Enbridge Line 6B MP 608

Marshall, Michigan

Quality Assurance Project Plan

Prepared: August 2, 2010

(Revised August 15, 2010 per U.S. EPA August 15, 2010 Letter)

Title and Signature Page

Title of Plan:	**QUALITY ASSURANCE PROJECT PLAN ENBRIDGE LINE 6B MP 608 RESPONSE PROJECT**
Implemented By:	**ENBRIDGE ENERGY, LIMITED PARTNERSHIP**
Effective Date:	**August 2010**

Project Coordinator/Manager	Date
Laboratory Project Chemist	Date
Quality Assurance Officer	Date
United States Environmental Protection Agency On Scene Coordinator	Date

By signing this page, the individual agrees to the conditions of this Quality Assurance Project Plan.

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Table of Contents

1.0 Project Management 1-1

1.1 Introduction 1-1

1.2 Project/Task Organization 1-2

1.2.1 Federal On-Scene Coordinator (FOSC) 1-2

1.2.2 Environmental Unit Leader 1-2

1.2.3 Sampling and Analysis Manager 1-3

1.2.4 Quality Assurance Officer (QAO) 1-4

1.2.5 Field Manager 1-5

1.2.6 Sample/Technical Manager 1-5

1.2.7 Laboratory 1-6

1.2.8 Data Manager 1-7

1.2.9 Third Party Data Validator 1-8

1.3 Problem Definition/Background Information 1-8

1.3.1 Overall Project Objectives 1-8

1.3.2 Site / Facility Description 1-9

1.4 Project Description and Schedule 1-10

1.4.1 Project Description 1-10

1.4.2 Project Schedule 1-11

1.5 Quality Assurance Objectives for Measurement of Data 1-11

1.5.2 Precision 1-12

1.5.2.1 Definition 1-12

1.5.2.2 Field Precision Objectives 1-12

1.5.2.3 Laboratory Precision Objectives 1-12

1.5.3 Accuracy 1-12

1.5.3.1 Definition 1-12

1.5.3.2 Field Accuracy Objectives 1-12

1.5.3.3 Laboratory Accuracy Objectives 1-13

1.5.4 Completeness 1-13
1.5.4.1 Definition 1-13
1.5.4.2 Field Completeness Objectives 1-13
1.5.4.3 Laboratory Completeness Objectives 1-13
1.5.5 Representativeness 1-13
1.5.5.1 Definition 1-13
1.5.5.2 Measures to Ensure Representativeness of Field Data 1-14
1.5.5.3 Measures to Ensure Representativeness of Laboratory Data 1-14
1.5.6 Comparability 1-14
1.5.6.1 Definition 1-14
1.5.6.2 Measures to Ensure Comparability of Field Data 1-14
1.5.6.3 Measures to Ensure Comparability of Laboratory Data 1-14
1.5.7 Sensitivity 1-14
1.5.7.1 Definition 1-14
1.6 Special Training Requirements and Certification 1-15
1.6.1 Training 1-15
1.6.2 Certification 1-15
1.7 Documents and Records 1-16
1.7.1 Data Reporting Format and Content 1-16
1.7.2 Records Disposition 1-17
1.7.3 Use of Historic Data 1-17
2.0 Sampling Process Design 2-1
2.1.1 Sampling Procedures and Methods 2-1
2.1.2 Location and Quantity Measurements 2-1
2.1.3 Custody Procedures 2-1
2.1.3.1 Field Custody and Documentation Procedures 2-2
2.1.3.2 Laboratory Custody Procedures 2-5
2.1.3.3 Final Evidence File 2-5
2.2 Analytical Methods 2-6
2.2.1 Field Analytical Procedures 2-6
2.2.2 Laboratory Analytical Procedures 2-6
2.2.2.1 Volatile Organic Compounds (VOCs) 2-7
2.2.2.2 Semivolatile Organic Compounds (SVOCs) 2-7
2.2.2.3 Polynuclear Aromatic Hydrocarbons (PAHs) 2-7
2.2.2.4 Gasoline Range Organics, Diesel Range Organics and Oil Range Organics GRO/DRO/ORO 2-7
2.2.2.5 Metals 2-7
2.2.2.6 PCBs 2-8
2.2.3 Field Quality Control Checks 2-8

2.2.4 Laboratory Quality Control Checks 2-8
2.2.5 Level of Quality Control Effort 2-9
2.2.6 Level of Quality Assurance Effort 2-10
2.3 Calibration Procedures and Frequency 2-10
2.3.1 Field Instrument Calibration 2-10
2.3.2 Laboratory Instrument Calibration 2-11
2.4 Preventive Maintenance 2-11
2.4.1 Field Instrument Preventive Maintenance 2-11
2.4.2 Laboratory Instrument Preventive Maintenance 2-11
2.4.3 Inspection/Acceptance Requirements for Supplies and Consumables 2-12
3.0 Assessment and Oversight 3-1
3.1 Field Performance and System Audits 3-1
3.1.1 Internal Field Audits 3-1
3.1.1.1 Internal Field Audit Responsibilities 3-1
3.1.1.2 Internal Field Audit Frequency 3-1
3.1.1.3 Internal Field Audit Procedures 3-1
3.1.2 External Field Audits 3-2
3.1.2.1 External Field Audit Responsibilities 3-2
3.1.2.2 External Field Audit Frequency 3-2
3.1.2.3 External Field Audit Procedures 3-2
3.2 Performance and System Audits 3-2
3.2.1 Performance Audits 3-2
3.2.2 System Audits 3-3
3.2.3 Audit Records 3-3
3.3 Laboratory Performance and Systems Audits 3-3
3.3.1 Internal Laboratory Audits 3-3
3.3.1.1 Internal Laboratory Audit Responsibilities 3-3
3.3.1.2 Internal Laboratory Audit Frequency 3-3
3.3.1.3 Internal Laboratory Audit Procedures 3-3
3.3.2 External Laboratory Audits 3-4
3.3.2.1 External Laboratory Audit Responsibilities 3-4
3.3.2.2 External Laboratory Audit Frequency 3-4
3.3.2.3 Overview of the External Laboratory Audit Process 3-4
3.4 Specific Routine Procedures Used to Evaluate Data Precision, Accuracy, and Completeness 3-5
3.4.1 Accuracy Assessment 3-6
3.4.2 Precision Assessment 3-7
3.4.3 Completeness Assessment 3-7

3.5 Overall Assessment of Data 3-7
3.6 Corrective Actions 3-9
3.6.1 Field Corrective Action 3-9
3.6.2 Laboratory Corrective Action 3-9
3.6.3 Corrective Action During Data Review/Validation and Assessment 3-10
3.7 Quality Assurance Reports to Management 3-10
3.7.1 Contents of Project QA Reports 3-10
4.0 Data Validation and Usability 4-1
4.1 Data Reduction 4-1
4.1.1 Field Data Reduction Procedures 4-1
4.1.2 Laboratory Data Reduction Procedures 4-1
4.2 Data Review and Validation 4-1
4.3 Data Reporting 4-2
4.3.1 Field Data Reporting 4-2
4.3.2 Laboratory Data Reporting 4-2
4.3.2.1 Case Narrative 4-2
4.3.2.2 Chemistry Data Package 4-3
4.4 Data Assessment 4-3
5.0 References 5-1

List of Tables

Table 1-1	Quality Control Level of Effort for Analytical Testing
Table 1-2	Laboratory Control Sample Accuracy and Precision Criteria for VOC Analysis
Table 1-3	MS/MSD Accuracy and Precision Criteria for VOC Analysis
Table 1-4	Laboratory Control Sample Accuracy and Precision Criteria for SVOC Analysis
Table 1-5	MS/MSD Accuracy and Precision Criteria for SVOC Analysis
Table 1-6	Laboratory Control Sample Accuracy and Precision Criteria for PAH Analysis
Table 1-7	MS/MSD Accuracy and Precision Criteria for PAH Analysis
Table 1-8	Laboratory Control Sample Accuracy and Precision Criteria for Polychlorinated Biphenyl Analysis
Table 1-9	MS/MSD Accuracy and Precision Criteria for Polychlorinated Biphenyl Analysis
Table 1-10	Laboratory Control Sample Accuracy and Precision Criteria for Metals Analysis
Table 1-11	MS/MSD Accuracy and Precision Criteria for Metals Analysis
Table 1-12	Surrogate Compound Accuracy Criteria for Organic Parameters
Table 1-13	Laboratory Analytical Methods
Table 1-14	Method Detection Limits and Reporting Limits for Soils and Sediment Samples Analyzed for VOCs
Table 1-15	Method Detection Limits and Reporting Limits for Soils and Sediment Samples Analyzed for SVOCs
Table 1-16	Method Detection Limits and Reporting Limits for Soils and Sediment Samples Analyzed for PAHs
Table 1-17	Method Detection Limits and Reporting Limits for Polychlorinated Biphenyls
Table 1-18	Method Detection Limits and Reporting Limits for Aqueous Samples Analyzed for Polychlorinated Biphenyls
Table 1-19	Method Detection Limits and Reporting Limits for Soil/Sediment Samples Analyzed for Metals
Table 1-20	Method Detection Limits and Reporting Limits for Aqueous Samples Analyzed for Metals
Table 1-21	Summary of Enbridge Analytes, Analytical Methods, Method Detection and Reporting Limits and QA/QC Accuracy and Precision Limits
Table 2-1	Sample Containers, Preservation and Holding Times

List of Figures

Figure 1 Project Organization Chart

List of Appendices

Appendix A Air Sampling and Monitoring Plan, dated July 31, 2010 (Air Sampling QAPP)

List of Attachments

Attachment 1 Laboratory Quality Assurance Manual(s) (on CD under separate cover)
Attachment 2 Laboratory Analytical Standard Operating Procedures (on CD under separate cover)

Acronyms and Abbreviations

µg	Microgram(s)
%D	Percent Difference
%R	Percent Recovery
ADR	Automated Data Review
°C	Degrees Celsius
CCC	Calibration Check Compounds
CCV	Continuing Calibration Verification
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
CLP	Contract Laboratory Program
COC	Chain-of-Custody
COD	Coefficient of Determination
Company	Enbridge Energy, Limited Partnership
COPC	Compound of Potential Concern
CQCP	Contractor Quality Control Plan
CV	Calibration Verification
CVAA	Cold Vapor Atomic Absorption
DNAPL	Dense Non-Aqueous Phase Liquid – A liquid with a Specific Gravity > 1.0
DO	Dissolved Oxygen
DRO	Diesel Range Organics
DQO	Data Quality Objective
ECD	Electron Capture Detector
EDD	Electronic Data Deliverable
EUL	Company Environmental Unit Leader
FOSC	Federal On-Scene Coordinator - The individual responsible for all incident activities. The FOSC has overall authority and responsibility for conducting incident operations and is responsible for the management of all incident operations at the incident site.
GC/MS	Gas Chromatography and Mass Spectrometer
GPS	Global Positioning System
GO/CO	Government Owned/Contractor Operated
GRO	Gasoline Range Organics
HAZWOPER	Hazardous Waste Operations and Emergency Response
HCl	Hydrochloric acid
HDPE	High Density Polyethylene
Hg	Mercury
HNO_3	Nitric acid
HSP	Health & Safety Plan
ICAL	Initial Calibration

ICP	Inductively Coupled Plasma
ICS	Interference Check Sample
ICV	Internal Calibration Verification
IDL	Instrument Detection Limit
IS	Internal Standard
J	Estimated
kg	Kilogram(s)
LCS	Laboratory Control Sample
LCSD	Laboratory Control Sample Duplicate
LDC	Laboratory Data Consultants, Inc.
LNAPL	Light Non-Aqueous Phase Liquid – A liquid with a Specific Gravity < 1.0
MDL	Method Detection Limit
MDNRE	Michigan Department of Natural Resources and Environment
MS/MD	Matrix Spike/Matrix Duplicate
MS/MSD	Matrix Spike/Matrix Spike Duplicate
NA	Not Applicable
NELAC	National Environmental Laboratory Accreditation Conference
NELAP	National Environmental Laboratory Accreditation Program
NFG	U.S. EPA National Functional Guidelines for Organic and Inorganic Data Review
NOAA	National Oceanic and Atmospheric Administration
NRDA	National Resource Damage Assessment
NREPA	Natural Resources and Environmental Protection Act
ORO	Oil Range Organics
OSHA	Occupational Safety and Health Administration
PAH	Polynuclear Aromatic Hydrocarbon
PCB	Polychlorinated Biphenyl
PDS	Post Digestion Spike
pH	Hydrion Ion Exponent
PM	Company Environmental Unit Leader
ppb	Part Per Billion
QA	Quality Assurance
QAO	Quality Assurance Officer
QAPP	Quality Assurance Project Plan
QA/QC	Quality Assurance/ Quality Control
QC	Quality Control
QSM	Quality Systems Manual
R	Rejected
r	Correlation Coefficient
RF	Response Factor
RL	Reporting Limit
RPD	Relative Percent Difference

