

11. AUDITS AND INSPECTIONS

11.1 Internal Quality Assurance Audits

Internal audits are performed by trained Quality Assurance personnel following a schedule planned yearly by the Quality Assurance Manager or at any time by the request of management. The audits cover all quality systems including but not limited to documentation practices, training, and adherence to current SOPs and methodology.

The following areas are identified to be audited by Quality Assurance:

a. Operations
b. Support Services
c. Sample Receiving and Login
d. Project Management and Sales
e. Information Technology (IT)
f. Quality Assurance

A written report with findings, observations, and/or recommendations is presented to the audited personnel, the team leaders, and management by the auditor. Responses to findings and observations are then submitted to the Quality Assurance Department within 30 days.

All audit notes, documentation, and reports are scanned and filed on the QA network drive.

11.2 Management Review System

A review of the laboratory's systems is performed by senior management on a biannual basis to evaluate effectiveness, identify areas requiring improvement, and establish timelines and accountability in addressing agreed-upon action items. This review includes internal assessment of the quality program and laboratory operations and external assessment through client feedback and audits. Four types of reports are generated by management or designated personnel:

11.2.1 **Quality Assurance Status Report:** Summarizes the results of internal and external assessments, the numbers and types of Corrective Action Reports (CARs) generated, status of any outstanding CARs, a summary of client inquiries received, proficiency tests (PT) results, and the number and types of reissued sample reports.

11.2.2 **Production Status Report:** Summarizes performance against key metrics such as turnaround time, details changes in sample mix and sample numbers, and outlines resource needs.

11.2.3 **Client Assessment Report:** Summarizes feedback from clients based on daily communication with project management and sales team as well as feedback collected by a third party as part of our Client Satisfaction Index (CSI) determination.

11.2.4 **Safety Assessment Report:** Outlines the safety incidents and "near misses" for the quarter and lists site assessment deficiencies.

The reports and records of the meetings are stored on a secure drive with management-only access for a minimum of five years.

11.3 Client Audits and Agency Inspections

Clients may audit our facility as assurance that their objectives are being met and that the laboratory is compliant with all applicable regulations, data quality, and project requirements.

Client audits can range from a laboratory tour to an intensive inspection of technical operations, procedures, regulatory compliance, and/or review of specific projects. Clients can only review data that pertains to their projects, and a non-disclosure agreement must be signed as per SOP #99.

Inspections can be performed by investigators or auditors from the USEPA, DoD, state and other regulatory agencies, third party accreditors (ACLASS), or regulatory agencies outside of the U.S.

The Quality Assurance Department is assigned the responsibility of hosting and working with agency and client representatives.

The Quality Assurance role includes:

- Escorting the investigator(s)
- Ensuring all questions are answered promptly and accurately
- Making note of all unresolved issues
- Informing management of the audit status and outcome
- Responding to the audit report
- Ensuring that appropriate corrective action is completed

11.4 Proficiency Testing Program

11.4.1 Proficiency Testing Samples (TNI/DoD)

Proficiency testing (PT) samples are used to measure analytical accuracy, precision, and report completeness. To be accredited under TNI and DoD-ELAP, the laboratory contracts with an outside approved PT sample provider in each field of testing (FOT). Testing is limited by availability of samples that meet NELAP and DoD-ELAP criteria (noted below). The provider must be a NIST-accredited PT provider. It may be necessary to participate in more than one proficiency testing program to be evaluated for multiple interdependent analyte groups. Currently, Eurofins Air Toxics participates in PT programs for EPA Method TO-15, which is ISO 17025 compliant, TO-13A, TO-17 VI, formaldehyde and emissions testing. In each calendar year, the laboratory will complete a minimum of one PT sample for each analyte or interdependent analyte group.

The following policies apply to laboratory PT sample analysis and reporting:

- The samples shall be analyzed and reported to the PT provider within 45 calendar days of receipt or the specific deadline specified by the PT provider.
- The PT sample is received and logged into an electronic sample receiving database in the same fashion as field samples.
- The laboratory must follow the PT provider's instructions for preparing the PT sample.
- The laboratory management and bench chemist ensure that the PT samples are prepared, analyzed, and reported in the same fashion as field samples using the same staff, equipment, and methods.
- Initial and continuing calibrations for the PT sample are analyzed at the same frequency of field samples.
- The PT sample cannot undergo duplicate or replicate analyses that would not ordinarily be performed on field samples. The PT sample result cannot be derived from averaging the results of multiple analyses unless specifically called for in the reference method.
- The PT sample can only be analyzed on equipment leased or owned by the company and handled only by bona fide employees of the company.
- The analysis of PT samples by temporary or contract employees is explicitly forbidden.

- The laboratory shall not subcontract any PT sample or portion.
- The laboratory shall not knowingly receive any PT sample or portion from another laboratory.
- The laboratory shall not communicate in any fashion with another laboratory concerning the PT sample or results.
- The laboratory shall not attempt to obtain the PT sample result prior to reporting.
- The PT sample reporting forms provided by the sample provider will be used to report the results and will be maintained in the laboratory's record system.
- The laboratory shall maintain copies of all written, printed, and electronic records relating the analysis or reporting of the PT sample for a period of five years or as required by the applicable regulatory program.
- A CAR will be generated any time an analyte result fails the PT assessment. A copy of the PT results will be sent to the accrediting agency, and associated corrective action summary will be sent upon request.
- The laboratory authorizes provider to release any PT assessment information to the accrediting agency.
- The QA Manager must sign the PT results form and, by so doing, attests that the sample was analyzed and reported in the same fashion as a field sample and followed the PT provider instructions for preparation.
- The laboratory must notify its primary accrediting agency and any other agencies under reciprocity that it has enrolled with a particular PT provider.
- The laboratory must notify its primary accrediting agency and any other agencies under reciprocity in the event it wishes to change PT providers.
- For each analyte or interdependent analyte group for which proficiency is not available, the certified laboratory will establish, maintain, and document the accuracy and reliability of its procedures through a system of internal quality management.
- Results of any failed PT samples are summarized in the Quarterly QA Status Report.

11.4.2 Proficiency Testing Samples (Non-NELAP/DoD)

Occasionally proficiency testing (PT) samples are submitted along with field samples by private clients. The laboratory processes and reports the

samples in the same fashion as field samples. When the client notifies the laboratory that one or more analytes appear to have failed, the report is processed through the normal Client Inquiry Corrective Action Process. The QA Manager will carry out an assessment and investigation into the circumstances surrounding the proficiency results, including aspects relating to how the client prepared the sample for submission. The outcome of the assessment will be documented as a CAR and maintained on file for a period of five years. Results of any failed external PT samples are summarized in the Quarterly QA Status Report.

12. CORRECTIVE AND PREVENTIVE ACTION

12.1 Laboratory Investigations and Corrective Action

The Quality Assurance (QA) Department manages the Corrective Action Program and maintains the Corrective Action tracking database using the c.Support software program. A Corrective Action Report is initiated any time sample results are affected by non-conformance with established SOPs or program requirements, any time an external assessment results in a finding, any time there is a failed proficiency evaluation sample, and when a client inquiry results in a quality finding. The expectation is that any CAR should be resolved within 30 days.

The client is notified if there is an issue that could potentially affect the quality of sample results. The communication with the clients is recorded.

The software program tracks all parts of the CAR system: root cause investigation, immediate corrective action, long-term corrective action, and preventive action. It also tracks client communications regarding the incident. The QA Manager reviews all opened CARs for completeness and resolution.

Detailed information about the CAR process is described in SOP #61.

13. SERVICE TO CLIENTS

The Project Management System is defined in SOP #1. The following are brief descriptions of the elements comprising project management systems.

13.1 Review of Work Requests, Tenders, and Contracts

Eurofins Air Toxics places great importance on understanding client requirements for a project. The laboratory ensures, to the best of our ability, that client and project requirements are outlined and understood prior to acceptance

of the project, including required laboratory accreditations and nonstandard work requests. All inconsistencies are discussed and addressed with both the client and the technical laboratory staff before the project is initiated and samples arrive. This is achieved in various ways, including the review of client work plans, Request for Proposals (RFPs) project Quality Assurance Project Plans (QAPPs), requested analytical methods and protocols, business contracts, and quality agreements. A key client contact is assigned to oversee each project. Communication between the client and Eurofins Air Toxics technical staff is coordinated through the Project Managers. The Project Management group relays any project changes or modifications to the technical group. They also relay issues encountered by the laboratory back to the client.

13.2 Timely Delivery

Evaluating laboratory capacity, assignment of resources, and ability to perform specific projects is a joint responsibility between the Technical Director and the Laboratory Director. Eurofins Air Toxics recognizes that one of the most important aspects of the services offered is turnaround time.

To ensure timely delivery, many analysts are cross-trained to perform a variety of tests, and there is redundant equipment available in the laboratory creating operation flexibility for routine work. Larger projects are reviewed against capacity estimates before a bid is submitted in order to meet a client's schedule.

Management regularly monitors the status of turnaround time including those projects that have exceeded a current turnaround time. Proactive communication regarding potentially missed deadlines is expected from the laboratory management to the Project Managers to keep the client informed of report delivery status.

Any changes to the established timeline by the client or the laboratory must be communicated to the client or laboratory as soon as possible. Upon communication of changes, a new timeline is established and agreed upon by both parties.

13.3 Subcontracting

Occasionally, Eurofins Air Toxics subcontracts analyses to other laboratories if the requested testing is not routinely performed in our laboratory. Testing is only subcontracted with the client's knowledge and approval. Subcontract laboratories are selected based on their qualifications. If tests require a specific agency certification, only an appropriately certified laboratory will be used.

eurofins | Air Toxics

LABORATORY QUALITY ASSURANCE MANUAL

(LQAM)

Appendix A

Terms and Definitions

(nine total pages including this cover)

Current as of March 5, 2014

TERMS AND DEFINITIONS

Accuracy: The degree of agreement between an observed value and an accepted reference value.

Active sampling: The process of collecting a sample using pump or vacuum source to pull a known volume of vapor through a sorbent cartridge, filter, or liquid impinger.

Ambient air: Outdoor air (also can include indoor air).

Analyte: The substance or component for which a sample is analyzed to determine its presence or quantity.

APH (air-phase hydrocarbons): Aliphatic and aromatic fractions identified in vapor-phase samples.

Approved: The determination by a state or federal accrediting agency that a certified laboratory may analyze for an analyte under the specified method.

Assessment: The process of inspecting, testing, and documenting findings for purposes of certification or to determine compliance.

ASTM International (formerly known as American Society for Testing and Materials)**:** Organization which develops international voluntary consensus-based standards.

Bag: An air-sampling container consisting of inert polymeric material.

Batch: A group of analytical samples (≤ 20) of the same matrix processed together, including extraction, concentration, and analysis using the same process, staff, and reagents.

BFB (4-Bromofluorobenzene): Compound used to verify that the mass spectrometer meets the tuning requirements of the method. Also can be used as an internal standard or surrogate.

Blank samples: Negative control samples used to assess potential contamination from sampling procedures or analytical processes. They can be field blanks or laboratory blanks.

BTEX: Benzene, toluene, ethylbenzene, and xylenes

Canister: A stainless steel spherical air-sampling device consisting of Summa polished or glass-lined internal walls and a leak-tight on/off valve.

Certificate of Analysis (C of A): An authenticated document, issued by an appropriate authority, that assures a regulated product has met its product specification and quality.

Chain of Custody (COC): The chronological documentation of the custody of an environmental sample from the time it is taken until it is disposed.

Contamination: The effect caused by the introduction of a target analyte from an outside source into the test system.

Continuing Calibration Verification (CCV): A component of Quality Control used to verify instrument linearity with respect to the Initial Calibration (ICAL). A CCV is analyzed at the beginning of every analytical sequence and then periodically depending on the method. Certain methods also include a CCV in every analytical sequence as an End Check.

Control charts: Statistical tools for monitoring the performance of a particular task on a continuing basis. The control chart is prepared for each test parameter after 20 determinations have been performed. The mean is plotted with the warning limits being ±2s and the control limits being ±3s (s = Standard deviation).

Corrective action: An action taken to eliminate the cause(s) of an existing nonconformity, defect, or other undesirable situation in order to prevent recurrence.

Corrective Action Report: See NCCAR.

Data reduction: A qualitative and quantitative evaluation of the documentation and procedures associated with environmental measurements to verify that the resulting data are of acceptable quality.

Demonstration of Capability: A procedure to establish the ability of the analyst to generate analytical results by a specific method and meet measurement quality objectives.

Detection Limit (DL): The smallest analyte concentration that can be demonstrated to be different from zero or a blank concentration with 99% confidence.

%Difference (%D): A measure of precision between the expected value and the actual value, typically used to measure performance of the daily CCV RRF as compared to the Initial Calibration average RRF.

DoD: U.S. Department of Defense

Duplicate sample: A sample collected for checking the preciseness of the sampling process. Duplicate samples are collected at the same time and from the same source as the study samples.

Equipment Blank: A sample that is known not to contain the target analyte, used to check the cleanliness of sampling devices. It is collected in a sampling container from a clean sample collection device and returned to the laboratory as a sample.

Field Blank: A sample that is known not to contain the target analyte, used to check for analytical artifacts or contamination introduced by sampling and analytical procedures. It is taken to the sampling site and exposed to sampling conditions, then returned to the laboratory and treated as an environmental sample.

Field Duplicate: A sample collected at the same time from the same source but submitted and analyzed as a separate sample.

GC (gas chromatograph): Analytical instrumentation used to resolve complex mixtures into individual peaks for identification and quantitation. Separation is achieved as chemicals are retained at varying rates by the column phase.

Holding time: The maximum time that a sample may be held prior to preparation or analysis.

HPLC (high-pressure liquid chromatography): A form of liquid chromatography used to separate compounds that are dissolved in solution (also known as high-performance liquid chromatography).

Impinger: A glass vessel used to contain collection solution through which a stream of air is bubbled for sampling purposes.

Initial Calibration (ICAL): Demonstration of a linear response to different concentrations of calibration standards within a defined range.

Initial Calibration Verification (ICV): Verifies the Initial Calibration using a different source standard from the one used for Initial Calibration.

Initial Demonstration of Analytical Capability: The procedure described in USEPA 40 CFR 136 Appendix A, used to determine a laboratory's accuracy and precision in applying an analytical method.

Instrument Blank: A sample that is known not to contain the target analyte, processed through the instrumental steps of the measurement process and used to determine the absence of instrument contamination prior to analysis of field samples.

Instrument Detection Limit (IDL): The concentration of the analyte that produces a signal greater than five times the signal-to-noise ratio of the instrument.

Interference: The effect on the final result caused by the sample matrix.

Internal Standard (IS): A measured amount of a certain compound added after preparation or extraction of a sample.

Ketones: Any of a class of organic compounds characterized by a carbonyl group attached to two carbon atoms.

Key Personnel: The laboratory director, technical director, quality assurance manager, and team leader, all of whom meet the requirements of the NELAP rule.

Laboratory Control Sample (LCS): An independent second source reference standard that goes through the same pretreatment and preparation procedures as the samples. It validates the accuracy of the Initial Calibration.

Laboratory Duplicate: An aliquot of the same sample that is prepared and analyzed at the same time.

Laboratory Information Management System (LIMS): A laboratory's electronic data system that collects, analyzes, stores, and archives records and documents.

Limit of Detection (LOD): The smallest concentration of a substance that must be present in a sample in order to be detected at the DL with 99% confidence.

Limit of Quantitation (LOQ): The smallest concentration that produces a quantitative result with known and recorded precision and bias.

Matrix: The component or substrate (e.g., surface water, drinking water, air, liquid waste) which contains the analyte(s) of interest.

Matrix Spike (MS): A sample prepared to determine the effect of the matrix on a method's recovery efficiency by adding a known amount of the target analyte to a specified amount of matrix sample for which an independent estimate of the target analyte concentration is available. It is used to evaluate accuracy.

Matrix Spike Duplicate (MSD): Duplicate of the matrix spike sample. Results are compared with MS to determine precision.

Mass spectrometer (MS): Analytical instrumentation used to identify and quantify chemicals utilizing spectral fragmentation patterns based on chemical structures.

Measurement uncertainty: Measurement uncertainty is the estimation of potential errors in a measurement process and is expressed as ± 2X(*s*) of the historical mean of LCS recoveries.

Method Detection Limit (MDL): The minimum concentration of a substance that can be measured and reported with 99% confidence that the analyte concentration is greater than zero as determined from analysis of a sample containing the analyte in a given matrix (40 CFR Part 136, Appendix B, July 1995).

NCCAR (Non-conformance/Corrective Action Report): A report that identifies, communicates, tracks, and resolves a non-conformance.

NIST: National Institute of Standards and Technology

NMOC: Non-methane organic compounds

OSHA: Occupational Safety and Health Administration

PAHs (polycyclic aromatic hydrocarbons): Hydrocarbons made up of fused aromatic ring molecules.

Passive sampling: Sample collection conducted without the use of mechanical pumps or vacuums. Collection relies on principle of diffusion.

PCBs (polychlorinated biphenyls): Biphenyl compounds with chlorine atoms positioned on the benzene rings.

ppbv: parts per billion by volume

ppmv: parts per million by volume

Practical Quantitation Limit (PQL): A synonym for the standard of lowest concentration contained in the Initial Calibration. It is the smallest concentration of the analyte that can be reported with a specific degree of confidence.

Precision: The degree to which a set of observations or measurements of the same property, obtained under similar conditions, conform to themselves. Precision is usually expressed as standard deviation, variance or a range, in either absolute or relative terms.

Preservation: The temperature control or the addition of a substance to maintain the chemical or biological integrity of the target analyte.

Proficiency Testing (PT): A means to evaluate a laboratory's performance under controlled conditions relative to a given set of criteria, through analysis of unknown samples provided by an external source.

Proficiency Test (PT) sample: A sample, the composition of which is unknown to the laboratory and is provided to test whether the analyst/laboratory can produce analytical results within specified acceptance criteria.

Quality Assurance (QA): An integrated system of activities involving planning, quality control, reporting, and quality assessment and improvement to ensure that the product meets defined standards of quality with a stated level of confidence.

Quality Assurance Project Plan (QAPP): An orderly assemblage of detailed procedures designed to produce data of sufficient quality to meet the data quality objectives for a specific data collection activity.

Quality Control (QC): A procedure or set of procedures intended to ensure that a product or performed service adheres to a defined set of quality criteria.

%R: %Recovery

Relative Percent Difference (RPD): A measure of precision between two measurements calculated by dividing the absolute value of the difference between the measurements by their average and expressed as a percentage.

Reporting Limit (RL): The smallest concentration of an analyte that can be measured with a stated probability of significance. All Initial Calibrations contain a standard at the Reporting Limit. The Reporting Limit is never less than the Practical Quantitation Limit (PQL).

Reporting Limit verification: A re-quantification of the lowest concentration data point of an Initial Calibration to test the percent recovery of each component. Analyte recovery should be between 50–150% to verify detection limit accuracy.

Relative Standard Deviation (RSD): A measure of precision often used to evaluate linearity of an Initial Calibration. The relative response factor is calculated at each calibration level, and the RSD is calculated by dividing the standard deviation by the average value.

RRF: Relative Response Factor

RT: Retention Time

Safety Data Sheet (SDS): A technical document that contains information on the chemical make-up, use, storage, handling, emergency procedures, and potential health effects related to a hazardous material (formerly Material Safety Data Sheets).

Selectivity: The capability of a method or instrument to respond to the target analyte in the presence of other substances or things.

Semivolatile compound (SVOC): An organic compound which has a boiling point higher than water and which may vaporize when exposed to temperatures above room temperature.

Sensitivity: The capability of a method or instrument to discriminate between measurement responses representing different levels of a target analyte.

Soil vapor (also referred to as "soil gas"): Vapor-phase volatile compounds that migrate or evaporate from contaminated soil.

Soil vapor extraction (SVE): A physical treatment process for in situ remediation of volatile contaminants in vadose zone (unsaturated) soils.

Standard Operating Procedure (SOP): A written document that details the steps of an operation, analysis, or action, the techniques and procedures for which are thoroughly prescribed and accepted as the procedure for performing certain routine or repetitive tasks.

Surrogate: A substance unlikely to be found in the environment that has properties which mimic the target analyte and that is added to a sample to check for analytical efficiency.

Target analyte: The analyte that a test is designed to detect or quantify.

Technical employee: A designated individual who performs the analytical method and associated techniques.

TIC: Tentatively Identified Compound

TNMOC: Total non-methane organic compounds

TPH: Total petroleum hydrocarbons

TRH: Total recoverable hydrocarbons, which are differentiated from total petroleum hydrocarbons (TPH) in that non-fuel-related peaks are subtracted from the TPH result but are included in TRH.

Trip Blank: A sample known not to contain the target analyte, which is carried to the sampling site and transported to the laboratory for analysis without having been exposed to the sampling procedures.

TVH: Total volatile hydrocarbons

Vapor intrusion (VI): The process by which vapors originating from contaminated soil or groundwater migrate through the subsurface into nearby buildings, potentially impacting indoor air quality.

VPH: Volatile Petroleum Hydrocarbons

CHAMBERS
TERMS AND DEFINITIONS

Air change rate: The flow rate of clean air into the chamber divided by the chamber volume. Also, the ratio of volume of clean, conditioned air brought into the emission test chamber or building space per unit time to the chamber or building space volume.

Air flow rate: Air volume entering the emission test chamber per unit time.

Air velocity: Air speed over the surface of the test specimen.

Aldehydes: Formaldehyde, acetaldehyde, and other carbonyl compounds detectable by derivatization with DNPH and analysis by HPLC.

Area specific flow rate: Ratio of the inlet air flow rate to the nominal surface area of the product or the product test specimen.

Background concentration: VOC concentrations in emission test chamber in the absence of a product test specimen.

CREL: Non-cancer chronic reference exposure level developed by Cal/EPA OEHHA. These are inhalation concentrations to which the general population, including sensitive individuals, may be exposed for long periods (10 years or more) without the likelihood of serious adverse systemic effects other than cancer.

Emission factor: Mass of VOC emitted per unit time from a specific unit area of product surface. Other unit measures such as product mass or length may be used as appropriate.

Emission rate: Mass of VOC emitted by an entire product or test specimen per unit time.

Emission test chamber: Non-contaminating, inert enclosure of defined volume with controlled environmental conditions for inlet air flow rate, temperature, and humidity used for determination of VOC emissions from product test specimens.

Loading factor: Ratio of the exposed surface area of the product or the test specimen to the volume of the building space or the emission test chamber.

Manufacturer's identification number: Unique product identifier from which a manufacturer is able to determine the product name, product category or subcategory, manufacturing location, date of manufacture, production line, and/or other pertinent identifying information for the product.

Product category: General group of similar products intended for a particular application and performance, such as VCT, laminated wood flooring, broadloom carpet, sheet vinyl flooring, plywood, OSB, interior paint, etc.

Product subcategory: Group of products within a product category having similar chemistry, construction, weight, formulation, and manufacturing process and which may have a similar VOC emissions profile.

Representative product sample: A product sample that is representative of the product manufactured and produced under typical operating conditions.

Sampling interval: Time over which a single air sample is collected.

Sampling period: Established time for collection of air sample from emission test chamber.

Specific emission rate: Emission rate normalized to the area, mass, or length of a product (i.e., equivalent to emission factor).

Test specimen: Portion of representative sample prepared for emission testing in an emission test chamber following a defined procedure.

TVOC: Sum of the concentrations of all identified and unidentified VOCs between and including n-hexane through n-hexadecane (i.e., C_6 – C_{16}) as measured by the GC/MS TIC method and expressed as a toluene equivalent value.

Ventilation rate: Same as air change rate.

Volatile organic compounds (VOCs): Carbon-containing compounds (excluding carbon monoxide, carbon dioxide, carbonic acid, metallic carbides and carbonates, and ammonium carbonate) with vapor pressures at standard conditions approximately ranging between those for n-pentane through n-heptadecane. For the purposes of this method, formaldehyde and acetaldehyde are considered to be VOCs.

Zero time: Time establishing the beginning of an emission test.

eurofins | Air Toxics

LABORATORY QUALITY ASSURANCE MANUAL

(LQAM)

Appendix B

Procedure Cross-Reference List

(Three total pages including this cover)

Current as of March 5, 2014

Procedure Cross-Reference List

Section	*Title*	*SOP*
2	***Organization and Personnel***	
2.7	Training	87
2.8	Employee Safety	30 17
2.9	Client Services/Project Management Responsibilities	1
2.10	Confidentiality	99
2.11	Operational Integrity	
3	***Buildings and Facilities***	
3.2	Security	30
4	***Document Control***	
4.1	Controlled Documents used at Eurofins Air Toxics	44
4.2	Document Approval, Issue, Control, and Maintenance	119
4.3	Laboratory Logbooks and Forms	44
4.4	Archival and Storage of Documents	119
5	***Sample Handling***	
5.2	Sample Receipt and Entry	50
5.3	Sample Identification and Tracking	50 96
5.4	Sample Storage	63
5.5	Sample Return/Disposal	
5.6	Chain of Custody	63
6	***Technical Requirements - Traceability of Measurements***	
6.2	Calibration Standards	33
6.3	Equipment and Instrumentation	19 34 118
6.4	Computerized Systems and Computer Software	96 104
7	***Purchasing Equipment and Supplies***	
7.1	Procurement	105
7.2	Supplier Evaluation	105
8	***Analytical Methods***	
8.3	Method Validation	39 107
8.4	Procedural Deviations	61

Section	*Title*	*SOP*
9	***Internal Quality Control Checks***	
9.3	Quality Control Charts	48
9.4	Measurement Uncertainty	48
10	***Assuring Quality of Test Results***	
10.1	Data Management	96
10.2	Data Documentation	96
10.3	Data Calculations	
10.4	Reporting Limits	
10.5	Data Review	78
10.6	Data Qualification	
10.7	Data Reporting	68 78
10.8	Data Storage, Security, and Archival	
11	***Audits and Inspections***	
11.1	Internal Quality Assurance Audits	27
11.2	Management Review System	106
11.3	Client Audits Agency Inspections	27
11.4	Proficiency Testing Program	
12	***Corrective and Preventive Action***	
12.1	Laboratory Investigations and Corrective Action	61
13	***Service to Clients***	
13.1	Review of Work Requests, Tenders, and Contracts	1
13.2	Timely Delivery	1
13.3	Subcontracting	4

LABORATORY QUALITY ASSURANCE MANUAL

(LQAM)

Appendix C

Certifications and Accreditations

(Two total pages including this cover)

Current as of March 5, 2014

Certifying Agency	Air Toxics Certificate #	Basis of Certification/Approval	Location of Certificate and Parameter List
Arizona DHS	AZ0775	Onsite assessment (annual), LQAM and SOP	Laboratory internal network: O:\QA\Certifications
California DPH (Primary NELAP)	12282CA	Onsite assessment (biennial) LQAM, SOP and WP PTs	Laboratory internal network: O:\QA\Certifications
New York State DOH	11291	LQAM, Secondary NELAP	Laboratory internal network: O:\QA\Certifications
Oregon DHS (Primary NELAP)	CA300005	Onsite assessment (biennial) LQAM and SOP Review	Laboratory internal network: O:\QA\Certifications
Texas CEQ	T104704434-13-6	LQAM, Secondary NELAP	Laboratory internal network: O:\QA\Certifications
State of Utah DOH	CA009332013-4	LQAM, WP PT, Secondary NELAP	Laboratory internal network: O:\QA\Certifications
Washington DOE	C935-13	PT, Secondary NELAP	Laboratory internal network: O:\QA\Certifications
DoD-ELAP_ ISO/IEC 17025:2005	ADE-1451	DOD QSM for Environmental Laboratories v.4.2 Onsite assessment (biennial)	Laboratory internal network: O:\QA\Certifications
Virginia DCLS	2612	Secondary NELAP	Laboratory internal network: O:\QA\Certifications
New Jersey DEP	CA016	LQAM, SOPs, Secondary NELAP	Laboratory internal network: O:\QA\Certifications

All latest certificates and licenses are posted by the laboratory entrance.

eurofins | Air Toxics

LABORATORY QUALITY ASSURANCE MANUAL

(LQAM)

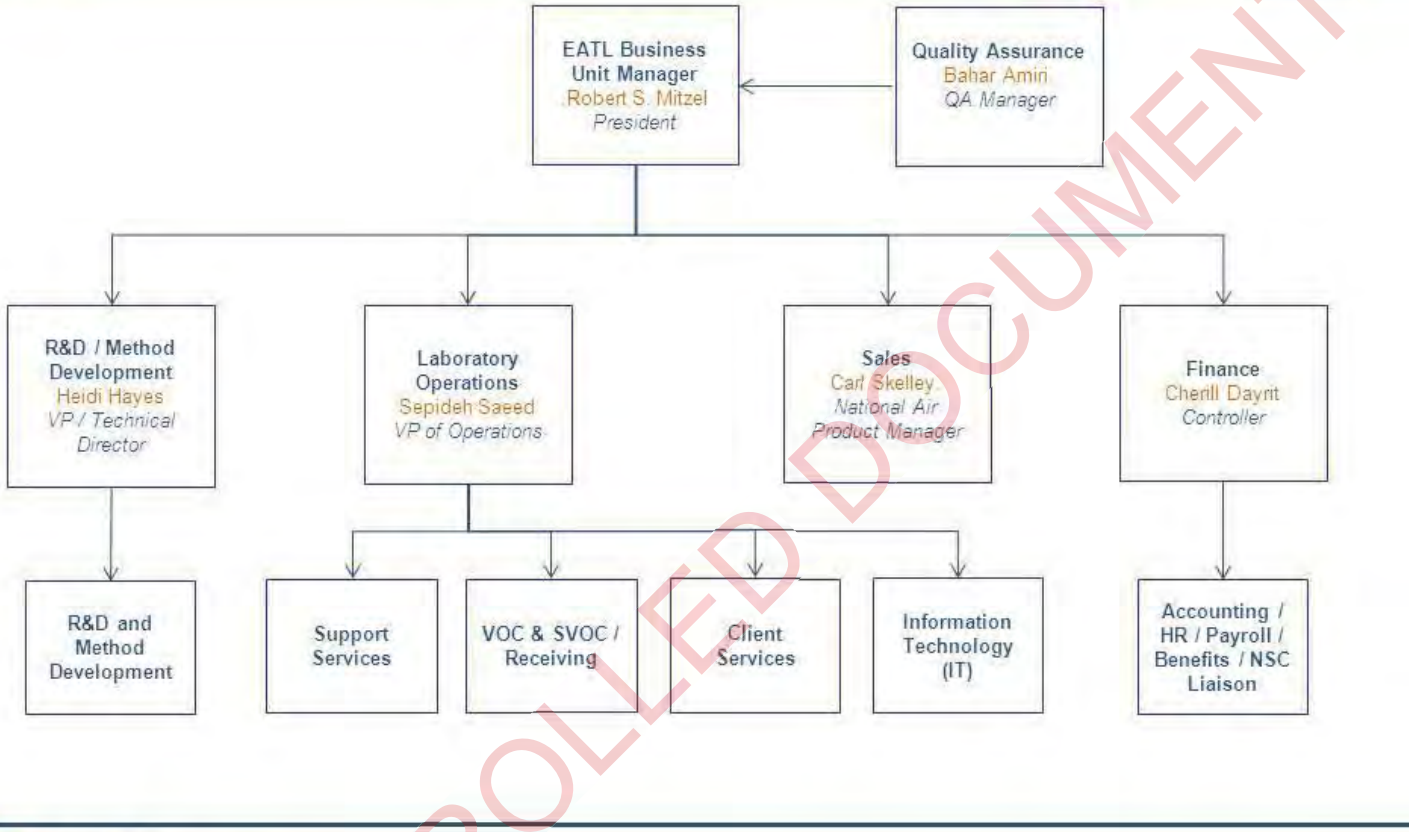
Appendix D

Organizational Charts

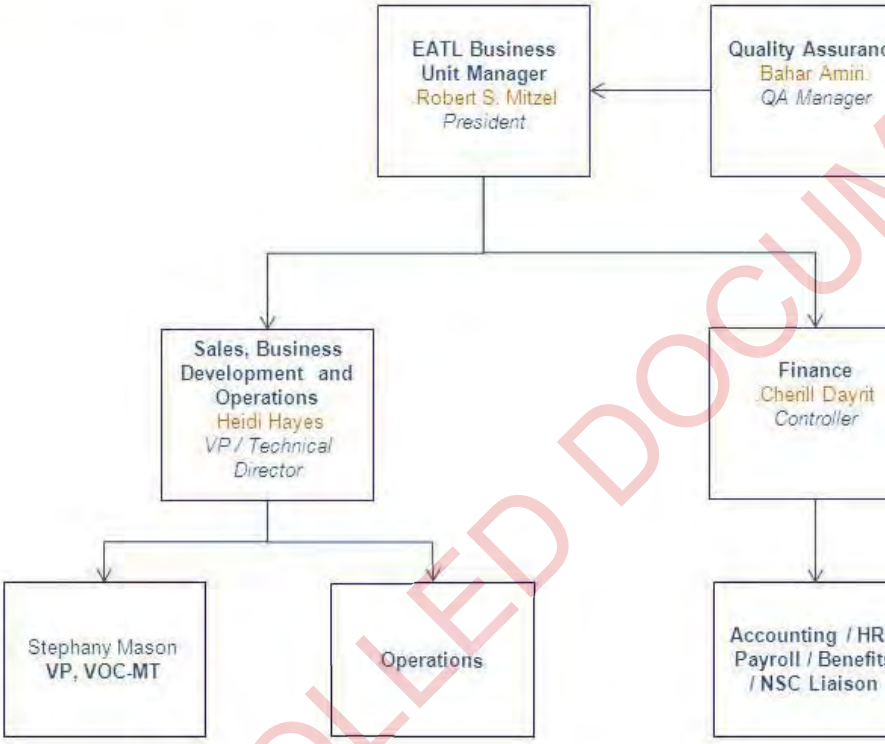
(four total pages including this cover)

Current as of March 5, 2014

Organization Chart – Eurofins Air Toxics, Inc.



Organization Chart – Product Testing



eurofins | Air Toxics

LABORATORY QUALITY ASSURANCE MANUAL

(LQAM)

Appendix E

Analytical Methods

(seventy-seven total pages including this cover)

Current as of March 5, 2014

ANALYTICAL METHODS

ANALYTICAL METHODS

Section 1.0

Method: Modified EPA TO-17 VOCs and SVOCs – General Applications

Eurofins Air Toxics SOP #5 Revision 15 Effective Date: December 23, 2013 Methods Manual Summary

Description: This method is an alternative to the canister-based sampling and analysis methods that are presented in EPA Compendium Methods TO-14A and TO-15. Sorbent sampling is also amenable to efficient collection and measurement of semi-volatile compounds that are prone to condensing on the surface of the canister. Thermal desorption gas chromatograph/mass spectrometer (GC/MS) can be applied to matrices beyond ambient air such as soil gas and materials emissions by carefully selecting the appropriate sorbent and sampling parameters. Single bed sorbents such as Tenax TA and Carbopack B can be utilized to collect a specific volatility range while multi-bed sorbent tubes are effective in collecting a wide volatility range. (See Air Toxics' TO-17 VI method for the multi-bed tube application.)

Samples are collected by drawing a measured volume of air through the sorbent tubes. Collection is performed using a low flow vacuum pump or a volumetric syringe attached to the outlet side of the tube. Analysis is accomplished by heating the sorbent tube and sweeping the desorbed compounds onto a secondary "cold" trap for water management and analyte refocusing. The secondary trap is heated for efficient transfer of compounds onto the gas chromatograph (GC) for separation followed by detection using mass spectrometry (MS).

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, safe sampling volume, and desorption efficiency are not validated. Full validation may be available upon request.

The TO-17 method offers significant flexibility in its scope and application depending on the sorbent selected. The most commonly requested sorbent tubes and associated analytes are summarized in the QC tables below.