RPDIA	Response Plan for Downstream Impacted Areas - A workplan describing interim response actions designed to protect navigable waters from the crude oil release
RRT	Relative Retention Time
RSD	Relative Standard Deviation
SAP	Sampling and Analysis Plan
SAQAM	Sampling, Analysis/Quality Assurance Manager
SAR	Source Area Response Plan - A workplan describing interim response actions designed to protect navigable waters from the crude oil release
SCAT	Shoreline Cleanup Assessment Technique also known as SCAT Assessment or SCAT Process – A systematic approach that uses standard terminology to collect data on impacted areas, support decision-making for cleanup; reference HAZMAT Report No. 2000-1; Office of Response and Restoration, Hazardous Materials Response Division, National Ocean Service, National Oceanic & Atmospheric Administration, Shoreline Assessment Manual – Third Edition, August 2000.
SCAT Team	A team of qualified individuals using SCAT, organized and reporting to the FOSC and comprised of representatives from USEPA, (as the FOSC), MDNRE (as the SOSC and state NRDA trustee), NOAA or USFWS (as federal NRDA trustees) and Company to assess impacted areas and recommend cleanup methods and priorities. At least one member should have sufficient expertise in wetland and aquatic ecology to evaluate the sensitivity of impacted areas.
SCFS	Sample Collection Field Sheet
SIM	Selected Ion Monitoring
SOP	Standard Operating Procedure
SOC	State On-Scene Coordinator
SOW	Scope of Work
SPCC	System Performance Check Compounds
SSHP	Site Safety and Health Plan
SAP	Sampling and Analysis Plan
SDWA	Safe Drinking Water Act
SVOC	Semivolatile Organic Compound
TAL	Target Analyte List
TM	Technical Manager
U	Nondetect
UJ	Estimated Nondetect
USEPA	United States Environmental Protection Agency
U.S. EPA NFG	National Functional Guidelines
UV	Ultraviolet
VOA	Volatile Organic Analysis
VOC	Volatile Organic Compound

1.0 Project Management

1.1 Introduction

This Quality Assurance Project Plan (QAPP) presents the organization, objectives, planned activities, and specific quality assurance/quality control (QA/QC) procedures associated with the Enbridge Energy, Limited Partnership (Company), Enbridge Marshall Line 6B MP 608 Response Project to be completed in Marshall, Michigan. It describes the sampling/analysis and quality assurance programs that the Company will adhere to in the short term during realization of the primary objective, which is the removal and/or abatement of visible oil and/or sheen that is either currently affecting navigable waterways and/or poses the threat of release of a visible oil and/or sheen discharge to navigable waterways.

Specific protocols for sampling, sample handling and storage, chain-of-custody (COC), and laboratory and field analyses are described in this QAPP. All QA/QC procedures are structured in accordance with applicable technical standards and United States Environmental Protection Agency's (USEPA's) requirements, regulations and guidance (Comprehensive Environmental Response, Compensation, and Liability Act [CERCLA]). This QAPP has been prepared in accordance with USEPA *Requirements for Quality Assurance Project Plans* (USEPA 2001), and *Guidance for Quality Assurance Project Plans* (USEPA 2002).

This QAPP is one of the following Work Plans prepared for the Enbridge Line 6B MP 608 Response:

- Health and Safety Plan (HSP), August 2, 2010
- Pipeline Repair Work Plan, August 2, 2010;
- Sampling and Analysis Plan (SAP), August 2, 2010;
- Oil Containment and Recovery Plan, August 2, 2010;
- Source Area Response (SAR) Plan, August 2, 2010;
- Response Plan for Downstream Impacted Areas (RPDIA), August 2, 2010; and
- Waste Treatment, Transportation and Disposal Plan, August 2, 2010.

Air sampling and monitoring activities have been addressed in the *Air Sampling and Monitoring Plan*, dated July 31, 2010, prepared by the Center for Toxicology and Environmental Health, LLC. See Appendix A for the *Air Sampling QAPP*.

1.2 Project/Task Organization

The project management team organization is discussed below. Due to the urgency and complexity of the project, numerous consultants and subcontractors will be working to complete the project. An organization chart showing the major positions as well as reporting and communication lines is shown on Figure 1.

1.2.1 Federal On-Scene Coordinator (FOSC)

The FOSC has regulatory oversight responsibilities for the development and approval of the documents and reports for this project. The responsibilities of the FOSC include, but are not limited to, the following:

- Schedule meetings, if necessary, between FOSC, agencies, and representatives of the Company;
- Review and approve means and methods of operations
- Review and approve proposed schedules;
- Review and approve resource allocations; and
- Review and approve documents and reports.

1.2.2 Environmental Unit Leader

The Company Environmental Unit Leader (EUL) is responsible for implementing the project, and has the authority to commit the resources necessary to meet project objectives and requirements. The EUL will comprise a rotation of Environmental Unit Leaders who will provide continuous management activities. The EUL will report to the FOSC. All communication and reporting will be conducted through the EUL. The EUL's primary function is to ensure that technical, financial, and scheduling objectives are achieved successfully. The EUL will:

- Oversee project objectives and develop a detailed work schedule;

- Establish project policy and procedures to address the specific needs of the project as a whole, as well as the objectives of each task;
- Acquire and apply technical and corporate resources as needed and appropriate (to ensure performance within budget and schedule constraints);
- Orient all field leaders and support staff concerning the project's special considerations;
- Monitor and direct the field leaders;
- Develop and meet ongoing project and/or task staffing requirements, including mechanisms to review and evaluate each task product;
- Review the work performed on each task to ensure its quality, responsiveness, and timeliness;
- Review and analyze overall task performance with respect to planned requirements and authorizations;
- Approve all reports (deliverables) before their submission to USEPA;
- Ultimately be responsible for the preparation and quality of interim and final reports;
- Represent the project team at meetings and public hearings; and
- Submit monthly progress reports.

1.2.3 Sampling and Analysis Manager

The Sampling and Analysis Manager (SAM) is responsible for establishing project scope and objectives and for communicating the project team. The SAM is also responsible for identifying internal, regulatory, and procedural requirements pertinent to the work that may differ from accepted industry standards of work. The SAM is responsible for assuring that projects are properly staffed and is ultimately responsible for the technical direction and quality of the work. He is responsible for establishing appropriate budgets and schedules, making available appropriate forms or equivalent of training, and monitoring the performance of the staff. The SAM may talk with regulatory agencies regarding methodologies and requirements. He is also responsible for monitoring the implementation of the quality assurance program.

Specific responsibilities include:

- Assure the provision of necessary resources including personnel, facilities, and equipment;

- Review and approve standard operating procedures and other project documents;
- Monitoring offsite area and onsite area laboratories for proper turnaround times;
- Support the efforts of the Field Managers, Quality Assurance (QA) Officers (QAO), and Data Manager(s) in all matters concerning the quality of work products;
- Assure effective response to corrective action requirements identified by any member of the project team of staff;
- Plan the activities of and ensure proper equipment, personnel, and subcontractor resources are allocated;
- Provide a liaison between the client, field, laboratory staff, and any other subcontractors;
- Effectively carry out the QA Program and this Sample and Analysis Plan;
- Assure completion of corrective actions, as needed.

1.2.4 Quality Assurance Officer (QAO)

The Quality Assurance Offer (QAO) is responsible for implementation of the QAPP in both field and laboratory operations. The QAO reports directly to the Environmental Unit Leader who has the authority to take any actions necessary to ensure the reliability and validity of work and deliverables according to the QAPP. The QAO is responsible for developing and implementing procedures to appropriately document all project activities, to provide specific means of measuring conformance to specifications, to manage the corrective actions program, and to provide periodic reports to management. Specific responsibilities include:

Develop, document, and carry out QA activities to ensure that appropriate Quality Control (QC) measures are being carried out and documented:

- Ensure all records related to quality assurance are documented and maintained securely and retrievably;
- Conduct periodic performance audits and/or surveillances to measure conformance to specifications;
- Prepare periodic quality reports and QA sections of final reports;

- Ensure corrective actions are carried out and documented in a way that precludes future occurrences;
- Review and approve SOPs, training records, and purchasing actions;
- Acquire and maintain required certifications and manage performance evaluation tests.

1.2.5 Field Manager

The Field Managers are responsible for implementing the SAP. The Field Managers' responsibilities include:

- Overseeing field equipment calibration, sample collection teams, field documentation, submission of samples to laboratories, and preparation of a summary report;
- Leading and coordinating the day-to-day activities of the various sample teams under their supervision;
- Implementing QC for technical data provided by the field staff including field measurement data;
- Schedule compliance, and adherence to management-developed study requirements;
- Identifying problems at the field team level, resolving difficulties in consultation with the SAM, implementing and documenting corrective action procedures, and provision of communication between team and upper management.

1.2.6 Sample/Technical Manager

The Sample/Technical Manager will be responsible for all sample collection and processing to the project organization in accordance with the QAPP. These tasks include:

- Development of the laboratory SOW;
- Procurement of laboratory services;
- Daily communication with the laboratory;
- Process samples for laboratory submittal;
- Address any chain-of-custody discrepancies or laboratory QA/QC anomalies, and;
- Logistically support Operations in the collection of samples.

1.2.7 Laboratory

Samples for laboratory analysis will be shipped to off-site laboratories. A summary of methods are listed in the table below. Detailed analytical methods, accuracy, precision limits, and reporting limits are provided in Table 1-21.

Analytical Laboratory Methods

Parameter	Method
Volatile Organic Compounds (VOCs)	EPA 8260B
Semi-volatile Organic Compounds (SVOCs)	EPA 8270A
Diesel Range Organics/Oil Range Organics (DRO/ORO)	EPA 8015B
Gas Range Organics (GRO)	EPA 8015B
Polychlorinated biphenyls (PCBs)	EPA 8082
Metals (Target Analyte List [TAL])	EPA 6010
Mercury	EPA 7470
Toxicity Characteristic Leaching Procedure (TCLP) Metals	SW 6020A
Flashpoint (P-M closed cup)	ASTM D93
pH	EPA 9040C
Turbidity	EPA 180.1
Conductivity	SM 2510
Dissolved Oxygen (DO)	ASTM D1498
Oxidation Reduction Potential (ORP)	ASTM D888
Paint Filter	EPA 9056

The laboratories to be used for the specific matrices are:

Drinking Water / Potable Wells
Merit Laboratories, Inc. - (EPA - Safe Drinking Water Methods)
2680 East Lansing Drive
East Lansing, MI 48823
Cell: 517-202-1340
Maya Murshak

Surface Water, Sediment, and Soil
TestAmerica, Inc. - (SW-846 Methods)
2417 Bond Street
University Park, IL 60484
708-534-5200

ALS | Environmental - (SW-846 Methods)
3352 128th Avenue
Holland. MI 49424
DIRECT PHONE 616-738-7346
OFFICE PHONE 616-399-6070 Ext. 525
MOBILE 616-218-5574
FAX 616-399-6185
www.alsglobal.com

New Age/Landmark, Inc. - (SW-846 Methods)
160 Veterans Blvd.
South Haven, Michigan 49090
Phone: (888) 685-1628
Fax: (269) 637-5664

Product Fingerprinting - (SW-846 Methods)
Pace Analytical Services, Inc.
7726 Moller Road
Indianapolis, IN 46268
Phone:317-875-5894
Karl Anderson

1.2.8 Data Manager

The Data Manager is responsible for all data reporting, quality checking and reporting to the project organization in accordance with the QAPP. These tasks include:

- Receiving analytical data; checking for completeness, and making sure that appropriate QA checks have been performed;
- Entering and maintenance of sample location data;
- Entering data into databases, including US.EPA's SCRIBE system;
- Maintenance of appropriate security measures to ensure data integrity.

1.2.9 Third Party Data Validator

The Third Party Data Validator is independent from the collection of samples and will be an entity not otherwise involved with the project. The Third Party Data Validator for this project will be:

Address:
eData Pro
6004 Perkins Road
Suite A-1
Baton Rouge, LA 70808
Attn: Dana Hebert

All laboratory data will be furnished with a Level II data package, which will be validated by a Third Party Data Validator. The laboratory will be instructed to have available upon request all of the data required to furnish a Level IV data packages upon request. The SAM will select 10% of the data from each matrix and request Level IV data packages from the laboratory. Full data validation of these Level IV data packages will be conducted following the U.S.EPA National Functional Guidelines for Inorganic and Organic Data Review (U.S. EPA 2008/2010) (NFG). If systematic issues or problems are identified during the data validation process, additional Level IV data packages may be requested for review and validation. The Third Party Data Validator will communicate data issues and final validation reports to the QA Officer for evaluation of any potential corrective actions and for final reporting.

1.3 Problem Definition/Background Information

1.3.1 Overall Project Objectives

On July, 26, 2010, approximately 19,500 barrels of crude oil was released from a ruptured pipeline near Marshall, MI. The crude oil flowed from the rupture site into Talmadge Creek and subsequently into the Kalamazoo River. Emergency response activities contained the release in Morrow Lake, approximately 37 river miles downstream. The primary response objective is the removal of visible oil and/or sheen that is either currently affecting navigable waterways and/or poses the threat of release of a visible oil and/or sheen discharge to navigable waterways.

The response consists of: (1) removal of free phase crude oil and sheen from the water way via containment and collection points; and (2) removal of heavily impacted crude oil media (soil and/or vegetation) from the leak area and downstream impacted areas. Waste generated during the response

will disposed of in accordance with the incident Waste Treatment, Transportation and Disposal Plan (August 8, 2010) .

Post response activities will be coordinated with the Michigan Department of Natural Resources and Environment (MDNRE) consistent with Part 201 (Environmental Remediation) of the Natural Resources and Environmental Protection Act (1994 PA 451, as amended and in consultation with other agencies with jurisdiction over future remedial actions.

As the response action progresses there may be the need to adapt sampling and analytical strategies to changing conditions and perhaps longer term remedial objectives. It is understood that the FOSC Structure will provide sufficient technical staff to facilitate supplementing or changing parts of the response plan and strategies as such situations arise, and will work with The Company to review and approve alterations.

1.3.2 Site / Facility Description

The impacted area encompasses an upland, wetland, flood plain, creek, and river areas along an approximate 37-mile reach from the leak site near Marshall, Michigan to downstream on the Kalamazoo River which is located in Calhoun and Kalamazoo Counties of Michigan.

The Source Area is comprised of an approximate 5-acre parcel adjacent to the pipeline release location (Spill Release Area) and the portion of the Talmadge Creek extending from the release site to the confluence with the Kalamazoo River (the Creek). Most of the Spill Release Area is within a wetland between the release site and Talmadge Creek. The surrounding area can be characterized as rural, including undeveloped and agricultural areas. Vegetation in the Source Area consists of herbaceous emergent wetland plants in low lying areas, as well as brush and trees in upland areas.

The Downstream Impacted Areas include the Kalamazoo River downstream of the confluence of Talmadge Creek and all subsequent downstream areas adjacent to the shoreline. This includes the river banks, islands and other natural features, wetlands and floodplains, and man-made structures. Response actions for these areas will be made in accordance with recommendations by the Shoreline Cleanup Assessment Technique (SCAT) Team.

The Talmadge Creek streambed consists primarily of rock and granular material. To date, no oil impacts (i.e., dense non-aqueous phase liquids (DNAPLs)) have been observed within this creek bed. During these Source Area interim response activities, a visual inspection of the streambed will be

completed to inspect for the presence of oil/DNAPL. Given the age and conditions associated with the release, a DNAPL component is not anticipated to exist. However, this will be further evaluated as part of the long-term remedial actions for the site. As part on the RPDIA, submitted under a separate cover, the potential for DNAPL impacts associated with the release will be evaluated with respect to product that may have sunk to the river bottom of the Kalamazoo River or Morrow Lake.

To date, the Company has collected the following types of discrete samples in the appropriate sample containers:

- Crude oil;
- Sediment;
- Soil;
- Groundwater (potable and basement wall seep);
- Surface water;
- Air; and,
- Waste characterization

1.4 Project Description and Schedule

1.4.1 Project Description

The project will be performed in phases. Work at various areas and reaches will progress at different rates and therefore different phases will be occurring concurrently.

The initial response phase is to remove free product from the water and provide immediate protection to humans and the environment by providing emergency wildlife rescue and alternate water sources as appropriate. The initial removal work will be guided by visual identification of impacted materials, and assessments generated by the Shoreline Cleanup Assessment Technique (SCAT) Team. The SCAT Process is described in detail in the Response Plan for Downstream Impacted Areas (RPDIA) submitted August 12, 2010 under a separate cover.

The second response phase of work will comprise removal of grossly impacted media and isolated areas of remaining product along the banks and on land. The primary objective is the removal and/or abatement of visible oil and/or sheen that is either currently affecting navigable waterways and/or

poses the threat of release of a visible oil and/or sheen discharge to navigable waterways. This action will be guided by a visual observation. Water samples will be collected from water supply wells to evaluate any impact to potable water supplies. Water samples will be analyzed in a fixed-based, laboratory(s) that are certified by the National Environmental Laboratory Accreditation Conference (NELAC). This data will be used as a screen tool for the local Health Department to determine whether the water is suitable for consumption.

Sediment samples will be collected to determine if free phase product has impacted sediments.

Wastewater, excavated soil, debris and other waste will be sampled to determine proper disposal characterization.

1.4.2 Project Schedule

Field work has commenced. Activities have been concentrated on free oil and visually impacted soil and sediment removal and preliminary sampling of surface water. Removal activities are conducted around the clock. Sampling is conducted in daylight hours. Removal of impacted soil is underway. Field and laboratory services are being performed on an on-going basis.

1.5 Quality Assurance Objectives for Measurement of Data

The overall quality assurance objectives are to develop and implement procedures for field sampling, chain of custody, laboratory analysis, and reporting that will provide the level of data required for determining the characteristics of the various environmental media. Specific procedures for sampling, chain-of-custody, laboratory instruments calibration, laboratory analysis, reporting of data, internal quality control, audits, preventive maintenance of field equipment, and corrective action are described in other sections of this QAPP. The purpose of this section is to address the specific objectives for accuracy, precision, completeness, representativeness, and comparability. The fundamental QA objective with respect to accuracy, precision, and sensitivity of laboratory analytical data is to achieve the QC acceptance criteria of the analytical protocols and thereby meeting the project objectives.

1.5.1.1.1 Analytical Data

Some sampling will be for screening purposes. Screening-level data will be produced by using portable equipment and field laboratory analyses. QA activities for the screening will be limited to calibration and periodic checks of the instrumentation, as well as chain-of-custody documentation.

Table 1-1 presents a comprehensive overview of the level of quality control effort for on-going investigative and monitoring samples will require. All analytical data will meet the requirements of these sections (including mobile laboratory).

The following subsection summarizes the precision, accuracy, completeness, representativeness, comparability and sensitivity to be used for all sample analyses.

1.5.2 Precision

1.5.2.1 Definition

Precision is a measure of the degree to which two or more measurements are in agreement.

1.5.2.2 Field Precision Objectives

Field precision is assessed through the collection and measurement of field duplicates and QA splits (split sample volume submitted to the laboratory for matrix spikes and matrix spike duplicates (MS/MSD). Field duplicates samples will be collected at an approximate rate of one duplicate per 20 analytical samples collected and QA split sample per method/per matrix or as defined by the approved analytical method.

1.5.2.3 Laboratory Precision Objectives

Precision in the laboratory is assessed through analysis of a laboratory control sample/laboratory control sample duplicate (LCS/LCSD); MS/MSDs and field duplicate pairs and the evaluation of the relative percent differences (RPD) between duplicate pairs. The equations for RPDs can be found in Section 3 of this QAPP. Precision control limits for chemical data are provided in Tables 1-2 through 1-6.

1.5.3 Accuracy

1.5.3.1 Definition

Accuracy is the degree of agreement between an observed value and an accepted reference or true value.

1.5.3.2 Field Accuracy Objectives

Accuracy in the field is assessed through the use of trip and field blanks to assess the potential of cross contamination. Every cooler with aqueous volatile organic compound (VOC) samples will

contain a trip blank sample. In addition, field accuracy is assessed by the adherence to all sample handling, preservation, and holding time criteria.

1.5.3.3 Laboratory Accuracy Objectives

Laboratory accuracy is assessed through the analysis of MS/MSD, LCS, surrogate compounds, or equivalent and the determination of percent recoveries. The equation to be used for accuracy in this project can be found in **Section 3** of this QAPP. Accuracy control limits are given in Tables 1-2 through 1-14.

1.5.4 Completeness

1.5.4.1 Definition

Completeness is a measure of the amount of valid data obtained from a measurement system compared to the amount that expected under normal conditions.

1.5.4.2 Field Completeness Objectives

Field completeness is a measure of the amount of valid measurements obtained from all the measurements taken in the project. The equation for completeness is presented in **Section 3** of this QAPP. The field completeness goal for this project is greater than 95 percent.

1.5.4.3 Laboratory Completeness Objectives

Laboratory completeness is a measure of the amount of valid measurements obtained from all the measurements taken in the project. The equation for completeness is presented in **Section 3** of this QAPP. The laboratory completeness objective for this project, with respect to parameters identified in Table 1-15 of this QAPP, is 95 percent or greater.

1.5.5 Representativeness

1.5.5.1 Definition

Representativeness expresses the degree to which data accurately and precisely represent a characteristic of a population, parameter variations at a sampling point, a process condition, or an environmental condition within a defined spatial and/or temporal boundary.

1.5.5.2 Measures to Ensure Representativeness of Field Data

Representativeness is dependent upon the proper design of the sampling program and will be satisfied by ensuring that the sampling and analysis protocols contained in the Work Plans and this QAPP are followed. These will include the analysis of trip blank and field blank data as well as calibration and documentation review of field instruments.

1.5.5.3 Measures to Ensure Representativeness of Laboratory Data

Laboratory representativeness is ensured by using the proper analytical procedures, appropriate methods, meeting sample holding times and analyzing and assessing field duplicate samples. The sampling network was designed to provide data representative of facility conditions.

1.5.6 Comparability

1.5.6.1 Definition

Comparability is an expression of the confidence with which one data set can be compared to another.

1.5.6.2 Measures to Ensure Comparability of Field Data

Comparability is dependent upon the proper design of the sampling program and will be satisfied by ensuring that proper sampling techniques are used.

1.5.6.3 Measures to Ensure Comparability of Laboratory Data

Analytical data will be comparable when similar sampling and analytical methods are used as documented in the QAPP. Comparability is also dependent on similar QA objectives and will be measured through QA split samples.

1.5.7 Sensitivity

1.5.7.1 Definition

Sensitivity is defined as the capability of a method or instrument to discriminate between measurement responses representing different levels of a variable of interest. Method detection limit (MDL) is defined as the minimum concentration of a substance that can be identified, measured, and reported with a 99 percent confidence that the analyte concentration is greater than zero and is determined from repeated analysis of a sample in a given matrix containing the analyte. Laboratory

MDLs have been determined as required in Title 40 of the Code of Federal Regulation (CFR) Part 136B. The reporting limit (RL) is greater than or equal to the lowest standard used to establish the calibration curve. The RLs for this investigation are generally at least 3 times greater than the MDL. Results greater than the MDL and less than the RL will be qualified estimated (J) by the laboratory. The laboratory MDLs, RLs and project sensitivity goals are identified in Tables 1-16 through 1-18 and 1-21.

Due to the difficult nature of VOC and SVOC analysis in oil matrices, the laboratory reporting limits and accuracy and precision limits cannot be pre-determined due to the necessity for sample dilution in the oil matrix. However, Table 1-21 includes the typical laboratory reporting limits for analysis of oil for VOC, SVOC, PAH, PCB and metals, respectively. The laboratory typically reports the smallest dilution possible and the actual reporting limits will be adjusted accordingly.

1.6 Special Training Requirements and Certification

1.6.1 Training

The field sampling will consist of soil, groundwater, surface water, and sediment sampling. Associated activities include sampling and soil removal location documentation. Personnel completing these activities have sufficient knowledge and on-the-job training to follow the procedures required for the activities listed above. Field personnel have completed the Occupational Safety and Health Administration (OSHA)-approved basic 40-hour health and safety training Hazardous Waste Operations and Emergency Response (HAZWOPER) course and annual refreshers of the same. The Field Manager will have OSHA approved 8-hour site supervisor training. Personnel training requirements and record retention requirements are included in the HSP; sample collection techniques are included in the SAP. Laboratory requirements for laboratory analysts are listed in the Quality Systems Manual (QSM) and the laboratory has self-declared compliance with the QSM.

Surveyors shall work under the purview of a professional surveyor, who shall be licensed in the State of Michigan.

1.6.2 Certification

Regarding off-site SW-846 contract laboratory analyses, the laboratory must have current National Environmental Laboratory Accreditation Conference (NELAC) certification. Off-site Safe Drinking

Water Act (SDWA) contract laboratory analyses must have current State of Michigan certification. The proposed laboratories performing the respective analytical methods were verified for certification on August 12, 2010. No additional certifications are required for this investigation.

1.7 Documents and Records

1.7.1 Data Reporting Format and Content

The hard copy and electronic copy of the laboratory data will be reported following the format identified below. For this project, a QC summary package and raw data package will be required. Hard copy reports will be submitted to the Sample Technical Manager. The chemical data will also be submitted electronically to the QA Officer for verification, and the third party validator for validation as required. The contents of the QC summary package include:

- Cover sheet;
- Laboratory case narrative;
- Cooler receipt forms;
- COC copy;
- Analytical results;
- Surrogate summary forms;
- Blank summary forms;
- Laboratory control sample summary forms; and
- Matrix spike/matrix spike duplicate/laboratory duplicates summary forms.