Table 1. Summary of Sorbent Applications

Sorbent	Typical Analyte Range	Water Management
Tenax TA	C7 – C26	Hydrophobic
Tenax GR	C7 – C30	Hydrophobic
Multi-bed "VI tube" (See TO-17 VI application)	C3 – C26	Largely Hydrophobic

Table 2. Method TO-17 VOCs (Tenax GR/TA) Reporting Limits and QC Limits

Analytes	Reporting Limit (ng)	QC Acceptance Criteria		
		ICAL (%RSD)	LCS (% R)	CCV (%D)
1,1,1-Trichloroethane	5.0	30	70 – 130	30
1,1,1,2-Tetrachloroethane	5.0	30	70 – 130	30
1,1,2,2-Tetrachloroethane	5.0	30	70 – 130	30
1,1,2-Trichloroethane	5.0	30	70 – 130	30
1,1-Dichloropropene	5.0	30	70 – 130	30
1,2,3-Trichlorobenzene	5.0	30	70 – 130	30
1,2,3-Trichloropropane	5.0	30	70 – 130	30
1,2,4-Trichlorobenzene	5.0	30	70 – 130	30
1,2,4-Trimethylbenzene	5.0	30	70 – 130	30
1,2-Dibromo-3-chloropropane	5.0	30	70 – 130	30
1,2-Dichlorobenzene	5.0	30	70 – 130	30
1,2-Dichloroethane	5.0	30	70 – 130	30
1,2-Dichloropropane	5.0	30	70 – 130	30
1,3,5-Trimethylbenzene	5.0	30	70 – 130	30
1,3-Dichlorobenzene	5.0	30	70 – 130	30
1,3-Dichloropropane	5.0	30	70 – 130	30
1,4-Dichlorobenzene	5.0	30	70 – 130	30
2-Chlorotoluene	5.0	30	70 – 130	30
4-Chlorotoluene	5.0	30	70 – 130	30
Benzene	10	30	70 – 130	30
Bromobenzene	5.0	30	70 – 130	30
Bromodichloromethane	5.0	30	70 – 130	30
Bromoform	5.0	30	70 – 130	30
Butylbenzene	5.0	30	70 – 130	30
Carbon Tetrachloride	5.0	30	70 – 130	30
Chlorobenzene	5.0	30	70 – 130	30
Chloroform	5.0	30	70 – 130	30
cis-1,3-Dichloropropene	5.0	30	70 – 130	30
cis-1,4-Dichloro-2-butene	5.0	30	70 – 130	30
Cumene	5.0	30	70 – 130	30

Dibromochloromethane	5.0	30	70 – 130	30
Dibromomethane	5.0	30	70 – 130	30
Ethylbenzene	5.0	30	70 – 130	30
Ethylene Dibromide	5.0	30	70 – 130	30
Hexachlorobutadiene	5.0	30	70 – 130	30
Naphthalene	5.0	30	70 – 130	30
m,p-Xylene	10	30	70 – 130	30
o-Xylene	5.0	30	70 – 130	30
p-Cymene	5.0	30	70 – 130	30
Propylbenzene	5.0	30	70 – 130	30
sec-Butylbenzene	5.0	30	70 – 130	30
Styrene	5.0	30	70 – 130	30
tert-Butylbenzene	5.0	30	70 – 130	30
Tetrachloroethene	5.0	30	70 – 130	30
Toluene	5.0	30	70 – 130	30
trans-1,3-Dichloropropene	5.0	30	70 – 130	30
trans-1,4-Dichloro-2-butene	5.0	30	70 – 130	30
Trichloroethene	5.0	30	70 – 130	30

Note: Full list may not be appropriate, depending on sample volume requirements.

Table 3. Commonly requested TPH parameters (Tenax GR/TA)

TPH	Reporting Limit (ng)	ICAL (%RSD)	ICV (% R)	CCV (%D)	LCS (%R)
GRO (Gasoline Range)	1000	30	70 – 130	30	70 – 130
DRO (C10-C24 Diesel Range)	1000	30	70 – 130	30	70 – 130
Kerosene	1000	30	70 – 130	30	70 – 130
Mineral Spirits (C9-C12 range)	1000	30	70 – 130	30	70 – 130

Table 4. Internal Standard and Field Surrogate Recoveries

Internal Standards		
Analyte	**CCV IS % Recovery**	**Sample IS % Recovery**
Bromochloromethane	60 – 140	60 – 140
1,4-Difluorobenzene	60 – 140	60 – 140
Chlorobenzene-d5	60 – 140	60 – 140
Field Surrogates		
Analyte	**% Recovery**	
1,2-Dichloroethane-d4	50 – 150	
Toluene-d8	50 – 150	
Naphthalene-d8	50 – 150	

Table 5. TO-17 SVOCs (Tenax GR/TA)

Analytes	Reporting Limit (ng)	Acceptance Criteria		
		ICAL (%RSD)	LCS (% R)	CCV (%D)
Naphthalene	5.0	30	70 – 130	30
2-Methylnaphthalene	5.0	30	70 – 130	30
Acenaphthylene	5.0	30	70 – 130	30
Acenaphthene	5.0	30	70 – 130	30
Fluorene	5.0	30	70 – 130	30
Phenanthrene	5.0	30	70 – 130	30
Anthracene	5.0	30	70 – 130	30
Fluoranthene	5.0	30	70 – 130	30
Pyrene	10	30	70 – 130	30
Internal Standards				
Analyte	**CCV IS % Recovery**		**Sample IS % Recovery**	
Bromofluorobenzene	60 – 140		60 – 140	
Field Surrogates				
Analyte	**% Recovery**			
Naphthalene-d8	50 – 150			

Table 5. Summary of Calibration and QC Procedures for TO-17 General Application

QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action
BFB Tune Check	Every 24 hours	TO-15 tune criteria	Correct problem then repeat tune.
5-Point Calibration	Prior to sample analysis	%RSD ≤ 30%, 2 allowed out up to 40%	Correct problem then repeat Initial Calibration Curve.
LCS	After each initial Calibration Curve and daily prior to analysis	Recovery 70 – 130%	If more than 5% target compounds exceed criteria, evaluate system and reanalyze the standard. Re-prepare the standard if necessary. Re-calibrate the instrument if the criteria cannot be met.
LCSD	Each analytical batch	Recovery 70 – 130%; %RPD ≤ 25%	If more than 5% target compounds exceed criteria, evaluate system and recollection process. Correct problem and reanalyze.
Continuing Calibration Verification (CCV)	At the start of each analytical clock	70 – 130 %	If project-specified risk drivers exceed these criteria, more than 5% of the compounds exceed these criteria, or any VOC exceeds 50–150% recovery, maintenance is performed and the CCV test repeated. If the system still fails the CCV, perform a new 5-point Calibration Curve.
Laboratory Blank	After the CCV and at the end of the analytical batch	Results less than the laboratory RL	Inspect the system and re-analyze the Blank. No corrective action for Lab Blank at end of batch.
Internal Standard (IS)	As each standard, Blank, and sample is being loaded	**CCVs:** area counts 60–140%, RT w/in 20 sec of mid-point in ICAL **Blanks and samples**: Retention time (RT) must be within ±0.33 minutes of the RT in the CCV. The IS area must be within ±40% of the CCV's IS area for the Blanks and samples.	**CCV:** Inspect and correct system prior to sample analysis. **Blanks:** Inspect the system and re-analyze the Blank. **Samples:** Samples cannot be re-analyzed due to the nature of the sorbent cartridges. However investigate the problem by reviewing the data. If necessary, run a Lab Blank to check the instrument performance. Report the data and narrate.

Field Surrogates	Each clean sample tube used for pumped sample collection and lab blank and QC samples	50 – 150%	**For blanks:** Inspect the system and re-analyze the Blank. **For samples:** If no obvious reason can be ascertained after evaluation of the data and sample collection parameters, the sample should be reanalyzed to verify out of control recovery. If recovery is out of acceptance criteria in both the primary and recollected sample, the primary sample is reported with the surrogate flagged.

ANALYTICAL METHODS

Section 2.0

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

Eurofins Air Toxics SOP #6 Revision 30 Effective Date: April 30, 2013 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
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
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**	2.0	≤40%	60 – 140	60 – 140	± 25
TPH (Gasoline) ***	25	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

Analyte	Accuracy (% R)
Bromochloromethane	60 – 140
1,4-Difluorobenzene	60 – 140
Chlorobenzene-d_5	60 – 140

Table 4. Surrogates

Analyte	Accuracy (% R)
1,2-Dichloroethane-d_4	70 – 130
Toluene-d_8	70 – 130
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 ≤ 30 with 2 compounds allowed out to ≤ 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.

QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action
Internal Standard (IS)	As each standard, blank, and sample is being loaded	Retention time (RT) for blanks and samples must be within ±0.33 min of the RT in the CCV and within ±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.
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 ≤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.

ANALYTICAL METHODS

Section 3.0

Method: ASTM D1946 – Atmospheric Gases

Eurofins Air Toxics SOP #8 Revision 22 Effective Date: December 24, 2013 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, fixed gases, and Non-Methane Organic Carbon (NMOC) using modified ASTM D1946 protocols. 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 FID and a 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 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.

Since the protocols in the ASTM D1946 standard were designed for the analysis of reformed gas, the laboratory has taken modifications 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, reporting limits (RL), Quality Control (QC) criteria, and QC summary can be found in the following tables.

Table 1. Summary of Method Modifications for ASTM D1946

Requirement	ASTM D1946	Eurofins Air Toxics Modifications
Calibration	A single-point calibration is performed using a reference standard closely matching the composition of the unknown.	A minimum 3-point calibration curve is performed. Quantitation is based on a daily calibration standard, which may or may not resemble the composition of the associated samples.
Reference Standard	The composition of any reference standard must be known to within 0.01 mol % for any component.	The standards used by Eurofins Air Toxics are blended to a ≥ 95% accuracy.
Sample Injection Volume	Components whose concentrations are in excess of 5% should not be analyzed by using sample volumes greater than 0.5 mL.	The sample container is connected directly to a fixed volume sample loop of 1.0 mL. Linear range is defined by the calibration curve. Bags may be loaded by vacuum or by positive pressure.
Normalization	Normalize the mole percent values by multiplying each value by 100 and dividing by the sum of the original values. The sum of the original values should not differ from 100% by more than 1.0%.	Results are not normalized. The sum of the reported values can differ from 100% by as much as 15%, either due to analytical variability or an unusual sample matrix.

Precision	Precision requirements established at each concentration level.	Duplicates should agree within 25% RPD for detections >5X the RL.

Table 2. ASTM D1946 Method Compound List and QC Limits

Compound	Reporting Limit (%)	ICAL Criteria (%RSD)	ICV/LCS Criteria (%R)	CCV Criteria (%D)	Precision Limits (RPD)**
Carbon Dioxide	0.010	≤ 15%	85 – 115	± 15%	± 25%
Carbon Monoxide	0.010	≤ 15%	85 – 115	± 15%	± 25%
Methane	0.00010	≤ 15%	85 – 115	± 15%	± 25%
Ethene	0.0010	≤ 15%	85 – 115	± 15%	± 25%
Ethane	0.0010	≤ 15%	85 – 115	± 15%	± 25%
Nitrogen	0.10	≤ 15%	85 – 115	± 15%	± 25%
NMOC	0.010	≤ 15%	85 – 115	± 15%	± 25%
Oxygen	0.10	≤ 15%	85 – 115	± 15%	± 25%
Helium	0.050	≤ 15%	85 – 115	± 15%	± 25%
Hydrogen	0.010*	≤ 15%	85 – 115	± 15%	± 25%

*Reporting limit is 1.0% when sample is pressurized with Helium.
**For detections greater than 5 times the reporting limit.

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 D1946

QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action
Initial Calibration Curve (ICAL)	Prior to sample analysis	RSD ≤ 15%	Correct problem then repeat Initial Calibration.
Second Source Verification (LCS)	All analytes: once per Initial Calibration, and with each analytical batch.	%R between 85–115%	Check the system and re-analyze the standard. Re-calibrate the instrument if the criteria cannot be met.
Continuing Calibration Verification (CCV)	Daily prior to sample analysis and after every 20 reportable samples.	%D ±15%	Check the system and re-analyze the standard. Re-calibrate the instrument if the criteria cannot be met.
Laboratory Blank (He) (N_2 for He and H_2 analysis)	After each daily check standard and prior to sample analysis, or when contamination is present.	Results below the RL	Inspect the system and re-analyze the Blank.
End Check	At the end of analytical sequence. It can be primary (CCV) or Independent Source (LCS).	%R between 85–115%	Check system and re-analyze the standard. If the 2nd analysis fails, identify and correct the problem. Samples analyzed after the last acceptable CCV are re-analyzed.
Sample Duplicates - Laboratory Control Spike Duplicate (LCSD)	One per analytical batch	RPD ≤ 25%	Narrate exceedances. Investigate the cause and perform maintenance as required and re-calibrate as needed.

ANALYTICAL METHODS

Section 4.0

Method: EPA Method TO-13A PAHs (Full Scan and SIM)

Eurofins Air Toxics SOP #10	Revision 18	Effective Date: April 26, 2013	Methods Manual Summary
Eurofins Air Toxics SOP #74	Revision 10	Effective Date: January 14, 2013	Methods Manual Summary

Description: This method involves drawing a measured volume of air through a filter and sorbent cartridge to collect Polychlorinated Biphenyls (PAHs) in the vapor and particulate phases. The cartridge can be PUF/XAD2 or XAD2 only. While TO-13A describes the use of a high-volume sampling pump, which allows for up to 300 cubic meters (m^3) of air to be collected over a 24-hour period, the method can also be applied to low-volume sample applications suitable for indoor air or soil gas. The sample media is extracted in the laboratory using Soxhlet extraction or pressurized fluid extraction (PFE). The concentrated extracts are analyzed for PAHs using a quadrupole gas chromatograph/mass spectrometer (GC/MS) in full scan or SIM mode by TO-13A protocol. Eurofins Air Toxics performs a modified version of this method. The method modifications, standard target analyte list, Limit of Quantitation (LOQ), QC criteria, and QC summary can be found in the following tables.

In relation to the prescribed media, sampling and collection efficiencies for compounds not listed in TO-13A have not been evaluated. However, if non-standard compounds are required for a project, the laboratory reports these 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.

Required Field QC: EPA Method TO-13 requires at least one field blank per sampling episode. Matrix spikes are referenced, but not definitively required in the routine QA specifications.

Table 1. Summary of Method Modifications for TO-13A

Requirements	EPA Method TO-13A	Eurofins Air Toxics Modifications
Extraction Solvent	10% ether in hexane for PUF; DCM for XAD sorbent. Final extract in hexane.	DCM for PUF/XAD cartridge and XAD sorbent. Final extract in DCM.
Glassware Cleaning	Muffle furnace is utilized.	Solvent cleaning procedure is used.
Extraction Technique	Soxhlet extraction	Soxhlet extraction or pressurized fluid extraction (PFE)
Reporting List	19 PAHs	See Table 2
Calibration range	0.1–2.5 µg/mL in hexane	1.0–160 µg/mL in methylene chloride for standard (quad) or 0.1–40 µg/mL for SIM
Method Blank	< MDL	< Reporting Limit

Table 2. Modified Method TO-13A Analyte List and Reporting Limits

Analyte	SIM RL (µg)	RL (µg)	Minimum ICAL RRF	ICAL (%RSD)	ICV (%R)	CCV (%R)	Precision (%RPD)
2-Chloronaphthalene*	0.1	1.0	NA	≤ 30	± 30	± 30	≤ 25%
2-Methylnaphthalene*	0.1	1.0	NA	≤ 30	± 30	± 30	≤ 25%
Acenaphthylene	0.1	1.0	1.3	≤ 30	± 30	± 30	≤ 25%
Acenaphthene	0.1	1.0	0.8	≤ 30	± 30	± 30	≤ 25%
Anthracene	0.1	1.0	0.7	≤ 30	± 30	± 30	≤ 25%
Benzo(a)anthracene	0.1	1.0	0.8	≤ 30	± 30	± 30	≤ 25%
Benzo(e)pyrene*	0.1	1.0	NA	≤ 30	± 30	± 30	≤ 25%
Benzo(a)pyrene	0.1	1.0	0.7	≤ 30	± 30	± 30	≤ 25%
Benzo(b)fluoranthene	0.1	1.0	0.7	≤ 30	± 30	± 30	≤ 25%
Benzo(g,h,i)perylene	0.1	1.0	0.5	≤ 30	± 30	± 30	≤ 25%
Benzo(k)fluoranthene	0.1	1.0	0.7	≤ 30	± 30	± 30	≤ 25%
Chrysene	0.1	1.0	0.7	≤ 30	± 30	± 30	≤ 25%
Dibenz(a,h)anthracene	0.1	1.0	0.4	≤ 30	± 30	± 30	≤ 25%
Fluoranthene	0.1	1.0	0.6	≤ 30	± 30	± 30	≤ 25%
Fluorene	0.1	1.0	0.9	≤ 30	± 30	± 30	≤ 25%
Indeno(1,2,3-c,d)pyrene	0.1	1.0	0.5	≤ 30	± 30	± 30	≤ 25%
Naphthalene	0.1	1.0	0.7	≤ 30	± 30	± 30	≤ 25%
Phenanthrene	0.1	1.0	0.7	≤ 30	± 30	± 30	≤ 25%
Pyrene	0.1	1.0	0.6	≤ 30	± 30	± 30	≤ 25%

* Not included in the TO-13A method.

The following two compounds can be analyzed upon client request:

Analyte	SIM RL (µg)	RL (µg)	Minimum ICAL RRF	ICAL (%RSD)	ICV (%R)	CCV (%R)	Precision (%RPD)
Perylene	N/A	1.0	0.5	≤ 30	± 30	± 30	≤ 25%
Coronene	N/A	1.0	0.7	≤ 30	± 30	± 30	≤ 25%

Table 3. Surrogates

Field Surrogates	Accuracy (%R)
Fluoranthene-d_{10}	50 – 150
Benzo(a)pyrene-d_{12}	50 – 150

Extraction Surrogates	Accuracy (%R)*
Fluorene-d_{10}	60 – 120
Pyrene-d_{10}	60 – 120

Table 4. Internal Standards

Analyte	Accuracy (%R)
Acenaphthene-d_{10}	-50 to +100
Chrysene-d_{12}	-50 to +100
1,4-Dichlorobenzene-d_4	-50 to +100
Naphthalene-d_8	-50 to +100
Perylene-d_{12}	-50 to +100
Phenanthrene-d_{10}	-50 to +100

Table 5. Extracted Laboratory Control Samples for TO-13A (PAHs) in Full Scan and SIM

Analyte	(%R)*
Naphthalene	60 – 120
Acenapthylene	60 – 120
Acenaphthene	60 – 120
Fluorene	60 – 120
Phenanthrene	60 – 120
Anthracene	60 – 120
Fluoranthene	60 – 120
Pyrene	60 – 120
Benzo(a)anthracene	60 – 120
Chrysene	60 – 120
Benzo(b)fluoranthene	60 – 120
Benzo(k)fluoranthene	60 – 120
Benzo(a)pyrene	60 – 120
Indeno(1,2,3-cd)pyrene	60 – 120
Dibenzo(a,h)anthracene	60 – 120
Benzo(g,h,i)perylene	60 – 120
2-Methylnaphthalene	60 - 120
2-Chloronaphthalene	60 – 120

*The LCS and Surrogate limits are derived from Compendium Method TO-13A, Sections 13.3.7.4 and 13.4.6.3 (January 1999). These limits only apply to samples that are extracted by Eurofins Air Toxics. When sample extracts are sent to the lab for analysis only, limits of 50-150 % are applied.

Table 6. Summary of Calibration and QC Procedures for EPA Method TO-13A

QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action
Tuning Criteria	Prior to calibration and at start of every 12 hours	TO-13A tuning criteria	Correct problem then repeat tune.
Initial 5-Point Calibration	Prior to sample analysis	ICAL criteria in Table 2	Correct problem then repeat initial calibration.
ICAL ICV	All analytes: Once per initial calibration	All target compound recoveries must be between 70 – 130%	Determine the source of discrepancy between standards. Re-calibrate if needed.
Continuing Calibration Verification (CCV)	At the start of every clock immediately after the DFTPP tune check	PAHs list: Meet Table 2 Min. RRF requirement; %D ≤ 30%	Investigate and correct the problem, up to and including re-calibration if necessary. High bias associated with non-detects in samples will not result in re-analysis.
Internal Standards (IS)	Injected into each standard, blank, and sample extract prior to analysis	**For CCV:** Area count within 50% to 200% of the midpoint of ICAL. **For blanks, samples, and non-CCV QC checks:** retention times within ± 0.33 minutes (20 seconds) and area counts within 50% to 200% of the CCV.	**For CCVs:** Investigate and correct the problem before proceeding with sample analysis. **For blanks:** Inspect the system and re-analyze the blank. **For samples and non-CCV QC:** Unless there is obvious matrix effect, re-analyze the samples and dilute the sample until the ISs meet the criteria; narrate the data to indicate interference.
Surrogates	Field Surrogates: Blank cartridges prior to transport to field for sampling and lab QC prior to extraction. Extraction Surrogates: All samples and lab QC prior to extraction.	See Table 3.	A new aliquot of the extract is analyzed. If Surrogate recoveries are out-of-control a second time, data is flagged and narrated. Re-analysis is not necessary for obvious matrix effects (data is flagged for out-of-control surrogate recoveries). Air samples cannot be re-extracted.
Extracted Laboratory Control Samples (LCS)	With each set of up to 20 extracted samples	See LCS criteria in Table 5.	Re-aliquot and re-analyze the extract. If within limits, report the re-analysis. Otherwise, narrate.

Laboratory Blank	With each set of up to 20 extracted samples	Results less than laboratory reporting limit (Table 2).	Re-aliquot and re-analyze the extract. If less than reporting limit, report the re-analysis. Otherwise, narrate and flag the data.
Solvent Blank	When samples that are extracted together are analyzed on different analytical shifts	All target compounds below the reporting limit (Table 2).	Re-aliquot and re-analyze the solvent. If less than reporting limit, report the re-analysis. Identify the source of contamination, and perform maintenance as needed. If maintenance required, restart the analytical clock.
Laboratory Duplicates – Laboratory Control Spike Duplicates	One per analytical batch	RPD ≤ 25%	Re-analyze duplicate. Investigate the cause, perform maintenance as required, and re-calibrate as needed.

ANALYTICAL METHODS

Section 5.0

Method: Modified EPA Method TO-11A Aldehydes/Ketones

Eurofins Air Toxics SOP #11 Revision 17 Effective Date: March 4, 2014 Methods Manual Summary

Description: This method involves high-pressure liquid chromatography (HPLC) analysis of aldehydes and ketones in ambient air samples. The sampling media is a 2,4-Dinitrophenylhydrazine (DNPH)-coated (silica) cartridge. Aldehydes and ketones are readily converted to a stable hydrazone derivative. The DNPH cartridges are eluted with acetonitrile using gravity-feed technique. Analysis is performed by reverse phase HPLC with UV detection at 360 nm.

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-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. For the extraction process, the non-standard compound recovery is evaluated in the extracted laboratory control spike. In addition, stability of the non-standard compound during sample storage is not validated. Full validation may be available upon request.

Eurofins Air Toxics performs modified versions of this method. The method modifications, standard target analyte list, Limits of Quantitation (LOQs), reporting limits (RLs), Quality Control (QC) criteria, and QC summary can be found in the following tables.

Table 1. Summary of Method TO-11A Modifications

Requirement	TO-11A	Eurofins Air Toxics Modifications
Initial Calibration Curve (ICAL)	Multi-point using linear regression performed every 6 months	Multi-point using average Response Factor; re-calibration if daily calibration fails, major maintenance, or column change. Linear regression is performed when requested. Initial Calibration (ICAL) is performed at least once per year.
ICAL Criteria	R^2 for curve ≥ 0.999	%RSD $\leq$ 10% unless linear regression is required, with R^2 for curve ≥ 0.999
Blank Subtraction	Average blank concentrations calculated. Blank value subtracted from sample result.	One Lab Blank is analyzed per batch; no automatic blank subtraction performed on samples.
Retention Times	Precision of Retention Times ±7%	Retention Time window study is performed, but RT windows are determined by bracketing standards.

Table 2. Method TO-11A Analyte List and QC Criteria (Environmental Field Samples)

Analyte	TO-11A LOQ/RL[a] (µg)	ICAL (%RSD)	ISCV (%R)	CCV (%R)
Acetaldehyde	0.10	≤ 10	± 15	± 10
Acrolein[b]	0.25[d]	≤ 10	± 15	± 10
Benzaldehyde	0.25	≤ 10	± 15	± 10
Crotonaldehyde	0.25	≤ 10	± 15	± 10
Formaldehyde	0.05	≤ 10	± 15	± 10
Hexanal	0.25	≤ 10	± 15	± 10
Isopentanal	0.25	≤ 10	± 15	± 10
MEK/Butyraldehydes[c]	0.25	≤ 10	± 15	± 10
m,p-Tolualdehyde	0.25	≤ 10	± 15	± 10
o-Tolualdehyde	0.25	≤ 10	± 15	± 10
Pentanal	0.25	≤ 10	± 15	± 10
Propanal	0.25	≤ 10	± 15	± 10
Acetone	0.25	≤ 10	± 15	± 10
Acetophenone*	N/A	≤ 10	± 15	± 10
Isophorone*	N/A	≤ 10	± 15	± 10
Heptaldehyde*	0.25	≤ 10	± 15	± 10
2,5-Dimethylbenzaldehyde*	0.25	≤ 10	± 15	± 10

[a] Noted reporting limits are subject to change based on most current MDL study.

[b] Because its derivative is not stable, when the target analyte list includes Acrolein the sample will need to be extracted in field. A special order should be placed with the laboratory during the project set-up stage.

[c] Methyl Ethyl Ketone and the Butyraldehydes co-elute.

[d] Not recommended.

* Special compounds upon request only.

Table 3. Summary of Calibration and QC Procedures for Method TO-11A

QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action
5-Point Initial Calibration Curve (ICAL)	Analyzed in triplicate prior to sample analysis	%RSD ≤ 10	Repeat calibration.
Instrument LCS	With each ICAL	%R = 85–115%	Check the system and re-analyze the standard. Re-calibrate the instrument if the criteria cannot be met.
Continuing Calibration Verification (CCV)	Daily prior to sample analysis, after a maximum of every 10 injections, and at the end of the analytical batch	Within ±10% of the expected value	Check the system and re-analyze the standard. If the criteria cannot be met, re-calibrate the instrument. If the standard is biased low, re-analyze all samples since last acceptable CCV. If biased high and samples are "ND", re-analysis is not required. "Q"-flag high recoveries.
Instrument (Solvent) Blank Analysis	Following analysis of Standards	Results less than the laboratory RL	Inspect the system and re-analyze the blank.
Laboratory Duplicates - Laboratory Control Spike Duplicate	One per analytical batch	RPD ≤ 25%	Re-analyze the sample a third time. If the limit is exceeded again, investigate the cause and bring the system back to working order. If no problem is found with the system, narrate the data.

ANALYTICAL METHODS

Section 6.0

Method: ASTM D5504 – Sulfur Compounds

Eurofins Air Toxics SOP #13 Revision 17 Effective Date: December 27, 2013 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 (H_2S), 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: The Quality Control (QC) elements listed in the latest ASTM Method D5504-01 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:

- All field samples are not analyzed in duplicate.
- Daily spiked field samples are not analyzed.

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 ≤ 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 2nd 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.

ANALYTICAL METHODS

Section 7.0

Method: Modified EPA Methods TO-4A/TO-10A Pesticides and PCBs

Eurofins Air Toxics SOP #26 Revision 18 Effective Date: December 27, 2013 Methods Manual Summary

Description: These methods involve drawing a measured volume of air through a filter and PUF cartridge to collect pesticides and Aroclors in the vapor and particulate phases. EPA Method TO-4A describes the use of a high-volume sampling pump which allows for up to 300 cubic meters (m^3) of air to be collected over a 24-hour period, while the TO-10A method describes a low-volume sample application suitable for indoor air. Filters are not required for TO-10A sample collection. The sample media is extracted in the laboratory using Soxhlet extraction or Pressurized Fluid Extraction (PFE). The extracts are solvent-exchanged to hexane, concentrated to a final volume, and analyzed for chlorinated pesticides and PCBs using a gas chromatograph (GC) equipped with a dual Electron Capture Detector (ECD) for detection and confirmation.

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. For the extraction process, the non-standard compound recovery is evaluated in the extracted laboratory control spike. In addition, stability of the non-standard compound during sample storage is not validated. Full validation may be available upon request.

Eurofins Air Toxics performs modified versions of these methods. The method modifications, standard target analyte list, reporting limit (RL) Quality Control (QC) criteria, and QC summary can be found in the following tables.

Table 1. Summary of Method Modifications for TO-4A/TO-10A

Requirement	EPA Methods TO-4A/TO-10A	Eurofins Air Toxics Modifications
Extraction Solvent	10% (5% for TO-10A) Diethyl Ether in Hexane	Dichloromethane (DCM) exchanging to Hexane during the concentration step
Reagent Blank	Set up extraction system without filter/PUF; reflux with solvent.	No Reagent Blank is extracted. Reagent lots are certified as acceptable prior to use.
Media certification (TO-10A only)	< 0.01 µg for single peak analytes; < 0.1 µg for PCBs	< Reporting Limit for all analytes
Frequency of Continuing Calibration Verification (CCV)	Every 10 samples	Every 20 samples with internal standard
PCB Quantitation	Requires a minimum of 5 peaks.	Use 4 peaks for quantitation.

Field Spike	Requires one PUF cartridge from each batch of 20 to be spiked with standard and not be used during the sampling period. The spiked PUF plug is placed in a sealed container, then extracted along with samples.	A spike is prepared at the time of sample extraction only.
Sampling Efficiency Determination	Prior to implementation of method and then periodically determine sampling efficiency by spiking PUF and sampling ambient air to determine recoveries.	No sampling efficiencies have been determined by the laboratory.

Table 2. Methods TO-4A/TO-10A Reporting and QC Limits

Analyte	RL (µg)	Low Point of the Curve (µg)	QC Acceptance Criteria			
			ICAL (%RSD)	ICV (%R)	CCV (%D)	LCS (%R)
4,4'-DDD	0.10	0.10	≤ 20	± 15	± 15	65 – 125
4,4'-DDE	0.10	0.10	≤ 20	± 15	± 15	65 – 125
4,4'-DDT	0.10	0.10	≤ 20	± 15	± 15	65 – 125
4,4'-Methoxychlor	1.0	1.0	≤ 20	± 15	± 15	65 – 125
Aldrin	0.10	0.10	≤ 20	± 15	± 15	65 – 125
alpha-BHC	0.10	0.10	≤ 20	± 15	± 15	65 – 125
cis-Chlordane	0.10	0.10	≤ 20	± 15	± 15	65 – 125
Aroclor 1016/1242	1.0	1.0	≤ 20	± 15	± 15	65 – 125
Aroclor 1221[①]	1.0	NA	≤ 20	± 15	± 15	
Aroclor 1232[①]	1.0	NA	≤ 20	± 15	± 15	
Aroclor 1248[①]	1.0	NA	≤ 20	± 15	± 15	
Aroclor 1254[①]	1.0	NA	≤ 20	± 15	± 15	
Aroclor 1260	1.0	1.0	≤ 20	± 15	± 15	65 – 125
beta-BHC	0.10	0.10	≤ 20	± 15	± 15	65 – 125
delta-BHC	0.10	0.10	≤ 20	± 15	± 15	65 – 125
Dieldrin	0.10	0.10	≤ 20	± 15	± 15	65 – 125
Endosulfan I	0.10	0.10	≤ 20	± 15	± 15	65 – 125
Endosulfan II	0.10	0.10	≤ 20	± 15	± 15	65 – 125
Endosulfan Sulfate	0.10	0.10	≤ 20	± 15	± 15	65 – 125
Endrin	0.10	0.10	≤ 20	± 15	± 15	65 – 125
Endrin Aldehyde*	0.10	0.10	≤ 20	± 15	± 15	65 – 125
Endrin Ketone	0.10	0.10	≤ 20	± 15	± 15	65 – 125
gamma-BHC (Lindane)	0.10	0.10	≤ 20	± 15	± 15	65 – 125
trans-Chlordane	0.10	0.10	≤ 20	± 15	± 15	65 – 125
Heptachlor	0.10	0.10	≤ 20	± 15	± 15	65 – 125
Heptachlor Epoxide	0.10	0.10	≤ 20	± 15	± 15	65 – 125
Technical Chlordane[①④]	1.0	NA	≤ 20	± 15	± 15	
Toxaphene[①]	1.0	NA	≤ 20	± 15	± 15	

Mirex is not included in the standard pesticides list but can be performed upon request.

*Internal studies have shown poor recoveries of Endrin Aldehyde from PUF cartridge. In-house generated control limits are used to evaluate recovery of this compound.

Surrogates③

Analyte	%R
2,4,5,6-Tetrachloro-m-xylene (TCMX)	60 – 120②
Decachlorobiphenyl (DCB)	60 – 120②

① *The noted multi-component compounds use a one-point calibration.*
② *Recovery limits are derived from Compendium Method TO-10A January 1999.*
③ *Recovery limits are for extracted samples only. Non-extracted samples use limits of 85–115 %R.*
④ *Not routinely reported but available at client request.*

Table 3. Summary of Calibration and QC Procedures for Methods TO-4A/TO-10A

QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action
5-Point Initial Calibration Curve (ICAL)*	Prior to sample analysis	%RSD ≤ 20 for each compound or average %RSD ≤ 20.	Use linear regression per SW-846 or re-calibrate.
Independent Calibration Verification (ICV)	After each Initial Calibration	Recovery of an individual component or the average of all the target components for a list of 5 or more target components within 85–115% recovery. Not to exceed 75–125% for any individual compounds.	Investigate the source of discrepancy, including re-preparation and re-analysis of standard. Re-calibrate if needed.
Breakdown Check (Endrin and p,p'-DDT)	Daily, prior to Initial Curve; CCV for pesticide analysis only.	Degradation ≤ 15%	Perform maintenance. Repeat breakdown check.
Continuing Calibration Verification (CCV)	Daily, prior to sample analysis, every 20 samples, and at the end of the analysis sequence, at a minimum of every 24 hours.	Recovery of an individual component or the average of all the pesticide target components for a list of 5 or more target components, within 15% of the expected values. Not to exceed 75–125% for any individual compounds.	Analyze new ICAL and/or prepare fresh standards. If the standard analyzed is recovering high and associated samples are ND, "Q" flag the high recoveries. If the standard analyzed is recovering low, re-analyze all samples.
Laboratory Control Spike (LCS) for compounds noted in Table 2.	Extracted with each set of up to 20 samples	As mentioned in Table 2	Analyze another aliquot. If it still fails, "Q" flag the compounds that are outside the control limits.

Surrogates	All samples, QC, and blanks prior to extraction	As mentioned in Table 2	Analyze another aliquot. If it still fails, "Q" flag the compounds outside the control limits.
Internal Standard	With all analyses	CCV 50–200% compared to midpoint of ICAL; samples 50–200% compared to first CCV of the daily analytical batch.	Analyze another aliquot. If a CCV fails, correct problem before proceeding. If a sample fails, analyze a second time. If it still fails, dilute the sample until IS meets the criteria. Narrate the matrix interference.
Laboratory Blanks	With each set of up to 20 samples extracted	Results less than the Laboratory reporting limit.	Analyze another aliquot. If it still fails, "B" flag the compounds that do not meet the acceptance criteria.
Laboratory Duplicates Laboratory Control Spike Duplicate	One per analytical batch	RPD ≤ 25%	Narrate exceedances. Investigate the cause and perform maintenance as required and re-calibrate as needed.
Second-Column Confirmation	100% for all positive results, for both pesticide and PCB analyses	Same as for initial or primary column analysis	Same as for initial or primary column analysis

* A single-point calibration is performed for Technical Chlordane, Toxaphene, and certain Aroclors.

ANALYTICAL METHODS

Section 8.0

Method: EPA Method TO-12 (Non-methane Organic Compounds)

Eurofins Air Toxics SOP #36 Revision 16 Effective Date: April 03, 2013 Methods Manual Summary

Description: This method involves gas chromatograph analysis of whole air samples collected in Summa™ canisters or Tedlar bags. Samples are analyzed for Non-Methane Organic Compounds (NMOC) using EPA Method TO-12 protocols. After concentration on a sorbent bed, samples are analyzed using a Flame Ionization Detector (FID). This method is used when speciation is not required.

NMOC concentrations are quantified using the response factor of heptane. As required by the project, NMOC results referenced to heptane can be converted to units of ppmC (parts per million of Carbon). Additionally, hydrocarbon ranges can be provided based on the elution time of the normal alkanes on the GC column.

Eurofins Air Toxics performs a modified version for each of these methods. The method modifications, standard target analyte list, RL, QC criteria, and QC summary can be found in the following tables.

Table 1. Summary of Method Modifications for TO-12

Requirement	EPA Method TO-12	Eurofins Air Toxics Modifications
Reporting Limit	0.02 ppmC	0.010 ppmv
Initial Calibration	Five levels: Each level three runs with %RSD < 3%; linearity criterion not specified	Minimum of three single levels; %RSD ≤ 30%.
Sample Analysis Frequency	Duplicate analysis with RPD<5%; report average results of two analyses.	Single analysis. Duplicate 10% of samples with RPD ≤ 25% for detections > 5X the RL.
Column*	GC column not used.	GC column used for analysis.
Sample concentration	Cyrogenic concentration	Multibed sorbent concentration

* The column modification implemented for sample analysis allows for additional characterization based on carbon ranges.

Table 2. Method Compound List and QC Limits

Analyte	RL (ppmv)	Acceptance Criteria		
		ICAL (%RSD)	LCS/CCV (%R)	Precision (%RPD)
Total NMOC ref. to Heptane	0.010	≤ 30	75-125%	≤ 25

Table 3. Summary of Calibration and QC Procedures for TO-12 (NMOC)

QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action
Initial Calibration Curve (ICAL)	Prior to sample analysis and/or annually	% RSD ≤ 30	Repeat the calibration.
Laboratory Control Sample (LCS)	With each initial calibration and analytical batch	75–125% of the expected value	Check the system and re-analyze the standard. Re-calibrate the instrument if the criteria cannot be met.
Continuing Calibration Verification (CCV)	Daily prior to sample analysis and after every 20 samples or at the end of the analytical sequence	% Difference ± 25 of expected value	Check the system and re-analyze the standard. Re-calibrate the instrument if the criteria cannot be met. Re-analyze all samples since the last acceptable CCV.
Laboratory Blank	In between analysis of standards and project samples	Results less than laboratory reporting limit	Repeat the Laboratory Blank. If the re-analysis of the Lab Blank contains above but at less than 5X the reporting limit, sample analysis may proceed and the associated sample results will be reported with a B flag.
Laboratory Duplicates/ Laboratory Control Spike Duplicate (LCSD)	One per analytical batch	RPD ≤ 25%	Narrate exceedances. Investigate the cause and perform maintenance as required and re-calibrate as needed.