The raw data package will consist of the elements presented in the QC summary package but will additionally include the raw data. The raw data includes chromatograms, mass spectra, manual integration correction data, quantitation reports, calibration data, preparation logs, and analytical logs. The raw data package will be similar in content to the Contract Laboratory Program (CLP) Level III or Level IV data package where applicable. Confirmatory samples may have higher levels of quality control documentation, as appropriate. All chemical data will also be submitted in electronic format.

1.7.2 Records Disposition

All project files and records will be stored on site until the Final Report has been approved by USEPA. The project files will be moved to an off-site storage facility and retained as required by applicable record retention requirements. Project information can be attained through a written request to the EUL. The requested information should be available within 7 working days.

1.7.3 Use of Historic Data

Only visual extent of the release was used to determine potential areas of concern. No historic data was available.

2.0 Sampling Process Design

2.1.1 Sampling Procedures and Methods

The sampling procedures to be used during the field activities will be consistent for the objectives of this project. Initial soil sampling will be limited to near-surface grab sampling. Post-removal sampling may include sampling at depth in special circumstances. Water sampling will be limited to grab samples for surface and water supply wells. The Standard Operating Procedures (SOPs) are presented as Appendix A of the SAP. Sample containers, preservatives, and holding time requirements for each parameter and matrix are presented in Table 2-1.

2.1.2 Location and Quantity Measurements

The location of sampling points, as well as the impacted soils and sediment removal locations will be surveyed and recorded to an established coordinate system, either latitude and longitude or UTM coordinates. Depths of removal can be recorded based on sidewall depth measurements. Preliminary sampling locations used for screening and planning purposes will be measured using global positioning system (GPS) equipment with a real-time horizontal accuracy of less than one meter. When necessary, the screening data collected by the GPS receiver can be further processed to obtain coordinate locations that are accurate to within 30 centimeters. Final, confirmatory samples will be surveyed to within one foot horizontal and one inch vertical accuracy, traceable to an established system such as USGS datum. Soil quantities disposed of will be traceable to US standards weights and measures using calibrated scales.

2.1.3 Custody Procedures

Custody is one of several factors that are necessary for the admissibility of environmental data as evidence in a court of law. Custody procedures help to satisfy the two major requirements for admissibility: relevance and authenticity. Sample custody is addressed in three parts: field sample collection, laboratory analysis, and final evidence files. Final evidence files, including originals of all laboratory reports and purge files, are maintained under document control in a secure area.

A sample or evidence file is under your custody if:

- The item is in actual possession of a person;
- The item is in the view of the person after being in actual possession of the person;

- The item was in actual physical possession but is locked up to prevent tampering; or
- The item is in a designated and identified secure area.

2.1.3.1 Field Custody and Documentation Procedures

Field Logbook

Field logbooks will provide the means of recording data collecting activities performed during the investigation. As such, entries will be described in as much detail as possible so that a person could reconstruct a particular situation without reliance on memory.

Field logbooks will be bound field survey books or notebooks. A project-specific document number will identify each logbook. The Field Manager will be responsible for assigning and tracking the numbers, as well as collecting and filing the completed books.

The title page of each logbook will contain the following:

- Person to whom the log book is assigned;
- Log book number;
- Project name;
- Project start date; and
- Estimated project end date.

Entries into the logbook will contain a variety of information. At the beginning of each entry, the date, start time, weather, names of all sampling team members present, level of personal protection equipment being used, and the signature of the person making the entry will be entered. The names of visitors to the site, field sampling or investigation team personnel, and the purpose of their visit will also be recorded in the field logbook.

Measurements made and samples collected will be recorded. All entries will be made in permanent ink, signed, and dated. If an incorrect entry is made, the information will be crossed out with a single strike mark that is signed and dated by the sampler. Whenever a sample is collected or a measurement is made, a detailed description of the location, which may include compass and distance measurements or latitude and longitude information (e.g., obtained by using a global positioning system) will be recorded. The number of the photographs taken, if any, will also be

noted. All equipment used to make measurements will be identified, along with the date of calibration.

Chain-of-Custody (COC)

The purpose of the COC procedure is to prevent misidentification of samples, prevent tampering of the samples during shipment and storage, allow easy identification of tampering, and allow for easy tracking of possession. If the COC is broken at any time from sample collection through sample analysis, the QA Officer will be notified. The QA Officer is responsible for implementing corrective action and responsible for ensuring that all necessary documentation is completed.

If an incorrect entry is made on the COC, the incorrect information will be crossed out with a single strike mark, and the change initialed and dated by the person making the COC change. A copy will be kept by the sampling team and will be included in the field activity documentation file.

The laboratory will compare the samples entered on the COC forms with the sample containers received by the laboratory. If the laboratory finds any discrepancies, the laboratory will contact the Project Chemist for resolution. The COC forms will be the primary source of information for the laboratory to enter data into the laboratory's sample tracking system. Sample coolers packaging is an integral part of field activities. Procedures for proper sample packaging will be followed as identified SAP.

When samples leave the sampler's immediate control (e.g., shipment to laboratory), custody seals will be placed on both the front and back of the shipping container. The custody seals will bear the collector's name and the date signed. The sample custody seal is used to ensure that the samples in the shipping container have not been tampered with, therefore ensuring sample integrity. At the beginning of the project, an example cooler custody seal will be sent to the laboratory so the laboratory has the signatures of the samplers on file.

Sample Collection Field Sheets

To supplement the information recorded in the field logbook, sample collection field sheets (SCFS) will also be completed for each soil sampling location. The SCFS will include the sample data as well as a sketch of the sampling location and coordinates of the location. The photograph of the location will be attached to the sheet, with a description of the direction of the photograph. The SCFS will be crosschecked for completeness and accuracy by the field area coordinator or his designee and

turned in to the Area Coordinator at the end of each day. The SCFS will be signed and dated by the sampler making entries on the SCFS.

Field Custody Procedures

Samples will be collected following the procedures presented in the SAP. The equipment used to collect samples will be noted, along with the time of sampling, sample description, depth at which the sample was collected, volume, and number of containers in the field logbook. Sample identification numbers will be assigned prior to sample collection. Field duplicate samples, which will receive a unique sample identification number, will be noted in the field logbook and on the SCFS.

The sample packaging and shipment procedures summarized below will be followed to ensure that the samples will arrive at the laboratory with the COC intact. The protocol for specific sample numbering and other sample designations are included in Section 5.1 of the SAP.

- The Field Area Coordinators are personally responsible for the care and custody of the samples until they are relinquished or properly dispatched. Field procedures have been designed such that as few individuals as possible will handle the samples.
- All bottles will be identified by the use of sample labels with sample numbers, sampling locations, date/time of collection, and type of analysis. The sample numbering system is presented in SAP.
- Sample labels will be completed for each sample using waterproof ink unless prohibited by weather conditions. For example, a logbook notation would explain that a pencil was used to fill out the sample tag because the ballpoint pen would not function in freezing weather. Sample labels will be affixed to the sample containers using clear tape.
- A properly completed COC form will accompany samples. The sample numbers and locations will be listed on the chain-of-custody form. When transferring the possession of samples, the individuals relinquishing and receiving will sign, date, and note the time on the record. This record documents transfer of custody of samples from the sampler to another person, to the permanent laboratory, or to/from a secure storage area.
- Samples will be properly packaged on ice at 4 degree Celsius (°C) ± 2oC for shipment and dispatched to the appropriate laboratory for analysis, with a separate signed custody record enclosed in and secured to the inside top of each sample box or cooler. Shipping containers

will be closed and secured with strapping tape and custody seals for shipment to the laboratory. The custody seals will be attached to the front right and back left of the cooler and covered with clear plastic tape after being signed by the field team leader. The cooler will be secured with strapping tape in at least two locations.

2.1.3.2 Laboratory Custody Procedures

Laboratory custody procedures for sample receiving and login, sample storage and numbering, tracking during sample preparation and analysis, and storage of data are described in the laboratory Quality Programs.

2.1.3.3 Final Evidence File

The final evidence file will be the central repository for all documents, which constitute evidence relevant to sampling and analysis activities as described in this QAPP. The Company's Command Center Environmental Office is the custodian of the evidence file and maintains the contents of evidence files for the investigation, including all relevant records, reports, logs, field notebooks, pictures, subcontractor reports, and data reviews in a secured, limited-access area and under custody of the EUL.

The final evidence file will include at a minimum:

- Field logbooks;
- Field data and data deliverables;
- Photographs;
- Drawings;
- Soil boring logs;
- Laboratory data deliverables
- Data review/validation reports;
- Data assessment reports;
- Progress reports, QA reports, interim project reports, etc.; and
- All custody documentation (tags, forms, air bills, etc.).

2.2 Analytical Methods

Analytical methods have been selected to provide adequate detection limits for compounds of interest, and for the final intended data usage. A list of anticipated laboratory methods and their corresponding detection limits can be found in the SAP. All solid sample results will be provided on a dry weight basis as the methodology specifies. Laboratory SOPs are based on an analytical method published by the U.S. EPA, Standard Methods or other recognized sources as available.

2.2.1 Field Analytical Procedures

If called for in the SAP, field analytical measurements for aqueous and soil samples and their respective field instrument are listed in the following table. Analytical procedures for field analyses are presented in the respective SAP.

Field Measurement	Field Instrument
Specific Conductance (surface water)	YSI ProPlus or 556 Plus or equivalent
Dissolved Oxygen	YSI ProPlus or 556 Plus or equivalent
pH (surface water)	YSI ProPlus or 556 Plus or equivalent
Temperature, Turbidity (surface water)	YSI ProPlus or 556 Plus or equivalent
Headspace (soil, sediment)	MiniRae 2000 Photoionization Detector or equivalent

2.2.2 Laboratory Analytical Procedures

The contract laboratories will implement the project-required SOPs. These laboratory SOPs for sample preparation, cleanup, and analysis are based on USEPA Test Method for Evaluating Solid Waste, Physical/Chemical Methods, Final Update IIIB, June 2005 or consistent with all method requirements under the Safe Drinking Water Act (SWDA) and other applicable methods. The analytical procedures will follow laboratory in-house limits; as appropriate. The laboratory will report all detections above the MDL. Values above the MDL and below the RL will be qualified as estimated (**J**). MDLs were determined as outlined in 40 CFR, Part 136B. The RLs are typically three to five times the MDL (the MDL should be below half any applicable action level where achievable). Available technology may limit the achievability of this for certain analysts. The laboratory will analyze a RL check sample for each parameter and an MDL check sample for organic parameters. In house limits will be used where no QSM limits exist.

2.2.2.1 Volatile Organic Compounds (VOCs)

VOCs include compounds among varying classes, such as halogenated organics, nonhalogenated organics, and aromatic organics. The first two classes include compounds associated with fuels, such as benzene, ethylbenzene, toluene, and xylenes. Samples (except potable water) requiring VOC analysis will be prepared using USEPA SW-846 Methods 5035 (soil/sediment) and analyzed using USEPA SW-846 Method 8260. USEPA SW-846 Method 8260 utilizes gas chromatography/mass spectrometry (GC/MS) for separation and detection, respectively. Potable water samples will be analyzed consistent with all analytical method requirements under SDWA for VOC, SVOC, PCB and Metals. The power of GC/MS lies in the capacity for positive identification of relatively low detection limits.

2.2.2.2 Semivolatile Organic Compounds (SVOCs)

USEPA SW-846 Method 8270C is a GC/MS method for determining semivolatile organic compounds (SVOCs). The target analytes, MDLs and laboratory RLs are presented in Table 1-10 (soil/sediment).

2.2.2.3 Polynuclear Aromatic Hydrocarbons (PAHs)

USEPA SW-846 Method 8270 is a GC/MS method for determining polynuclear aromatic hydrocarbons (PAHs). The target analytes, MDLs and laboratory RLs are presented in Table 1-16 (soil/sediment).

2.2.2.4 Gasoline Range Organics, Diesel Range Organics and Oil Range Organics GRO/DRO/ORO

DRO, GRO and ORO testing will be used for screening and assessment of aesthetic qualities. The work will be done by both the field laboratory and ALS. The analyses will be performed as specified in Table 1-21.

2.2.2.5 Metals

USEPA SW-846 Method 6020/7470/7471A will be used for determining metals concentrations in crude oil and background media. The target analytes, MDLs and laboratory RLs are presented in Table 1-19 (soil/sediment).

2.2.2.6 PCBs

USEPA SW-846 Method 8082 will be used for assessing the presence of contaminants in crude oil and background media. The target analytes, MDLs and laboratory RLs are presented in Table 1-17.