ANALYTICAL METHODS

Section 9.0

Method: EPA Method TO-14A/TO-15 Volatile Organic Compounds by SIM

Eurofins Air Toxics SOP #38 Revision 17 Effective Date: December 27, 2013 Methods Manual Summary

Description: This method involves Selective Ion Monitoring (SIM) 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 the sample is withdrawn from the canister through a mass flow controller and concentrated onto a hydrophobic drying system that removes water from the sample stream. The sample is then focused onto a cryogenic-cooled column prior to analysis by GC/MS in the SIM mode.

Mass spectrometer detectors can be set to acquire both SIM and full scan data simultaneously. This generates two separate data files in the analytical software. One file contains full scan data and the other contains SIM data for selected compounds. The results for each sample in a report will be from two separate data files originating from the same analytical run. The two data files have the same base file name and are differentiated with a "sim" extension on the SIM data file.

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 SIM.

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. If full validation of the required compound(s) is not available, the laboratory will present Quality Control (QC) options to the client based on the project objectives.

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.

All samples submitted for TO-15 SIM are screened prior to analysis. If samples contain high concentrations of target and/or non-target VOCs, samples may be analyzed by an alternative TO-15 method (i.e. Standard or 5&20) with a higher dynamic calibration range.

Eurofins Air Toxics performs a modified version of TO-15 SIM as detailed in Table 1. Additionally, 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, Eurofins Air Toxics performs a modified version of method TO-14A as described in Table 2. The default SIM target list, reporting limits (RL), QC criteria and QC summary may be found in tables 3 and 4.

Table 1. Summary of TO-15 SIM Method Modifications

Requirement	TO-15	Eurofins Air Toxics Modifications
Blank and standards	Zero Air	Nitrogen

Table 2. Summary of TO-14A SIM Method Modifications

Requirement	TO-14A	Eurofins Air Toxics Modifications
Sample Drying System	Nafion Dryer	Multibed hydrophobic sorbent
ICAL %RSD acceptance criteria	≤ 30% RSD for listed 39 VOCs	Follow TO-15 requirements of ≤ 30%RSD with 2 of standard compound list allowed out to ≤ 40%RSD
Blank and standards	Zero air	Nitrogen
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%

Table 3. Method TO-14A/TO-15 Standard Analyte List (SIM) and QC Limits

Analyte	RL/LOQ (ppbv)	QC Acceptance Criteria			
		ICAL (%RSD)	CCV (%R)	ICV/LCS (%R)	Precision Limits (Max. RPD)
Dichlorodifluoromethane (Fr12)	0.020	≤ 30%	70 – 130	70 – 130	± 25
Freon 114	0.020	≤ 30%	70 – 130	70 – 130	± 25
Chloromethane	0.050	≤ 30%	70 – 130	70 – 130	± 25
Vinyl Chloride	0.010	≤ 30%	70 – 130	70 – 130	± 25
Chloroethane	0.050	≤ 30%	70 – 130	70 – 130	± 25
1,1-Dichloroethene	0.010	≤ 30%	70 – 130	70 – 130	± 25
Trans-1,2-Dichloroethene	0.100	≤ 30%	70 – 130	70 – 130	± 25
Methyl tert-Butyl Ether	0.100	≤ 30%	70 – 130	70 – 130	± 25
1,1-Dichloroethane	0.020	≤ 30%	70 – 130	70 – 130	± 25
cis-1,2-Dichloroethene	0.020	≤ 30%	70 – 130	70 – 130	± 25
Chloroform	0.020	≤ 30%	70 – 130	70 – 130	± 25
1,1,1-Trichloroethane	0.020	≤ 30%	70 – 130	70 – 130	± 25
Carbon Tetrachloride	0.020	≤ 40%	60 - 140	60 - 140	± 25
Benzene	0.050	≤ 30%	70 – 130	70 – 130	± 25
1,2-Dichloroethane	0.020	≤ 30%	70 – 130	70 – 130	± 25
Trichloroethene	0.020	≤ 30%	70 – 130	70 – 130	± 25
Toluene	0.020	≤ 30%	70 – 130	70 – 130	± 25
1,1,2-Trichloroethane	0.020	≤ 30%	70 – 130	70 – 130	± 25
Tetrachloroethene	0.020	≤ 30%	70 – 130	70 – 130	± 25
1,2-Dibromoethane	0.020	≤ 30%	70 – 130	70 – 130	± 25
Ethyl Benzene	0.020	≤ 30%	70 – 130	70 – 130	± 25
m,p-Xylene	0.040	≤ 30%	70 – 130	70 – 130	± 25
o-Xylene	0.020	≤ 30%	70 – 130	70 – 130	± 25
1,1,2,2-Tetrachloroethane	0.020	≤ 30%	70 – 130	70 – 130	± 25
1,4-Dichlorobenzene	0.020	≤ 30%	70 – 130	70 – 130	± 25
Naphthalene	0.050	≤ 40%	60 – 140	60 – 140	± 25

Table 3 is the list of Standard compounds, reporting limits and QC acceptance criteria. Each project may be customized as needed. Additional compounds and different reporting limits may be obtainable and/or achieved upon request.

Table 4. Summary of Calibration and QC Procedures for Methods TO-14A/TO-15 by SIM

QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action
Tuning Criteria	Every 24 hours	TO-15 Ion Abundance criteria	Correct problem then repeat tune.
Multi-point Calibration (Minimum of 5 points)	Prior to sample analysis	≤ 30% for standard compounds with 2 compounds allowed out to ≤ 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% (≤ 40% for Methyl tert-Butyl Ether and trans-1,2-Dichloroethene). No recovery may be ≤ 50%. 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 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 re-analyze 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)	At the start of each day after the BFB 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 re-analyze 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 re-analyze 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 (Table 4) or project required 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 ±0.33 min of the RT in the CCV and within ±40% of the area counts of the daily CCV internal standards.	**For blanks:** Inspect the system and re-analyze 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.
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 re-analyze 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 Duplicate (LCSD)	One per analytical batch	RPD ≤ 25%	Narrate exceedances. If more than 5% of compound list outside criteria or if compound is > 40%RPD, investigate the cause and perform maintenance as required. If instrument maintenance is required, calibrate as needed.

ANALYTICAL METHODS

Section 10.0

Method: EPA Methods TO-3 and TO-14A (BTEX/TPH)

Eurofins Air Toxics SOP #43 Revision 20 Effective Date: April 02, 2013 Methods Manual Summary

Description: This method involves GC analysis of whole air samples collected in Summa canisters or Tedlar bags. Samples are analyzed for Benzene, Toluene, Ethylbenzene, Xylenes, (BTEX) and Total Petroleum Hydrocarbons (TPH). Either modified EPA Method TO-3 or Method TO-14A or can be used to reference laboratory protocols. BTEX is measured using a Photo Ionization Detector (PID), and TPH is measured using a Flame Ionization Detector (FID). Depending on the client's request, TPH is analyzed and referenced to either gasoline or jet fuel.

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.

Eurofins Air Toxics performs a modified version for these methods. The method modifications, standard target analyte list, reporting limit (RL), QC criteria, and QC summary can be found in the following tables.

Table 1. Summary of Method Modifications for TO-14A

Requirement	EPA Method TO-14A	Eurofins Air Toxics Modifications
Sample Drying System*	Nafion Dryer	Multi-bed sorbent
Sample collection containers	Specially treated stainless steel canisters	Method TO-14A is validated for samples collected in 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. Associated results are considered qualified.

* The pre-concentrator modification implemented for sample analysis allows for superior performance over the water management and concentration procedures outlined in Method TO-14A. This multi-bed sorbent approach used in EPA Method TO-15 allows for the inclusion of polar compounds such as MTBE, and demonstrates superior performance by minimizing carryover issues that can be problematic using the Nafion dryer scenario described in Method TO-14A.

Table 2. Summary of Method Modifications for TO-3

Requirement	EPA Method TO-3	Eurofins Air Toxics Modifications
Sample Collection	In-line field method	Collection of sample in specially treated canisters or alternative containers for transport to and analysis by an off-site laboratory.
Preparation of Standards	Levels achieved through dilution of gas mixture	Levels achieved through loading various volumes of the gas mixture.
Initial Calibration Calculation	4-point calibration using a linear regression model	5-point calibration using average Response Factor
Initial Calibration Frequency	Weekly	When daily calibration standard recovery is outside 75–125%, or upon significant changes to the procedure or instrumentation.
Daily Calibration Standard Frequency	Prior to sample analysis and every 4-6 hrs	Prior to sample analysis
Minimum Detection Limit (MDL)	Calculated using the equation DL = A+3.3S, where A is intercept of calibration line and S is the standard deviation of at least 3 reps of low level standard.	40 CFR Part 136, App. B
Sample pre-concentration and moisture management	Cyrogenic pre-concentrator with a Nafion dryer	Multi-bed sorbent system

Table 3. Method Compound List and QC Limits

Analyte	RL (ppmv)	Acceptance Criteria		
		ICAL (%RSD)	LCS/CCV (%R)	Precision (%RPD)
Benzene	0.001	≤ 30	± 25	≤ 25
Toluene	0.001	≤ 30	± 25	≤ 25
Ethyl Benzene	0.001	≤ 30	± 25	≤ 25
m,p-Xylenes	0.001	≤ 30	± 25	≤ 25
o-Xylene	0.001	≤ 30	± 25	≤ 25
MTBE	0.001	≤ 30	± 25	≤ 25
TPH (Gasoline Range) MW = 100	0.025	≤ 30	± 25	≤ 25
TPH (JP-4 Range) MW = 156	0.025	≤ 30	± 25	≤ 25

Table 4. Surrogate QC Limits

Surrogate	PID Accuracy (%R)	FID Accuracy (%R)
Fluorobenzene	75–125%	75–150%

Table 5. Summary of Calibration and QC Procedures for TO-3/TO-14A (BTEX & TPH)

QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action
5-Point Initial Calibration (ICAL)	Prior to sample analysis and annually	%RSD ≤ 30	Correct problem, then repeat the calibration.
Initial Calibration Verification and Laboratory Control Sample (ICV/LCS)	With each initial calibration, and with each analytical batch.	±25% of the expected value	Check the system and re-analyze the standard. Re-prepare the standard or re-calibrate the instrument if the criteria cannot be met.
Continuing Calibration Verification (CCV)	Daily prior to sample analysis and can be used as an End Check	±25% of the expected value	**For initial CCV:** Check the system and re-analyze the standard. Re-calibrate the instrument if the criteria cannot be met. **For Mid- and End Checks:** Check system and re-analyze the standard. If the second analysis fails, identify and correct the problem, then re-analyze all samples since the last acceptable CCV.
Laboratory Blank	In between analysis of standards and project samples	Results less than the laboratory Reporting Limit	Inspect the system and re-analyze the Laboratory Blank.
Surrogate	As each standard, blank, and sample is being loaded	75–125% recovery on the PID; 75–150% on the FID	Low surrogate recovery results in re-analysis (at a higher dilution if high levels of moisture are present). If recovery is out and still low, report the analysis with the better recovery and flag. Because of TPH interference, high surrogate recoveries do not result in re-analysis. Data is flagged to note high recovery.
Laboratory Duplicate - Laboratory Control Spike Duplicate (LCSD)	One per analytical batch	RPD ≤ 25%	Narrate exceedances. Investigate the cause, perform maintenance as required, and re-calibrate as needed.

ANALYTICAL METHODS

Section 11.0

Method: ASTM D1945 – Fixed Gases & C1-C6

Eurofins Air Toxics SOP #54 Revision 18 Effective Date: December 27, 2013 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 3-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
Reference Standard	Concentration should not be < half of nor differ by more than 2X the concentration of the sample. Run 2 consecutive checks; must agree within 1%.	A minimum 3-point linear calibration. The acceptance criterion is RSD ≤ 15%. All target analytes must be within the linear range of calibration (with the exception of O_2, N_2, and C6+ hydrocarbons).
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	≤ 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.	± 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 ≤ 25%	Narrate exceedances. Investigate the cause and perform maintenance as required and re-calibrate as needed.

ANALYTICAL METHODS

Section 12.0

Method: PM10/TSP – Particulate Matter

Eurofins Air Toxics SOP #66 Revision 13 Effective Date: December 30, 2013 Methods Manual Summary

Description: This method involves equilibrating quartz filters in a conditioning environment of a specified temperature and humidity range and weighing the filters before and after field sampling. Samples are analyzed for method PM_{10} using 40 CFR Part 50 Appendix J or for Total Suspended Particulate (TSP) using 40 CFR Part 50 Appendix B. An analytical balance with 0.1 mg resolution is used to measure the filter weights. The corresponding change in mass represents the TSP or PM_{10} result, expressed in µg or $\mu g/m^3$. The reporting limit is typically 1000 µg. Sampling volumes are required to calculate results in units of $\mu g/m^3$.

Table 1. Conditioning Environment Criteria for Methods PM10 and TSP

Method	Conditioning Environment Temperature (˚F)	Conditioning Environment Relative Humidity (%)
PM10	59°F – 86°F ± 5°F	20% – 45% ± 5%
TSP	59°F – 86°F ± 5°F	≤ 50% ± 5%

Table 2. Summary of Calibration and QC Procedures for Methods PM10 and TSP

QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action
Calibration	Calibration checks of 3.00 grams (g) and 5.00 g are weighed to bracket the expected filter weight of ~4.5 g prior to sample analysis and at the end of the analytical batch.	Accuracy limits of 3.00 g weight: 2.997 g – 3.003 g Accuracy limits of 5.00 g weight: 4.995 g - 5.005 g	Correct problem then repeat calibration.
Laboratory Duplicates	Unexposed filters: One per analytical batch Exposed filters: One duplicate per work order	Unexposed filters: Weights of the clean filters should be within ±0.0028 g of the original value. Exposed filters: ≤ 25% RPD and weights must be within ±0.005 g	Re-condition the filter and re-weigh.
Laboratory Blanks	Immediately after the calibration checks	Post-weight of Lab Blank is less than pre-weight and the difference is < 0.0028 g.	Confirm the weight difference and narrate.

ANALYTICAL METHODS

Section 13.0

Method: EPA Method TO-14A/TO-15 Volatile Organic Compounds (Low-Level)

Eurofins Air Toxics SOP #83 Revision 12 Effective Date: February 13, 2014 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 250 mL 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 GC/MS for separation and detection. Compounds are detected using a MS operating in full scan mode.

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 (Low-Level).

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.

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, Eurofins Air Toxics 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 is 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.

All samples submitted for TO-15 Low-Level are screened prior to analysis. If samples contain high concentrations of target and/or non-target VOCs, samples may be analyzed by an alternative TO-15 method (i.e., Standard or 5&20) with a higher dynamic calibration range.

Table 1. Summary of TO-14A Method Modifications

Requirement	TO-14A	Eurofins Air Toxics Modifications
Sample Drying System	Nafion Dryer	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 taken when recovery is less than 60%.
Blanks and standards	Zero Air	UHP Nitrogen provides a higher purity gas matrix than zero air.
Initial Calibration	≤ 30% RSD for listed 39 VOCs	≤ 30% RSD with 4 compounds allowed out to ≤ 40%

Table 2. Summary of Method TO-15 Modifications

Requirement	TO-15	Eurofins Air Toxics Modifications
Initial Calibration	≤ 30% RSD with 2 compounds allowed out to < 40% RSD	≤ 30% RSD with 4 compounds allowed out to ≤ 40%
Blanks and standards	Zero Air	UHP Nitrogen provides a higher purity gas matrix than zero air.

The standard target analyte list, reporting limits (RL), also referred to as Limit of Quantitation (LOQ), Quality Control (QC) criteria, and QC summary can be found in tables 3 through 6.

Table 3. Method TO-14A/TO-15 Analyte List (Low-Level) and QC Limits

Analyte	RL/LOQ (ppbv)	QC Acceptance Criteria			
		ICAL (%RSD)	CCV (%R)	ICV/LCS* (%R)	Precision Limits (Max. RPD)
1,1,2,2-Tetrachloroethane	0.1	≤ 30%	70 – 130	70 – 130	± 25
1,1,2-Trichloroethane	0.1	≤ 30%	70 – 130	70 – 130	± 25
1,1-Dichloroethane	0.1	≤ 30%	70 – 130	70 – 130	± 25
1,1-Dichloroethene	0.1	≤ 30%	70 – 130	70 – 130	± 25
1,2,4-Trichlorobenzene	0.5	≤ 30%	70 – 130	70 – 130	± 25
1,2,4-Trimethylbenzene	0.1	≤ 30%	70 – 130	70 – 130	± 25
1,2-Dibromoethane (EDB)	0.1	≤ 30%	70 – 130	70 – 130	± 25
1,2-Dichlorobenzene	0.1	≤ 30%	70 – 130	70 – 130	± 25
1,2-Dichloroethane	0.1	≤ 30%	70 – 130	70 – 130	± 25
1,2-Dichloropropane	0.1	≤ 30%	70 – 130	70 – 130	± 25
1,3,5-Trimethylbenzene	0.1	≤ 30%	70 – 130	70 – 130	± 25
1,3-Dichlorobenzene	0.1	≤ 30%	70 – 130	70 – 130	± 25
1,4-Dichlorobenzene	0.1	≤ 30%	70 – 130	70 – 130	± 25
Benzene	0.1	≤ 30%	70 – 130	70 – 130	± 25
Bromomethane	0.5	≤ 30%	70 – 130	70 – 130	± 25
Carbon Tetrachloride	0.1	≤ 30%	70 – 130	70 – 130	± 25
Chlorobenzene	0.1	≤ 30%	70 – 130	70 – 130	± 25
Chloroethane	0.5	≤ 30%	70 – 130	70 – 130	± 25
Chloroform	0.1	≤ 30%	70 – 130	70 – 130	± 25
Chloromethane	0.5	≤ 30%	70 – 130	70 – 130	± 25
Chlorotoluene (Benzyl Chloride)	0.1	≤ 30%	70 – 130	70 – 130	± 25
cis-1,2-Dichloroethene	0.1	≤ 30%	70 – 130	70 – 130	± 25
cis-1,3-Dichloropropene	0.1	≤ 30%	70 – 130	70 – 130	± 25
Dichloromethane (Methylene Chloride)	0.2	≤ 30%	70 – 130	70 – 130	± 25
Ethylbenzene	0.1	≤ 30%	70 – 130	70 – 130	± 25
Freon 11 (Trichlorofluoromethane)	0.1	≤ 30%	70 – 130	70 – 130	± 25
Freon 113 (Trichlorotrifluoroethane)	0.1	≤ 30%	70 – 130	70 – 130	± 25
Freon 114	0.1	≤ 30%	70 – 130	70 – 130	± 25
Freon 12 (Dichlorodifluoromethane)	0.1	≤ 30%	70 – 130	70 – 130	± 25
Hexachlorobutadiene	0.5	≤ 30%	70 – 130	70 – 130	± 25
m,p-Xylene	0.1	≤ 30%	70 – 130	70 – 130	± 25

Methyl Chloroform (1,1,1-Trichloroethane)	0.1	≤ 30%	70 – 130	70 – 130	± 25
o-Xylene	0.1	≤ 30%	70 – 130	70 – 130	± 25
Styrene	0.1	≤ 30%	70 – 130	70 – 130	± 25
Tetrachloroethene	0.1	≤ 30%	70 – 130	70 – 130	± 25
Toluene	0.1	< 30%	70 – 130	70 – 130	± 25
trans-1,3-Dichloropropene	0.1	≤ 30%	70 – 130	70 – 130	± 25
Trichloroethene	0.1	≤ 30%	70 – 130	70 – 130	± 25
Vinyl Chloride	0.1	≤ 30%	70 – 130	70 – 130	± 25
1,3-Butadiene	0.1	≤ 30%	70 – 130	70 – 130	± 25
1,4-Dioxane	0.1	≤ 30%	70 – 130	70 – 130	± 25
2-Butanone (Methyl Ethyl Ketone)	0.5	≤ 30%	70 – 130	70 – 130	± 25
2-Hexanone	0.5	≤ 30%	70 – 130	70 – 130	± 25
4-Ethyltoluene	0.1	≤ 30%	70 – 130	70 – 130	± 25
4-Methyl-2-Pentanone (MIBK)	0.1	≤ 30%	70 – 130	70 – 130	± 25
Acetone	0.5	≤ 30%	70 – 130	70 – 130	± 25
Bromodichloromethane	0.1	≤ 30%	70 – 130	70 – 130	± 25
Bromoform	0.1	≤ 30%	70 – 130	70 – 130	± 25
Carbon Disulfide	0.5	≤ 30%	70 – 130	70 – 130	± 25
Cumene	0.1	≤ 30%	70 – 130	70 – 130	± 25
Cyclohexane	0.1	≤ 30%	70 – 130	70 – 130	± 25
Dibromochloromethane	0.1	≤ 30%	70 – 130	70 – 130	± 25
Ethanol	0.5	≤ 30%	70 – 130	70 – 130	± 25
Heptane	0.1	≤ 30%	70 – 130	70 – 130	± 25
Hexane	0.1	≤ 30%	70 – 130	70 – 130	± 25
Isopropanol	0.5	≤ 30%	70 – 130	70 – 130	± 25
Methyl tert-Butyl Ether (MTBE)	0.1	≤ 30%	70 – 130	70 – 130	± 25
Propylbenzene	0.1	≤ 30%	70 – 130	70 – 130	± 25
Tetrahydrofuran	0.5	≤ 30%	70 – 130	70 – 130	± 25
trans-1,2-Dichloroethene	0.1	≤ 30%	70 – 130	70 – 130	± 25
2,2,4-Trimethylpentane	0.5	≤ 30%	70 – 130	70 – 130	± 25
3-Chloroprene	0.5	≤ 30%	70 – 130	70 – 130	± 25

Non-Standard Compounds

Analyte	RL/LOQ (ppbv)	QC Acceptance Criteria			
		ICAL (%RSD)	CCV (%R)	ICV/LCS (%R)	Precision Limits (Max. RPD)
Acrolein	0.5	≤ 40%	60 – 140	60 – 140	± 25
Butane	0.5	≤ 40%	60 – 140	60 – 140	± 25
Ethyl tert-Butyl Ether	0.5	≤ 40%	60 – 140	60 – 140	± 25
Isopentane	0.5	≤ 40%	60 – 140	60 – 140	± 25
Isopropyl Ether	0.5	≤ 40%	60 – 140	60 – 140	± 25
Methylcyclohexane	0.5	≤ 40%	60 – 140	60 – 140	± 25
Naphthalene**	0.5	≤ 40%	60 – 140	60 – 140	± 25
Propylene	0.5	≤ 40%	60 – 140	60 – 140	± 25
tert-Amyl Methyl Ether	0.5	≤ 40%	60 – 140	60 – 140	± 25
Vinyl Acetate	0.5	≤ 40%	60 – 140	60 – 140	± 25
tert-Butyl Alcohol	0.5	≤ 40%	60 – 140	60 – 140	± 25
TPH (Gasoline)***	10	1- Point Calibration	N/A	ICV only: 60 – 140	± 25
NMOC (Hexane/Heptane)***	2.0	1- Point Calibration	N/A	N/A	± 25

*See Table 6.

**Due to its low vapor pressure, Naphthalene does not meet 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 therefore included in Table 3.

***TPH and NMOC are not on Eurofins Air Toxics' standard TO-15 list, but are included in Table 3 due to common requests.

Table 4. Internal Standards

Analyte	Accuracy (% R)
Bromochloromethane	60 – 140
1,4-Difluorobenzene	60 – 140
Chlorobenzene-d_5	60 – 140

Table 5. Surrogates

Analyte	Accuracy (% R)
1,2-Dichloroethane-d_4	70 – 130
Toluene-d_8	70 – 130
4-Bromofluorobenzene	70 – 130

Table 6. Summary of Calibration and QC Procedures for Methods TO-14A/TO-15 Low-Level

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 ≤ 30 with 4 compounds allowed out to ≤ 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 re-analyze 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 re-analyze 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 4 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 re-analyze 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 re-analyze 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 ±0.33 min of the RT in the CCV and within ± 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 unless obvious matrix interference is documented. If the ISs are within limits in the re-analysis, report the second analysis. If ISs are out-of-limits a second time, report data from first analysis and narrate.
Surrogates	As each standard, blank, and sample is being loaded	70–130% R If specified by the client, in-house generated control limits may be used.	**For blanks:** Inspect the system and re-analyze 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 Duplicate (LCSD)	One per analytical batch	RPD ≤25%	Narrate exceedances. If more than 5% of compound list is outside criteria or if compound is >40% RPD, investigate the cause and perform maintenance as required. If instrument maintenance is required, calibrate as needed.

ANALYTICAL METHODS

Section 14.0

Method: EPA Method TO-14A/TO-15 Volatile Organic Compounds (5&20)

Eurofins Air Toxics SOP #91 Revision 5 Effective Date: January 14, 2013 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 0.05 liters of air is withdrawn from the canister utilizing a volumetric syringe 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 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 (5&20). The 5&20 analytical configuration is designed to directly measure ppmv concentrations with minimal offline dilutions due to its wide dynamic calibration range.

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 "5&20" configuration. 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 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	ATL 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%

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

Table 2. Method TO-14A/TO-15 Analyte List (5&20)

Analyte	RL/LOQ (ppbv)	QC Acceptance Criteria			
		ICAL (%RSD)	CCV (%R)	ICV/LCS (%R)	Precision Limits (Max. RPD)
1,1,2,2-Tetrachloroethane	5.0	≤ 30%	70 – 130	70 – 130	± 25
1,1,2-Trichloroethane	5.0	≤ 30%	70 – 130	70 – 130	± 25
1,1-Dichloroethane	5.0	≤ 30%	70 – 130	70 – 130	± 25
1,1-Dichloroethene	5.0	≤ 30%	70 – 130	70 – 130	± 25
1,2,4-Trichlorobenzene	20	≤ 30%	70 – 130	70 – 130	± 25
1,2,4-Trimethylbenzene	5.0	≤ 30%	70 – 130	70 – 130	± 25
1,2-Dibromoethane (EDB)	5.0	≤ 30%	70 – 130	70 – 130	± 25
1,2-Dichlorobenzene	5.0	≤ 30%	70 – 130	70 – 130	± 25
1,2-Dichloroethane	5.0	≤ 30%	70 – 130	70 – 130	± 25
1,2-Dichloropropane	5.0	≤ 30%	70 – 130	70 – 130	± 25
1,3,5-Trimethylbenzene	5.0	≤ 30%	70 – 130	70 – 130	± 25
1,3-Dichlorobenzene	5.0	≤ 30%	70 – 130	70 – 130	± 25
1,4-Dichlorobenzene	5.0	≤ 30%	70 – 130	70 – 130	± 25
Benzene	5.0	≤ 30%	70 – 130	70 – 130	± 25
Bromomethane*	5.0	≤ 30%	70 – 130	70 – 130	± 25
Carbon Tetrachloride	5.0	≤ 30%	70 – 130	70 – 130	± 25
Chlorobenzene	5.0	≤ 30%	70 – 130	70 – 130	± 25
Chloroethane	20	≤ 30%	70 – 130	70 – 130	± 25

Dibromochloromethane	5.0	≤ 30%	70 – 130	70 – 130	± 25
Chloroform	5.0	≤ 30%	70 – 130	70 – 130	± 25
Chloromethane	20	≤ 30%	70 – 130	70 – 130	± 25
Chlorotoluene (Benzyl Chloride)	5.0	≤ 30%	70 – 130	70 – 130	± 25
cis-1,2-Dichloroethene	5.0	≤ 30%	70 – 130	70 – 130	± 25
cis-1,3-Dichloropropene	5.0	≤ 30%	70 – 130	70 – 130	± 25
Dichloromethane (Methylene Chloride)	5.0	≤ 30%	70 – 130	70 – 130	± 25
Ethylbenzene	5.0	≤ 30%	70 – 130	70 – 130	± 25
Freon 11 (Trichlorofluoromethane)	5.0	≤ 30%	70 – 130	70 – 130	± 25
Freon 113 (Trichlorotrifluoroethane)	5.0	≤ 30%	70 – 130	70 – 130	± 25
Freon 114	5.0	≤ 30%	70 – 130	70 – 130	± 25
Freon 12 (Dichlorodifluoromethane)	5.0	≤ 30%	70 – 130	70 – 130	± 25
Hexachlorobutadiene	20	≤ 30%	70 – 130	70 – 130	± 25
m,p-Xylene	5.0	≤ 30%	70 – 130	70 – 130	± 25
Methyl Chloroform (1,1,1-Trichloroethane)	5.0	≤ 30%	70 – 130	70 – 130	± 25
o-Xylene	5.0	≤ 30%	70 – 130	70 – 130	± 25
Styrene	5.0	≤ 30%	70 – 130	70 – 130	± 25
Tetrachloroethene	5.0	≤ 30%	70 – 130	70 – 130	± 25
Toluene	5.0	≤ 30%	70 – 130	70 – 130	± 25
trans-1,3-Dichloropropene	5.0	≤ 30%	70 – 130	70 – 130	± 25
Trichloroethene	5.0	≤ 30%	70 – 130	70 – 130	± 25
Vinyl Chloride	5.0	≤ 30%	70 – 130	70 – 130	± 25
1,3-Butadiene	5.0	≤ 30%	70 – 130	70 – 130	± 25
1,4-Dioxane	20	≤ 30%	70 – 130	70 – 130	± 25
2-Butanone (Methyl Ethyl Ketone)	20	≤ 30%	70 – 130	70 – 130	± 25
2-Hexanone	20	≤ 30%	70 – 130	70 – 130	± 25
4-Ethyltoluene	5.0	≤ 30%	70 – 130	70 – 130	± 25
4-Methyl-2-Pentanone (MIBK)	5.0	≤ 30%	70 – 130	70 – 130	± 25
Acetone	20	≤ 30%	70 – 130	70 – 130	± 25
Bromodichloromethane	5.0	≤ 30%	70 – 130	70 – 130	± 25
Bromoform	5.0	≤ 30%	70 – 130	70 – 130	± 25
Carbon Disulfide	5.0	≤ 30%	70 – 130	70 – 130	± 25
Cyclohexane	5.0	≤ 30%	70 – 130	70 – 130	± 25

Dibromochloromethane	5.0	≤ 30%	70 – 130	70 – 130	± 25
Ethanol	20	≤ 30%	70 – 130	70 – 130	± 25
Heptane	5.0	≤ 30%	70 – 130	70 – 130	± 25
Hexane	5.0	≤ 30%	70 – 130	70 – 130	± 25
Isopropanol	20	≤ 30%	70 – 130	70 – 130	± 25
Methyl t-Butyl Ether (MTBE)	5.0	≤ 30%	70 – 130	70 – 130	± 25
Tetrahydrofuran	5.0	≤ 30%	70 – 130	70 – 130	± 25
trans-1,2-Dichloroethene	5.0	≤ 30%	70 – 130	70 – 130	± 25
2,2,4-Trimethylpentane	5.0	≤ 30%	70 – 130	70 – 130	± 25
Cumene	5.0	≤ 30%	70 – 130	70 – 130	± 25
Propylbenzene	5.0	≤ 30%	70 – 130	70 – 130	± 25
3-Chloroprene	20	≤ 30%	70 – 130	70 – 130	± 25
Naphthalene**	20	≤ 40%	60 – 140	60 – 140	± 25
TPH (Gasoline) ***	100	1- Point Calibration	NA	ICV only: 60 – 140	± 25
NMOC (Hexane/Heptane)***	100	1- Point Calibration	NA	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

Analyte	Accuracy (% R)
Bromochloromethane	60 – 140
1,4-Difluorobenzene	60 – 140
Chlorobenzene-d_5	60 – 140

Table 4. Surrogates

Analyte	Accuracy (% R)
1,2-Dichloroethane-d_4	70 – 130
Toluene-d_8	70 – 130
4-Bromofluorobenzene	70 – 130

Table 5. Summary of Calibration and QC Procedures for Methods TO-14A/TO-15 (5&20)

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 ≤ 30 with 2 compounds allowed out to ≤ 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)	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.
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 ±0.33 min of the RT in the CCV and within ±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.

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 ≤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.

ANALYTICAL METHODS

Section 15.0

Method: TO-15 Aliphatic and Aromatic Volatile Petroleum Hydrocarbons (VPH) Fractions by GC/MS

Eurofins Air Toxics SOP #103 Revision 5 Effective Date: January 29, 2014 Methods Manual Summary

Description: The TO-15 VPH method outlines procedures to estimate the concentrations of gaseous phase Aliphatic and Aromatic ranges in ambient air and soil gas collected in stainless steel Summa canisters. The volatile Aliphatic hydrocarbons are collectively quantified within the C5 to C6 range, C6 to C8 range, C8 to C10 range, and the C10 to C12 range. Additionally, the volatile Aromatic hydrocarbons are collectively quantified within the C8 to C10 range and the C10 to C12 range. The Aromatic ranges refer to the equivalent carbon (EC) ranges.

Data is acquired using standard TO-15 GC/MS instrumentation. Procedures are largely based on the hydrocarbon ranges and calibration reference compounds defined by the Washington State Department of Ecology (WSDE) Method for the Determination of Volatile Petroleum Hydrocarbons (VPH) Fractions, dated June 1997. Additionally, the WSDE VPH calibration and quantitation procedures for the Aromatic fraction have been enhanced to more effectively isolate the compounds of interest. The Aromatic fraction measurement is based on a modification of the Massachusetts Department of Environmental Protection (MADEP) Air Phase Hydrocarbon Method (2009).

Eurofins Air Toxics performs a modified version of this method. The method modifications, standard target analyte list, reporting limit (RL) or Limit of Quantitation (LOQ), QC criteria, and QC summary can be found in the following tables.

Table 1. Summary of Method Modifications for TO-15 VPH

Requirement	VPH	Eurofins Air Toxics Modifications
Detector	Tandem GC/FID/PID	GC/MS
Matrix	Soil, water, and sediments	Whole air samples
C6-C8 Reference Compound	Octane	Heptane
Surrogate	2,5-Dibromotoluene	Bromochloromethane, 1,2-Dichloroethane-d4, Toluene-d8, Chlorobenzene-d5, and 4-Bromofluorobenzene
%RSD for Reference Compounds	≤ 20% RSD	≤ 30% RSD with the exception of Decane, Dodecane, 1,2,4,5-Tetramethylbenzene, and Naphthalene at ≤ 40% RSD
%D for the CCV	±20%D	±30%D with the exception of Decane, Dodecane, 1,2,4,5-Tetramethylbenzene, and Naphthalene at ±40%D

Laboratory Control Spike	Matrix Spiking Solution	Independently prepared source performed after initial calibration, 70–130% recovery, with the exception of Decane, Dodecane,1,2,4,5-Tetramethylbenzene, and Naphthalene at 60–140%
CCV Frequency	Before and after every 10 samples	Daily before sample analysis
IDOC	4 Replicates of a CCV at ±20%D; %RSD ≤ 20%	Not performed for this method; TO-15 IDOC performed on the same instrument

Table 2. VPH Standard Target Analyte List (Note: TO-15 analytes can also be included.)