2.2.3 Field Quality Control Checks

The QC criteria for each field measurement are provided in **Section 1** of this QAPP. The collection of field duplicates and quality assurance duplicates for laboratory analysis will make an assessment of field sampling precision and bias. Collection of the samples will be in accordance with the SAP as referenced in **Section 2.1** and will be collected at the frequency indicated in Table 1-1 of this QAPP.

2.2.4 Laboratory Quality Control Checks

ALS has a QC program in place to ensure the reliability and validity of the analysis performed at the laboratory. All analytical procedures are documented in writing as SOPs, and each SOP includes a QC section, which addresses the minimum QC requirements for the procedure. The internal QC checks differ slightly for each individual procedure, but, in general, the QC requirements include the following:

- Method blanks;
- Reagent/preparation/calibration blanks (applicable to inorganic analysis);
- Instrument blanks;
- Initial calibration (ICAL);
- Initial calibration verification (ICV);
- Continuing calibration verification (CCV);
- Method detection limit verification;
- Method reporting limit verification;
- MS/MSDs;
- Surrogate spikes;
- Laboratory duplicates;
- Laboratory control standards;
- Internal standard areas for GC/MS analysis; and
- Mass tuning for GC/MS analysis.

All data obtained will be properly recorded. The data package will include a full deliverable package capable of allowing the recipient to reconstruct QC information and compare it to QC criteria. The laboratory will reanalyze any samples analyzed in nonconformance with the QC criteria, if sufficient volume is available. It is expected that sufficient volumes/weights of samples will be collected to allow for reanalysis when necessary. Data packages will be available in electronic form.

2.2.5 Level of Quality Control Effort

Method blank, trip blank, rinse blank, field duplicate, laboratory duplicate, laboratory control and matrix spike samples will be analyzed to assess the quality of the data resulting from the field sampling and analytical programs.

- Method blank samples are generated within the laboratory and used to assess contamination resulting from laboratory procedures. A method blank will be analyzed by the laboratory with each analytical batch samples for organic analyses and will be re-analyzed if common laboratory contaminants are detected above the RL or when non-laboratory contaminants are reported >½ the RL. Samples for metals analyses will be re-analyzed if the blank concentration is > than the RL.
- Trip blanks are generated in the laboratory and used to assess contamination resulting from shipping and handling. A trip blank will be included in each shipment of VOC samples.
- Rinse blanks are used to assess decontamination of reusable sampling equipment. Rinse blanks will be taken at a rate of one per day when using sampling equipment that requires decontamination between samples.
- Duplicate samples are analyzed to check for sampling and analytical reproducibility. Field duplicate samples will be collected at an approximate 5 percent frequency. The laboratory will analyze laboratory duplicates with each metals analytical batch.
- MS/MSDs provide information about the effect of the sample matrix on the digestion and measurement methodology. Depending on site-specific circumstances, one MS/MSD will be collected for every 20 or fewer investigative samples of a given matrix. MS/MSD samples are designated/collected for organic analyses only. A MS/MSD will be collected for metals analyses and will also be collected at a frequency of 1 percent or as required by the laboratory.

- LCSs provide information about the accuracy of the analytical system, independent of matrix. LCSs are laboratory-generated sample spikes with target analytes. An LCS is analyzed as part of every analytical batch. Investigative samples and the associated LCS will be re-analyzed if more than 5 percent of the LCS recoveries are less than the lower limit or any one recovery is less than ½ the lower limit.

The general level of the QC effort will be one field duplicate for every 20 investigative samples and one MS/MSD, LCS and blank for every 10 investigative confirmatory samples. A trip blank will be included with each cooler containing VOC samples. The number of field blank and rinse blank samples to be collected is listed in the SAP, and will be dependent upon the whether the sampling equipment t us reused at multiple sampling locations.

In addition to the QC parameters identified above, the laboratory analyzes additional QC samples as part of the analytical method. Table 1-1 summarizes all QC parameters and frequency of analysis.

2.2.6 Level of Quality Assurance Effort

QA samples will be collected at a frequency of 5% and will be analyzed by each respective laboratory.

2.3 Calibration Procedures and Frequency

This section describes the calibration procedures and the frequency at which these procedures will be performed for both field and laboratory instruments.

2.3.1 Field Instrument Calibration

The field instruments will be calibrated as described in the manufacturer's manual and procedures identified in the SAP. In general, instruments will be calibration checked at the beginning of each day and calibrated weekly. For specific instructions on the calibration frequency, the acceptance criteria, and the conditions that will require more frequent calibration, refer to the specific SOPs.

All calibration procedures performed will be documented in the field logbook and will include the date/time of calibration, name of person performing the calibration, reference standard used, temperature at which readings were taken, and the readings. Multiple readings on one sample or standard, as well as readings on replicate samples, will likewise be documented.

2.3.2 Laboratory Instrument Calibration

All laboratory instrumentation will be calibrated in accordance with the respective analytical method. In general, calibration procedures for a specific laboratory instrument will consist of initial calibrations (three or five points), initial calibration verifications, and continuing calibration verification.

The laboratory maintains a sample logbook for each instrument which will contain the following information: instrument identification, serial number, date of calibration, analyst, calibration solutions run, and the samples associated with these calibrations.

2.4 Preventive Maintenance

To ensure that all analytical data generated for this project are reliable, all equipment and instruments will have a prescribed routine maintenance schedule in addition to a calibration schedule. Preventive maintenance will be completed and documented by qualified project personnel.

2.4.1 Field Instrument Preventive Maintenance

The field equipment for this project may include photoionization detectors, flame ionization detectors, and a multiparameter probe for the analysis of pH, temperature and specific conductance. Specific preventative maintenance procedures to be followed for field equipment are based on those recommended by the manufacturer. Field instruments will be calibration checked daily before use and calibrated weekly. Calibration checks will be documented in the field logbook. Critical spare parts, such as tape and batteries, will be kept on site to reduce potential downtime. Backup instruments and equipment will be available within one-day shipment to avoid delays in the field schedule.

2.4.2 Laboratory Instrument Preventive Maintenance

As part of the QA Program Plan, the contract laboratory conducts a routine preventative maintenance program to minimize the occurrence of instrument failure and other system malfunctions. Designated laboratory employees regularly perform routine scheduled maintenance and repair of (or coordinate with the vendor for the repair of) all instruments. All maintenance that is performed is documented in the laboratory's operating record. All laboratory instruments are maintained in accordance with manufacturer's specifications. The frequency of laboratory preventive maintenance is identified in the laboratory Quality Programs.

2.4.3 Inspection/Acceptance Requirements for Supplies and Consumables

The Field Manager are responsible for ensuring that all consumable materials and ancillary sampling equipment is adequate for its intended use, compatible with other equipment, and free of defects. An inspection of all field supplies should be done and recorded in the logbook. The table below summarizes the supply and consumables inspection and acceptance requirements.

Supply Name	Inspection/ Testing Requirements	Acceptance Criteria	Testing Method	Frequency of Testing	Responsible Individual	Expiration Date	Handling / Storage Requirements
Preserved sample containers	Certified as pre-cleaned by supplier and containing appropriate preservative	Certified as pre-cleaned by laboratory	Review of documentation and visual inspection	Upon receipt	Field	3 months	Store in dry and secure location
Unpreserved sample containers	Certified as pre-cleaned by supplier	Certified as pre-cleaned by laboratory	Review of documentation and visual inspection	Upon receipt	Area Field Coordinators	None	Store in dry and secure location

3.0 Assessment and Oversight

A field audit may be conducted to verify that sampling is performed in accordance with the procedures established in the SAP and QAPP. A performance and system audit of the laboratory may be conducted to verify analyses are completed as identified in the SOPs. The audits of field and laboratory activities include two independent parts: internal and external audits.

3.1 Field Performance and System Audits

3.1.1 Internal Field Audits

3.1.1.1 Internal Field Audit Responsibilities

Internal audits of field activities, including sampling and field measurements, can be conducted prior to, at the start of, or at any time during field sampling activities by the QA Officer or designee. These audits will verify that all established procedures are being followed. The audit will be completed at the beginning of the project and will include a review of all field activities completed at that time.

3.1.1.2 Internal Field Audit Frequency

Internal field audits will be conducted at least once at the beginning of the site sample collection activities. If warranted, additional field audits may be completed.

3.1.1.3 Internal Field Audit Procedures

The audits will include examination of field sampling records; field screening analytical results; field instrument operating records; sample collection, handling, and packaging in compliance with the established procedures; maintenance of QA procedures; chain-of-custody; etc. Follow-up audits may be required to correct deficiencies and to verify that QA procedures are maintained throughout the investigation. The audits will involve review of field measurement records, instrumentation calibration records, and sample documentation. The QA Officer will issue an audit report to the EUL. Nonconformances will be addressed and resolved by the EUL

3.1.2 External Field Audits

3.1.2.1 External Field Audit Responsibilities

If performed, external field audits may be conducted prior to, at the start of, or at any time during field sampling activities.

3.1.2.2 External Field Audit Frequency

External field audits may be conducted any time during the field operations. These audits may or may not be announced.

3.1.2.3 External Field Audit Procedures

External field audits will be conducted according to the field activity information presented in the procedures in the SAP. The external field audit process can include (but not be limited to): sampling equipment decontamination procedures, sample bottle preparation procedures, sampling procedures, examination of field sampling and safety plans, sample vessel cleanliness and QA procedures, procedures for verification of field duplicates, sample preservation and preparation for shipment, as well as field screening practices. The QA Officer will issue an audit report to the EUL. Non-conformances will be addressed and resolved by the EUL.

3.2 Performance and System Audits

Performance and system audits may be conducted to verify documentation and implementation of the QA program, assess the effectiveness of the work plan, identify any non-conformances, and verify corrective action of identified deficiencies. Repeated failure or gross irregularities in field duplicate, QA split, and calibration or quality control samples may warrant the need for an audit.

3.2.1 Performance Audits

Performance audits of the laboratories participating in the project are performed in accordance with the procedures and frequencies established for SW-846 and SDWA methodologies.

The QA Officer will evaluate the need for additional performance audits with due consideration given to the recommendations of the EUL. Performance audits are used to quantitatively assess the accuracy of measurement data through the use of performance evaluation and blind check samples. The performance audit, if needed, will be performed by the QA Officer or his/her designee in accordance with documented procedures.

3.2.2 System Audits

The QA Officer may conduct a system audit of the fieldwork performance. The Field Manager is responsible for supervising and checking that samples are collected and handled in accordance with the approved project plans and that documentation of work is adequate and complete. The EUL- is responsible for overseeing that the project field team follows the field procedures set forth in the SAP. Reports and technical correspondence will be peer reviewed by an assigned qualified individual, otherwise external to the project, before being finalized.

3.2.3 Audit Records

If an audit is completed, the original records generated for all audits will be retained within the central project files. Records will include audit reports, written replies, the record of completion of corrective actions, and documents associated with the conduct of audits, which support audit findings and corrective actions as appropriate.

3.3 Laboratory Performance and Systems Audits

3.3.1 Internal Laboratory Audits

3.3.1.1 Internal Laboratory Audit Responsibilities

If performed during this project, the QA Officer will conduct the internal laboratory audit prior to, at the start of, or at any time during field sampling activities.

3.3.1.2 Internal Laboratory Audit Frequency

The internal system audits will be done on an annual basis, while the internal performance audits will be conducted on a quarterly basis.

3.3.1.3 Internal Laboratory Audit Procedures

The internal system audits will include an examination of laboratory documentation on sample receiving, sample log-in, sample storage, COC procedures, sample preparation and analysis, instrument operating records, etc.

The performance audits, if performed will involve preparing blind QC samples and submitting them, along with project samples, to the laboratory for analysis throughout the project. The QA Officer will evaluate the analytical results of these blind performance samples to ensure the laboratory

maintains acceptable QC performance. If the laboratory fails the QC sample analysis, they will be given another opportunity for blind QC sample analysis. A second failure will be cause for termination of the laboratory from the project.

3.3.2 External Laboratory Audits

3.3.2.1 External Laboratory Audit Responsibilities

An external audit may be conducted, as required, by the QA Officer or designee.

3.3.2.2 External Laboratory Audit Frequency

If performed, the external audit will be conducted prior to, during, or after sampling and analysis activities. These audits may or may not be announced. Repeated failure or gross irregularities in the field duplicate, QA split, and calibration or quality control samples may warrant the need for an audit.

3.3.2.3 Overview of the External Laboratory Audit Process

External audits may include any or all of: review of laboratory analytical procedures, laboratory on-site visits, and/or submission of performance evaluation samples to the laboratory for analysis. Non-conformances will be listed by the QA Officer or designee and a report will be issued to the EUL and the laboratory. The laboratory will be given a week to address the non-conformances to the satisfaction of the QA Officer or designee and the EUL. Failure to resolve any or all audit procedures chosen can lead to laboratory disqualification and the requirement that another suitable laboratory be chosen.