Analyte	Standard RL (ppbv)	5&20 RL (ppbv)	Acceptance Criteria		
			ICAL %RSD	ICV (%R)	CCV (%D)
Pentane	NA	NA	≤ 30%	70-130	≤ 30%
Hexane	NA	NA	≤ 30%	70-130	≤ 30%
C_5-C_6 Aliphatics Pentane + Hexane	**10**	**50**	**≤ 30%**	**70-130**	**≤ 30%**
C_6-C_8 Aliphatics ref. to Heptane	**10**	**50**	**≤ 30%**	**70-130**	**≤ 30%**
C_8-C_{10} Aliphatics ref. to Decane	**10**	**50**	**≤ 40%**	**60-140**	**≤ 40%**
C_{10}-C_{12} Aliphatics ref. to Dodecane	**10**	**50**	**≤ 40%**	**60-140**	**≤ 40%**
Ethyl benzene	2	10	≤ 30%	70-130	≤ 30%
m/p-Xylene	2	10	≤ 30%	70-130	≤ 30%
o-Xylene	2	10	≤ 30%	70-130	≤ 30%
1,2,3-Trimethylbenzene	NA	NA	≤ 30%	70-130	≤ 30%
C_8-C_{10} Aromatics	**10**	**50**	**≤ 30%**	**70-130**	**≤ 30%**
Naphthalene	2	10	≤ 40%	60-140	≤ 40%
1,2,4,5-Tetramethylbenzene	NA	NA	≤ 40%	60-140	≤ 40%
C_{10}-C_{12} Aromatics	**10**	**50**	**≤ 40%**	**60-140**	**≤ 40%**

Table 3. Internal Standard Acceptance Criterion – Aliphatic Fraction

Analyte	Recovery Limits (%R)
1,4-Difluorobenzene	50 – 200%

Table 4. Internal Standard Acceptance Criterion – Aromatic Fraction

Analyte	Recovery Limits (%R)
Chlorobenzene-d_5	60 – 140%

Table 4. Summary of Calibration and QC Procedures

QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action
Tuning Criteria	Every 24 hours	Compendium of Methods for Toxic Organic Air Pollutants, Method TO-15, January 1999	Correct problem then repeat tune.
6-Point Initial Calibration (ICAL)	Prior to sample analysis	%RSD ≤ 30% for VPH Target Analyte List with exceptions for 1,2,4,5-Tetramethylbenzene and Naphthalene, which are ≤40%	Correct problem then repeat initial calibration curve.
Initial Calibration Verification (ICV)	After each initial calibration curve	Recoveries for VPH target compounds 70–130%, or 60–140% for 1,2,4,5-Tetramethylbenzene and Naphthalene. If recovery of any compound is above 130%, analyze samples as long as compound is not detected.	Check the system and re-analyze the standard. Re-prepare the standard if necessary. Re-calibrate the instrument if the criteria cannot be met.
Continuing Calibration Verification (CCV)	At the start of each analytical clock after the tune check	%D ≤ 30% for VPH target compounds with exceptions for 1,2,4,5-Tetramethylbenzene and Naphthalene, which are <40%. One compound is allowed to be out as long as it is ≤ 50%D. If recovery of any compound is above 150% the instrument must be re-calibrated.	Perform maintenance and repeat test. If the CCV still fails, perform maintenance and a new 6-point calibration curve.
Laboratory Blank	After the CCV	Results less than the laboratory RL	Inspect the system and re-analyze the blank.
Internal Standard (IS)	As each standard, blank, and sample is being loaded.	Retention time (RT) for the blanks and samples must be within ±0.33 min of the RT in the CCV. For the aliphatic fraction using the total ion area, the IS area must be within -50% to 200% of the CCV's IS area for the blanks and samples. For the aromatic fraction using extracted ion areas, the IS area must be within -40% to +40% of the CCV's extracted ion IS area.	**For blanks:** Inspect the system and re-analyze the blank **For samples:** If there is not obvious interference with the internal standard, re-analyze the sample. If the ISs are within limits in the re-analysis, report the second analysis. Dilution of the sample to get IS areas within limits may be used if the RL is being obtained.
Laboratory Duplicates	One per analytical batch; since VPH analysis occurs with TO-15 analysis, the Duplicate is reported from the daily TO-15 LCS/LCSD pair. The result is not reported with the VPH fraction.	RPD ≤ 25% for detections >5X the RL	Re-analyze the sample a third time. If the limit is exceeded again, investigate the cause and bring the system back to working order. If no problem is found with the system, narrate.

ANALYTICAL METHODS

Section 16.0

Method: Modified EPA TO-17 VOCs and SVOCs (Vapor Intrusion Application) by GC/MS (Full Scan)

Eurofins Air Toxics SOP #109 Revision 4 Effective Date: December 24, 2013 Methods Manual Summary

Description: The TO-17 "Vapor Intrusion" method utilizes a multi-bed thermal desorption tube for the measurement of air-phase Volatile Organic Compounds (VOCs) and Polycyclic Aromatic Hydrocarbons (PAHs). These tubes are marketed by Eurofins Air Toxics as "TO-17 VI" tubes. The TO-17 VI tubes are applicable to a wide variety of vapor matrices including soil gas, indoor air, and outdoor air. Parameters are optimized to effectively manage high humidity conditions. The TO-17 VI method is an alternative to the canister-based sampling and analysis methods that are presented in EPA Compendium Methods TO-14A and TO-15 as well as an alternative to PUF/XAD sampling for semi-volatile compounds as described by EPA Compendium TO-13A. The VI tube provides sufficient retention of light VOCs such as 1,3-Butadiene while providing an efficient desorption of semi-volatile compounds such as Pyrene.

Samples are collected by drawing a measured volume of air through the VI sorbent tubes. Collection is performed using a low-flow vacuum pump or a volumetric syringe attached to the outlet side of the tube. Analysis is accomplished by heating the sorbent tube and sweeping the desorbed compounds onto a secondary "cold" trap for water management and analyte refocusing. The secondary trap is heated for efficient transfer of compounds onto the gas chromatograph (GC) for separation followed by detection using mass spectrometry (MS).

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 compounds during sample storage, safe sampling volume, and desorption efficiency are not validated. Full validation may be available upon request.

Since the TO-17 VI application significantly extends the scope of target compounds addressed in EPA Method TO-15 and TO-17, the laboratory has implemented several method modifications as outlined in Table 1.

Table 1. EPA TO-17 Method Modifications – VI Application

Requirement	TO-17	Eurofins Air Toxics Modifications
Initial Calibration	%RSD ≤ 30% with 2 allowed out up to 40%	For the VOC list: %RSD ≤ 30% with 2 allowed out up to 40% For the PAH list: %RSD ≤ 30% with 2 allowed out up to 40%
Daily Calibration	%D for each target compound within ±30%.	Fluorene, Phenanthrene, Anthracene, Fluoranthene, and Pyrene within ±40%D
Audit Accuracy	70 – 130%	Second source recovery limits for Fluorene, Phenanthrene, Anthracene, Fluoranthene, and Pyrene = 60 – 140%
Distributed Volume Pairs	Collection of distributed volume pairs required for monitoring ambient air to ensure high quality.	If the client is sampling well-characterized air or has verified performance through previous sampling or distributed pairs, single tube sampling may be appropriate. Distributed volume pairs may not be practical or useful for soil vapor collection due to required configuration and volume constraints.

Table 2. Method TO-17 VI Standard Analyte List and QC Limits

Volatile Organic Compounds	Reporting Limit (ng)	QC Acceptance Criteria			
		ICAL (%RSD)	ICV (%R)	CCV (%D)	LCS (%R)
Freon 114	14	30	70 – 130	30	70 – 130
Vinyl Chloride	2.6	30	70 – 130	30	70 – 130
1,3-Butadiene	2.2	30	70 – 130	30	70 – 130
Isopentane	5.9	30	70 – 130	30	70 – 130
Freon 11	11	30	70 – 130	30	70 – 130
1,1-Dichloroethene	4.0	30	70 – 130	30	70 – 130
Methylene Chloride	21	30	70 – 130	30	70 – 130
Freon 113	7.7	30	70 – 130	30	70 – 130
Trans-1,2-Dichloroethene	4.0	30	70 – 130	30	70 – 130
1,1-Dichloroethane	4.0	30	70 – 130	30	70 – 130
cis-1,2-Dichloroethene	4.0	30	70 – 130	30	70 – 130
Hexane	35	30	70 – 130	30	70 – 130
Chloroform	4.9	30	70 – 130	30	70 – 130
1,2-Dichloroethane	4.0	30	70 – 130	30	70 – 130
1,1,1-Trichloroethane	5.4	30	70 – 130	30	70 – 130
Benzene	6.4	30	70 – 130	30	70 – 130
Carbon Tetrachloride	6.3	30	70 – 130	30	70 – 130

Cyclohexane	6.9	30	70 – 130	30	70 – 130
1,2-Dichloropropane	4.6	30	70 – 130	30	70 – 130
Trichloroethene	5.4	30	70 – 130	30	70 – 130
1,4-Dioxane	11	30	70 – 130	30	70 – 130
2,2,4-Trimethylpentane	9.4	30	70 – 130	30	70 – 130
Heptane	8.2	30	70 – 130	30	70 – 130
Methylcyclohexane	8.0	30	70 – 130	30	70 – 130
1,1,2-Trichloroethane	5.4	30	70 – 130	30	70 – 130
Methyl isobutyl ketone	8.2	30	70 – 130	30	70 – 130
Toluene	7.5	30	70 – 130	30	70 – 130
Methylbutylketone	8.2	30	70 – 130	30	70 – 130
Tetrachloroethene	6.8	30	70 – 130	30	70 – 130
Chlorobenzene	4.6	30	70 – 130	30	70 – 130
Ethylbenzene	4.3	30	70 – 130	30	70 – 130
M,p-xylene	8.7	30	70 – 130	30	70 – 130
o-Xylene	8.7	30	70 – 130	30	70 – 130
Styrene	8.5	30	70 – 130	30	70 – 130
1,1,2,2-Tetrachloroethane	6.9	30	70 – 130	30	70 – 130
Cumene	9.8	30	70 – 130	30	70 – 130
n-Propylbenzene	9.8	30	70 – 130	30	70 – 130
4-Ethyltoluene	9.8	30	70 – 130	30	70 – 130
1,3,5-Trimethylbenzene	9.8	30	70 – 130	30	70 – 130
1,2,4-Trimethylbenzene	29	30	70 – 130	30	70 – 130
1,3-Dichlorobenzene	6.0	30	70 – 130	30	70 – 130
1,4-Dichlorobenzene	6.0	30	70 – 130	30	70 – 130
1,2-Dichlorobenzene	6.0	30	70 – 130	30	70 – 130
1,2,4-Trichlorobenzene	15	30	70 – 130	30	70 – 130
Hexachlorobutadiene	21	30	70 – 130	30	70 – 130
Chloroethane†	16	30	70 – 130	30	70 – 130
Isopropyl alcohol†	49	30	70 – 130	30	70 – 130
Carbon Disulfide†	6.2	30	70 – 130	30	70 – 130
MTBE†‡	22	30	70 – 130	30	70 – 130
Methyl Ethyl Ketone†	59	30	70 – 130	30	70 – 130

Polyaromatic Hydrocarbons	Reporting Limit (ng)	ICAL (%RSD)	ICV (%R)	CCV (%D)	LCS (%R)
Naphthalene	0.5	30	70 – 130	30	70 – 130
2-Methylnaphthalene	1.0	30	70 – 130	30	70 – 130
1-Methylnaphthalene	1.0	30	70 – 130	30	70 – 130
Acenaphthylene	5.0	30	70 – 130	30	70 – 130
Acenaphthene	5.0	30	70 – 130	30	70 – 130
Fluorene	5.0	30	60 – 140	40	60 – 140
Phenanthrene	5.0	30	60 – 140	40	60 – 140
Anthracene	5.0	30	60 – 140	40	60 – 140
Fluoranthene	5.0	30	60 – 140	40	60 – 140
Pyrene	5.0	30	60 – 140	40	60 – 140

†Non-routine compounds by special request only.
‡Poor recovery performance when dry purge is applied for sample collection volumes greater than 1 Liter.

Table 3. Commonly requested TPH parameters – Optional

TPH	Reporting Limit (ng)	ICAL (%RSD)	ICV (%R)	CCV (%D)	LCS (%R)
GRO (Gasoline Range)	1000	30	60-140	30	60 – 140
DRO (C10-C24 Diesel Range)	1000	30	60-140	30	60 – 140

Table 4. Internal Standard and Field Surrogate Recoveries

Internal Standards		
Analyte	**CCV IS % Recovery**	**Sample IS % Recovery**
Bromochloromethane	60 – 140	60 – 140
1,4-Difluorobenzene	60 – 140	60 – 140
Chlorobenzene-d_5	60 – 140	60 – 140
Bromofluorobenzene	60 – 140	60 – 140
Field Surrogates		
Analyte	**% Recovery**	
1,2-Dichloroethane-d4	50 – 150	
Toluene-d8	50 – 150	
Naphthalene-d8	50 – 150	

Table 5. Summary of Calibration and QC Procedures for Modified Method TO-17 VI

QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action
BFB Tune Check	Before initial and daily calibration. Check is valid for 24 hours.	TO-15 tune criteria	Correct problem then repeat tune.
5-Point Calibration	Prior to sample analysis	%RSD $\leq$ 30% with 2 VOCs exceeding up to 40% RSD and 2 PAHS exceeding criteria up to 40%RSD.	Correct problem then repeat Initial Calibration Curve.
Initial Calibration Verification (ICV)	After each initial Calibration Curve	See Table 2; 20% of the compounds are allowed to exceed criterion.	Determine if the exceedance is due to an inaccurate calibration standard or inaccurate ICV standard. Recalibrate with an accurate standard or re-prepare the ICV as necessary. If any VOC exceeds 50–150% recovery, system is checked and the ICV is reanalyzed. For compounds with recoveries greater than 150% and no positive detections in the samples, approval to proceed will be granted on a case-by-case basis.
Continuing Calibration Verification (CCV)	At the start of each 24-hour clock after the Tune Check	70 – 130% 60–140% for Fluorene, Phenanthrene, Anthracene, Fluoranthene and Pyrene	If project-specified risk drivers exceed these criteria, more than 5% of the compounds exceed these criteria, or any VOC exceeds 50–150% recovery, maintenance is performed and the CCV test repeated. If the system still fails the CCV, perform a new 5-point Calibration Curve.
Laboratory Blank	After the CCV and before the samples and at end of sequence	Results less than the laboratory RL for Lab Blank analyzed prior to samples	Inspect the system and re-analyze the Blank. Flag associated data as appropriate.
Laboratory Control Spike (LCS)	Once per analytical batch	70 – 130% 60–140% for Fluorene, Phenanthrene, Anthracene, Fluoranthene and Pyrene; 20% of compound list may exceed criteria before corrective action is required.	Verify accuracy of standard. Re-prepare LCS if necessary. If calibration curve and/or system is found to be out of control, perform maintenance and re-calibrate. If any VOC exceeds 50–150% recovery, maintenance is performed and the ICV test is repeated. For compounds with recoveries greater than 150% and no positive detections in the samples, approval to proceed will be granted on a case-by-case basis.

QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action
Laboratory Control Spike Duplicate (LCSD)	Once per analytical batch (reanalysis of LCS)	≤ 20% RPD	Verify accuracy of standard. Re-prepare LCS if necessary. If calibration curve and/or system is found to be out of control, perform maintenance and re-calibrate. If any VOC exceeds 50–150% recovery, maintenance is performed and the ICV test is repeated. For compounds with recoveries greater than 150% and no positive detections in the samples, approval to proceed will be granted on a case-by-case basis.
Internal Standard (IS)	As each QC sample and sample are being loaded	**CCVs:** Area counts > 60% recovery; Retention Time (RT) within 20 seconds of mid-point in ICAL. **Blanks and samples**: Retention time (RT) must be within ±0.33 minutes of the RT in the CCV. The IS area must be within ±40% of the CCV's IS area for the Blanks and samples.	**CCV:** Inspect and correct system prior to sample analysis. **Blanks:** Inspect the system and re-analyze the Blank. **Samples:** Investigate the problem by verifying the instrument is in control by running a Lab Blank. Re-analyze recollected samples to verify recovery. Report the run with acceptable IS recovery. If both runs are unacceptable, narrate and flag associated data.
Field Surrogates	Added to each tube prior to shipment to field. Added to QC samples prior to analysis.	50–150%	**For blanks:** Inspect the system and re-analyze the Blank. **For samples:** Review data to determine whether sample collection parameters or matrix interference resulted in the exceedances. If so, narrate and flag recovery. If no cause is evident, verify the instrument is in control by running a Lab Blank. Re-analyze recollected sample to verify recovery.
Field Blank	Project-dependent	Artifact levels should be less than the reporting limit or less than 10% of the mass measured on the sampled tubes, whichever is less.	Flag associated results and evaluate tube conditioning and storage procedures.
Distributed Pairs	Project-dependent	%RPD ≤ 25%	Narrate discrepancy.

ANALYTICAL METHODS

Section 17.0

Method: ANALYSIS OF VOCS BY GC/MS COLLECTED ON CHARCOAL-BASED PASSIVE SAMPLERS

Eurofins Air Toxics SOP #100 Revision 4 Effective Date: January 10, 2014 Methods Manual Summary

Description: This method involves gas chromatograph/mass spectrometer (GC/MS) analysis of volatile organic compounds (VOCs) collected using charcoal-based passive samplers. These passive samplers include the Radiello® 130, SKC badges (575 and Ultra series), 3M™ OVM badges, and the WMS™ permeation sampler. Passive samplers are used to measure vapor-phase VOCs in a variety of gaseous matrices including indoor air, outdoor air, extracted soil gas, and emissions from materials. VOCs in the sampling environment pass through the diffusive barrier or permeable membrane of the sampler at a known, controlled rate (defined as the sampling rate) and adsorb to the charcoal-based sorbent pad of the sampler. The sorbent is extracted using a volume of carbon disulfide, and the extract is directly injected into a GC equipped with an MS. The retention time and spectral pattern of a compound are compared with that of known standard. Concentrations of the analytes are calculated from the average relative response factors of calibration curves obtained from analysis of standard solutions. The results are reported in units of μg/sample or $\mu g/m^3$ if the sampling rate and duration is known. Results for subsurface soil gas measurements are typically reported in units of μg/sample since there may be a low bias in the calculated $\mu g/m^3$ concentration due to starvation effects. Starvation effects occur when the uptake rate of the sampler exceeds the delivery rate of vapors from the surrounding soil.

There are no regulatory methods for the preparation and analysis of the Radiello and WMS samplers, while OSHA methods are available for workplace exposure measurements for several of the VOCs using 3M OVM 3500 and SKC 575 series samplers. The OSHA methods and recommended procedures published by Radiello (FSM) and 3M serve as the basis for this standard operating procedure for the analysis of environmental samples. Additionally, QC elements outlined in EPA SW-846 8260 and 8270 are incorporated as applicable. One variance of note that Eurofins Air Toxics has taken to the OSHA, Radiello, and the OVM 3500 methods is the use of GC/MS instead of GC/FID, thus providing more definitive compound identification and quantification for trace level environmental measurements.

Table 1 lists the target analytes routinely calibrated, along with the extract reporting limits and QC acceptance criteria. Tables 4 through 6 list the reporting limit for each sampler type in units of mass and the sampling rate. The sampling rates for the WMS sampler are maintained as proprietary and are not published as part of this document. To calculate the sample reporting limit in terms of $\mu g/m^3$, the compound sampling rate and the sample duration are required. Please consult with the laboratory to determine the appropriate sampler to meet project objectives.

Table1. Target Analytes, (Extract) Reporting Limits, and QC Criteria

Analytes	Reporting Limit (µg/mL)	Acceptance Criteria			
		ICAL (%RSD)	ICV (% R)	LCS (%R)	CCV (%D)
Chloromethane	0.2	30	70 – 130	50 – 140	%D ≤ 40%
Vinyl Chloride	0.2	30	50 – 140	50 – 140	%D ≤ 40%
Ethanol	0.5	30	70 – 130	50 – 130*	%D ≤ 30%
1,1-Dichloroethene	0.2	30	70 – 130	70 – 130	%D ≤ 30%
Acetone	0.1	30	70 – 130	70 – 130	%D ≤ 30%
2-Propanol	0.1	30	50 – 130	50 – 130	%D ≤ 30%
MTBE	0.05	30	70 – 130	70 – 130	%D ≤ 30%
trans-1,2-Dichloroethene	0.1	20	80 – 120	70 – 130	%D ≤ 20%
Hexane	0.05	30	70 – 130	70 – 130	%D ≤ 30%
1,1-Dichloroethane	0.05	20	80 – 120	70 – 130	%D ≤ 20%
Ethyl Acetate	0.2	30	70 – 130	70 – 130	%D ≤ 30%
2-Butanone	0.05	30	70 – 130	70 – 130	%D ≤ 30%
cis-1,2-Dichloroethene	0.1	20	80 – 120	70 – 130	%D ≤ 20%
Chloroform	0.05	20	80 – 120	70 – 130	%D ≤ 20%
Cyclohexane	0.05	30	70 – 130	70 – 130	%D ≤ 20%
1,1,1-trichloroethane	0.05	20	80 – 120	70 – 130	%D ≤ 20%
Carbon Tetrachloride	0.05	20	80 – 120	70 – 130	%D ≤ 20%
Benzene	0.2	30	70 – 130	70 – 130	%D ≤ 30%
1,2-Dichloroethane	0.05	20	80 – 120	70 – 130	%D ≤ 20%
Heptane	0.05	20	80 – 120	70 – 130	%D ≤ 20%
Trichloroethene	0.05	20	80 – 120	70 – 130	%D ≤ 20%
4-Methyl-2-pentanone	0.1	30	70 – 130	70 – 130	%D ≤ 30%
Toluene	0.05	20	80 – 120	70 – 130	%D ≤ 20%
1,1,2-Trichloroethane	0.05	20	80 – 120	70 – 130	%D ≤ 20%
Tetrachloroethene	0.05	20	80 – 120	70 – 130	%D ≤ 20%
Chlorobenzene	0.05	20	80 – 120	70 – 130	%D ≤ 20%
Ethylbenzene	0.05	20	80 – 120	70 – 130	%D ≤ 20%
m,p-Xylene	0.05	20	80 – 120	70 – 130	%D ≤ 20%
o-Xylene	0.05	30	70 – 130	70 – 130	%D ≤ 20%
Styrene	0.05	30	70 – 130	20-100*	%D ≤ 30%

1,1,2,2-Tetrachloroethane	0.05	30	70 – 130	60 – 130	%D ≤ 30%
Propylbenzene	0.05	20	80 – 120	70 – 130	%D ≤ 20%
1,3,5-Trimethylbenzene	0.05	20	80 – 120	70 – 130	%D ≤ 20%
1,2,4-Trimethylbenzene	0.05	20	80 – 120	70 – 130	%D ≤ 20%
1,3-Dichlorobenzene	0.05	30	70 – 130	50 – 110**	%D ≤ 30%
1,4-Dichlorobenzene	0.05	30	70 – 130	50 – 110**	%D ≤ 30%
1,2-Dichlorobenzene	0.05	30	70 – 130	50 – 110**	%D ≤ 30%
Naphthalene	0.05	30	70 – 130	5-80*	%D ≤ 30%

*Acceptance limits based on desorption efficiency studies
**60 – 130% for WMS

Table 2. Internal Standard

Analyte	CCV IS (%R)	Sample IS (%)R
2-Fluorotoluene	50 – 200	50 – 200

Table 3. Surrogate

Analyte	%R
Toluene-d8	70-130

Table 4. Sampling Rates for "Standard" target compounds (RAD 130)

Analytes	Reporting Limit (µg/mL)	Reporting Limit (µg/sampler)	Sampling Rates for Radiello 130 Sampler (mL/min)
Chloromethane	0.2	0.4	107*
Vinyl Chloride	0.2	0.4	90*
Ethanol	0.5	1.0	102
1,1-Dichloroethene	0.2	0.4	76*
Acetone	0.1	0.2	77
2-Propanol	0.1	0.2	52
MTBE	0.05	0.1	65
trans-1,2-Dichloroethene	0.1	0.2	60*
Hexane	0.05	0.1	66
1,1-Dichloroethane	0.05	0.1	63*
Ethyl Acetate	0.2	0.4	78
2-Butanone	0.05	0.1	79
cis-1,2-Dichloroethene	0.05	0.1	62*
Chloroform	0.05	0.1	75
Cyclohexane	0.05	0.1	54
1,1,1-trichloroethane	0.05	0.1	62
Carbon Tetrachloride	0.05	0.1	67
Benzene	0.2	0.4	80
1,2-Dichloroethane	0.05	0.1	77
Heptane	0.05	0.1	58
Trichloroethene	0.05	0.1	69
4-Methyl-2-pentanone	0.1	0.2	67
Toluene	0.05	0.1	74

1,1,2-Trichloroethane	0.05	0.1	66*
Tetrachloroethene	0.05	0.1	59
Chlorobenzene	0.05	0.1	68
Ethylbenzene	0.05	0.1	68
m,p-Xylene	0.05	0.1	70
o-Xylene	0.05	0.1	65
Styrene	0.05	0.1	61
1,1,2,2-Tetrachloroethane	0.05	0.1	60*
Propylbenzene	0.05	0.1	57
1,3,5-Trimethylbenzene	0.05	0.1	53*
1,2,4-Trimethylbenzene	0.05	0.1	50
1,3-Dichlorobenzene	0.05	0.1	59*
1,4-Dichlorobenzene	0.05	0.1	51
1,2-Dichlorobenzene	0.05	0.1	58*
Naphthalene	0.05	0.1	25

*Estimated rate

Table 5. Sampling Rates for "Standard" target compounds (OVM)

Analytes	Reporting Limit (µg/mL)	Reporting Limit (µg/sampler)	Sampling Rates for OVM Sampler (mL/min)
Chloromethane	0.2	0.30	Estimated
Vinyl Chloride	0.2	0.30	41
Ethanol	0.5	0.75	44
1,1-Dichloroethene	0.2	0.30	Estimated
Acetone	0.1	0.15	40
2-Propanol	0.1	0.15	39
MTBE	0.05	0.075	38
trans-1,2-Dichloroethene	0.1	0.15	Estimated
Hexane	0.05	0.075	32
1,1-Dichloroethane	0.05	0.075	33
Ethyl Acetate	0.2	0.3	34
2-Butanone	0.05	0.075	36
cis-1,2-Dichloroethene	0.05	0.075	Estimated
Chloroform	0.05	0.075	34
Cyclohexane	0.05	0.075	32
1,1,1-trichloroethane	0.05	0.075	31
Carbon Tetrachloride	0.05	0.075	30
Benzene	0.2	0.30	80
1,2-Dichloroethane	0.05	0.075	33
Heptane	0.05	0.075	29
Trichloroethene	0.05	0.075	31
4-Methyl-2-pentanone	0.1	0.15	30
Toluene	0.05	0.075	31
1,1,2-Trichloroethane	0.05	0.075	30
Tetrachloroethene	0.05	0.075	28
Chlorobenzene	0.05	0.075	29
Ethylbenzene	0.05	0.075	27
m,p-Xylene	0.05	0.075	27

o-Xylene	0.05	0.075	27
Styrene	0.05	0.075	29
1,1,2,2-Tetrachloroethane	0.05	0.075	28
Propylbenzene	0.05	0.075	Estimated
1,3,5-Trimethylbenzene	0.05	0.075	Estimated
1,2,4-Trimethylbenzene	0.05	0.075	Estimated
1,3-Dichlorobenzene	0.05	0.075	Estimated
1,4-Dichlorobenzene	0.05	0.075	27.8
1,2-Dichlorobenzene	0.05	0.075	27.8
Naphthalene	0.05	0.075	25

Table 6. Sampling Rates for "Standard" target compounds (SKC Badge)

Analytes	Reporting Limit (µg/mL)	Reporting Limit (µg/sampler)	Sampling Rates for Indoor Air Applications „Zero Face velocity' (mL/min)	Sampling Rates for Outdoor/Worker Exposure (mL/min)
Chloromethane	0.2	0.4	Estimated	Estimated
Vinyl Chloride	0.2	0.4	17.4*	21.2*
Ethanol	0.5	1.0	11.7	20.0
1,1-Dichloroethene	0.2	0.4	9.74	12.3
Acetone	0.1	0.2	12.6	15.2
2-Propanol	0.1	0.2	9.65	20.0
MTBE	0.05	0.1	9.84	13.6
trans-1,2-Dichloroethene	0.1	0.2	10.2	14.8
Hexane	0.05	0.1	9.59	14.3
1,1-Dichloroethane	0.05	0.1	13.14	12.3
Ethyl Acetate	0.2	0.4	9.26	13.75
2-Butanone	0.05	0.1	6.27	17.1
cis-1,2-Dichloroethene	0.05	0.1	11.54*	14.8*
Chloroform	0.05	0.1	10.14	13
Cyclohexane	0.05	0.1	7.76	15.6
1,1,1-trichloroethane	0.05	0.1	9.40	14.1
Carbon Tetrachloride	0.05	0.1	10.41	14.1
Benzene	0.2	0.4	10.69	16
1,2-Dichloroethane	0.05	0.1	11.79	14.2
Heptane	0.05	0.1	9.38	13.9
Trichloroethene	0.05	0.1	11.47	14.9
4-Methyl-2-pentanone	0.1	0.2	7.29	13.5
Toluene	0.05	0.1	8.90	14.5
1,1,2-Trichloroethane	0.05	0.1	9.64	12.5
Tetrachloroethene	0.05	0.1	10.02	13.1
Chlorobenzene	0.05	0.1	8.23*	18.74*
Ethylbenzene	0.05	0.1	9.02	12.9
m,p-Xylene	0.05	0.1	8.1	12.65
o-Xylene	0.05	0.1	8.11	11.9
Styrene	0.05	0.1	9.04	13.7
1,1,2,2-Tetrachloroethane	0.05	0.1	9.98	11.8
Propylbenzene	0.05	0.1	6.41*	11.69*
1,3,5-Trimethylbenzene	0.05	0.1	7.29*	12.1*

1,2,4-Trimethylbenzene	0.05	0.1	9.92*	12.1*
1,3-Dichlorobenzene	0.05	0.1	5.79*	12.7*
1,4-Dichlorobenzene	0.05	0.1	10.74*	12.7*
1,2-Dichlorobenzene	0.05	0.1	4.97*	12.6*
Naphthalene	0.05	0.1	2.71*	13.7*

*Calculated by SKC

Table 7. Summary of Calibration and QC Procedures

QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action
Tuning Criteria	Prior to calibration and at the start of every 12-hour clock	Method 8260B tuning criteria	Correct problem then repeat tune.
Initial 5-Point Calibration (ICAL)	Prior to sample analysis	Compound criteria in Table 1	Correct problem then repeat initial calibration. Analysis may proceed if no more than 2 VOCs exceed criteria or 5% of VOCs if short list is used. Narrate exceedances.
Initial Calibration Verification (ICV)	Once per initial calibration	See Table 1	Verify concentrations and standard preparation. Analysis may proceed if no more than 2 VOCs exceed criteria or 5% of VOCs if short list is used. Narrate exceedances.
Continuing Calibration Verification (CCV)	At the start of every shift immediately after the BFB tune check	See "CCV criteria" column in Table 1	Investigate and correct the problem, up to and including recalibration if necessary. Analysis may proceed if no more than 2 VOCs exceed criteria or 5% of VOCs if short list is used. Associated results are flagged.
Internal Standards (IS)	IS is added at the time of extraction to all samples and QC samples.	**For CCVs:** Area counts 50 –200%; RT w/in 30 seconds of midpoint in ICAL **For blanks, samples and non-CCV QC checks:** Area counts 50 – 200%; RT within 20 seconds of RT in CCV	**CCV:** Inspect and correct system prior to sample analysis. **For blanks:** Inspect the system and re-analyze the blank. **For samples:** Re-analyze; if out again, flag data.
Surrogate	Surrogate is added at the time of extraction to all samples and QC samples.	70–130%	Same as for Internal Standards.
Solvent Blanks	Immediately after the calibration standard or after samples with high concentrations	Results less than laboratory reporting limit (see Table 1)	Re-aliquot and re-analyze solvent blank. If detections remain, flag concentrations in associated samples.

Extracted Laboratory Blank	Each set of up to 20 samples	Results less than the reporting limit	Flag sample concentrations in associated extraction batch.
Extracted Laboratory Control Spike (LCS)	Each set of up to 20 samples	See Table 1.	Re-aliquot and re-analyze the extract. If within limits, report the re-analysis. Otherwise, narrate.
Extracted Laboratory Control Spike Duplicate (LCSD)	Each set of up to 20 samples	%RPD ≤ 25%	Analysis may proceed if no more than 2 VOCs exceed criteria (or 5% for short list exceed criteria). Run a 3rd time; perform corrective action or narrate as appropriate.

LABORATORY QUALITY ASSURANCE MANUAL

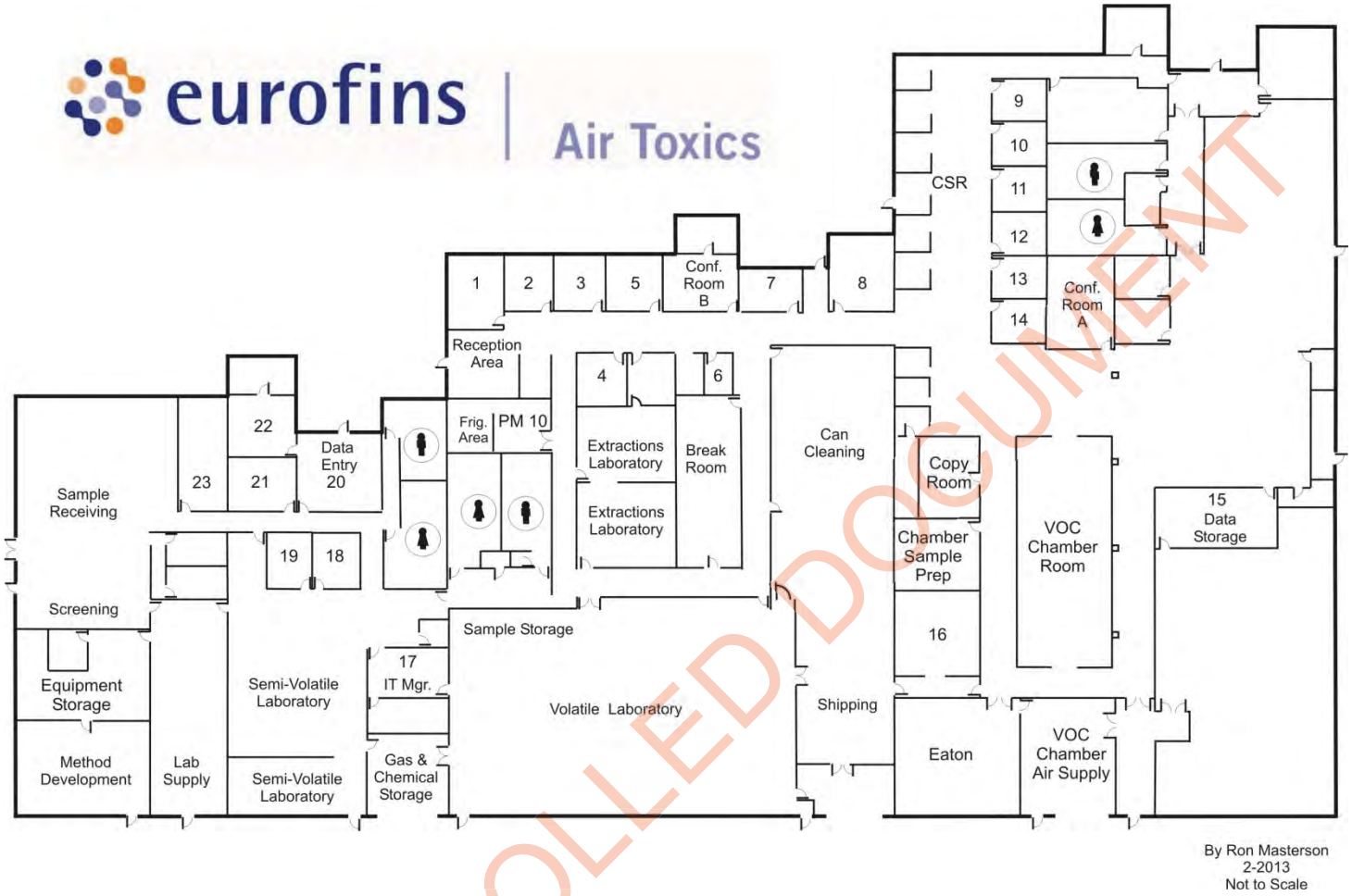
(LQAM)

Appendix F

Facility Map

(Two total pages including this cover)

Current as of March 5, 2014



eurofins | Air Toxics

LABORATORY QUALITY ASSURANCE MANUAL

(LQAM)

Appendix G

References

(Two total pages including this cover)

Current as of March 5, 2014

REFERENCES

- Air Monitoring Quality Assurance Manual, Volume VI: Standard Operating Procedures for Stationary Sources Emission Monitoring and Testing. State of California Air Resources Board. Available at: http://www.arb.ca.gov/testmeth/testmeth.htm
- Annual Book of ASTM Standards, ASTM International. Available at: www.astm.org
- Compendium of Methods for the Determination of Air Pollutants in Indoor Air. Winberry et al. Atmospheric Research and Exposure Assessment Laboratory, Office of Research and Development, U.S. Environmental Protection Agency. September 1989.
- Compendium of Methods for the Determination of Toxic Organic Compounds in Ambient Air. U.S. EPA Center for Environmental Research Information. Second Edition. January 1999.
- Environmental Sampling and Analysis: Lab Manual. Maria Csuros. Lewis Publishers, New York. 1997.
- Guidelines Establishing Test Procedures for the Analysis of Pollutants. U.S. EPA Clean Water Act. 40 CFR 136. 1984.
- OSHA Analytical Methods Manual, U.S. Department of Labor. Available at: https://www.osha.gov/dts/sltc/methods/index.html
- Quality Systems Manual (QSM) for Environmental Laboratories. Department of Defense (DoD). Version 5.0. July 2013.
- Statement of Work for Organics Analysis. U.S. EPA Contract Laboratory Program. OLM04.2. May 1999.
- Test Methods for Evaluating Solid Waste, Physical/Chemical Methods. SW-846. Available at: http://www.epa.gov/solidwaste/hazard/testmethods/index.htm
- TNI Standard. Volume 1: Management and Technical Requirements for Laboratories Performing Environmental Analysis. The NELAC Institute Environmental Laboratory Sector. 2009. Available at: http://www.nelac-institute.org/docs/standards/2009/EL_Volume1_2011.pdf

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

Eurofins Air Toxics SOP#6 Revision 30 Effective Date: April 30, 2013 Methods Manual Summary

Description: This method involves full scan GC/MS analysis of whole air samples collected in evacuated stainless steel canisters. Samples are analyzed for volatile organic compounds 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 (6.28) 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 & ppmv range vapor matrices
TO-14A/TO-15 (Standard or Quad)	0.5 – 5.0 ppbv	Ambient Air, Soil Gas & 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 Air Toxics' standard target analyte list. These compounds are communicated at the time of client proposal request. Unless otherwise directed, ATL 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 Air Toxics applies TO-15 methodology to all Summa canisters regardless of whether TO-14A or TO-15 is specified by the project, Air Toxics 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	ATL 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	Follow TO-15 requirements of ≤ 30% RSD with 2 of ATL's 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 (Standard 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

Analyte	RL/LOQ (ppbv)	QC Acceptance Criteria			
		ICAL (%RSD)	CCV (%R)	ICV/LCS (%R)	Precision Limits (Max. RPD)
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
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

Analyte	RL/LOQ (ppbv)	QC Acceptance Criteria			
		ICAL (%RSD)	CCV (%R)	ICV/LCS (%R)	Precision Limits (Max. RPD)
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
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**	2.0	≤40%	60 - 140	60 – 140	± 25
TPH (Gasoline) ***	25	One Point Calibration	NA	ICV only; 60 - 140	± 25
NMOC (Hexane/Heptane)***	10	One Point Calibration	NA	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 Air Toxics 'standard' TO-15 list, it is commonly requested and included in Table 2.

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

Table 3. Internal Standards

Analyte	Accuracy (% R)
Bromochloromethane	60 - 140
1,4-Difluorobenzene	60 - 140
Chlorobenzene-d_5	60 - 140

Table 4. Surrogates

Analyte	Accuracy (% R)
1,2-Dichloroethane-d_4	70 – 130
Toluene-d_8	70 – 130
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 ≤ 30 with two compounds allowed out to ≤ 40% RSD. Note: Bromomethane and alpha-Chlorotoluene may exceed 40%RSD. All associated data is flagged as estimated.	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)	At the start of each day after the BFB 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 (Table 2).	Inspect the system and Re-analyze the blank. B-flag data for common contaminants.

QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action
Internal Standard (IS)	As each standard, blank, and sample is being loaded.	Retention time (RT) for blanks and samples must be within ±0.33 min of the RT in the CCV and within ±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.
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 Duplicate (LCSD)	One per analytical batch.	RPD ≤25%.	Narrate exceedances. If more than 5% of compound list outside criteria or if compound is >40%RPD, investigate the cause and perform maintenance as required. If instrument maintenance is required, calibrate as needed.

Method: ASTM D1945 – Fixed Gases & C1-C6

Eurofins Air Toxics SOP #54 Revision 18 Effective Date: December 27, 2013 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 3-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
Reference Standard	Concentration should not be < half of nor differ by more than 2X the concentration of the sample. Run 2 consecutive checks; must agree within 1%.	A minimum 3-point linear calibration. The acceptance criterion is RSD ≤ 15%. All target analytes must be within the linear range of calibration (with the exception of O_2, N_2, and C6+ hydrocarbons).
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	≤ 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.	± 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 ≤ 25%	Narrate exceedances. Investigate the cause and perform maintenance as required and re-calibrate as needed.

Method: ASTM D5504 – Sulfur Compounds

Eurofins Air Toxics SOP #13 Revision 17 Effective Date: December 27, 2013 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 (H_2S), 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: The Quality Control (QC) elements listed in the latest ASTM Method D5504-01 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:

- All field samples are not analyzed in duplicate.
- Daily spiked field samples are not analyzed.

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 ≤ 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 2nd 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.

Eurofins Air Toxics, Inc. 2Q 2013 TO-14A/TO-15 QUAD Limit of Detections (LODs)
Effective 07-01-2013

CAS #	Analyte	Molecular Weight (MW)	LOD (ppbv)	LOQ (ppbv)	LOD (ug/m3)	LOQ (ug/m3)
71-55-6	1,1,1-Trichloroethane	133.42	0.14	0.5	0.76396	2.72843
79-34-5	1,1,2,2-Tetrachloroethane	167.86	0.14	0.5	0.96116	3.43272
79-00-5	1,1,2-Trichloroethane	133.42	0.14	0.5	0.76396	2.72843
75-34-3	1,1-Dichloroethane	98.97	0.14	0.5	0.5667	2.02393
75-35-4	1,1-Dichloroethene	96.95	0.14	0.5	0.55513	1.98262
120-82-1	1,2,4-Trichlorobenzene*	181.46	0.62083	2	4.6076	14.84335
95-63-6	1,2,4-Trimethylbenzene	120.19	0.14	0.5	0.6882	2.45787
106-93-4	1,2-Dibromoethane (EDB)	187.88	0.14	0.5	1.0758	3.84213
95-50-1	1,2-Dichlorobenzene	147.01	0.14	0.5	0.84178	3.00634
107-06-2	1,2-Dichloroethane	98.96	0.14	0.5	0.56664	2.02372
78-87-5	1,2-Dichloropropane	112.99	0.14	0.5	0.64698	2.31063
108-67-8	1,3,5-Trimethylbenzene	120.19	0.14	0.5	0.6882	2.45787
106-99-0	1,3-Butadiene	54.09	0.14	0.5	0.30972	1.10613
541-73-1	1,3-Dichlorobenzene	147.01	0.14	0.5	0.84178	3.00634
106-46-7	1,4-Dichlorobenzene	147.01	0.14	0.5	0.84178	3.00634
123-91-1	1,4-Dioxane*	88.11	0.68099	2	2.45407	7.20736
540-84-1	2,2,4-Trimethylpentane	114.22	0.14	0.5	0.65402	2.33579
78-93-3	2-Butanone*	72.11	0.50797	2	1.49815	5.89857
591-78-6	2-Hexanone*	100.16	0.5349	2	2.19123	8.19305
67-63-0	2-Propanol*	60.09	0.6705	2	1.64787	4.91534
107-05-1	3-Chloropropene*	76.53	0.64629	2	2.02293	6.26012
622-96-8	4-Ethyltoluene	120.19	0.14	0.5	0.6882	2.45787
108-10-1	4-Methyl-2-pentanone	100.16	0.14	0.5	0.57351	2.04826
67-64-1	Acetone*	58.08	0.65443	5	1.55457	11.8773
100-44-7	alpha-Chlorotoluene	126.58	0.14	0.5	0.72479	2.58855
71-43-2	Benzene	78.11	0.14	0.5	0.44726	1.59734
75-27-4	Bromodichloromethane	163.83	0.14	0.5	0.93809	3.35031
75-25-2	Bromoform	252.77	0.14	0.5	1.44735	5.16912
74-83-9	Bromomethane	94.95	0.25	5	0.97086	19.41718
75-15-0	Carbon Disulfide*	76.14	0.65589	2	2.04251	6.22822
56-23-5	Carbon Tetrachloride	153.84	0.14	0.5	0.88088	3.14601
108-90-7	Chlorobenzene	112.56	0.14	0.5	0.64452	2.30184
75-00-3	Chloroethane*	64.52	0.76882	2	2.0288	5.27771
67-66-3	Chloroform	119.39	0.14	0.5	0.68362	2.44151
74-87-3	Chloromethane*	50.49	0.62486	5	1.29036	10.32515
156-59-2	cis-1,2-Dichloroethene	96.94	0.14	0.5	0.55508	1.98241
10061-01-5	cis-1,3-Dichloropropene	110.97	0.14	0.5	0.63541	2.26933
98-82-8	Cumene	120.19	0.14	0.5	0.6882	2.45787
110-82-7	Cyclohexane	84.16	0.14	0.5	0.4819	1.72106
124-48-1	Dibromochloromethane	208.28	0.14	0.5	1.19261	4.2593
64-17-5	Ethanol	46.07	1	2	1.88425	3.76851

CAS #	Analyte	Molecular Weight (MW)	LOD (ppbv)	LOQ (ppbv)	LOD (ug/m3)	LOQ (ug/m3)
100-41-4	Ethyl Benzene	106.16	0.14	0.5	0.60787	2.17096
75-69-4	Freon 11	137.38	0.14	0.5	0.78663	2.80941
76-13-1	Freon 113	187.39	0.14	0.5	1.07299	3.83211
76-14-2	Freon 114	170.93	0.14	0.5	0.97874	3.4955
75-71-8	Freon 12	120.92	0.14	0.5	0.69238	2.4728
142-82-5	Heptane	100.2	0.14	0.5	0.57374	2.04908
87-68-3	Hexachlorobutadiene*	260.76	0.58904	2	6.28213	21.33006
110-54-3	Hexane	86.17	0.14	0.5	0.49341	1.76217
108-38-3	m,p-Xylene	106.17	0.14	0.5	0.60793	2.17117
1634-04-4	Methyl tert-butyl ether	88.15	0.14	0.5	0.50474	1.80266
75-09-2	Methylene Chloride	84.94	0.25	5	0.86851	17.37014
91-20-3	Naphthalene	128.17	2	2	10.48425	10.48425
95-47-6	o-Xylene	106.17	0.14	0.5	0.60793	2.17117
103-65-1	Propylbenzene	120.19	0.14	0.5	0.6882	2.45787
115-07-1	Propylene*	42.08	0.7781	2	1.33916	3.44213
100-42-5	Styrene	104.14	0.14	0.5	0.5963	2.12965
127-18-4	Tetrachloroethene	165.85	0.14	0.5	0.94965	3.39162
109-99-9	Tetrahydrofuran	72.1	0.14	0.5	0.41284	1.47444
108-88-3	Toluene	92.13	0.14	0.5	0.52753	1.88405
156-60-5	trans-1,2-Dichloroethene	96.94	0.14	0.5	0.55508	1.98241
10061-02-6	trans-1,3-Dichloropropene	110.97	0.14	0.5	0.63541	2.26933
79-01-6	Trichloroethene	131.39	0.14	0.5	0.75234	2.68691
108-05-4	Vinyl Acetate*	86.09	0.59035	2	2.07866	7.04213
75-01-4	Vinyl Chloride	62.5	0.14	0.5	0.35787	1.27812

ppbv - part per billion by volume

Concentration (ug/m3) = Concentration (ppbv)*MW/24.45

Instrument ID - msd17.i file msd17.i/18jun13.b/17061807.d msd17.i/18jun13.b/17061808.d msd17.i/18jun13.b/17061809a.d msd17.i/18jun13.b/17061810a.d msd17.i/18jun13.b/17061812.d msd17.i/18jun13.b/17061813.d

*LOD was less then the MDL therefore was raised to equal the MDL value.

Eurofins Air Toxics, Inc. 2Q 2013 ASTM Limit of Detections (LODs) Effective 07-01-2013				
CAS #	Analyte	Molecular Weight (MW)	LOD (%)	LOQ (%)
74-86-2	Acetylene	26.0373	0.000059	0.001
106-97-8	Butane	58.1222	0.000059	0.001
C6+	C6+	100	0.000059	0.01
124-38-9	Carbon Dioxide*	44.0095	0.008567	0.01
74-84-0	Ethane	30.069	0.000059	0.001
74-85-1	Ethylene	28.0532	0.000059	0.001
7440-59-7	Helium*	4.002602	0.006778	0.05
75-28-5	Isobutane	58.1222	0.000059	0.001
78-78-4	Isopentane	72.1488	0.000059	0.001
74-82-8	Methane	16.0425	0.000018	0.0001
463-82-1	Neopentane	72.1488	0.000059	0.001
109-66-0	Pentane	72.1488	0.000059	0.001
74-98-6	Propane	44.0956	0.000059	0.001

Instrument ID - gc9.i file gc9.i/19Apr2013.b/9041903.d gc9.i/19Apr2013.b/9041905.d gc9.i/11Jun2013.b/9061105b.d gc9.i/12Jun2013.b/9061207b.d

*LOD was less then the MDL therefore was raised to equal the MDL value.

Eurofins Air Toxics, Inc. 2Q 2013 ASTM D-1945/1946 ASTM Limit of Detections (LODs) Effective 07-01-2013				
CAS #	Analyte	Molecular Weight (MW)	LOD (%)	LOQ (%)
7782-44-7	Oxygen	32	0.002631*	0.1
7727-37-9	Nitrogen	28.01	0.01132*	0.1
74-86-2	Acetylene	26.0373	0.0001	0.001
106-97-8	Butane	58.1222	0.0001	0.001
C6+	C6+	100	0.0001	0.01
124-38-9	Carbon Dioxide	44.0095	0.005	0.01
630-08-0	Carbon Monoxide	28.0101	0.005	0.01
74-84-0	Ethane	30.069	0.0001	0.001
74-85-1	Ethylene	28.0532	0.0001	0.001
7440-59-7	Helium	4.002602	0.0078	0.05
1333-74-0	Hydrogen	2.01588	0.006	0.01
75-28-5	Isobutane	58.1222	0.0001	0.001
78-78-4	Isopentane	72.1488	0.0001	0.001
74-82-8	Methane	16.0425	0.00006	0.0001
463-82-1	Neopentane	72.1488	0.0001	0.001
109-66-0	Pentane	72.1488	0.0001	0.001
74-98-6	Propane	44.0956	0.0001	0.001

*LOD analysis required dilution of lowest concentration standard, but O2 and N2 cannot be reported from a diluted analysis. These analytes may only be reported MDL (DL). The MDL values from 03-19-13 are entered in the table.

Instrument ID - gc10.i file gc10.i/26Jun2013.b/10062610b.d gc10.i/26Jun2013.b/10062605c.d gc10.i/26Jun2013.b/10062632c.d gc10.i/25Jun2013.b/10062505.d gc10.i/25Jun2013.b/10062509.d

CERTIFICATE OF ACCREDITATION

ANSI-ASQ National Accreditation Board/ACLASS
500 Montgomery Street, Suite 625, Alexandria, VA 22314, 877-344-3044

This is to certify that

Eurofins Air Toxics, Inc.
180 Blue Ravine Road, Ste. B
Folsom, CA 95630

has been assessed by ACLASS
and meets the requirements of

ISO/IEC 17025:2005 and DoD-ELAP

while demonstrating technical competence in the field(s) of

TESTING

Refer to the accompanying Scope(s) of Accreditation for information regarding the types of tests to which this accreditation applies.

ADE - 1451
Certificate Number

ACLASS Approval

Certificate Valid: 04/27/2014 - 04/27/2016
Version No. 004 Issued: 08/22/2014

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*).

SCOPE OF ACCREDITATION TO ISO/IEC 17025:2005 & DoD-ELAP

Eurofins Air Toxics, Inc.

180 Blue Ravine Rd. Suite B, Folsom, CA 95630
Bahar Amiri Phone: 916-985-1000

TESTING

Valid to: April 27, 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

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. Refer to Accredited Analyte Listing for specific analytes in which the laboratory is accredited.*
3. *This scope is part of and must be included with the Certificate of Accreditation No. ADE – 1451.*

Vice President

500 Montgomery St. Suite 625 | Alexandria, VA 22314 | 703-836-0025 | www.aclasscorp.com

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

Eurofins Air Toxics, Inc.						
Folsom, CA						
Analyte	**Matrix**					
	Air					
Cumene	TO-15	TO-17				
Propylbenzene	TO-15	TO-17				
1,3-Dichlorobenzene	TO-15	TO-17				
alpha-chlorotoluene	TO-15					
1,2,4-Trichlorobenzene	TO-15	TO-17				
Hexachlorobutadiene	TO-15	TO-17				
m,p-Xylene	TO-15	TO-17	TO-3			
o-Xylene	TO-15	TO-17	TO-3			
Naphthalene	TO-15	TO-17				
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		
1,1,1-Trichloroethane						

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 :

	Air	*Drinking Water*	*Non Potable Water*	*Solids and Chem. Waste*	*Tissue*
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: 10/18/2014

EXPIRATION DATE: 10/17/2015

Certificate No: CA300005 - 005

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 - 005

Eurofins Air Toxics, Inc

180 Blue Ravine Road, Ste. B
Folsom CA 95630

Issue Date: 10/18/2014 ***Expiration Date:*** 10/17/2015

As of 10/18/2014 ***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
EPA CODE: CA00933
Certificate: CA300005 - 005

Eurofins Air Toxics, Inc

180 Blue Ravine Road, Ste. B
Folsom CA 95630

Issue Date: 10/18/2014 ***Expiration Date:*** 10/17/2015

As of 10/18/2014 ***this list supercedes all previous lists for this certificate number. Customers. Please verify the current accreditation standing with ORELAP.***

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 TO-10A (GC/ECD) **10247504** **Pesticides and PCBs with HV PUF by GC/ECD**

Analyte Code	*Analyte*
7355	4,4'-DDD
7360	4,4'-DDE
7365	4,4'-DDT
7025	Aldrin
7110	alpha-BHC (alpha-Hexachlorocyclohexane)
7240	alpha-Chlordane
8880	Aroclor-1016 (PCB-1016)
8890	Aroclor-1232 (PCB-1232)
8895	Aroclor-1242 (PCB-1242)
8900	Aroclor-1248 (PCB-1248)
8905	Aroclor-1254 (PCB-1254)
8910	Aroclor-1260 (PCB-1260)
7115	beta-BHC (beta-Hexachlorocyclohexane)
7250	Chlordane (tech.)
7105	delta-BHC
7470	Dieldrin
7510	Endosulfan I
7515	Endosulfan II
7520	Endosulfan sulfate
7540	Endrin
7530	Endrin aldehyde
7535	Endrin ketone
7120	gamma-BHC (Lindane, gamma-Hexachlorocyclohexane)
7245	gamma-Chlordane
7685	Heptachlor
7690	Heptachlor epoxide
7810	Methoxychlor
8250	Toxaphene (Chlorinated camphene)

EPA TO-11A **10311805** **Determination of Formaldehyde in Ambient Air Using Adsorbent Cartridge Followed by High Performance Liquid Chromatography (HPLC)**

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)

ORELAP Fields of Accreditation

ORELAP ID: CA300005
EPA CODE: CA00933
Certificate: CA300005 - 005

Eurofins Air Toxics, Inc

180 Blue Ravine Road, Ste. B
Folsom CA 95630

Issue Date: 10/18/2014 ***Expiration Date:*** 10/17/2015

As of 10/18/2014 ***this list supercedes all previous lists for this certificate number.***
Customers. Please verify the current accreditation standing with ORELAP.

EPA TO-12 **10248201** **Non-Methane Organic Compounds by GC/FID**

Analyte Code	*Analyte*
3860	Non-methane organics

EPA TO-13A **10248405** **Polycyclic Aromatic Hydrocarbons in Ambient Air by GC/MS**

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
5005	Naphthalene
6615	Phenanthrene
6665	Pyrene

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

Analyte Code	*Analyte*
6380	1-Methylnaphthalene
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
5905	Dibenzofuran
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

ORELAP Fields of Accreditation

ORELAP ID: CA300005
EPA CODE: CA00933
Certificate: CA300005 - 005

Eurofins Air Toxics, Inc

180 Blue Ravine Road, Ste. B
Folsom CA 95630

Issue Date: 10/18/2014 ***Expiration Date:*** 10/17/2015

As of 10/18/2014 ***this list supercedes all previous lists for this certificate number. Customers. Please verify the current accreditation standing with ORELAP.***

Analyte Code	*Analyte*
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
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
5155	1,2,4-Trichlorobenzene
5210	1,2,4-Trimethylbenzene
4585	1,2-Dibromoethane (EDB, Ethylene dibromide)
4610	1,2-Dichlorobenzene
4635	1,2-Dichloroethane (Ethylene dichloride)

ORELAP Fields of Accreditation

ORELAP ID: CA300005
EPA CODE: CA00933
Certificate: CA300005 - 005

Eurofins Air Toxics, Inc

180 Blue Ravine Road, Ste. B
Folsom CA 95630

Issue Date: 10/18/2014 ***Expiration Date:*** 10/17/2015

As of 10/18/2014 ***this list supercedes all previous lists for this certificate number. Customers. Please verify the current accreditation standing with ORELAP.***

Analyte Code	*Analyte*
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)
4836	1-Propene
5220	2,2,4-Trimethylpentane
4410	2-Butanone (Methyl ethyl ketone, MEK)
4860	2-Hexanone
4542	4-Ethyltoluene
4995	4-Methyl-2-pentanone (MIBK)
4315	Acetone
4325	Acrolein (Propenal)
4355	Allyl chloride (3-Chloropropene)
4375	Benzene
5635	Benzyl chloride
4395	Bromodichloromethane
4400	Bromoform
4450	Carbon disulfide
4455	Carbon tetrachloride
4475	Chlorobenzene
4575	Chlorodibromomethane
4485	Chloroethane (Ethyl chloride)
4505	Chloroform
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)
4900	Isopropylbenzene
4950	Methyl bromide (Bromomethane)
4960	Methyl chloride (Chloromethane)
5000	Methyl tert-butyl ether (MTBE)
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)
5225	Vinyl acetate
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
5195	1,1,2-Trichloro-1,2,2-trifluoroethane (Freon 113)
5165	1,1,2-Trichloroethane
4630	1,1-Dichloroethane

ORELAP Fields of Accreditation

ORELAP ID: CA300005
EPA CODE: CA00933
Certificate: CA300005 - 005

Eurofins Air Toxics, Inc

180 Blue Ravine Road, Ste. B
Folsom CA 95630

Issue Date: 10/18/2014 ***Expiration Date:*** 10/17/2015

As of 10/18/2014 ***this list supercedes all previous lists for this certificate number.***
Customers, Please verify the current accreditation standing with ORELAP.

Analyte Code	*Analyte*
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
9318	1,3-Butadiene
4615	1,3-Dichlorobenzene
4620	1,4-Dichlorobenzene
4410	2-Butanone (Methyl ethyl ketone, MEK)
4860	2-Hexanone
4542	4-Ethyltoluene
4995	4-Methyl-2-pentanone (MIBK)
4315	Acetone
4375	Benzene
5635	Benzyl chloride
4395	Bromodichloromethane
4400	Bromoform
4450	Carbon disulfide
4455	Carbon tetrachloride
4475	Chlorobenzene
4575	Chlorodibromomethane
4485	Chloroethane (Ethyl chloride)
4505	Chloroform
4645	cis-1,2-Dichloroethylene
4680	cis-1,3-Dichloropropene
4625	Dichlorodifluoromethane (Freon-12)
4765	Ethylbenzene
5240	m+p-xylene
4950	Methyl bromide (Bromomethane)
4960	Methyl chloride (Chloromethane)
5000	Methyl tert-butyl ether (MTBE)
4975	Methylene chloride (Dichloromethane)
5005	Naphthalene
4825	n-Heptane
4855	n-Hexane
5250	o-Xylene
5100	Styrene
5115	Tetrachloroethylene (Perchloroethylene)
5140	Toluene
4700	trans-1,2-Dichloroethylene
4685	trans-1,3-Dichloropropylene
5170	Trichloroethene (Trichloroethylene)
5175	Trichlorofluoromethane (Fluorotrichloromethane, Freon 11)
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
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)

ORELAP Fields of Accreditation

ORELAP ID: CA300005
EPA CODE: CA00933
Certificate: CA300005 - 005

Eurofins Air Toxics, Inc

180 Blue Ravine Road, Ste. B
Folsom CA 95630

Issue Date: 10/18/2014 ***Expiration Date:*** 10/17/2015

As of 10/18/2014 ***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)
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
4910	4-Isopropyltoluene (p-Cymene)
5500	Acenaphthene
5505	Acenaphthylene
5555	Anthracene
4375	Benzene
4450	Carbon disulfide
4455	Carbon tetrachloride
4475	Chlorobenzene
4575	Chlorodibromomethane
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
4950	Methyl bromide (Bromomethane)
4960	Methyl chloride (Chloromethane)
5000	Methyl tert-butyl ether (MTBE)
4965	Methylcyclohexane
4975	Methylene chloride (Dichloromethane)
5005	Naphthalene
4435	n-Butylbenzene
4825	n-Heptane
4855	n-Hexane
5090	n-Propylbenzene
5250	o-Xylene
6615	Phenanthrene
6665	Pyrene
4440	sec-Butylbenzene
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)

ORELAP Fields of Accreditation

ORELAP ID: CA300005
EPA CODE: CA00933
Certificate: CA300005 - 005

Eurofins Air Toxics, Inc

180 Blue Ravine Road, Ste. B
Folsom CA 95630

Issue Date: 10/18/2014 ***Expiration Date:*** 10/17/2015

As of 10/18/2014 ***this list supercedes all previous lists for this certificate number.***
Customers. Please verify the current accreditation standing with ORELAP.

EPA TO-3 **10249000** **Cryogenic Trapping**

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

EPA TO-4A **10249204** **Pesticides and PCBs by HV PUF GC**

Analyte Code	*Analyte*
7355	4,4'-DDD
7360	4,4'-DDE
7365	4,4'-DDT
7025	Aldrin
7110	alpha-BHC (alpha-Hexachlorocyclohexane)
7240	alpha-Chlordane
8880	Aroclor-1016 (PCB-1016)
8890	Aroclor-1232 (PCB-1232)
8895	Aroclor-1242 (PCB-1242)
8900	Aroclor-1248 (PCB-1248)
8905	Aroclor-1254 (PCB-1254)
8910	Aroclor-1260 (PCB-1260)
7115	beta-BHC (beta-Hexachlorocyclohexane)
7250	Chlordane (tech.)
7105	delta-BHC
7470	Dieldrin
7510	Endosulfan I
7515	Endosulfan II
7520	Endosulfan sulfate
7540	Endrin
7530	Endrin aldehyde
7535	Endrin ketone
7120	gamma-BHC (Lindane, gamma-HexachlorocyclohexanE)
7245	gamma-Chlordane
7685	Heptachlor
7690	Heptachlor epoxide
7810	Methoxychlor
8250	Toxaphene (Chlorinated camphene)

ATTACHMENT 2
STANDARD OPERATING PROCEDURES

Standard Operating Procedure

Field Documentation

PR-TC-01.04.01.00 v2

Effective Date: 05 June 2013

Reviewed by: _____ Date: 14 May 2013
Rogerio Leong, Project Geologist

Reviewed by: _____ Date: 15 May 2013
Jim Schollard, Program QA/QC Manager

Approved by: _____ Date: 05 June 2013
Jeffrey Hess, Director Technical Services

Review / Revision History:

Version	Changes	Affects Section/Pages	Effective Date	Approval*
1.0	Initial Issue	NA	14 Mar 2011	NA
2.0	Updated and revised documentation requirements, and instructions for uploading completed daily field documents to eDMS and project servers.	All pages	05 Jun 2013	NA

* Approval required for minor changes not requiring updated review and approval by signatures to the SOP.

Table of Contents

List of Attachments

1.0 PURPOSE AND SCOPE

This standard operating procedure (SOP) provides an overview of required field documentation to be performed as part of an environmental site visit or field activity performed by ITSI Gilbane Company (ITSI Gilbane). This documentation occurs through the use of specific field forms identified herein, and the use of other forms applicable to specific work activities that may be performed, as identified in their SOPs, in project specific plans, or by the client.

Proper documentation of field activities is a crucial part of any and all field activities, both for technical and legal defensibility. The field documentation should, at a minimum, provide the basic information from the site visit or field activity, such as time onsite, the names of the crew, subcontractors onsite, names of any visitors, weather conditions, activities performed, significant findings or observations, and references to any site or activity-specific forms completed that day.

In the event that site conditions change, or direction is received from client or regulatory agency personnel, potentially resulting in changes to the scope of activities specified in the approved plans (i.e., work plan, sampling and analysis plan [SAP]), the field documentation should properly and adequately reflect such changes, provide the basis of each change, and fully document instructions received from client or regulatory agency personnel.

2.0 ACRONYMS AND DEFINITIONS

For purposes of this procedure, a number of terms and acronyms have the meanings defined below.

APP: Accident Prevention Plan

CPR: Contractor Production Report

CQCP: Contractor Quality Control Plan

DAR: Daily Activity Report, a hand-written form used to document the daily field activities performed at a project site.

DoD: Department of Defense

eDMS: environmental data management system

FTL: Field Team Leader

GPS: global positioning system

HSP: Health and Safety Plan

IDW: investigation-derived waste

QA: Quality Assurance

QCM: Quality Control Manager

SCL: Sample Collection Log

SAP: Sampling and Analysis Plan

SOP: Standard Operating Procedure

3.0 EQUIPMENT/MATERIALS

The list below represents the equipment and materials recommended to complete the tasks defined in the SOP:

- Daily Activity Report (or in some cases, a bound field logbook for specific programs, sites or regulatory applications)
- Other field forms as appropriate for the project
- Indelible pen (fine-tip preferable).
- Camera
- GPS

4.0 PROCEDURES

The following subsections describe the procedures for field documentation. In the event that these procedures cannot be performed as written in this SOP, the field personnel must contact the individual in charge of the project (e.g., project manager) to obtain approval for deviation of procedures prior to starting field activities.

4.1 DAILY ACTIVITY REPORT (DAR)

Each Field Team Leader (FTL), Task Manager, or Site Superintendent overseeing or conducting field activities shall be responsible for completing and maintaining a DAR (or field logbook, when applicable) to document the activities performed each day in the field. DARs must be filled-in by hand using an indelible pen, unless use of a computer is specifically allowed for a given project (based on type of work and available infrastructure) and if permissible by program requirements and with prior approval of the project manager. A copy of the DAR is attached (Section 6.0).

At a minimum the following information shall be recorded in the DAR (or field logbook):

- Project name and project number
- Site name and location
- Date(s) of field activity
- Name of individual reporting field notes
- Name, affiliation, and responsibilities of the personnel (both ITSI Gilbane and subcontractors) on site. For larger projects with significant field staff, this information may be entered into the Contractor Production Report (discussed in Section 4.2)
- Arrival and departure times
- Daily weather conditions
- Chronology and location of field activities
- Pertinent field observations, including:

  - Physical description and sketch or map of the field activity location (to include details such as structures, sample points, borings, wells, stained areas, and any other pertinent information)
  - References to global positioning system (GPS) data collected, if applicable (note, all locations where information is collected (such as sample locations, water quality testing locations, photographs of key features) should be located using a GPS)
  - References to photographs of the site and site activities, as applicable, including location and direction faced when taken
- Record of relevant daily telephone calls, project e-mails, and/or direct contact with individuals at the site where direction may have been received (e.g., from client, program or project management), comments or requests received from regulators, or issues brought up by subcontractors.

Other pertinent information should be included, with the specific nature of this information dependent on the type of field activity. For example, if the field activity involved the collection of samples for environmental or geotechnical analysis, relevant information to include in the DAR (or field logbook, when applicable) would consist of the following:

- Daily summary of equipment preparation procedures, as appropriate
- A description of sampling methodology and type of equipment used
- Time and locations of sample collection (unless reported in an appropriate Sample Collection Log [SCL]. If SCLs are used, reference the accompanying SCLs in the DAR and the focus of the DAR should then be on summarizing the day's activities.)
- Numbers, types of samples collected, and sample identification numbers (unless reported in SCLs and summarized in the accompanying Sample Tracking Log. If SCLs are used, the emphasis should be on summarizing the day's production.)
- Management and disposal of investigation-derived wastes (IDW). Describe type and quantities of IDW generated each day, and location of stored IDW.

Specific field programs, sites, regulatory or weather conditions, may necessitate the use of bound field logbooks in addition to or in lieu of completing DAR forms. There are several types of acceptable logbooks, depending on the requirements of the field activity. One of two types of logbooks are recommended, if used: 1) permanently bound, sequentially numbered, pocket-sized logbook with water-resistant paper; or 2) custom logbook consisting of approved forms printed on water-resistant paper and spiral-bound to prevent pages from being added or removed in the field. Other options exist, but care should be taken if alternate logbooks are used to make sure the selection is consistent with the underlying requirement for use of a logbook in place of a DAR.

The FTL, Task Manager, or Site Superintendent overseeing or conducting field activities will be responsible for completing the DAR (or completing and maintaining the field logbook[1]). Blank lines should not be left on the completed DAR. Any blank space on the DAR should be crossed-out with a single line, initialed, and dated.

When completing any field documentation, all errors should be lined-out with a single line through the entry. Never correct an error by overwriting text. Corrections or insertions must be clearly indicated and all changes must be initialed and dated with the current date by the person making the changes directly above the lined-out correction. Field personnel shall adhere to the field reporting protocol described above, and ensure that all entries are recorded in a manner consistent with this SOP.

4.2 CONTRACTOR PRODUCTION REPORT (CPR)

The Contractor Production Report (CPR) form is used to record hours worked by employees and all subcontractor personnel onsite, generally by individual tradecraft. The CPR also covers construction equipment onsite and used each day and any equipment or materials that are received. This form is required for all work on Department of Defense (DoD) projects in order to document total field hours for all personnel (ITSI Gilbane and subcontractors) onsite consistent with reporting requirements in EM-385, and similar reporting of all hours worked on jobsites is required for all projects by Gilbane Building Company. A copy of the CPR is attached (Section 6.0).

This form is used to report needed information on costs on a daily basis, since it contains a list of all personnel onsite on a daily basis, all equipment used, and all materials received. When coupled with the DAR listing other incurred costs (e.g., the number and type of samples collected, the volume and type of waste generated, etc.), the CPR:

- Provides the needed detail to review and approve vendor invoices for subcontractor hours, materials, equipment, and waste transport and disposal.
- Allows for near real-time monitoring of incurred costs on our field projects – a necessity for some of our cost-reimbursable government contracts and important on fixed-price projects to support any needed change order or request for equitable adjustment.

4.3 OTHER FORMS

In addition to the DAR and CPR, the following additional forms may be needed to document specific field activities:

- Quality Control Report. This series of forms is used to document the day-by-day quality control activities, including but not limited to preparatory meetings, initial inspections,

[1] Each page of the field logbook will be sequentially numbered and dated. When using field logbooks, all entries shall be legible and each day will be documented in chronological order, reflecting the order of each day's activities as they transpire. Unused partial pages (i.e., at the end of each workday) should be crossed-out, signed and dated. If an event is inadvertently not recorded in proper sequence, or was missed, the item should be flagged with an asterisk (*) at the beginning and end of the entry when it is added to the logbook, along with the time of the actual entry and the author's initials. If field logbook duties are transferred to another party, then the individuals relinquishing and receiving the logbook will both sign and date the logbook and record the transfer time.

follow-up or ongoing inspections, incoming materials inspections, and development of a "punch list" during activity closeout. These forms are provided in the site-specific Contractor Quality Control Plan (CQCP).

- Tailgate Safety Meeting form. This form is used to ensure all field personnel are informed of the nature of the work being performed and the safety precautions for that day. The form is provided in the site-specific Health and Safety Plan (HSP) or Accident Prevention Plan (APP).
- Equipment and Truck Inspection Checklist. This form may be required for vehicles accessing some sites, to ensure compliance with site-specific requirements (i.e., presence of fire extinguisher in the vehicle, properly operating brake lights, etc.). This form is provided in the site-specific HSP or APP.
- Visitor Sign-in Log. This form is typically used for projects with extended field periods to document 3rd-party personnel onsite. This form is provided in the site-specific HSP or APP.
- Health and Safety Plan Acknowledgement Form. This form is used to ensure all field personnel have read and understand the information provided in the site-specific Health and Safety Plan (HSP) or Accident Prevention Plan (APP).
- Field Change Request Form (attached; Section 6.0). This form is used to request changes to criteria specified in the approved site-specific plans that are identified during implementation of the work (i.e., changes in sampling methodology, analyte list, sample locations, etc.).
- Field activity-specific forms used to document specific field activities at environmental sites provided with their respective SOPs and the site-specific SAP. These can include, but are not limited to, the following:
    - Monitoring Well Water Level Measurement Forms
    - Instrument Calibration Records
    - Monitoring Well Purge and Sample Forms
    - Sample Collection Logs
    - Sample Tracking Log
    - Chains-of-Custody

Feld personnel shall use these forms (and any other forms identified in the site-specific plans or by project management on a project- or task-specific basis), in addition to the DAR and CPR as described in Section 4.1 and Section 4.2, respectively, to assure that all activities are properly and fully documented at the time the work is performed.

4.4 FEDERAL, STATE, AND LOCAL AGENCY FORMS

Any forms required by federal, state, and/or local agencies (i.e., site access, hot work permits, Uniform Hazardous Waste Manifests, local drilling and well construction/destruction permits, etc.) shall be completed and submitted in accordance with current federal, state and local guidance requirements and regulations. A copy of each document shall be included in the "daily field documentation package".