An external on-site review can consist of: sample receipt procedures, custody, and sample security and log in procedures, sample throughput tracking procedure, review of instrument calibration records, instrument logs and statistics (number and type), review of QA procedures, logbooks, sample prep procedures, sample analytical SOP review, instrument (normal or extends quantitation report) reviews, personnel interviews, review of deadlines and glassware prep, and a close out to offer potential corrective action.

It is common practice when conducting an external laboratory audit to review one or more data packages from sample lots recently analyzed by the laboratory. This review will most likely include, but not be limited to, the following:

- Comparison of resulting data to the SOP or method, including coding for deviations;
- Verification of initial and continuing calibrations within control limits;
- Verification of surrogate recoveries and instrument timing results, where applicable;
- Review of extended quantitation reports for comparisons of library spectra to instrument spectra, where applicable;
- Recoveries on control standard runs;
- Review of run logs with run times, ensuring proper order of runs;
- Review of spike recoveries/QC sample data;
- Review of suspected manually integrated GC data and its cause (where applicable);
- Review of GC peak resolution for isolated compounds as compared to reference spectra (where applicable); and
- Assurance that samples are run within holding times.

An external audit may initiate within the laboratory to review procedures and verify the list above. Data packages may be requested either in hard copy or electronic form to be reviewed on or off the laboratory premises.

3.4 Specific Routine Procedures Used to Evaluate Data Precision, Accuracy, and Completeness

The purpose for this investigation falls in line with the data quality objectives (DQOs) for the site. Factors considered in this assessment include, but are not limited to:

- Evaluation of site conditions and potential receptors;
- Evaluation of contaminants known and/or suspected to be of concern at the site, as they relate to the data quality level parameters chosen; and
- The choice of analytical and sample preparation methods for contaminants of concern whose method reportable limits will meet or exceed the data quality level concentrations for those contaminants.

Analytical data quality will be assessed based on these chosen goals and objectives to determine if the objectives have been met. In addition, the data will be reviewed for indications of interferences to results caused by sample matrices, cross contamination during sampling, cross contamination in the laboratory, and sample preservation and storage anomalies (i.e., samples holding time or analytical instrument problems).

3.4.1 Accuracy Assessment

In order to assure the accuracy of the analytical procedures, an environmental sample will be spiked with a known amount of the analytes included in Tables 1-2 through 1-6. At a minimum, one sample spike should be included in every set of 20 samples tested on each instrument, for each sample matrix to be tested (i.e., groundwater and soil). The increase in concentration of the analyte observed in the spiked sample, due to the addition of a known quantity of the analyte, compared to the reported value of the same analyte in the parent sample determines the percent recovery.

Accuracy is similarly assessed by determining percent recoveries for surrogate compounds added to each field and QC sample to be analyzed for organic analyses. Accuracy for metals analysis will also be further assessed through determination of percent recoveries for laboratory control samples (as well as MS samples).

Percent recovery for MS/MSD results is determined according to the following equation:

$$\%R = \left(\frac{\text{Amount in Spiked Sample - Amount in Parent Sample}}{\textit{Amount of Spike Added}} \right) * 100$$

Percent recovery for LCS and surrogate compound results is determined according to the following equation:

$$\%R = \left(\frac{\textit{Amount Found in Spiked Sample}}{\textit{Amount of Spike Added}} \right) * 100$$

3.4.2 Precision Assessment

The RPD between the spike and matrix spike, or matrix spike and sample duplicate in the case of metals, and field duplicate pair or laboratory duplicate pair is calculated to compare to precision DQOs and plotted. The RPD is calculated according to the following formula.

$$RPD = \left[\frac{|\ Amount\ in\ Sample\ 1 - Amount\ in\ Sample\ 2\ |}{\frac{Amount\ in\ Sample\ 1 + Amount\ in\ Sample\ 2}{2}} \right] * 100$$

The RPDs for the parameters to be analyzed are shown in Tables 1-2 through 1-13.

3.4.3 Completeness Assessment

Completeness is the ratio of the number of valid sample results to the total number of samples analyzed with a specific matrix and/or analysis. Following completion of the analytical testing, the percent completeness will be calculated by the following equation:

$$Completeness = \left(\frac{Number\ of\ Valid\ Measurements}{Total\ Number\ of\ Measurements} \right) * 100$$

3.5 Overall Assessment of Data

The laboratory QC results will be compared to the objectives presented in Tables 1-2 through 1-6 of this QAPP and assess the apparent human and/or ecological risks associated from any contamination found. Only data generated in association with QC results meeting these objectives will be considered usable for decision-making purposes, which is used to evaluate the nature and extent of contamination at the site.

In addition, the data obtained will be both qualitatively and quantitatively assessed on a project-wide, matrix-specific, parameter-specific, and unit-specific basis. The QA Officer will perform this assessment and the results presented and discussed in detail in the final investigation report. Factors to be considered in this assessment of field and laboratory data will include, but not necessarily be limited to, the following.

- Were all samples obtained using the methodologies proposed in the SAP?
- Were all proposed analyses performed according to the SOPs provided in the QAPP?

- Were samples obtained from all proposed sampling locations and depths?
- Do any analytical results exhibit elevated detection limits due to matrix interferences or contaminants present at high concentrations?
- Were any analytes not expected to be present at the facility, or a given unit, identified as target parameters?
- Were all field and laboratory data validated according to the validation protocols, including project-specific QC objectives, proposed in the QAPP?
- Which data sets were found to be unusable (qualified as "R") based on the data validation results?
- Which data sets were found to be usable for limited purposes (qualified as "J") based on the data validation results?
- What effects do qualifiers applied as a result of data validation have on the ability to implement the project decision rules?
- Has sufficient data of appropriate quality been generated to support a human health and/or ecological screening risk assessment?
- Were the human health and/or ecological screening risk assessments conducted properly?
- Can valid conclusions be drawn for all matrices at each unit and/or area under investigation?
- Were all issues requiring corrective action, as presented in the monthly QA Reports to management fully resolved?
- Were the project-specific decision rules used as proposed during the actual investigation?
- For any cases where the proposed procedures and/or requirements have not been met, has the effect of these issues on the project objectives been evaluated?
- Have any remaining data gaps been identified and summarized in the final investigation report?

Based on the overall findings of the investigation and this assessment, were the original project objectives appropriately defined? If not, have revised project objectives been developed?

Corrective action is the process of identifying, recommending, approving, and implementing measures to counter unacceptable procedures or out-of-QC performance that can affect data quality. Corrective action can occur during field activities, laboratory analyses, data validation, and data assessment. All corrective action proposed and implemented will be documented in the regular QA reports to management. Corrective action will only be implemented after approval by the EUL, or designee.

For noncompliance problems, a formal corrective action program will be determined and implemented at the time the problem is identified. The person who identifies the problem is responsible for notifying the EUL, who in turn will notify the USEPA OSC. If the problem is analytical in nature, information on these problems will be promptly communicated to the QA Officer.

Any nonconformance with the established QC procedures in the QAPP or SAP will be identified and corrected in accordance with the QAPP. The EUL or designee will issue a nonconformance report for each nonconformance condition.

3.6 Corrective Actions

3.6.1 Field Corrective Action

Corrective action in the field may be needed when the sample network is changed (i.e., more/less samples, sampling locations other than those specified in the SAP, etc.), sampling procedures and/or field analytical procedures require modification, etc., due to unexpected conditions. In general, the Field Area Coordinators, QA Officer, or the EUL may identify the need for corrective action. The field staff in consultation with the Field Area Coordinators will recommend a corrective action. The EUL will approve the corrective measure (after consultation with and concurrence by the FOSC)which will be implemented by the field team. It will be the responsibility of the EUL to ensure the corrective action has been implemented. All corrective actions implemented will be documented in the field logbooks.

3.6.2 Laboratory Corrective Action

Corrective action in the laboratory may occur prior to, during, and after initial analyses. A number of conditions (such as broken sample containers, multiple phases, low/high pH readings, potentially high concentration samples) may be identified during sample login or just prior to analysis.

Following consultation with lab analysts and section leaders, it may be necessary for the QA Officer to approve the implementation of corrective action. Depending on the condition encountered, the laboratory QA Officer may consult the QA Officer for input. Conditions during or after analysis that may automatically trigger corrective action or optional procedures include dilution of samples, additional sample extract cleanup, automatic reinjection/reanalysis when certain QC criteria are not met, etc. A summary of method-specific corrective actions is available in the laboratory QAPP (available upon request). All laboratory corrective actions will be documented and also identified in the case narrative of the data packages.

3.6.3 Corrective Action During Data Review/Validation and Assessment

The need for corrective action may be required during either the data review/validation or data assessment. Potential types of corrective action may include resampling by the field team or re-extraction/re-analysis of samples by the laboratory. These actions are dependent upon the ability to mobilize the field team, whether the data to be collected is necessary to meet the required QA objectives (e.g., the holding time for samples is not exceeded, etc.). If the Sample/Technical Manager identifies a corrective action situation, it is the EUL who will be responsible for approving the implementation of corrective action, including re-sampling, during data assessment. All corrective actions of this type will be documented by the EUL.

3.7 Quality Assurance Reports to Management

3.7.1 Contents of Project QA Reports

The Field Area Coordinators will report to the EUL on a daily basis regarding progress of the fieldwork and quality control issues associated with field activities.

The laboratory maintains detailed procedures for laboratory recordkeeping in order to support the validity of all analytical work. Each data set report submitted to the QA Officer will contain the laboratory's written certification that the requested analytical methods were run and that all QA/QC checks were within established control limits for all samples analyzed.

After receipt of all analytical data, the Sample/Technical Manager will submit a Data Review Report for each data set to the QA Officer and the EUL describing the accuracy and precision of the data. Verbal reports will be provided following the receipts of individual packages as they are received. If any QA problems are encountered, the laboratory Project Manager will call the Project Chemist

immediately for corrective action and also issue a written report to the Project Chemist. The Project Chemist will immediately report the QA problem to the QA Officer and the EUL.

After the fieldwork is complete and the final analyses are completed, reviewed and validated, a final report will be prepared. The report will summarize the quality assurance and audit information (if completed), indicating any corrective actions taken and the overall results of QAPP compliance. The Sample Technical Manager (or designee) will prepare this final summary and submit this to the QA Officer for review. The report will be utilized during the decision-making process and will be incorporated as part of the Final Report.

4.0 Data Validation and Usability

4.1 Data Reduction

All data generated through field activities or by the laboratory operation, will be reduced and validated prior to reporting. The laboratory will not disseminate data until it has been subjected to these procedures, which are summarized in subsections below.

4.1.1 Field Data Reduction Procedures

All field data will be written into field logbooks immediately after measurements are taken. If errors are made, results will be legibly crossed out, initialed, and dated by the field member, and corrected in a space adjacent to the original (erroneous) entry. Periodically throughout the field sampling effort, the Field Area Coordinators will review the forms to determine whether the field crew has made any errors.

4.1.2 Laboratory Data Reduction Procedures

Laboratory data reduction procedures are located in the laboratory Quality Programs.

4.2 Data Review and Validation

One hundred percent of the data will undergo a data review by the QA Officer or by the Third Party Validator. The data review will include the review of the QC parameters listed below. The criteria used to evaluate the QC parameters are those criteria identified in Tables 1-2 through 1-6 and/or in the U.S. EPA NFG. In summary, data validation includes the following items:

- Chain of custody;
- Laboratory case narrative/cooler receipt form;
- Holding time / sample preparation;
- Method blanks;
- Initial and Continuing Calibration;
- Reagent/preparation blanks (applicable to inorganic analysis);
- MS/MSDs;

- Surrogate spikes (for organic analyses);
- Laboratory duplicates;
- Laboratory control standards; and
- Field duplicates.

All data obtained will be properly recorded. The data package will include a full deliverable package capable of allowing the recipient to reconstruct QC information and compare it to QC criteria for 10% of the deliverables. The laboratory will reanalyze any samples analyzed in non-conformance with the QC criteria, if sufficient volume is available. It is expected that sufficient volumes/weights of samples will be collected to allow for possible reanalysis if necessary.

Ten percent of the confirmatory sample analyses for each matrix will be validated by a third party validator in accordance with the U.S. EPA NFG. This data will be the primary source of data for risk and final cleanup evaluation. In the event the data are unacceptable, additional validation may be required.

4.3 Data Reporting

Data reporting procedures will be carried out for field and laboratory operations as indicated below.

4.3.1 Field Data Reporting

Field data reporting will be conducted principally through the transmission of report sheets containing tabulated results of all measurements made in the field and documentation of all field calibration activities.

4.3.2 Laboratory Data Reporting

The task of reporting laboratory data begins after the independent validation activity has been concluded. The QA Officer must perform a final review of the report summaries and case narratives to determine whether the report meets project requirements. In addition to the record of COC, the report format will consist of the following:

4.3.2.1 Case Narrative

- Date of issuance;
- Laboratory analysis performed;

- Any deviations from intended analytical strategy;
- Laboratory batch number;
- Numbers of samples and respective matrices;
- QC procedures utilized and also references to the acceptance criteria;
- Laboratory report contents;
- Project name and number;
- Condition of samples 'as-received';
- Discussion of whether or not sample holding times were met;
- Discussion of technical problems or other observations which may have created analytical difficulties; and
- Discussion of any laboratory QC checks which failed to meet project criteria.

4.3.2.2 Chemistry Data Package

- Case narrative for each analyzed batch of samples;
- Summary page indicating dates of analyses for samples and laboratory QC checks;
- Cross referencing of laboratory sample to project sample identification numbers;
- Description of data qualifiers to be used;
- Sample preparation and analyses for samples;
- Sample results (Analytical results will be reported as estimated J when detected above the MDL and below the RL);
- Raw data for sample results and laboratory QC samples (including LCS, MS/MSD, surrogates, serial dilutions, blanks, etc.);
- Results of (dated) initial and continuing calibration checks; and
- GC/MS tuning results.

All chemical data will also be submitted in electronic format.

4.4 Data Assessment

After all data have been reviewed and validated, a list of all data points having either a high or low bias (qualified data) will be compiled and evaluated for determination of data usability.

5.0 References

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Tables

TABLE 1-1
QUALITY CONTROL LEVEL OF EFFORT FOR ANALYTICAL TESTING

Parameter	QC Measure	Minimum Frequency
All Parameters	Initial Calibration	Initially
All Parameters	Initial Calibration Verification	After each Initial Calibration
All Parameters	Reporting Limit Verification	Bracket project samples
All Parameters	Method Detection Limit Verification	Once per quarter per instrument used
All Parameters	Method Blank	Every analytical batch
VOCs/SVOCs/PAHs	Instrument Tuning	Every 12 hours
Organic Parameters	Continuing Calibration	Every 12 hour period of analysis
Metals	Continuing Calibration	Every 10 samples
Metals	Continuing Calibration Blank	Every 10 samples
All Parameters	Laboratory Control Sample	Every preparation batch
All Parameters	Matrix Spike	Every preparation batch
Organic Parameters	Matrix Spike Duplicate	Every preparation batch
Metals	Matrix Duplicate	Every preparation batch
VOCs/SVOCs/PAHs	Internal Standard	Every sample
Organic Parameters	Surrogate	All QC and project samples
ICP Metals	Interelement Check Standard	Beginning of analytical sequence
Metals	Serial Dilution	As needed to assess new and unusual matrices
Metals	Post digestion spike	As needed to confirm matrix effect
All Parameters	Quality Assurance	At a frequency of 5%
All Parameters	Field Duplicate	Every 10 investigative samples

Note: An analytical batch consists of 20 or fewer samples extracted/analyzed together.
While the frequency of MS/MSD and duplicates is for every analytical batch, consultant will submit MS/MSD at a frequency of 1/20 and field duplicates at a rate of 1/10.
Samples will be submitted to the QA Lab.

ICP - Inductively Coupled Plasma
PAHs - Polynuclear Aromatic Hydrocarbons
QA - Quality Assurance
QC - Quality Control
SVOCs - Semivolatile Organic Compounds
VOCs - Volatile Organic Compounds

TABLE 1-2
LABORATORY CONTROL SAMPLE ACCURACY AND PRECISION CRITERIA FOR VOC ANALYSIS

Spiking Compound	Accuracy (%R)		Precision (RPD)	
	Aqueous	Soil/Sediment	Aqueous	Soil/Sediment
1,1,1-Trichloroethane	(1)	(1)	(1)	(1)
1,1,2,2-Tetrachloroethane	(1)	(1)	(1)	(1)
1,1,2-Trichloroethane	(1)	(1)	(1)	(1)
1,1-Dichloroethane	(1)	(1)	(1)	(1)
1,1-Dichloroethene	(1)	(1)	(1)	(1)
1,1,2-Trichloro-1,2,2-trifluoroethane	(1)	(1)	(1)	(1)
1,2-Dichloroethane	(1)	(1)	(1)	(1)
1,2-Dichloropropane	(1)	(1)	(1)	(1)
2-Butanone	(1)	(1)	(1)	(1)
2-Hexanone	(1)	(1)	(1)	(1)
4-Methyl-2-pentanone	(1)	(1)	(1)	(1)
Acetone	(1)	(1)	(1)	(1)
Benzene	(1)	(1)	(1)	(1)
Bromodichloromethane	(1)	(1)	(1)	(1)
Bromoform	(1)	(1)	(1)	(1)
Bromomethane	(1)	(1)	(1)	(1)
Carbon disulfide	(1)	(1)	(1)	(1)
Carbon tetrachloride	(1)	(1)	(1)	(1)
Chlorobenzene	(1)	(1)	(1)	(1)
Chloroethane	(1)	(1)	(1)	(1)
Chloroform	(1)	(1)	(1)	(1)
Chloromethane	(1)	(1)	(1)	(1)
cis-1,2-Dichloroethene	(1)	(1)	(1)	(1)
cis-1,3-Dichloropropene	(1)	(1)	(1)	(1)
Dibromochloromethane	(1)	(1)	(1)	(1)
Dichlorodifluoromethane	(1)	(1)	(1)	(1)
Ethylbenzene	(1)	(1)	(1)	(1)
m,p-Xylenes	(1)	(1)	(1)	(1)
Methylene chloride	(1)	(1)	(1)	(1)
Methyl-tert butyl ether	(1)	(1)	(1)	(1)
o-Xylenes	(1)	(1)	(1)	(1)
Styrene	(1)	(1)	(1)	(1)
Tetrachloroethene	(1)	(1)	(1)	(1)
Toluene	(1)	(1)	(1)	(1)
trans-1,2-Dichloroethene	(1)	(1)	(1)	(1)
trans-1,3-Dichloropropene	(1)	(1)	(1)	(1)
Trichloroethene	(1)	(1)	(1)	(1)
Vinyl chloride	(1)	(1)	(1)	(1)

(1) See Table 1-21 for updated analytes and their associated accuracy and precision limits.

Laboratory accuracy and precision limits and MDLs are laboratory-specific and subject to change.

Quality control limits are updated periodically and subject to change.

N/A - Not applicable

%R - Percent Recovery

RPD - Relative Percent Difference

VOC - Volatile Organic Compound

Samples will be prepared using Method 5035 (soil/sediment) and analyzed by Method 8260B. Soil samples for VOC analysis will be methanol preservative (4°C) and sodium bisulfate (4°C). For low level VOC analysis sodium bisulfate will be used.

If any control analyte in the LCS is outside the laboratory established historical control limits, corrective action must occur. All non-controlling compounds must attain a recovery of 10% or greater if the compound is on the client's list

TABLE 1-3
MS/MSD ACCURACY AND PRECISION CRITERIA FOR VOC ANALYSIS

Spiking Compound	Accuracy (%R)		Precision (RPD)	
	Aqueous	Soil/Sediment	Aqueous	Soil/Sediment
1,1,1-Trichloroethane	(1)	(1)	(1)	(1)
1,1,2,2-Tetrachloroethane	(1)	(1)	(1)	(1)
1,1,2-Trichloroethane	(1)	(1)	(1)	(1)
1,1-Dichloroethane	(1)	(1)	(1)	(1)
1,1-Dichloroethene	(1)	(1)	(1)	(1)
1,1,2-Trichloro-1,2,2-trifluoroethane	(1)	(1)	(1)	(1)
1,2-Dichloroethane	(1)	(1)	(1)	(1)
1,2-Dichloropropane	(1)	(1)	(1)	(1)
2-Butanone	(1)	(1)	(1)	(1)
2-Hexanone	(1)	(1)	(1)	(1)
4-Methyl-2-pentanone	(1)	(1)	(1)	(1)
Acetone	(1)	(1)	(1)	(1)
Benzene	(1)	(1)	(1)	(1)
Bromodichloromethane	(1)	(1)	(1)	(1)
Bromoform	(1)	(1)	(1)	(1)
Bromomethane	(1)	(1)	(1)	(1)
Carbon disulfide	(1)	(1)	(1)	(1)
Carbon tetrachloride	(1)	(1)	(1)	(1)
Chlorobenzene	(1)	(1)	(1)	(1)
Chloroethane	(1)	(1)	(1)	(1)
Chloroform	(1)	(1)	(1)	(1)
Chloromethane	(1)	(1)	(1)	(1)
cis-1,2-Dichloroethene	(1)	(1)	(1)	(1)
cis-1,3-Dichloropropene	(1)	(1)	(1)	(1)
Dibromochloromethane	(1)	(1)	(1)	(1)
Dichlorodifluoromethane	(1)	(1)	(1)	(1)
Ethylbenzene	(1)	(1)	(1)	(1)
m,p-Xylenes	(1)	(1)	(1)	(1)
Methylene chloride	(1)	(1)	(1)	(1)
Methyl-tert butyl ether	(1)	(1)	(1)	(1)
o-Xylenes	(1)	(1)	(1)	(1)
Styrene	(1)	(1)	(1)	(1)
Tetrachloroethene	(1)	(1)	(1)	(1)
Toluene	(1)	(1)	(1)	(1)
trans-1,2-Dichloroethene	(1)	(1)	(1)	(1)
trans-1,3-Dichloropropene	(1)	(1)	(1)	(1)
Trichloroethene	(1)	(1)	(1)	(1)
Vinyl chloride	(1)	(1)	(1)	(1)

(1) See Table 1-21 for updated analytes and their associated accuracy and precision limits.

Laboratory accuracy and precision limits and MDLs are laboratory-specific and subject to change.

Quality control limits are updated periodically and subject to change.

N/A - Not applicable

%R - Percent Recovery

RPD - Relative Percent Difference

VOC - Volatile Organic Compound

Samples will be prepared using Method 5035 (soil/sediment) and analyzed by Method 8260B. Soil samples for VOC analysis will be methanol preservative (4°C) and sodium bisulfate (4°C). For low level VOC analysis sodium bisulfate will be used.

TABLE 1-4
LABORATORY CONTROL SAMPLE ACCURACY AND PRECISION CRITERIA FOR SVOC ANALYSIS

Spiking Compound	Accuracy (%R)		Precision (RPD)	
	Aqueous	Soil/Sediment	Aqueous	Soil/Sediment
1,2,4-Trichlorobenzene	(1)	(1)	(1)	(1)
1,2-Dichlorobenzene	(1)	(1)	(1)	(1)
1,3-Dichlorobenzene	(1)	(1)	(1)	(1)
1,4-Dichlorobenzene	(1)	(1)	(1)	(1)
2,4,5-Trichlorophenol	(1)	(1)	(1)	(1)
2,4,6-Trichlorophenol	(1)	(1)	(1)	(1)
2,4-Dichlorophenol	(1)	(1)	(1)	(1)
2,4-Dimethylphenol	(1)	(1)	(1)	(1)
2,4-Dinitrophenol	(1)	(1)	(1)	(1)
2,4-Dinitrotoluene	(1)	(1)	(1)	(1)
2,6-Dinitrotoluene	(1)	(1)	(1)	(1)
2-Chloronaphthalene	(1)	(1)	(1)	(1)
2-Chlorophenol	(1)	(1)	(1)	(1)
2-Methylnaphthalene	(1)	(1)	(1)	(1)
2-Methylphenol	(1)	(1)	(1)	(1)
2-Nitroaniline	(1)	(1)	(1)	(1)
2-Nitrophenol	(1)	(1)	(1)	(1)
3,3'-Dichlorobenzidine	(1)	(1)	(1)	(1)
3/4-Methylphenol	(1)	(1)	(1)	(1)
3-Nitroaniline	(1)	(1)	(1)	(1)
4,6-Dinitro-2-methylphenol	(1)	(1)	(1)	(1)
4-Bromophenyl phenyl ether	(1)	(1)	(1)	(1)
4-Chloro-3-methylphenol	(1)	(1)	(1)	(1)
4-Chloroaniline	(1)	(1)	(1)	(1)
4-Chlorophenyl phenyl ether	(1)	(1)	(1)	(1)
4-Nitroaniline	(1)	(1)	(1)	(1)
4-Nitrophenol	(1)	(1)	(1)	(1)
Acenaphthylene	(1)	(1)	(1)	(1)
Acenaphthene	(1)	(1)	(1)	(1)
Anthracene	(1)	(1)	(1)	(1)
Benzo(a)anthracene	(1)	(1)	(1)	(1)
Benzo(a)pyrene	(1)	(1)	(1)	(1)
Benzo(b)fluoranthene	(1)	(1)	(1)	(1)
Benzo(g,h,i)perylene	(1)	(1)	(1)	(1)
Benzo(k)fluoranthene	(1)	(1)	(1)	(1)
Benzoic acid	(1)	(1)	(1)	(1)
Benzyl alcohol	(1)	(1)	(1)	(1)
bis(2-Chloroethoxy) methane	(1)	(1)	(1)	(1)
bis(2-Chloroethyl) ether	(1)	(1)	(1)	(1)
bis(2-Chloroisopropyl) ether	(1)	(1)	(1)	(1)
bis(2-Ethylhexyl) phthalate	(1)	(1)	(1)	(1)
Butyl benzyl phthalate	(1)	(1)	(1)	(1)
Carbazole	(1)	(1)	(1)	(1)
Chrysene	(1)	(1)	(1)	(1)
Dibenz(a,h)anthracene	(1)	(1)	(1)	(1)
Dibenzofuran	(1)	(1)	(1)	(1)
Diethyl phthalate	(1)	(1)	(1)	(1)
Dimethyl phthalate	(1)	(1)	(1)	(1)
Di-n-butyl phthalate	(1)	(1)	(1)	(1)
Di-n-octyl phthalate	(1)	(1)	(1)	(1)
Fluoranthene	(1)	(1)	(1)	(1)
Fluorene	(1)	(1)	(1)	(1)
Hexachlorobenzene	(1)	(1)	(1)	(1)
Hexachlorobutadiene	(1)	(1)	(1)	(1)