5.0 FIELD RECORDS MANAGEMENT

All records associated with the field activities shall be managed by the designated responsible party (*e.g.*, FTL, Task Manager, Site Supervisor, Quality Control Manager (QCM), site health and safety officer, or onsite Project Manager). Completed forms shall be gathered into "daily field documentation packages", scanned and submitted to the client, as required (i.e., daily by 10 a.m. the next morning for projects with Navy ROICC oversight), and also uploaded daily (unless otherwise permitted by the Project Manager and Project Health and Safety and QC Managers) to:

1) eDMS[2] for field efforts involving the collection of environmental data (whether physical samples for fixed or mobile laboratory analysis, data collected from instrumentation in the field, or field observations of an environmental nature);
2) Program or client required portals (e.g, EPA, NAVFAC or USACE) for field efforts not involving the collection of environmental data but on projects with associated program or client portals; or
3) DMS for field projects not involving the collection of environmental data and with no required program or client portals.

After scanning and uploading, the hard copies of the daily field documentation packages should then be kept in a binder or folder onsite during field activities to allow for client inspections, and subsequently maintained in the project files after completion of field activities.

Daily uploading of the daily field documentation packages is critical for any project with samples being collected, to allow for timely coordination between the sample crew, the project chemist, and the analytical laboratory. For projects with no sampling occurring, uploading the daily field documentation packages no later than the end of each week may be acceptable, with concurrence from the project manager and both health and safety and quality assurance oversight personnel.

After the daily field documentation packages (i.e., DAR, field forms, sampling forms, etc.) have been completed, scanned and uploaded, field records shall be reviewed by the appropriate project personnel (i.e., Project Manager, Quality Assurance (QA), Project Chemist, etc.), and corrections made as needed. All corrections shall be noted how/where, and original documents that required corrections will be scanned in and uploaded along with the corrected documents, and also attached to the back of the corrected documents and retained in the project files.

[2] Instructions on both uploading and approving daily field documentation packages are provided in Attachment A. Directly uploading to eDMS has the advantage of being web-based and does not require logging into the VPN network, required when uploading the daily field documentation packages to the project servers.

6.0 ATTACHMENTS/FORMS

6.1 ATTACHMENTS

Copies of the following documents are attached.

- Attachment A - Instructions on Uploading and Approving Documents in eDMS
- Attachment B - Field Forms

6.2 FORMS

Copies of the following forms are attached. Additional approved activity-specific forms such as those identified in Section 4.3 are provided with their respective SOPs, in project specific plans, or by the client.

- Daily Activity Report (DAR)
- Contractor Production Report (CPR)

7.0 REFERENCES

Los Alamos National Laboratory, 2010. *SOP-5181 Environmental Programs Waste and Environmental Services for Notebook and Logbook Documentation for Environmental Directorate Technical and Field Activities.* 2010.

U.S. Environmental Protection Agency (USEPA) Region 4, 2007. *Operating Procedure for Logbooks,* SESDPROC-010-R3. November.

USEPA, 2011. *Contract Laboratory Program Guidance for Field Samplers,* Office of Superfund Remediation and Technology Innovation, OSWER 9240.0-47, EPA 540-R-09-03. January.

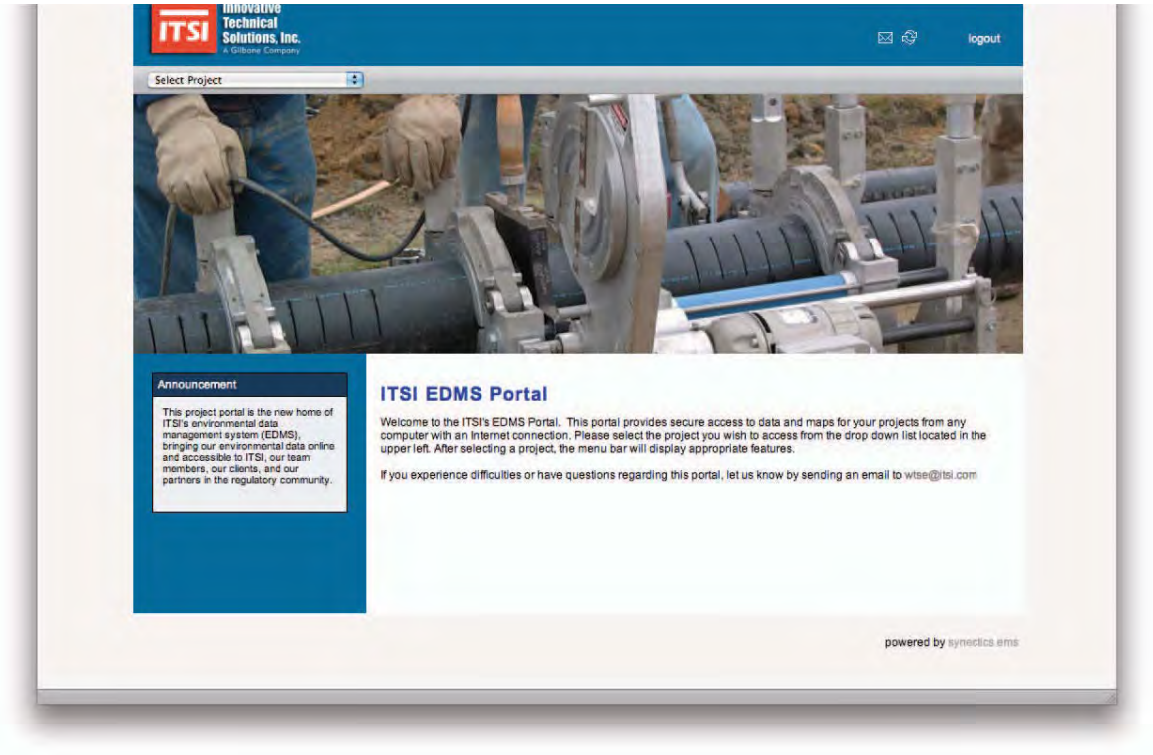
Attachment A

Instructions on Uploading and Approving Documents in eDMS:

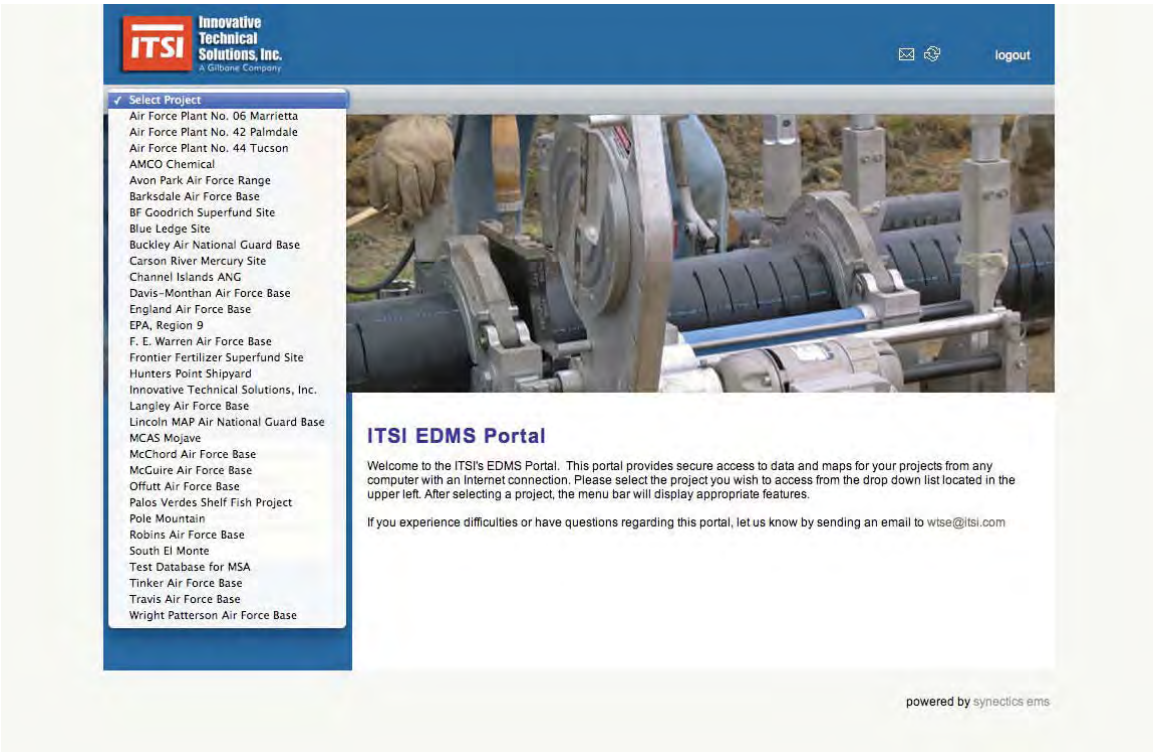
- Uploading Documents in eDMS
- Approving Documents in eDMS

Instructions
Uploading Documents in eDMS

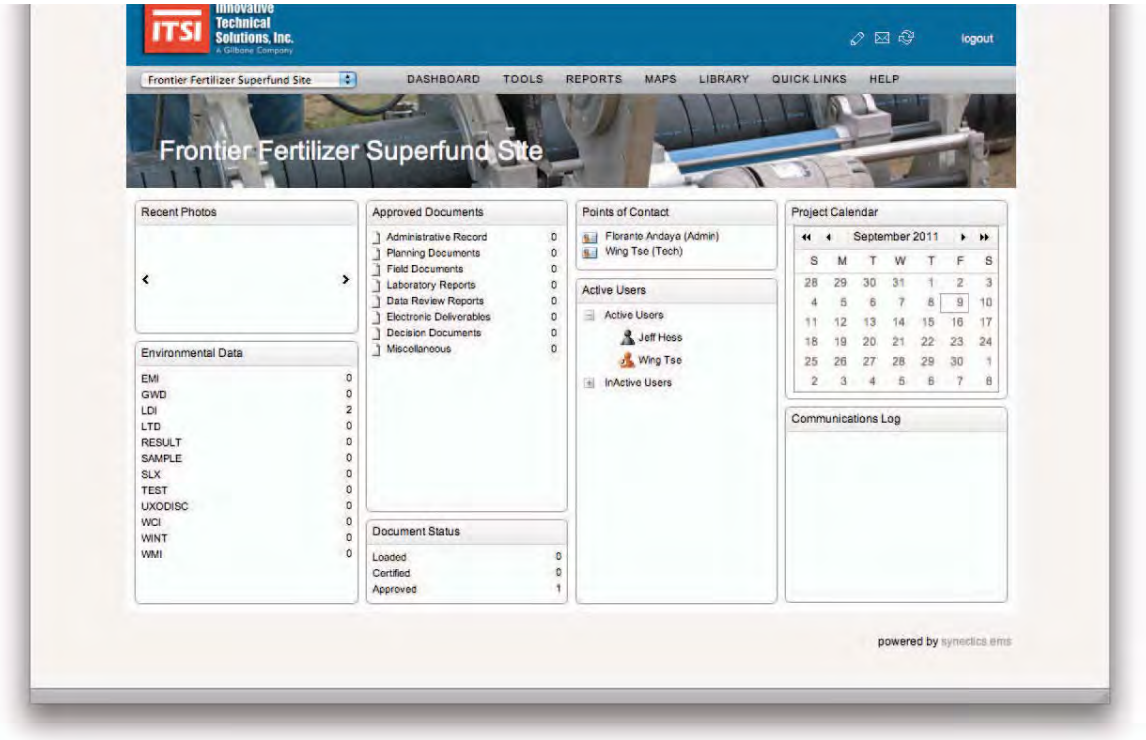
Open your browser, and go to http://edms.itsi.com



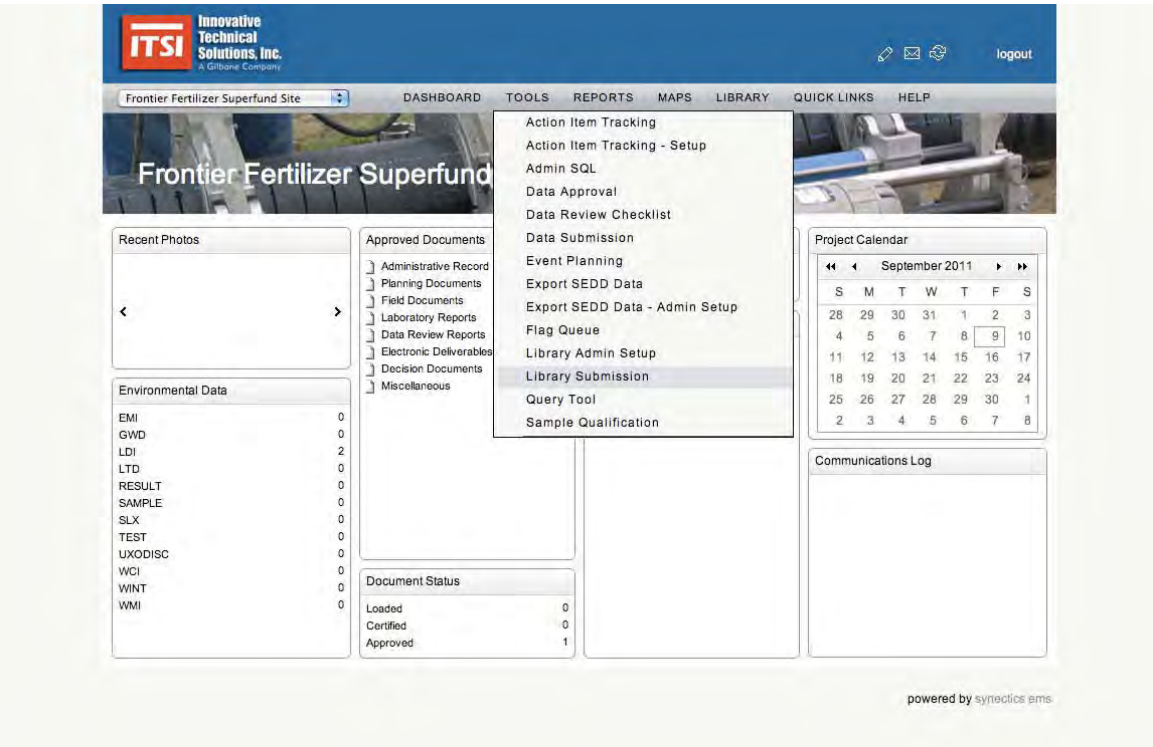
Select your project from the pull-down menu. Note, each person's list of projects will vary, as only those projects you have permissions for are shown.



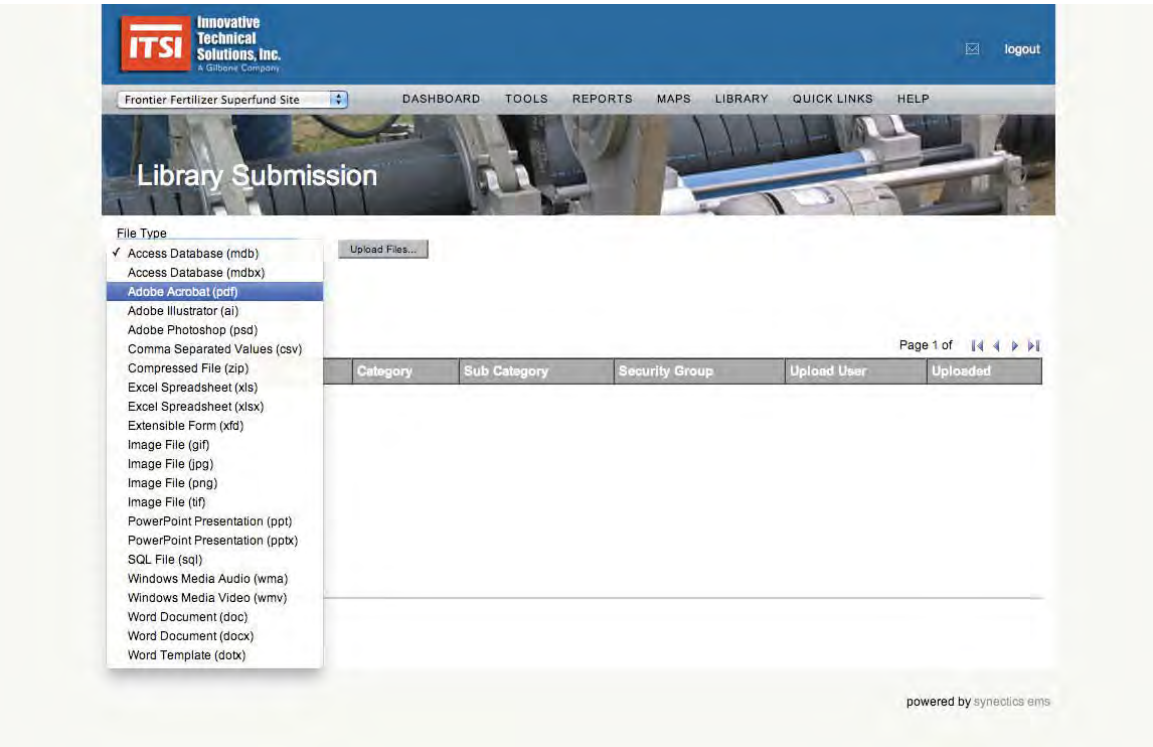
The screenshot below is of the “dashboard” for the Frontier Fertilizer project database under eDMS, as an example. The dashboard shows the status of various submittals, points of contact, project calendar, and displays recent photos uploaded to the project database.



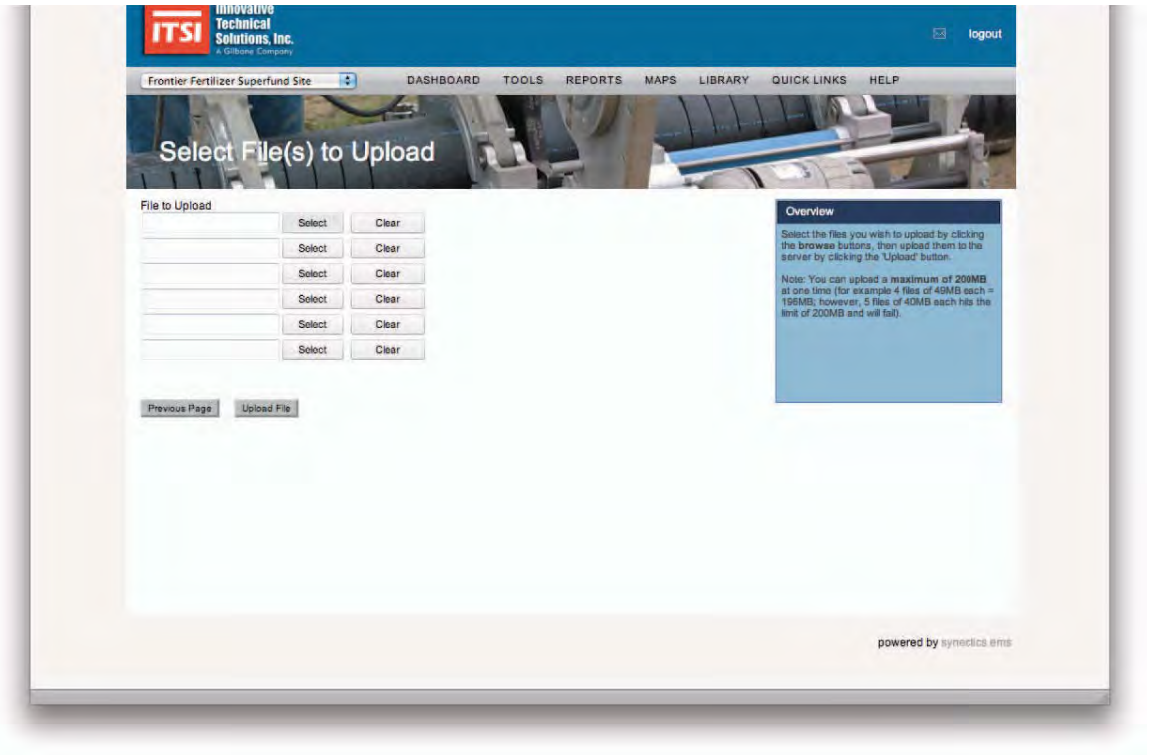
To upload documents to the library in the project database, click on the “Tools” menu and select “Library Submission”.



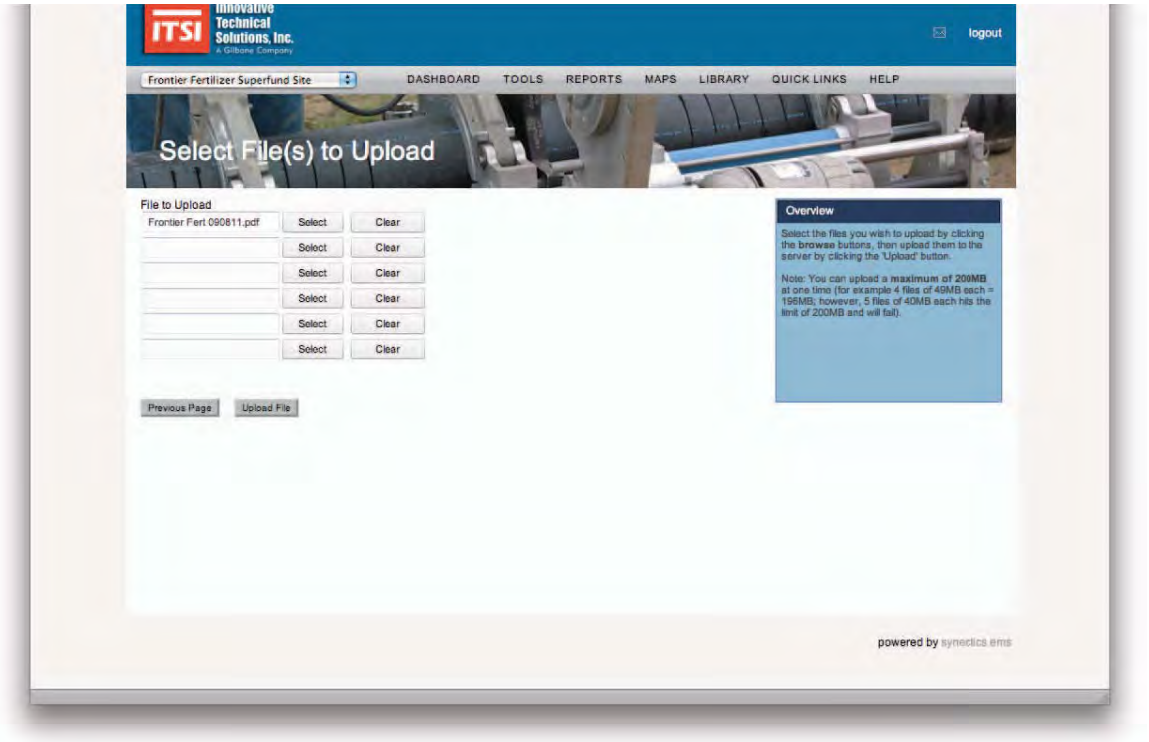
Select the “File Type” from the pull-down menu.



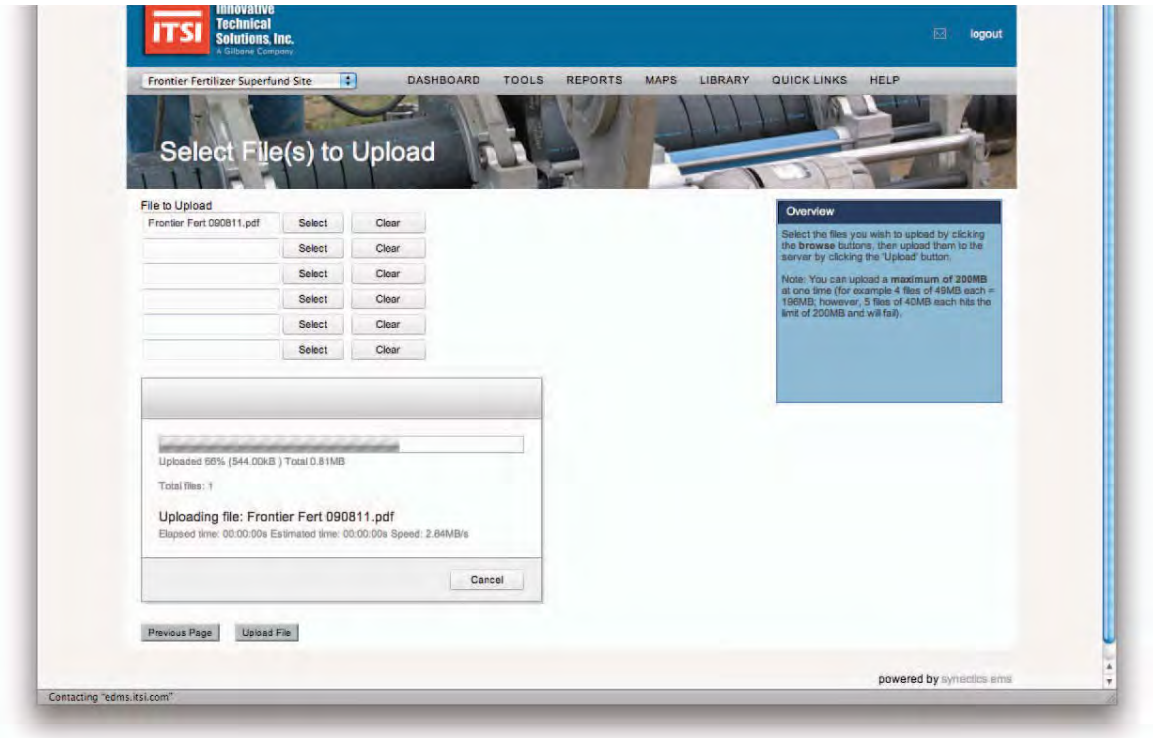
A menu appears which allows up to 6 files to be uploaded at once, with a 200 MB maximum upload.



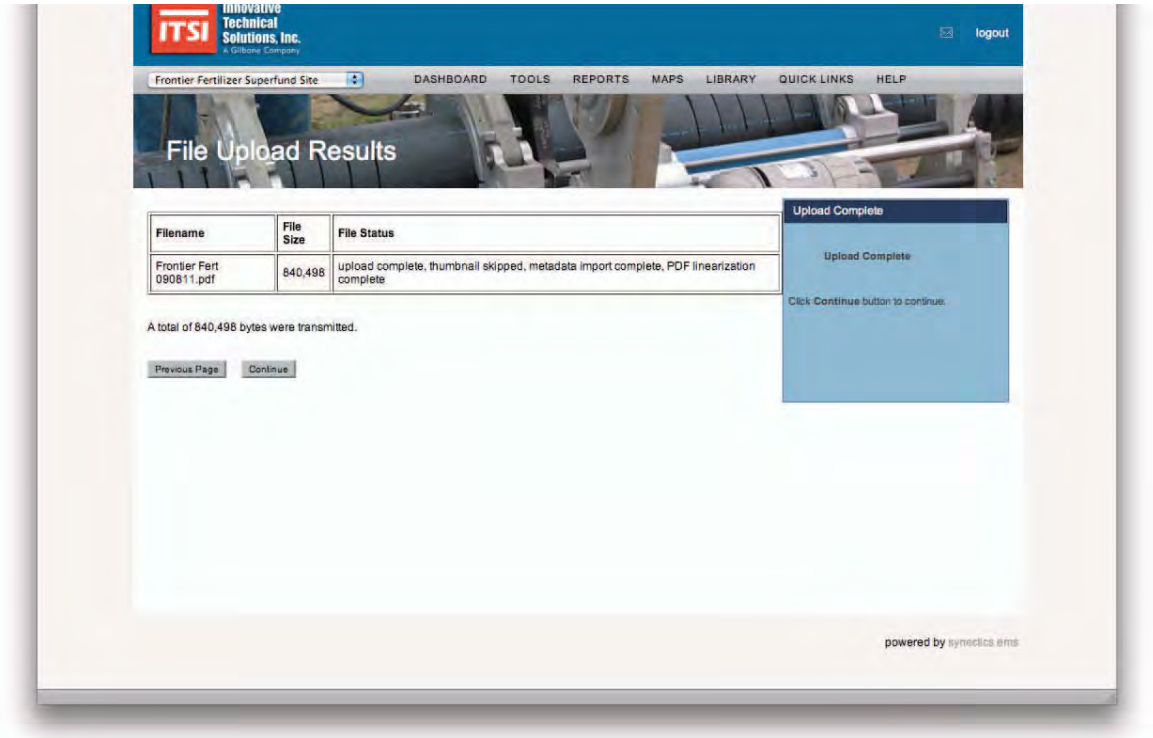
Click on the “Select” button and select the file to upload from your computer.



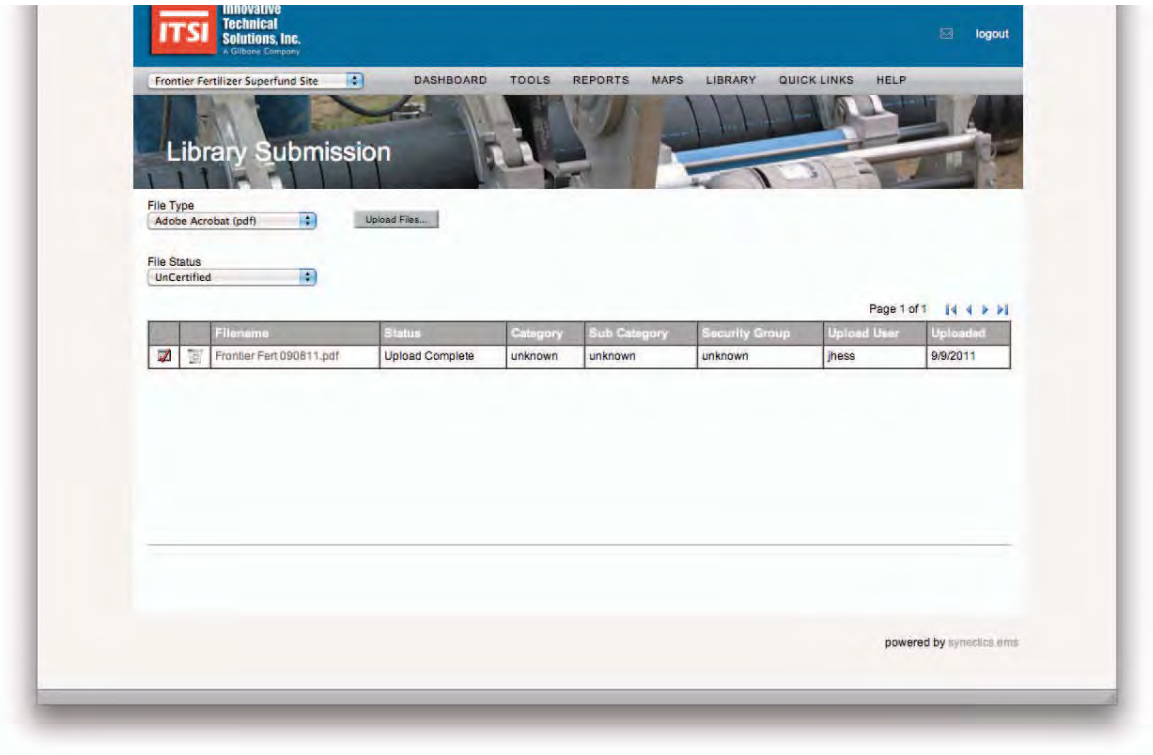
Hit “Upload File”. The upload process is then displayed.



The file is then listed in the “File Upload Results” screen, and shows the uploaded file size.



Hit the “Continue” button.



The file is now displayed in the “Library Submission” screen as an “uncertified” file. Files have three states:

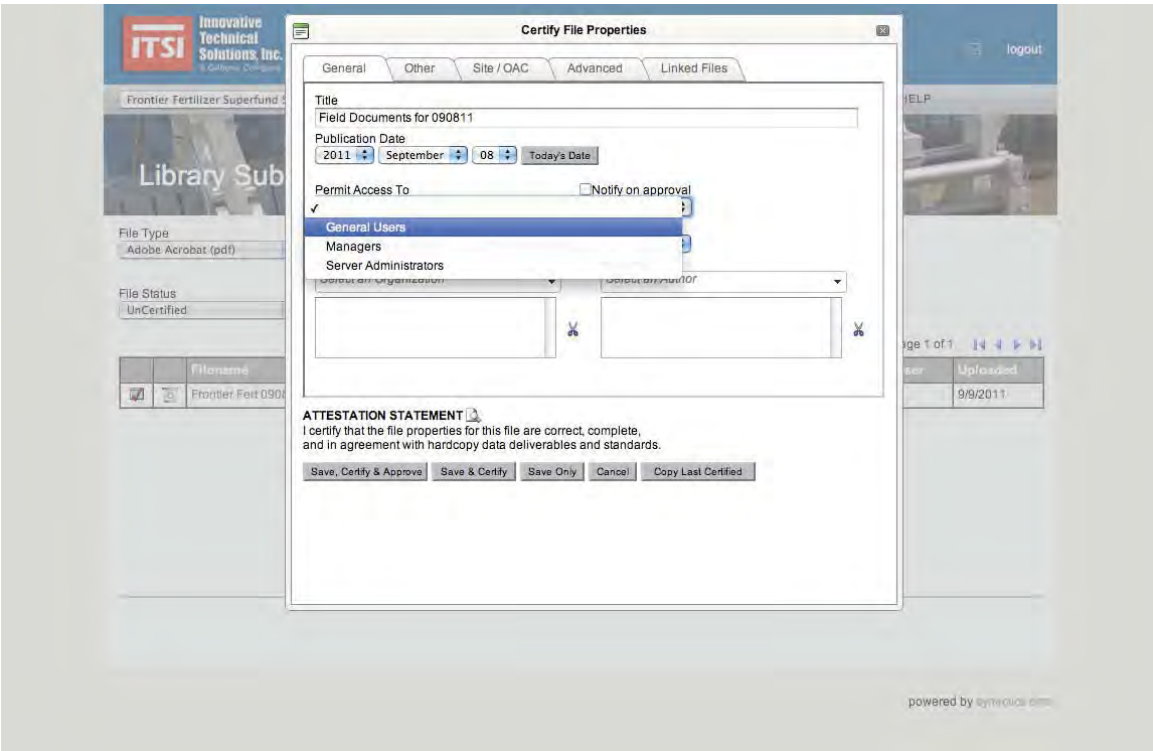
1) **Uncertified**. Uncertified files represent the initial uploaded document without completed metadata, and can only be accessed and edited by the person who uploaded the file.
2) **Certified**. The file is complete from the perspective of the person uploading the file. The document and associated metadata is ready for QC, and is visible only to those parties with approval authority.
3) **Approved**. The document and associated metadata is complete and accurate, represents information collected consistent with the planning documents and other requirements of the project, and was successfully QC’ed by an appropriately knowledgeable second person. The “approved” document is now viewable by all parties who have appropriate access to the project database.

Since the above document is still “Uncertified”, the file upload process is not yet complete until additional information (the metadata) is input relative to the file, and the file is “certified” by the submitter.

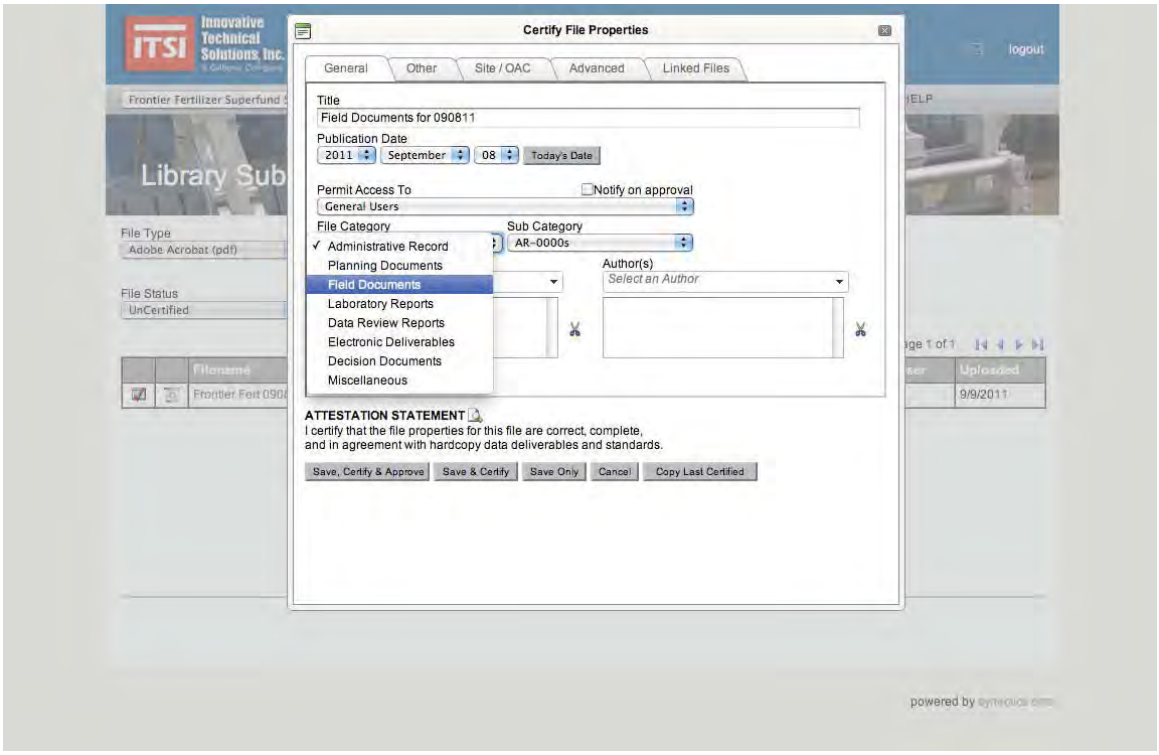
To edit the metadata (source data) associated with the uploaded file, click on the far left box with the check mark and enter the appropriate information on the resulting “Certify File Properties” screen. This information includes (at a minimum):

- Title of the document (this is the name the document will have in the project library, so keep this consistent for the same type of document),
- Date of the document (or date the field or meeting notes represent)
- Permit access to (who can access the document, typically this is “general users” but the system does allow for the storage of confidential information available only to a select category of user)
- Document “file category” and “sub category” (these are important, as specific searches can be performed by sub category of document, such as requesting all chain-of-custodies on the project to date)
- Author organization (typically ITSI for our reports, memorandums, field notes etc.)

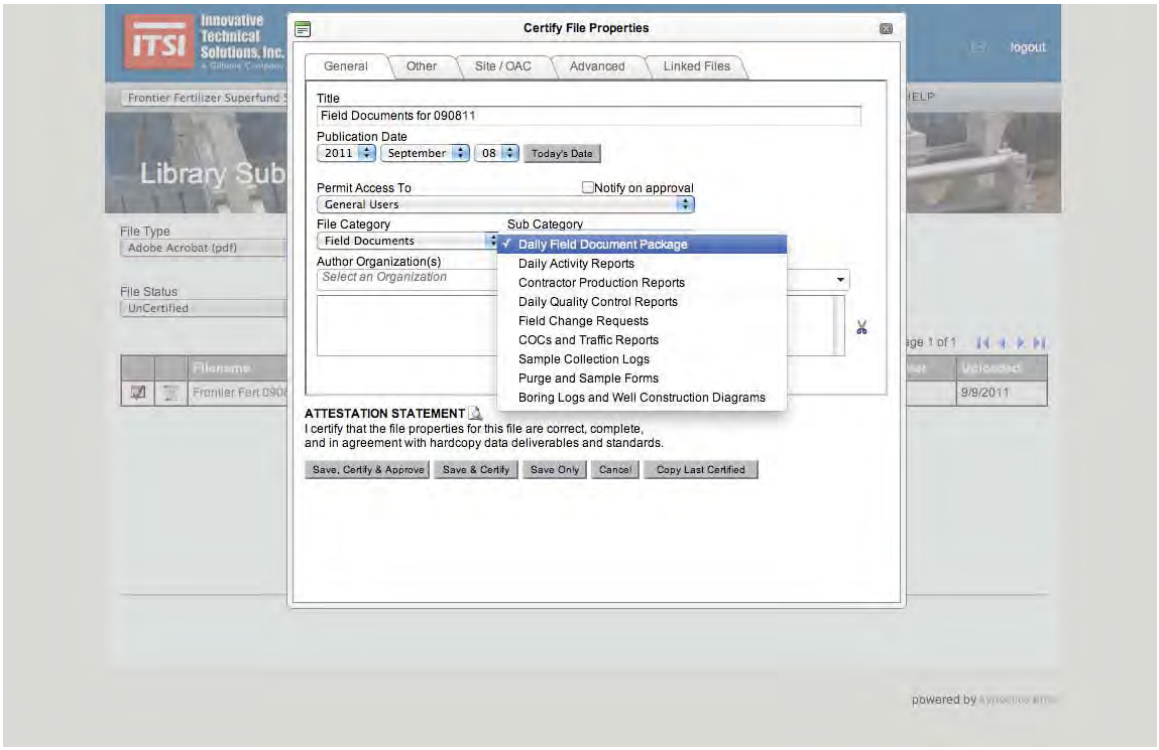
To set the document access:



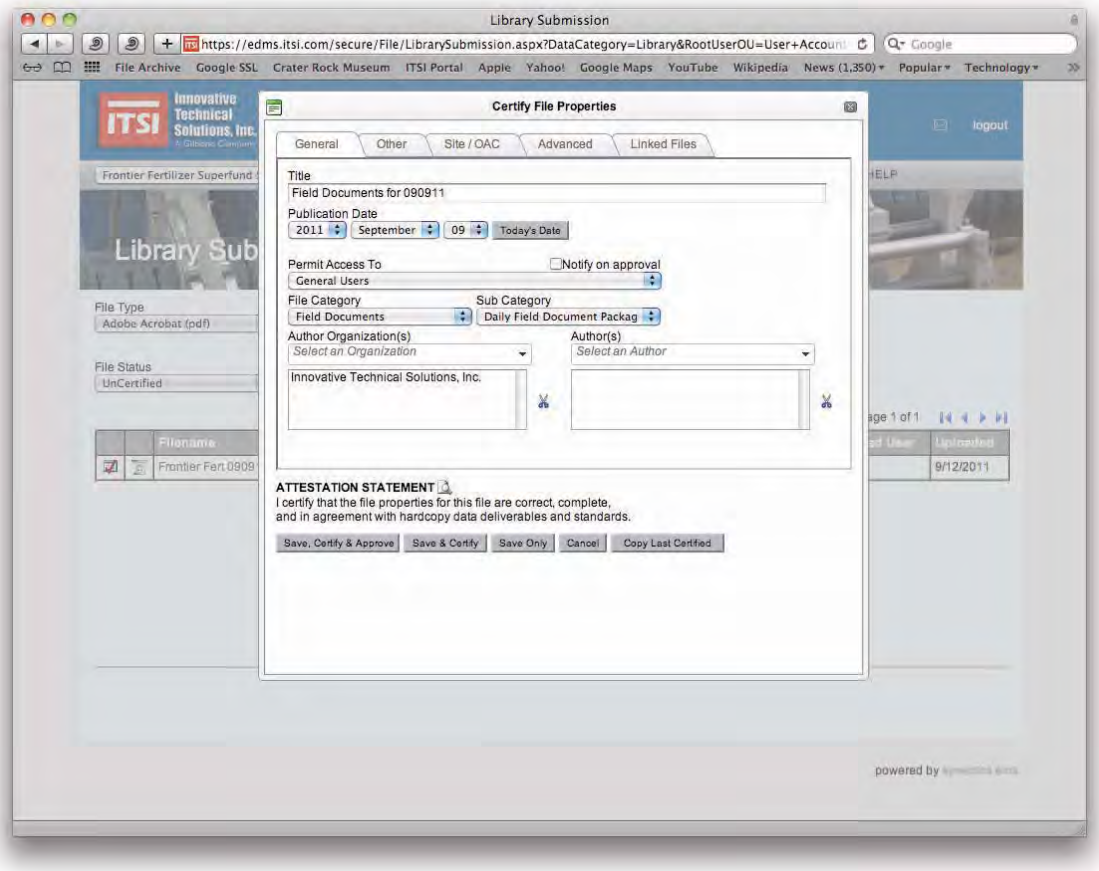
To set the “File Category”:



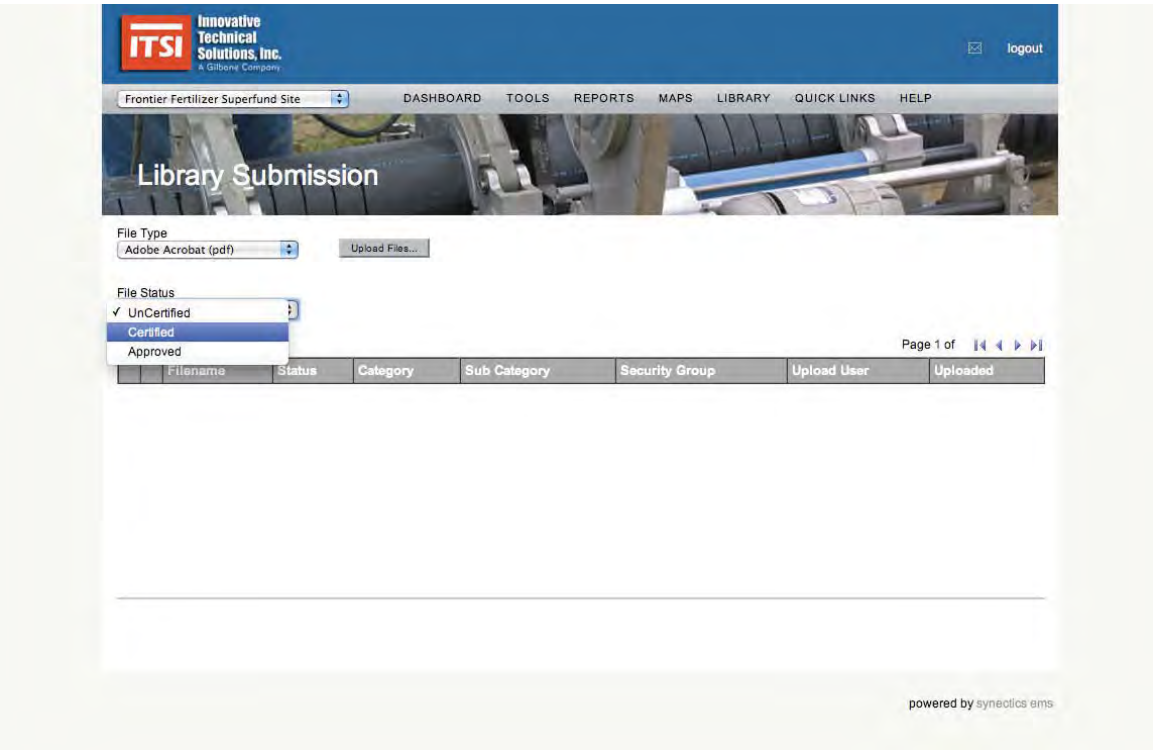
To set the document “Sub Category”:



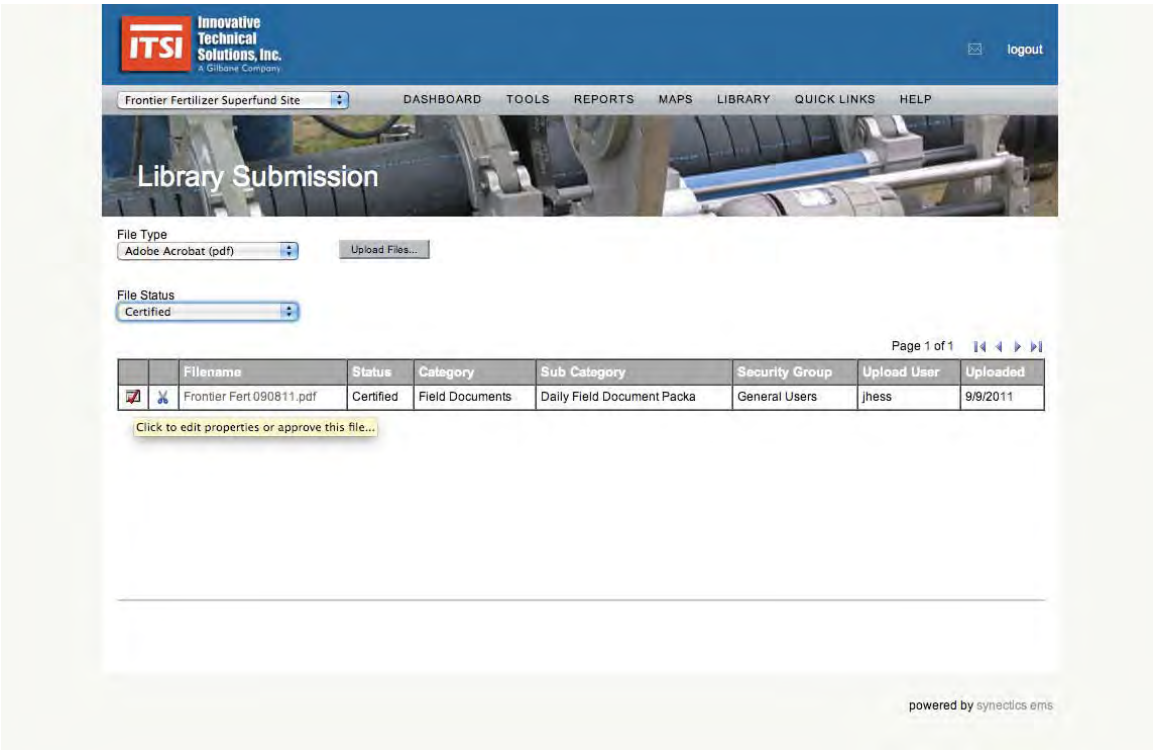
Once the metadata is completely entered (at least the minimum set of information as identified above), click the “Save and Certify” button.



To verify the document has been saved and certified, select ‘Certified” from the pull down menu under “File Status”.



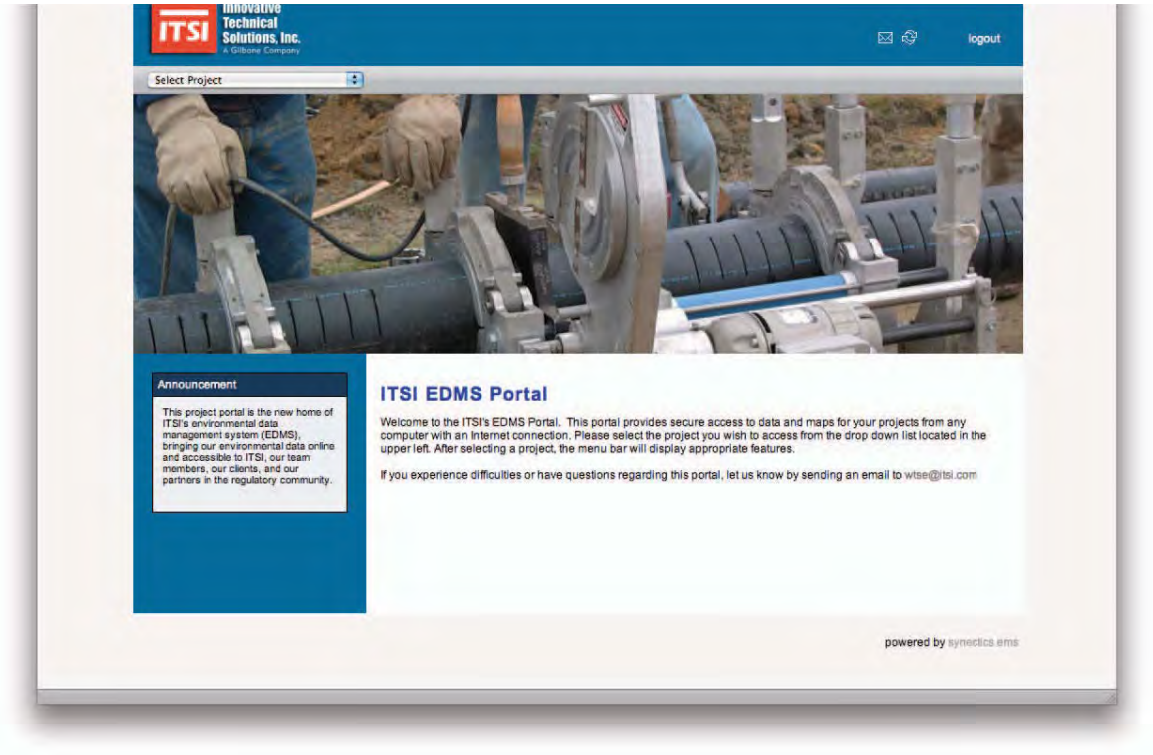
The document will now appear in the list under “Certified”.



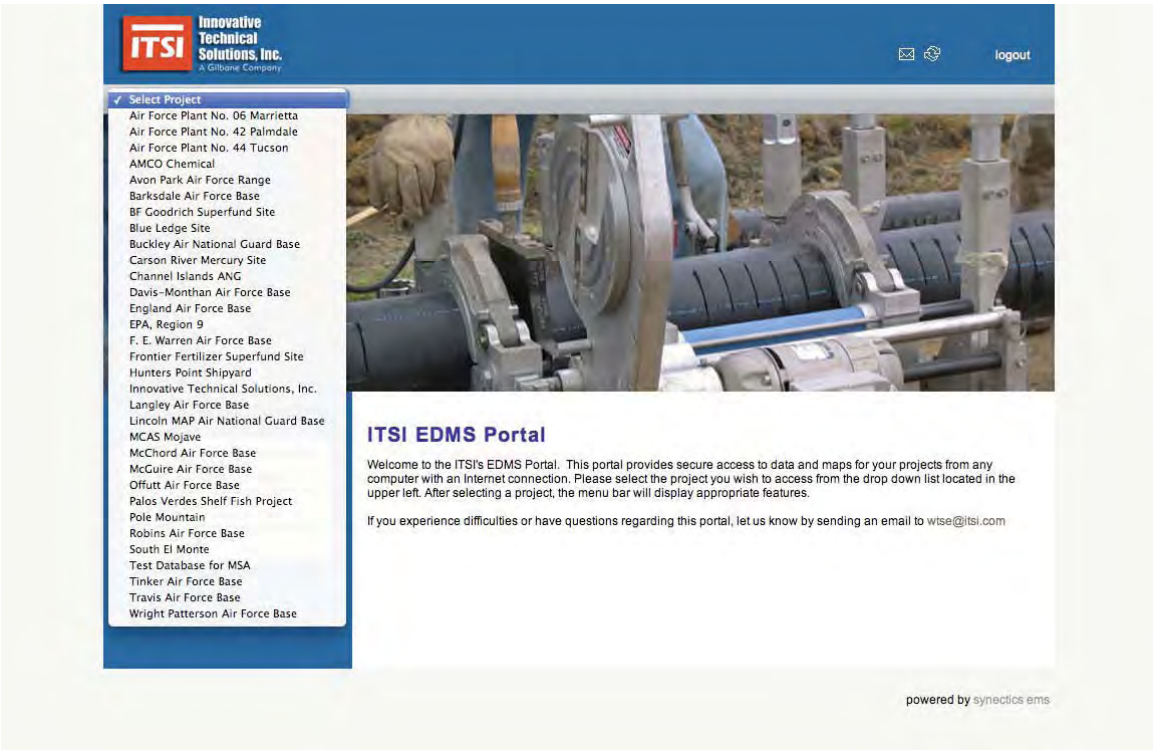
The document has now successfully been uploaded to the project library. However, at this step the document is only available to those who have approval rights to the database, not general users. To make the document available to all users, the document must be QC checked and "approved". Separate instructions are provided for the approval process.

Instructions
Approving Documents in eDMS

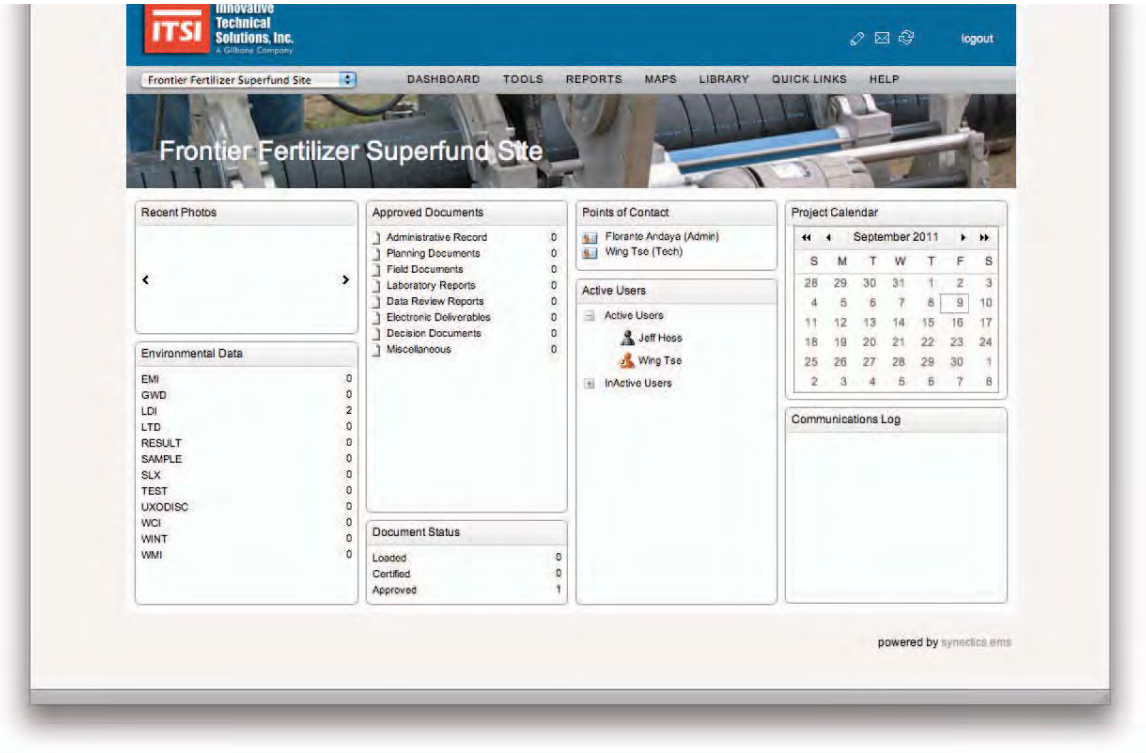
Open your browser, and go to http://edms.itsi.com



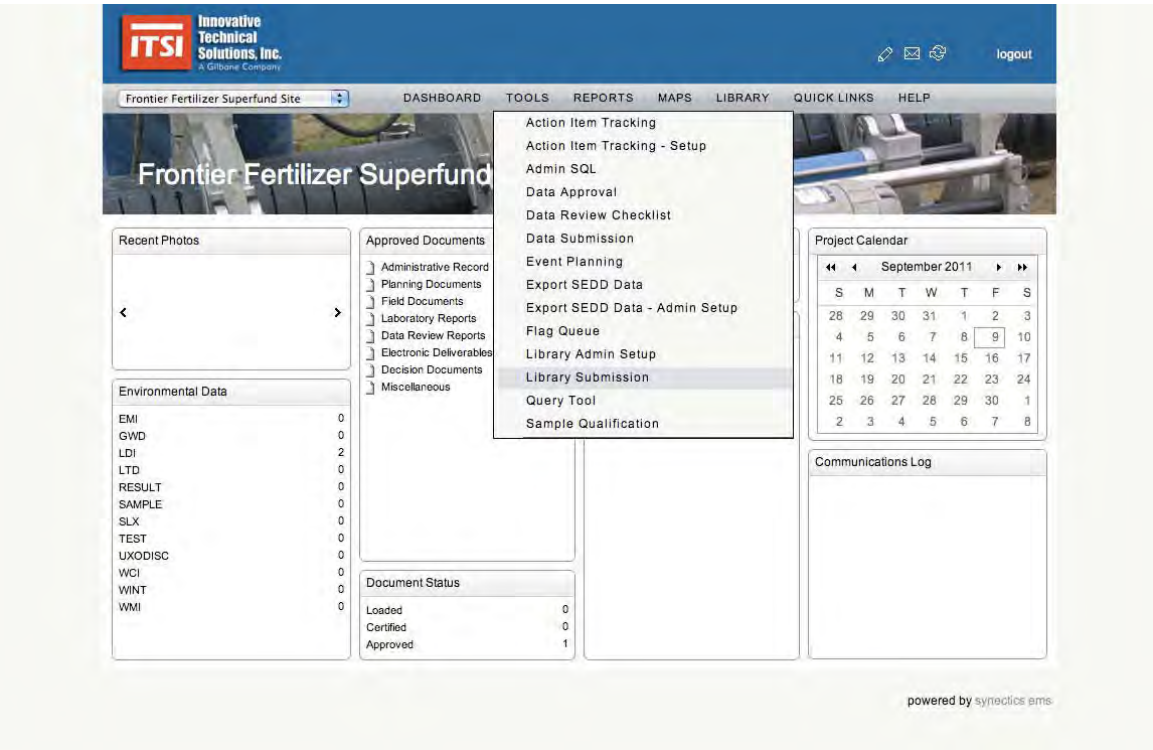
Select your project from the pull-down menu. Note, each person's list of projects will vary, as only those projects you have permissions for are shown.



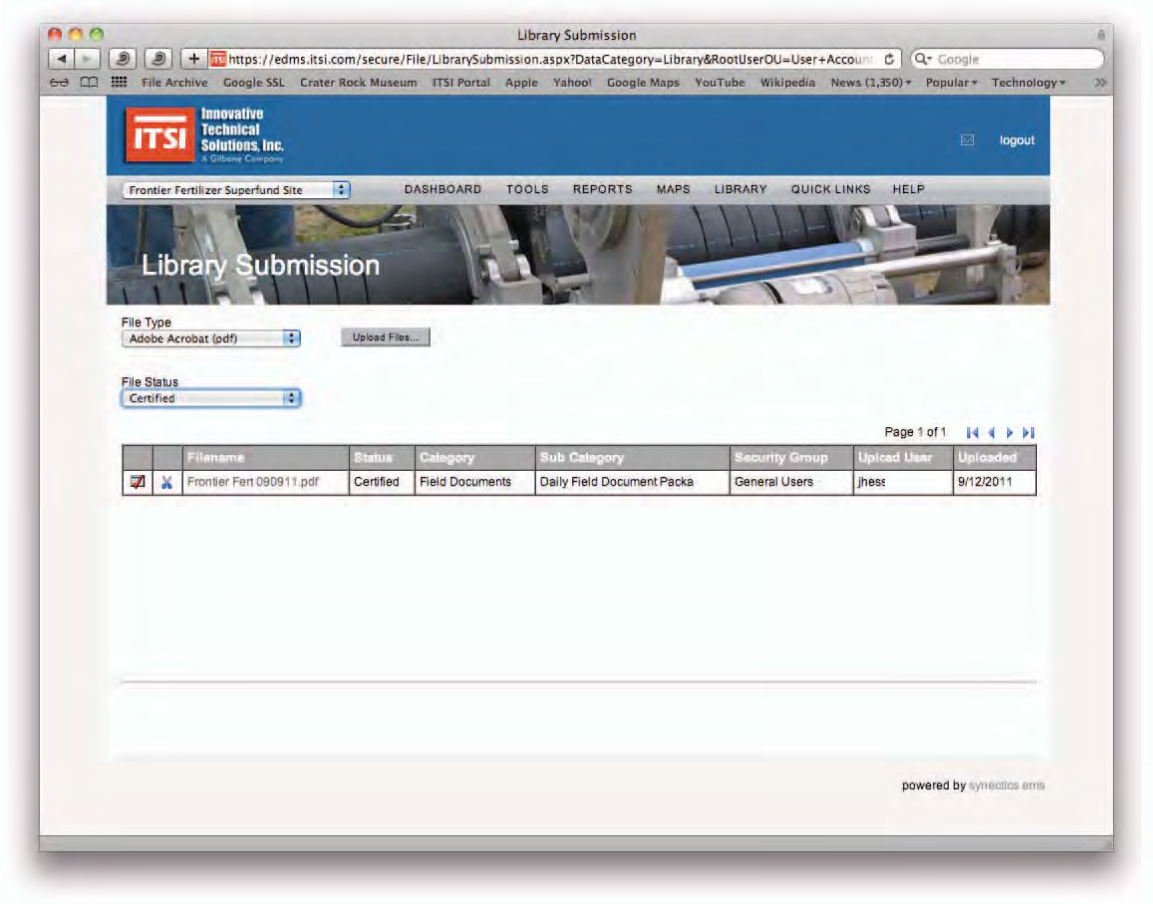
The screenshot below is of the “dashboard” for the Frontier Fertilizer project database under eDMS, as an example. The dashboard shows the status of various submittals, points of contact, project calendar, and displays recent photos uploaded to the project database.



To QC and approve a document in the library in the project database, click on the “Tools” menu and select “Library Submission”.



Select “Certified” from the “File Status” pull-down menu.



Click on the document filename. This pulls the document up in a separate window to review the contents of the document. There are two options at this point:

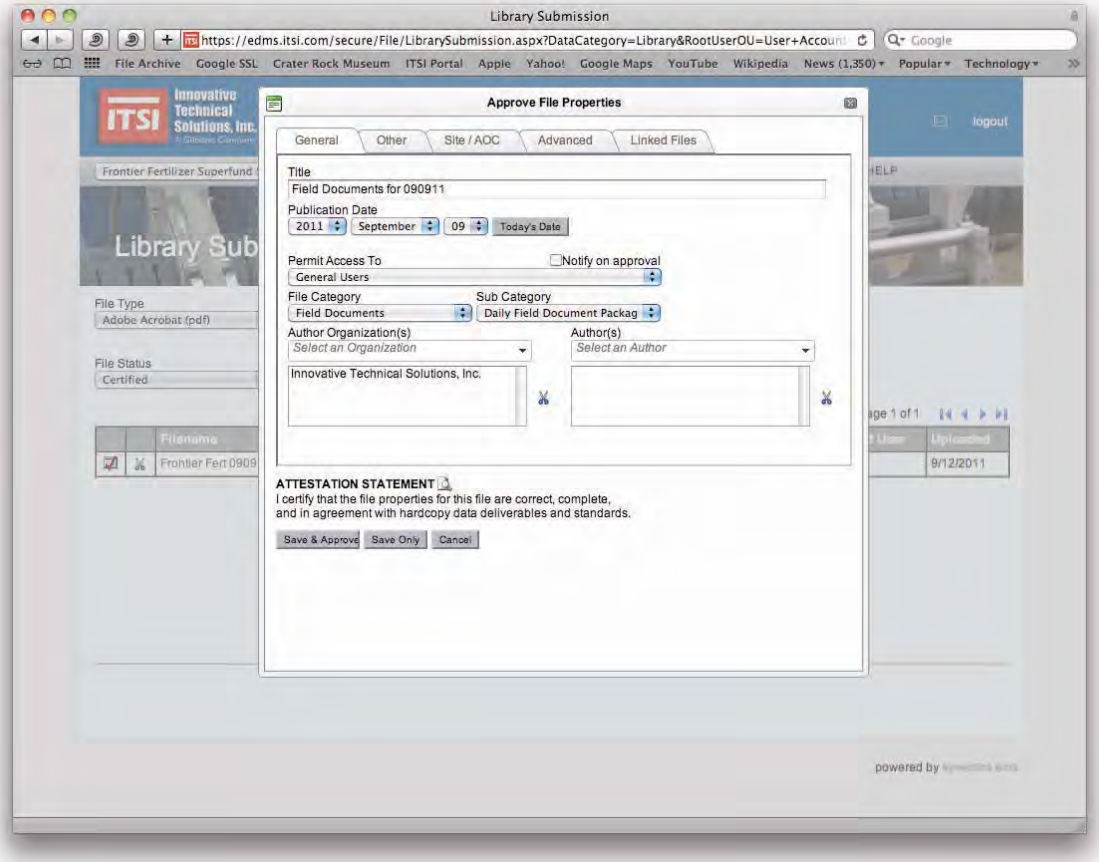
1. If there are problems with the document and it needs to be corrected or amended by the submitter, click on the box containing the scissors and “uncertify” the document. This will return it to “uncertified” status and allow for the document to be replaced with a corrected version by the original submitter. The reviewer will then need to notify the original submitter regarding the necessary corrections and that the document will need to be re-uploaded once corrected.
2. If the document is ok, then click on the far left box with the check mark. This pulls up the metadata (source data) associated with the document. Please verify the information is correct and make any changes needed to the metadata to complete the minimum required information and make it consistent with previous entries. The minimum needed metadata includes:
    a. Title of the document (this is the name the document will have in the project library, so keep this consistent for the same type of document),
    b. Date of the document (or date the field or meeting notes represent)

c. Permit access to (who can access the document, typically this is “general users” but the system does allow for the storage of confidential information available only to a select category of user)

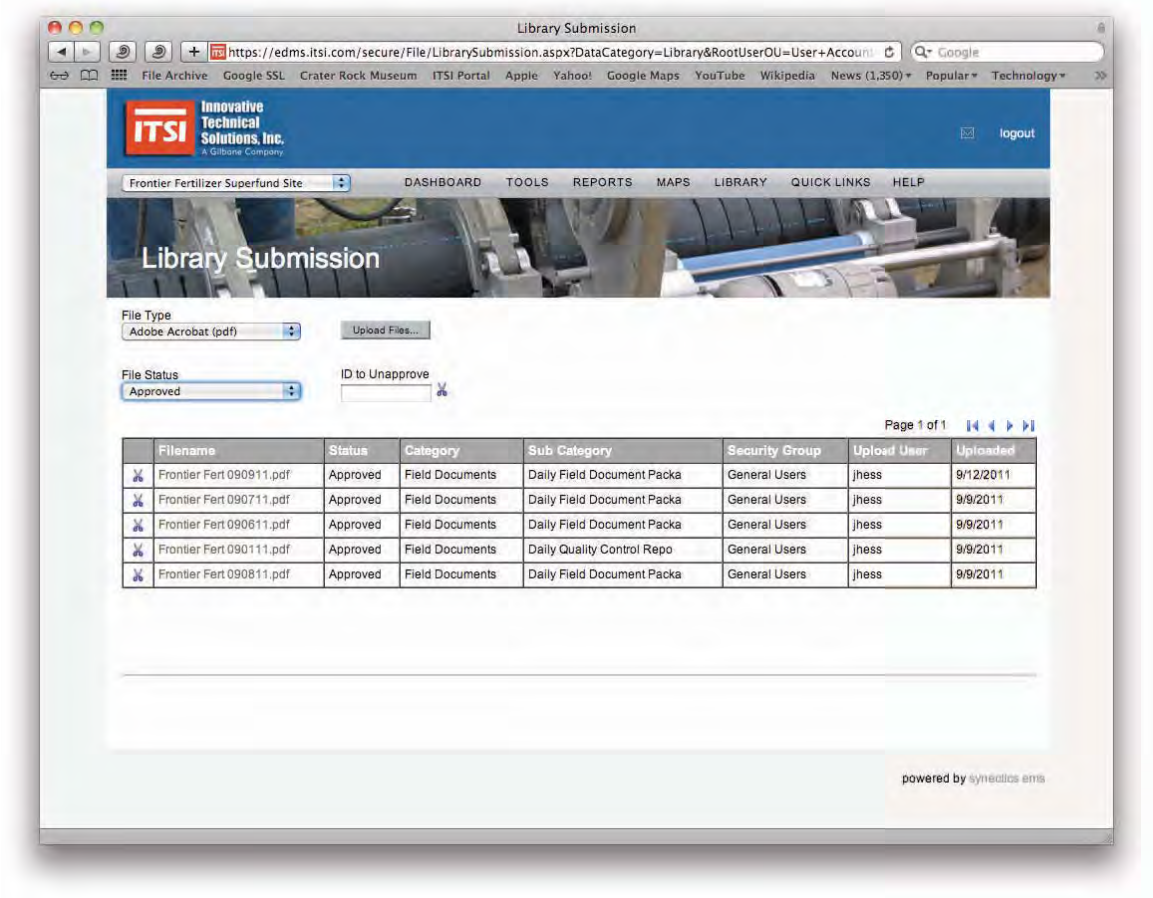
d. Document “file category” and “sub category” (these are important, as specific searches can be performed by sub category of document, such as requesting all chain-of-custodies on the project to date)

e. Author organization (typically ITSI for our reports, memorandums, field notes etc.)

3. Once the metadata has been verified, click the “Save and Approve” button.



To verify the document has been saved and approved, select “Approved” from the pull down menu (“File Status”). The document will now appear in the list under “Approved”.



The document has now successfully been approved for full access in the project library and is available to all users who possess the minimum permissions established for the document.

ATTACHMENT 2
STANDARD OPERATING PROCEDURES

Attachment 2

Field Forms

- Daily Activity Report
- Contractor Production Report

Daily Activity Report (DAR)

ITSI Gilbane

Project Name:	Page of
Project No./Task Code:	Date:
Description of Work:	
Visitors / Subcontractors:	
Weather:	

Description of Field Activities

Prepared by:	Signature:

Contractor Production Report

(Attach Additional Sheets if Necessary)

ITSI Gilbane

Project Name:	Page of
Project No./Task Code:	Date:
Subcontractors:	

Work Performed Today

Schedule Activity No.	Work Location and Description	Employer	Number	Trade	Hours

Job Safety

Was a tailgate safety meeting held this date? (If yes, attach copy of the sign-in sheet)	☐	☐
Were any vehicle/heavy equipment inspections done? (If yes, attach copies of the inspections performed)	☐	☐
Was any trenching/confined space/crane/manlift work done? (If yes, attach statement or checklist showing inspections performed)	☐	☐
Were there any lost time accidents this date? (If yes, attach copy of completed accident report)	☐	☐

Total Work Hours on Job Site Today (including any Continuation Sheets)	
Cumulative Total of Work Hours from Previous Reports	
Total Work Hours from Start of Field Activity	

Schedule Activity No.	List Safety Actions Taken Today/Safety Inspections Conducted	☐ Safety Requirements Have Been Met.

Equipment/Material Received Today To Be Incorporated In Job (Indicate Schedule Activity Number)

Schedule Activity No.	Submittal #	Description of Equipment/Material Received

Construction And Plant Equipment On Job Site Today (Indicate Hours Used And Schedule Activity Number)

Schedule Activity No.	Owner	Description of Construction Equipment Used Today (include Make and Model)	Hours Used

Schedule Activity No.	Remarks

Prepared by:	Signature:

Standard Operating Procedure

Sample Handling, Packaging and Shipping

PR-TC-02.04.01.01 v2

Effective Date: 14 June 2013

Prepared by: _____ Date: 13 June 2013
Kristen Carlyon, Program Chemist

Reviewed by: _____ Date: 13 June 2013
Jim Schollard, Program QA/QC Manager

Approved by: _____ Date: 13 June 2013
Jeffrey Hess, Director Technical Services

Review / Revision History:

Version	Changes	Affects Section/Pages	Effective Date	Approval
1.0	Initial Issue	NA	30 Sep 2009	NA
1.1	Added perchlorate to the Sample Preservation and Storage Requirements Table.	Attachment A	24 Feb 2010	J Hess
1.2	Remove references to SOPs currently under revision for inclusion of CLP procedures.	Pgs 4-5	06 Aug 2010	J Hess
2.0	Added in SW846 Revision 4	Attachment A	13 Jun 2013	NA

* Approval required for minor changes not requiring updated review and approval by signatures to the SOP.

Table of Contents

1.0 PURPOSE

The objective of this procedure is to establish a uniform method for the handling of environmental samples. This includes using the appropriate sample containers and preservatives, following correct chain-of-custody procedures, and using appropriate sample shipment methods.

2.0 SCOPE AND APPLICABILITY

This procedure will be used during the collection and handling of all types of environmental media, including but not limited to, groundwater, surface water, soil, sediment, and air samples.

This procedure applies to the shipping and packing of all non-hazardous samples. Non-hazardous samples are those that do not meet any hazard class definitions found in 49 CFR 107-178, including materials designated as Class 9 materials and materials that represent Reportable Quantities (hazardous substances). In general, most soil, air, and aqueous samples do not meet any of DOT's hazardous materials definitions. However, samples for which screening has shown a potential hazard sufficient to meet a DOT definition or that are derived from a source known or suspected to meet a DOT definition must be packaged and shipped in accordance with applicable DOT and/or IATA requirements.

3.0 ACRONYMS AND DEFINITIONS

For purposes of this procedure, a number of terms and acronyms have the meanings defined below.

°C: degrees Celcius

Bubble wrap: Plastic sheeting with entrained air bubbles; used for protective packaging purposes.

CFR: Code of Federal Regulations

CLP: Contract Laboratory Program

COC: Chain-of-custody

Cooler: Any hard-sided insulated container meeting DOT or IATA packaging requirements.

DOT: U.S. Department of Transportation.

IATA: International Air Transport Association.

Packing material: Styrofoam beads ("peanuts"), or equivalent

PPE: Personal protective equipment.

QAPP: Quality Assurance Project Plan

Shipping container: *see* Cooler

VOA vial: 40-mL glass vial used for the collection of samples for volatile organic analysis.

4.0 EQUIPMENT AND MATERIALS

Equipment and materials that may be required to implement this SOP include the following:

- Bubble wrap
- Packing material
- Tape (packing tape, duct tape, or other tear-resistant material)
- Large plastic trash bags
- Ziploc bags (freezer grade, gallon and quart sizes)
- Shipping containers (e.g. coolers)
- Sample container(s) as specified in the approved project plans
- Ice
- Custody seals
- "This Side Up" arrows
- Address labels and/or airbills
- Chain-of-Custody forms
- Sample Collection Forms, Daily Activity Reports, activity-specific sampling forms
- Black waterproof pen (e.g., fine-point Sharpie marker).

5.0 PROCEDURE

5.1 GENERAL

The following method outlines general considerations for sample handling in the field and maintaining sample custody after collection.

Environmental samples are collected in the field in order to evaluate whether conditions in soil gas, soil, surface water, groundwater or atmosphere are hazardous. These samples therefore, should be handled with the utmost care to maintain sample integrity, so that analytical data represent field conditions as closely as possible. In addition, sample care, custody, and control are extremely important for establishing that sample integrity was maintained between field crews and the laboratory.

General considerations for handling during sampling are:

- Always wear proper PPE when handling samples.
- Wrap sample container in a way that is both protective of the sample container and other surrounding sample containers.

- Document all collection procedures thoroughly in sampling forms (e.g. Sample Collection Form) and general field notes in the Daily Activity Report (or field logbook, when applicable). There is never "too much information".

Samples must be stabilized for transport from the field to the laboratory through the use of the proper sample containerization and preservation. This is due to the potential chemical and/or biological degradation that may occur after samples are collected. Typical sample containerization and preservation are presented in Table 1. Unless otherwise indicated in the site-specific QAPP, sample containers should be cooled immediately after completion of sampling and maintained at a temperature not to exceed the temperature specified in Attachment A until received by the laboratory.

5.2 SAMPLE CONTAINERIZATION AND PRESERVATION

The appropriate sample container types, volumes, preservatives, and holding time requirements for soil and groundwater samples for the most commonly requested analyses are listed in Attachment A, Sample Preservation and Storage Requirements.

Methods of sample preservation are intended to retard biological action, retard hydrolysis, and reduce sorption effects. Preservation methods are generally limited to pH control, chemical addition, refrigeration, and protection from light.

All sample containers will be properly labeled and monitored for temperature control in the field and during laboratory transport and storage. Temperature blanks will be used in all coolers containing samples requiring preservation at reduced temperature.

5.3 SAMPLE IDENTIFICATION AND LABELS

All samples will be properly labeled to prevent misidentification of samples. Generally, preprinted sample labels are encouraged to enhance legibility and reduce transcription errors at the laboratory. The label will be affixed to the sample container prior to transportation to the laboratory and will generally contain the following information (except when using CLP):

- Project name, number, and location
- Site name
- Name of collector
- Date and time of collection
- Sample identification number
- Preservative, if any
- Requested test methods or analyses.

See the site-specific QAPP for any additional sample identification protocols.

5.4 CHAIN OF CUSTODY

Chain-of-custody (COC) procedures are implemented to ensure that all samples are traceable from the time that they is collected until they, or their derived data, are used. A sample is considered to be "in custody" under the following conditions:

- It is in personal possession.
- It is in personal view after being in personal possession.
- It was in personal possession when it was properly secured.
- It is in a designated secure area.

Sample custody will be documented through the use of COC forms. These forms will be used to track sample custody from the point of sample collection through sample disposal. The security of samples will be ensured by the use of the procedures described below.

5.4.1 Chain-of-Custody Forms

A COC form will be filled out for and will accompany every group of samples sent to the analytical laboratory, to document sample care, custody, and control from the time of collection to sample receipt.

The following information will be recorded on the COC form:

- COC form number
- Company name, address, and telephone number
- Company contact person
- Laboratory name, address, and telephone number
- Laboratory contact person
- Sample identification
- Date and time of collection
- Sampler's name
- Analytical method(s) requested
- Sample volume (e.g., three 40-milliliter [mL] vials)
- Sample matrix (e.g., soil or groundwater)
- Preservative (e.g., hydrochloric acid [HCl])
- Request for matrix spike analysis or other QC analysis
- Signatures of individuals releasing and accepting samples
- Times of release and acceptance of samples
- Air bill number if shipping by commercial courier

- Any comments to identify special conditions or requests.

5.4.2 Custody Seals

Custody seals will be used when samples are shipped via courier service, and must be placed on the shipping container (cooler) so that the seals have to be broken before the container can be opened. The seal must be signed and dated by the field personnel. Custody seals are not deemed necessary when the samples will be in the continuous possession of project, field, or laboratory personnel.

5.5 PACKAGING FOR SHIPMENT

Samples will be packaged for shipment as follows:

- Use tape to seal off the cooler drain on the inside and outside to prevent leakage.
- Place packing material (bubble wrap) on the bottom of the shipping container (cooler) to provide a soft impact surface.
- Place a 55-gallon or equivalent plastic bag into the cooler (to minimize the possibility of leakage during transit).
- Place each sample bottle or set of volatile organic analysis (VOA) vials in a separate plastic bag and seal the bag. Squeeze air from the bag before sealing.
- Starting with the largest glass containers, wrap each container with sufficient bubble wrap to ensure the best chance to prevent breakage of the container.
- Pack the largest glass containers in bottom of the cooler, placing packing material between the containers to partially cover the sample containers (more than halfway) to avoid breakage from bumping. Cardboard separators may be placed between the containers at the discretion of the shipper.
- Double-bag ice chips or cubes in gallon or quart freezer-grade Ziploc plastic bags and wedge the ice bags between the sample containers.
- Add bagged ice across the tops of the samples.
- Continue filling the shipping container in the same manner (e.g., using bubble-wrap and ice) with smaller sample containers/vials.
- When the container is sufficiently full (or all samples have been packed), seal the inner protective plastic bag (with twist-ties and/or packing tape), and place additional packing material on top of the bag to minimize shifting of containers during shipment.
- Tape a gallon Ziploc bag to the inside of the cooler lid, place one copy of the completed COC document for the shipment inside, and seal the bag shut.
- Tape the shipping container (cooler) shut using packing tape, duct tape, or other tear-resistant adhesive strips. Taping should be sufficient to ensure that the lid will not open during transport.

- In situations where samples will not be in the continuous possession of project, field, or laboratory personnel, place custody seals on two separate portions of the cooler, to provide evidence that the lid has not been opened prior to receipt by the intended recipient.

5.5.1 Labeling

Label the shipping container/cooler as follows:

- Attach a "This Side Up" arrow securely to each side of the cooler. Affix "fragile" or other labels on the cooler as appropriate.
- Attach a label with the name and address of the receiver and the shipper to the top of the cooler.
- If the cooler is to be shipped by overnight carrier, attach a properly completed airbill to the top of the cooler.

6.0 ATTACHMENTS

- Attachment A: Sample Preservation and Storage Requirements

7.0 FORMS

The following forms are attached:

- Chain of Custody Form

8.0 REFERENCES

ITSI, 2006. *Final Chemical Data Quality Management Plan, 8(a) Remedial Action Contract Number N68711-005-D-6403*. January.

U.S. Department of Transportation Regulations, 49 CFR Parts 108-178.

International Air Transport Association (IATA), Dangerous Goods Regulations, current edition.

Attachment A

Sample Preservation and Storage Requirements
PR-TC-02.04.01.01

Matrix	Analytical Group	Analytical Method	Containers (number, size and type)	Preservation Requirements (chemical, temperature, light protected)	Maximum Holding Time (preparation/analysis)
Water	VOC	Gasoline Range Organics (GRO) 8015B	3 X 40 mL VOA vials with PTFE septa	HCL to pH < 2 / 4 ± 2°C	14 days analysis
Water	VOC	Gasoline Range Organics (GRO) 8015C	3 X 40 mL VOA vials with PTFE septa	HCL to pH < 2/ ≤ 6 °C	14 days analysis
Water	VOC	Gasoline Range Organics (GRO) 8015D	3 X 40 mL VOA vials with PTFE septa	HCL to pH < 2/ ≤ 6 °C	14 days analysis
Water	VOC	GCMS VOCs 8260B	3 X 40 mL VOA vials with PTFE septa	HCL to pH < 2 / 4 ± 2°C	14 days analysis (7 days unpreserved)
Water	VOC	GCMS VOCs 8260C	3 X 40 mL VOA vials with PTFE septa	HCL to pH < 2/ ≤ 6 °C	14 days analysis (7 days unpreserved)[a,b]
Water	VOC	GC VOCs 8021B (SW846 Update III)	3 X 40 mL VOA vials with PTFE septa	HCL to pH < 2 / 4 ± 2°C	14 days analysis (7 days unpreserved)
Water	VOC	GC VOCs 8021B (SW846 Update IV)	3 X 40 mL VOA vials with PTFE septa	HCL to pH < 2 / ≤ 6 °C	14 days analysis (7 days unpreserved)[b]
Water	SVOC	Phenols 8041A (SW846 Update III)	2 X 1.0 liter amber glass with PTFE-lined lid	4 ± 2°C	7 days extraction 40 days analysis (after extraction)
Water	SVOC	Phenols 8041A (SW846 Update IV)	2 X 1.0 liter amber glass with PTFE-lined lid	≤ 6 °C	7 days extraction 40 days analysis (after extraction)
Water	SVOC	Organochlorine Pesticides 8081A	2 X 1.0 liter amber glass with PTFE-lined lid	4 ± 2°C	7 days extraction 40 days analysis (after extraction)
Water	SVOC	Organochlorine Pesticides 8081B	2 X 1.0 liter amber glass with PTFE-lined lid	≤ 6 °C	7 days extraction 40 days analysis (after extraction)
Water	SVOC	Polychlorinated Biphenyls (PCBs) 8082	2 X 1.0 liter amber glass with PTFE-lined lid	4 ± 2°C	7 days extraction 40 days analysis (after extraction)
Water	SVOC	Polychlorinated Biphenyls (PCBs) 8082A	2 X 1.0 liter amber glass with PTFE-lined lid	≤ 6 °C	None
Water	SVOC	Organophosphorus Pesticide 8141A	2 X 1.0 liter amber glass with PTFE-lined lid	4 ± 2°C	7 days extraction 40 days analysis (after extraction)
Water	SVOC	Organophosphorus Pesticide 8141B	2 X 1.0 liter amber glass with PTFE-lined lid	≤ 6 °C	7 days extraction 40 days analysis (after extraction)

Attachment A

Sample Preservation and Storage Requirements
PR-TC-02.04.01.01

Matrix	Analytical Group	Analytical Method	Containers (number, size and type)	Preservation Requirements (chemical, temperature, light protected)	Maximum Holding Time (preparation/analysis)
Water	SVOC	Chlorinated Herbicides 8151A (SW846 Update III)	2 X 1.0 liter amber glass with PTFE-lined lid	4 ± 2°C	7 days extraction 40 days analysis (after extraction)
Water	SVOC	Chlorinated Herbicides 8151A (SW846 Update IV)	2 X 1.0 liter amber glass with PTFE-lined lid	≤ 6 °C	7 days extraction 40 days analysis (after extraction)
Water	SVOC	GCMS SVOC 8270C	2 X 1.0 liter amber glass with PTFE-lined lid	4 ± 2°C	7 days extraction 40 days analysis (after extraction)
Water	SVOC	GCMS SVOC 8270D	2 X 1.0 liter amber glass with PTFE-lined lid	≤ 6 °C	7 days extraction 40 days analysis (after extraction)
Water	SVOC	Dioxins and Furans 8280A; 8290	2 X 1.0 liter amber glass with PTFE-lined lid	4 ± 2°C, store in the dark	30 days extraction 45 days analysis (after extraction)
Water	SVOC	Dioxins and Furans 8280B; 8290A	2 X 1.0 liter amber glass with PTFE-lined lid	≤ 6 °C	None
Water	SVOC	Polycyclic Aromatic Hydrocarbons 8310 (SW846 Update III) ; 8270CSIM	2 X 1.0 liter amber glass with PTFE-lined lid	4 ± 2°C	7 days extraction 40 days analysis (after extraction)
Water	SVOC	Polycyclic Aromatic Hydrocarbons 8310 (SW846 Update IV); 8270DSIM	2 X 1.0 liter amber glass with PTFE-lined lid	≤ 6 °C	7 days extraction 40 days analysis (after extraction)
Water	SVOC	Nitroaromatics and Nitroamines 8330A; 8330B	2 X 1.0 liter amber glass with PTFE-lined lid	≤ 6 °C	7 days extraction 40 days analysis (after extraction)
Water	SVOC	Diesel and Oil Range Organics (DRO and ORO) 8015B	2 X 1.0 liter amber glass with PTFE-lined lid	4 ± 2°C	7 days extraction 40 days analysis (after extraction)
Water	SVOC	Diesel and Oil Range Organics (DRO and ORO) 8015C	2 X 1.0 liter amber glass with PTFE-lined lid	≤ 6 °C	7 days extraction 40 days analysis (after extraction)
Water	SVOC	Diesel and Oil Range Organics (DRO and ORO) 8015D	2 X 1.0 liter amber glass with PTFE-lined lid	≤ 6 °C	7 days extraction 40 days analysis (after extraction)
Water	Metals	ICP-AES Metals 6010B; 6010C	1 X 500 mL plastic	HNO_3 to pH < 2	6 months analysis
Water	Metals	ICP-MS Metals 6020; 6020A	1 X 500 mL plastic	HNO_3 to pH < 2	6 months analysis

Attachment A

Sample Preservation and Storage Requirements
PR-TC-02.04.01.01

Matrix	Analytical Group	Analytical Method	Containers (number, size and type)	Preservation Requirements (chemical, temperature, light protected)	Maximum Holding Time (preparation/analysis)
Water	Metals	Mercury by CVAA 7470A (SW846 Update III)	1 X 500 mL plastic	HNO_3 to pH < 2; 4 $\pm$ 2°C	28 days analysis
Water	Metals	Mercury by CVAA 7470A (SW846 Update IV)	1 X 500 mL plastic	HNO_3 to pH < 2; $\leq$ 6 °C	28 days analysis
Water	Inorganic	Hexavalent Chromium 7196A; 7199	1 X 250 mL plastic	4 $\pm$ 2°C	24 hours analysis
Water	Inorganic	Hexavalent Chromium 7196A; 7199	1 X 250 mL plastic	$\leq$ 6 °C	24 hours analysis
Water	Inorganic	Anions by IC 300.0 / 9056A (S846 Update III)	1 X 250 mL plastic	4 $\pm$ 2°C	48 hours for nitrate, nitrite, and orthophosphate analysis 28 days for chloride, sulfate, bromide, and fluoride analysis
Water	Inorganic	Anions by IC 300.0 / 9056A (SW846 Update IV)	1 X 250 mL plastic	$\leq$ 6 °C	48 hours for nitrate, nitrite, and orthophosphate analysis 28 days for chloride, sulfate, bromide, and fluoride analysis
Water	Inorganic	Nitrate and Nitrite as N Total 353.2	1 X 250 mL plastic	H_2SO_4 to pH < 2 / 4 $\pm$ 2°C	28 days analysis
Water	Inorganic	Kjeldahl Nitrogen 351.4 / SM 4500NH3-C	1 X 250 mL plastic	H_2SO_4 to pH < 2 / 4 $\pm$ 2°C	28 days analysis
Water	Inorganic	Chemical Oxygen Demand (COD) 410.4 / SM 5220D	1 X 250 mL plastic	H_2SO_4 to pH < 2 / 4 $\pm$ 2°C	28 days analysis
Water	Inorganic	Alkalinity SM 2320B / 310.1	1 X 250 mL plastic	4 $\pm$ 2°C	14 days analysis
Water	Inorganic	Total Dissolved Solids (TDS) SM 2540C / 160.1	1 X 250 mL plastic	4 $\pm$ 2°C	7 days analysis
Water	Inorganic	pH SM 4500-H+B	1 X 250 mL plastic	None	15 minutes analysis
Water	Inorganic	pH 150.1	1 X 250 mL plastic	None	24 hour analysis

Attachment A

Sample Preservation and Storage Requirements
PR-TC-02.04.01.01

Matrix	Analytical Group	Analytical Method	Containers (number, size and type)	Preservation Requirements (chemical, temperature, light protected)	Maximum Holding Time (preparation/analysis)
Water	Inorganic	Conductivity SM 2510B / 120.1	1 X 250 mL plastic	4 $\pm$ 2°C	28 days analysis
Water	Radiochem	Gross Alpha/Gross Beta 900.0	500-mL glass or plastic	HNO_3 to pH < 2	6 months analysis[e]
Water	Radiochem	Gamma-Emitting Radionuclides 901.1	2 X 1-liter glass or plastic	HNO_3 to pH < 2	6 months analysis[e]
Water	Radiochem	Radium-226 by Radon Emanation 903.1	2 X 1 liter glass or plastic	HNO_3 to pH < 2	6 months analysis[e]
Water	Radiochem	Gamma Radioassay HASL300 GA-01-R	2 X 1 liter glass or plastic	HNO_3 to pH < 2	6 months analysis[e]
Water	Radiochem	Radium-228 EPA 904.0	2 X 1 liter glass or plastic	HNO_3 to pH < 2	6 months analysis[e]
Water	Radiochem	Strontium-90 905.0	2 X 1 liter glass or plastic	HNO_3 to pH < 2	6 months analysis[e]
Water	Radiochem	Tritium 906.0	2 X 1 liter glass or plastic	None	6 months analysis[e]
Water	Radiochem	Plutonium 238 and 239/240 HASL 300-Pu-11	2 X 1 liter glass or plastic	HNO_3 to pH < 2	6 months analysis[e]
Water	Radiochem	Uranium-234, -235, and -238 HASL 300 U-02-RC	2 X 1 liter glass or plastic	HNO_3 to pH < 2	6 months analysis[e]
Soil	VOC	Gasoline Range Organics (GRO) 8015B	3 X 5g EnCore® or equivalent	4 $\pm$ 2 °C	48 hours until transfer to glass vials – 14 days analysis / 7 days if no acid (including 48 hours)
Soil	VOC	Gasoline Range Organics (GRO) 8015C	3 X 5g EnCore® or equivalent	$\leq$ 6 °C	48 hours until transfer to glass vials – 14 days analysis / 7 days if no acid (including 48 hours)
Soil	VOC	Gasoline Range Organics (GRO) 8015D	3 X 5g EnCore® or equivalent	$\leq$ 6 °C	48 hours until transfer to glass vials – 14 days analysis / 7 days if no acid (including 48 hours)
Soil	VOC	GCMS VOCs 8260B	3 X 5g EnCore® or equivalent	4 $\pm$ 2 °C	48 hours until transfer to glass vials – 14 days analysis / 7 days if no acid (including 48 hours)

Attachment A

Sample Preservation and Storage Requirements
PR-TC-02.04.01.01

Matrix	Analytical Group	Analytical Method	Containers (number, size and type)	Preservation Requirements (chemical, temperature, light protected)	Maximum Holding Time (preparation/analysis)
Soil	VOC	GCMS VOCs 8260C	3 X 5g EnCore® or equivalent	≤ 6 °C	48 hours until transfer to glass vials – 14 days analysis / 7 days if no acid (including 48 hours)[a]
Soil	VOC	GC VOCs 8021B (SW846 Update III)	3 X 5g EnCore® or equivalent	4 ± 2 °C	48 hours until transfer to glass vials – 14 days analysis / 7 days if no acid (including 48 hours)
Soil	VOC	GC VOCs 8021B (SW846 Update IV)	3 X 5g EnCore® or equivalent	≤ 6 °C	48 hours until transfer to glass vials – 14 days analysis / 7 days if no acid (including 48 hours)
Soil	SVOC	Phenols 8041A (SW846 Update III)	Sleeves[c] with PTFE™ end caps or 8 oz glass jar	4 ± 2 °C	extraction - 14 days analysis - 40 days
Soil	SVOC	Phenols 8041A (SW846 Update IV)	Sleeves[c] with PTFE™ end caps or 8 oz glass jar	≤ 6 °C	extraction - 14 days analysis - 40 days
Soil	SVOC	Organochlorine Pesticides 8081A	Sleeves[c] with PTFE™ end caps or 8 oz glass jar	4 ± 2 °C	extraction - 14 days analysis - 40 days
Soil	SVOC	Organochlorine Pesticides 8081B	Sleeves[c] with PTFE™ end caps or 8 oz glass jar	≤ 6 °C	extraction - 14 days analysis - 40 days
Soil	SVOC	Polychlorinated Biphenyls (PCBs) 8082	Sleeves[c] with PTFE™ end caps or 8 oz glass jar	4 ± 2 °C	extraction - 14 days analysis - 40 days
Soil	SVOC	Polychlorinated Biphenyls (PCBs) 8082A	Sleeves[c] with PTFE™ end caps or 8 oz glass jar	≤ 6 °C	None
Soil	SVOC	Organophosphorus Pesticides 8141A	Sleeves[c] with PTFE™ end caps or 8 oz glass jar	4 ± 2 °C	extraction - 14 days analysis - 40 days
Soil	SVOC	Organophosphorus Pesticides 8141B	Sleeves[c] with PTFE™ end caps or 8 oz glass jar	≤ 6 °C	extraction - 14 days analysis - 40 days
Soil	SVOC	Chlorinated Herbicides 8151A (SW846 Update III)	Sleeves[c] with PTFE™ end caps or 8 oz glass jar	4 ± 2 °C	extraction - 14 days analysis - 40 days
Soil	SVOC	Chlorinated Herbicides 8151A (SW846 Update IV)	Sleeves[c] with PTFE™ end caps or 8 oz glass jar	≤ 6 °C	extraction - 14 days analysis - 40 days
Soil	SVOC	GCMS SVOCs 8270C	Sleeves[c] with PTFE™ end caps or 8 oz glass jar	4 ± 2 °C	extraction - 14 days analysis - 40 days

Attachment A

Sample Preservation and Storage Requirements
PR-TC-02.04.01.01

Matrix	Analytical Group	Analytical Method	Containers (number, size and type)	Preservation Requirements (chemical, temperature, light protected)	Maximum Holding Time (preparation/analysis)
Soil	SVOC	GCMS SVOCs 8270D	Sleeves[c] with PTFE™ end caps or 8 oz glass jar	≤ 6 °C	extraction - 14 days analysis - 40 days
Soil	SVOC	Dioxins and Furans 8280A; 8290	Sleeves[c] with PTFE™ end caps or 8 oz glass jar	4 ± 2 °C ; store in the dark	extraction - 30 days analysis - 45 days
Soil	SVOC	Dioxins and Furans 8280B; 8290A	Sleeves[c] with PTFE™ end caps or 8 oz glass jar	≤ 6 °C	None
Soil	SVOC	Polycyclic Aromatic Hydrocarbons 8310 (SW386 Update III); 8270CSIM	Sleeves[c] with PTFE™ end caps or 8 oz glass jar	4 ± 2 °C	extraction - 14 days analysis - 40 days
Soil	SVOC	Polycyclic Aromatic Hydrocarbons 8310 (SW386 Update IV); 8270DSIM	Sleeves[c] with PTFE™ end caps or 8 oz glass jar	≤ 6 °C	extraction - 14 days analysis - 40 days
Soil	SVOC	Nitroaromatics and Nitramines 8330A	Sleeves[c] with PTFE™ end caps or 8 oz glass jar	≤ 6 °C	extraction - 14 days analysis - 40 days
Soil	SVOC	Nitroaromatics and Nitramines 8330B	1.5 grams of soil in specially prepared locking plastic bag	≤ 6 °C	extraction - 14 days analysis - 40 days
Soil	SVOC	Diesel and Oil Range Organics 8015B	Sleeves[c] with PTFE™ end caps or 8 oz glass jar	4 ± 2 °C	extraction - 14 days analysis - 40 days
Soil	SVOC	Diesel and Oil Range Organics 8015C	Sleeves[c] with PTFE™ end caps or 8 oz glass jar	≤ 6 °C	extraction - 14 days analysis - 40 days
Soil	SVOC	Diesel and Oil Range Organics 8015D	Sleeves[c] with PTFE™ end caps or 8 oz glass jar	≤ 6 °C	extraction - 14 days analysis - 40 days
Soil	Metals	ICP-AES 6010B; 6010C	Sleeves[c] with PTFE™ end caps or 4 oz glass jar	None	analysis - 6 months
Soil	Metals	ICP-MS 6020; 6020A	Sleeves[c] with PTFE™ end caps or 4 oz glass jar	None	analysis - 6 months
Soil	Metals	Mercury by CVAA 7471A	Sleeves[c] with PTFE™ end caps or 4 oz glass jar	4 ± 2 °C	analysis - 28 days
Soil	Metals	Mercury by CVAA 7471B	Sleeves[c] with PTFE™ end caps or 4 oz glass jar	≤ 6 °C	analysis - 28 days
Soil	Inorganics	Conductivity 9050A/ 9050A	1 X 4 oz glass jar	4 ± 2 °C	analysis - 28 days

Attachment A

Sample Preservation and Storage Requirements
PR-TC-02.04.01.01

Matrix	Analytical Group	Analytical Method	Containers (number, size and type)	Preservation Requirements (chemical, temperature, light protected)	Maximum Holding Time (preparation/analysis)
Soil	Inorganics	Hexavalent Chromium 7196A / 7199 (SW846 Update III)	1 X 4 oz glass jar	4 ± 2 °C	analysis - 24 hours
Soil	Inorganics	Hexavalent Chromium 7196A / 7199 (SW846 Update IV)	1 X 4 oz glass jar	≤ 6 °C	analysis - 24 hours
Soil	Inorganics	pH 9045D	1 X 4 oz glass jar	None	analysis - immediately
Soil	Radiochem	Gamma-Emitting Radionuclides 901.1M	1 X 16 oz glass or plastic jar[d]	None	6 months analysis[e]
Soil	Radiochem	Radium-226 by Radon Emanation 903.1M	1 X 16 oz glass or plastic jar[d]	None	6 months analysis[e]
Soil	Radiochem	Gamma Radioassay HASL300 GA-01-R	1 X 16 oz glass or plastic jar[d]	None	6 months analysis[e]
Soil	Radiochem	Radium-228 904.0M	1 X 16 oz glass or plastic jar[d]	None	6 months analysis[e]
Soil	Radiochem	Strontium-90 905.0M	1 X 16 oz glass or plastic jar[d]	None	6 months analysis[e]
Soil	Radiochem	Tritium 906.0M	1 X 16 oz glass or plastic jar[d]	None	6 months analysis[e]
Soil	Radiochem	Plutonium 238 and 239/240 HASL 300-Pu-11	1 X 16 oz glass or plastic jar[d]	None	6 months analysis[e]
Soil	Radiochem	Uranium-234, -235, and -238 HASL 300 U-02-RC	1 X 16 oz glass or plastic jar[d]	None	6 months analysis[e]

Abbreviations and Notes:
AES = Atomic Emission Spectrometry
°C = degrees centigrade
CVAA = Cold Vapor Atomic Absorption
GC = Gas Chromatography
HCl = Hydrochloric Acid
H2SO4 = Sulfuric Acid
IC = Ion Chromatography
ICP = Inductively Coupled Plasma
mL = milliliters
MS = Mass Spectrometry
oz = ounce
SVOC = Semi-volatile Organic Compounds
VOA = Volatile Organic Analysis
VOC = Volatile Organic Compounds

Attachment A

Sample Preservation and Storage Requirements
PR-TC-02.04.01.01

Abbreviations and Notes:

[a] If vinyl chloride, sytene, or 2-chloroethyl vinyl ether are analytes of interest, collect a second set of samples without acid preservatives and analyze as soon as possible (7 day hold time).

[b] If carbonaceous materials are present (or if MTBE and other fuel oxygenate ethers are present and a high temperature sample preparative method is to be used), do not acid preserve the sample.

[c] Sleeves may be stainless steel, acetate, brass or PTFE, depending on project needs.

[d] Sample volume and container dependent on required site-specific reporting limits. See the site-specific plan for details or variances such as tuna cans.

[e] Manual for the Certification of Laboratories Analyzing Drinking Water, EPA 815-B-97-001, March 1997 Criteria and Procedures Quality Assurance

ITSI Gilbane

2730 Shadelands Drive
Walnut Creek, California 94598
(925) 946-3100 – (925) 256-8998 (fax)

Chain-of-Custody

Project Name and Number: _____ Laboratory Name: _____ Date: _____

Project Manager: _____ Address: _____ Contact Name: _____ Page: _____ of _____

Site Location: _____ _____ Phone: _____

Sample I.D.	Sample Depth	Date	Time	No. of Containers	Sample Matrix	Analysis: / Preservative: / Container Type:	Special Instructions/Comments

Sampled By: _____

Signature: _____

Special Instructions: _____

Send Results to: _____
(w/fax #) _____

Turnaround Time: _____

Sampler: _____ Courier/Airbill No.: _____

Relinquished By/Affiliation:	Date:	Time:	Received By/Affiliation:	Date:	Time:

ATTACHMENT 3
RESPONSE TO COMMENTS

RESPONSES TO COMMENTS

Document:	*Draft, Quality Assurance Project Plan, Superfund Response Actions, Former Fort Ord, California, Volume II, Operable Unit 2 Landfills*
Commenting Organization:	California EPA Department of Toxic Substances Control
Name:	Min Wu
Date of Comments:	August 7, 2014

Comment 1:

Distribution List

Please remove Franklin Mark from the distribution list.

Response to Comment 1:

Agreed. Franklin Mark will be removed from the distribution list.

Comment 2:

Acronym and Abbreviation List

Should "VF" be defined as "Passive Vent in Area F?"

Response to Comment 2:

Agreed. The acronym “VF” will be added to the Acronym and Abbreviation List as “Passive Vent in Area F.”

Comment 3:

Section 1.0 Introduction

The first sentence refers to Volume III, but the document title refers to Volume II. Please indicate the correct volume.

Response to Comment 3:

Agreed. The USACE has determined that the OU2 Landfills QAPP will be included in Volume I of the Fort Ord QAPP as Appendix D.

RESPONSES TO COMMENTS

Comment 4:

The "Plate," and the same diagram on Appendix A page 8

The organizational chart of the project team lists Franklin Mark as the DTSC point of contact (POC). Please change that POC to Min Wu at min.wu@dtsc.ca.gov and (916) 255-3621.

Response to Comment 4:

Agreed. Franklin Mark will be replaced in the organizational chart and the remainder of the document with Min Wu.

Comment 5:

Appendix A title

The appendix title refers to Volume III; however the document title and the second appendix title page refer to Volume II. Please revise and indicate the correct volume number.

Response to Comment 5:

Agreed. The USACE has determined that the OU2 Landfills QAPP will be included in Volume I of the Former Fort Ord UFP-QAPP as Appendix D.

Comment 6:

Appendix A, Section 2.2 Project/Data Quality Objectives (QAPP Worksheet #11)

Page 25 second bullet from bottom refers to Region IX preliminary remediation goals (PRGs). Region IX currently uses regional screening levels (RSLs). See also page 36, Section 2.6 second paragraph.

Response to Comment 6:

The criteria specified in the QAPP are based on a 2004 PRG value which was agreed upon in 2006 with the regulatory agencies in Field Work Variance 108 to the *Post Closure Operation and Maintenance Plan, Areas B Through F, Operable Unit 2 Landfills Remedial Action, Fort Ord, CA*. The current RSL value is actually higher than the 2004 PRG value for vinyl chloride (6.7 vs. 4.1 ppbv [multiplying both by 100]). Therefore the text will be modified as follows:

Pages 25/26 text will be modified to:

RESPONSES TO COMMENTS

"The following decision rules relate to volatile organic compounds 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 probes with previous measured detections greater than 100 times the 2004 EPA Region IX Ambient Air preliminary remediation goal (PRG) for vinyl chloride in gas (100 x PRG = 4.1 parts per billion by volume [ppbv]): if the concentration of vinyl chloride exceeds the previous maximum recorded value, the probe will be sampled quarterly until two successive measurements show declining or constant concentrations.
- For compliance probes with no previous measured detections greater than 100 times the 2004 EPA Region IX PRG for vinyl chloride in gas: if the concentration remains less than 100 times the PRG, then no action is required.
- For compliance probes with no previous measured detections greater than 100 times the 2004 EPA Region IX PRG for vinyl chloride in gas: if the concentration exceeds 100 times the PRG, then the probe will be sampled quarterly until two successive measurements show declining or constant concentrations

The 2004 EPA Region IX PRG for vinyl chloride is more conservative than the current EPA Region IX Ambient Air Regional Screen Level for vinyl chloride; therefore, this value will continue to be used in the decision rules."

Page 31 text will be revised to:

- "For compliance probes with previous measured detections greater than 100 times the 2004 EPA Region IX ~~preliminary remediation goal (~~PRG~~)~~ for vinyl chloride in gas (100 x PRG = 4.1 ~~parts per billion by volume [~~ppbv~~]~~): if the concentration of vinyl chloride exceeds the previous maximum recorded value, sample quarterly until two successive measurements show declining or constant concentrations.

One hundred times the current (2014) EPA Region IX ~~PRG~~ Regional Screening Level (RSL) for vinyl chloride is ~~6.3~~ 6.7 ppbv. Therefore, the requirements presented in the O&M Plan (actions triggered at 4.1 ppbv) are more conservative than the current RSL~~PRG~~. The only regulatory requirement for VOCs on the perimeter probes is 27 California Code of Regulations (CCR), Section 20921(a)(3), which states: "Trace gases shall be controlled to prevent adverse acute and chronic exposure to toxic and/or carcinogenic compounds". Since this applies to all trace gases, all VOCs (as measured by TO-15) have been quantified on probes, both historically and in the present."

RESPONSES TO COMMENTS

Comment 7:

Appendix A, Figures 2 and 3

These figures are not dated; please include a date when the figures were prepared.

Response to Comment 7:

Agreed. Preparation dates will be added to Figures 2 and 3.

Comment 8:

Appendix A, Section 2.6, Worksheet #15

Concentrations for aquifer cleanup levels and discharge limits for treated water in the table are listed with units of milligrams per liter. However, the OU2 Landfill ROD (Army, 1994) lists the units in ppb which is micrograms per liter. Please correct the units in the table to ppb or micrograms per liter.

Response to Comment 8:

Agreed. The concentrations in Worksheet #15 will be changed to micrograms per liter.

Comment 9:

Appendix A, Attachment 1, Laboratory Information

A letter dated April 25, 2014 from ANSI-ASQ National Accreditation Board states that accreditation for DoD ELAP expired on April 27, 2014 and a 90 day extension was granted. Please include evidence of current accreditation.

Response to Comment 9:

Current accreditation for the laboratory will be included in the draft final version.