TABLE 1-4
LABORATORY CONTROL SAMPLE ACCURACY AND PRECISION CRITERIA FOR SVOC ANALYSIS

Spiking Compound	Accuracy (%R)		Precision (RPD)	
	Aqueous	Soil/Sediment	Aqueous	Soil/Sediment
Hexachlorocyclopentadiene	(1)	(1)	(1)	(1)
Hexachloroethane	(1)	(1)	(1)	(1)
Indeno(1,2,3-cd)pyrene	(1)	(1)	(1)	(1)
Isophorone	(1)	(1)	(1)	(1)
Naphthalene	(1)	(1)	(1)	(1)
Nitrobenzene	(1)	(1)	(1)	(1)
N-Nitroso-di-n-propylamine	(1)	(1)	(1)	(1)
N-Nitrosodiphenylamine	(1)	(1)	(1)	(1)
Pentachlorophenol	(1)	(1)	(1)	(1)
Phenanthrene	(1)	(1)	(1)	(1)
Phenol	(1)	(1)	(1)	(1)
Pyrene	(1)	(1)	(1)	(1)

(1) See Table 1-21 for updated analytes and their associated accuracy and precision limits.
Laboratory accuracy and precision limits and MDLs are laboratory-specific and subject to change.
N/A - Not applicable
%R - Percent Recovery
RPD - Relative Percent Difference
SVOCs - Semivolatile Organic Compound
If any control analyte in the LCS is outside the laboratory established historical control limits, corrective action must occur.
All non-controlling compounds must attain a recovery of 10% or greater if the compound is on the client's list
Samples will be prepared using preparatory Methods 3540C, 3550C or 3541 (soil/sediment) and analyzed by Method 8270C as shown on

TABLE 1-4
LABORATORY CONTROL SAMPLE ACCURACY AND PRECISION CRITERIA FOR SVOC ANALYSIS

TABLE 1-4
LABORATORY CONTROL SAMPLE ACCURACY AND PRECISION CRITERIA FOR SVOC ANALYSIS

Table 1-21.

TABLE 1-5
MS/MSD ACCURACY AND PRECISION CRITERIA FOR SVOC ANALYSIS

Spiking Compound	Accuracy (%R)		Precision (RPD)	
	Aqueous	Soil/Sediment	Aqueous	Soil/Sediment
1,2,4-Trichlorobenzene	(1)	(1)	(1)	(1)
1,2-Dichlorobenzene	(1)	(1)	(1)	(1)
1,3-Dichlorobenzene	(1)	(1)	(1)	(1)
1,4-Dichlorobenzene	(1)	(1)	(1)	(1)
2,4,5-Trichlorophenol	(1)	(1)	(1)	(1)
2,4,6-Trichlorophenol	(1)	(1)	(1)	(1)
2,4-Dichlorophenol	(1)	(1)	(1)	(1)
2,4-Dimethylphenol	(1)	(1)	(1)	(1)
2,4-Dinitrophenol	(1)	(1)	(1)	(1)
2,4-Dinitrotoluene	(1)	(1)	(1)	(1)
2,6-Dinitrotoluene	(1)	(1)	(1)	(1)
2-Chloronaphthalene	(1)	(1)	(1)	(1)
2-Chlorophenol	(1)	(1)	(1)	(1)
2-Methylnaphthalene	(1)	(1)	(1)	(1)
2-Methylphenol	(1)	(1)	(1)	(1)
2-Nitroaniline	(1)	(1)	(1)	(1)
2-Nitrophenol	(1)	(1)	(1)	(1)
3,3'-Dichlorobenzidine	(1)	(1)	(1)	(1)
3/4-Methylphenol	(1)	(1)	(1)	(1)
3-Nitroaniline	(1)	(1)	(1)	(1)
4,6-Dinitro-2-methylphenol	(1)	(1)	(1)	(1)
4-Bromophenyl phenyl ether	(1)	(1)	(1)	(1)
4-Chloro-3-methylphenol	(1)	(1)	(1)	(1)
4-Chloroaniline	(1)	(1)	(1)	(1)
4-Chlorophenyl phenyl ether	(1)	(1)	(1)	(1)
4-Nitroaniline	(1)	(1)	(1)	(1)
4-Nitrophenol	(1)	(1)	(1)	(1)
Acenaphthylene	(1)	(1)	(1)	(1)
Acenaphthene	(1)	(1)	(1)	(1)
Anthracene	(1)	(1)	(1)	(1)
Benzo(a)anthracene	(1)	(1)	(1)	(1)
Benzo(a)pyrene	(1)	(1)	(1)	(1)
Benzo(b)fluoranthene	(1)	(1)	(1)	(1)
Benzo(g,h,i)perylene	(1)	(1)	(1)	(1)
Benzo(k)fluoranthene	(1)	(1)	(1)	(1)
Benzoic acid	(1)	(1)	(1)	(1)
Benzyl alcohol	(1)	(1)	(1)	(1)
bis(2-Chloroethoxy) methane	(1)	(1)	(1)	(1)
bis(2-Chloroethyl) ether	(1)	(1)	(1)	(1)
bis(2-Chloroisopropyl) ether	(1)	(1)	(1)	(1)
bis(2-Ethylhexyl) phthalate	(1)	(1)	(1)	(1)
Butyl benzyl phthalate	(1)	(1)	(1)	(1)
Carbazole	(1)	(1)	(1)	(1)
Chrysene	(1)	(1)	(1)	(1)
Dibenz(a,h)anthracene	(1)	(1)	(1)	(1)
Dibenzofuran	(1)	(1)	(1)	(1)
Diethyl phthalate	(1)	(1)	(1)	(1)
Dimethyl phthalate	(1)	(1)	(1)	(1)
Di-n-butyl phthalate	(1)	(1)	(1)	(1)
Di-n-octyl phthalate	(1)	(1)	(1)	(1)

TABLE 1-5
MS/MSD ACCURACY AND PRECISION CRITERIA FOR SVOC ANALYSIS

Spiking Compound	Accuracy (%R)		Precision (RPD)	
	Aqueous	Soil/Sediment	Aqueous	Soil/Sediment
Fluoranthene	(1)	(1)	(1)	(1)
Fluorene	(1)	(1)	(1)	(1)
Hexachlorobenzene	(1)	(1)	(1)	(1)
Hexachlorobutadiene	(1)	(1)	(1)	(1)
Hexachlorocyclopentadiene	(1)	(1)	(1)	(1)
Hexachloroethane	(1)	(1)	(1)	(1)
Indeno(1,2,3-cd)pyrene	(1)	(1)	(1)	(1)
Isophorone	(1)	(1)	(1)	(1)
Naphthalene	(1)	(1)	(1)	(1)
Nitrobenzene	(1)	(1)	(1)	(1)
N-Nitroso-di-n-propylamine	(1)	(1)	(1)	(1)
N-Nitrosodiphenylamine	(1)	(1)	(1)	(1)
Pentachlorophenol	(1)	(1)	(1)	(1)
Phenanthrene	(1)	(1)	(1)	(1)
Phenol	(1)	(1)	(1)	(1)
Pyrene	(1)	(1)	(1)	(1)

(1) See Table 1-21 for updated analytes and their associated accuracy and precision limits.

Laboratory accuracy and precision limits and MDLs are laboratory-specific and subject to change.

MS/MSD - Matrix Spike/Matrix Spike Duplicate

N/A - Not applicable

%R - Percent Recovery

RPD - Relative Percent Difference

SVOC - Semivolatile Organic Compound

If any control analyte in the LCS is outside the laboratory established historical control limits, corrective action must occur.

All non-controlling compounds must attain a recovery of 10% or greater if the compound is on the client's list

Samples will be prepared using preparatory Methods 3540C, 3550C or 3541 (soil/sediment) and analyzed by Method 8270C as shown on Table 1

TABLE 1-5
MS/MSD ACCURACY AND PRECISION CRITERIA FOR SVOC ANALYSIS

TABLE 1-5
MS/MSD ACCURACY AND PRECISION CRITERIA FOR SVOC ANALYSIS

TABLE 1-6
LABORATORY CONTROL SAMPLE ACCURACY AND PRECISION CRITERIA FOR PAH ANALYSIS

Spiking Compound	Accuracy (%R)		Precision (RPD)	
	Aqueous	Soil/Sediment	Aqueous	Soil/Sediment
Acenaphthylene	(1)	(1)	(1)	(1)
Acenaphthene	(1)	(1)	(1)	(1)
Anthracene	(1)	(1)	(1)	(1)
Benzo(a)anthracene	(1)	(1)	(1)	(1)
Benzo(a)pyrene	(1)	(1)	(1)	(1)
Benzo(b)fluoranthene	(1)	(1)	(1)	(1)
Benzo(g,h,i)perylene	(1)	(1)	(1)	(1)
Benzo(k)fluoranthene	(1)	(1)	(1)	(1)
Chrysene	(1)	(1)	(1)	(1)
Dibenz(a,h)anthracene	(1)	(1)	(1)	(1)
Fluoranthene	(1)	(1)	(1)	(1)
Fluorene	(1)	(1)	(1)	(1)
Indeno(1,2,3-cd)pyrene	(1)	(1)	(1)	(1)
Naphthalene	(1)	(1)	(1)	(1)
Phenanthrene	(1)	(1)	(1)	(1)
Pyrene	(1)	(1)	(1)	(1)

(1) See Table 1-21 for updated analytes and their associated accuracy and precision limits.
Laboratory accuracy and precision limits and MDLs are laboratory-specific and subject to change.
N/A - Not applicable
PAH - Polynuclear Aromatic Hydrocarbon
%R - Percent Recovery
RPD - Relative Percent Difference
If any control analyte in the LCS is outside the laboratory established historical control limits, corrective action must occur.
All non-controlling compounds must attain a recovery of 10% or greater if the compound is on the client's list
Samples will be prepared using Method 3540C (soil/sediment) and analyzed by Method 8270C-SIM as shown on Table 1-21.

TABLE 1-7
MS/MSD ACCURACY AND PRECISION CRITERIA FOR PAH ANALYSIS

Spiking Compound	Accuracy (%R)		Precision (RPD)	
	Aqueous	Soil/Sediment	Aqueous	Soil/Sediment
Acenaphthylene	(1)	(1)	(1)	(1)
Acenaphthene	(1)	(1)	(1)	(1)
Anthracene	(1)	(1)	(1)	(1)
Benzo(a)anthracene	(1)	(1)	(1)	(1)
Benzo(a)pyrene	(1)	(1)	(1)	(1)
Benzo(b)fluoranthene	(1)	(1)	(1)	(1)
Benzo(g,h,i)perylene	(1)	(1)	(1)	(1)
Benzo(k)fluoranthene	(1)	(1)	(1)	(1)
Chrysene	(1)	(1)	(1)	(1)
Dibenz(a,h)anthracene	(1)	(1)	(1)	(1)
Fluoranthene	(1)	(1)	(1)	(1)
Fluorene	(1)	(1)	(1)	(1)
Indeno(1,2,3-cd)pyrene	(1)	(1)	(1)	(1)
Naphthalene	(1)	(1)	(1)	(1)
Phenanthrene	(1)	(1)	(1)	(1)
Pyrene	(1)	(1)	(1)	(1)

(1) See Table 1-21 for updated analytes and their associated accuracy and precision limits.

Laboratory accuracy and precision limits and MDLs are laboratory-specific and subject to change.

N/A - Not applicable

PAH - Polynuclear Aromatic Hydrocarbon

%R - Percent Recovery

RPD - Relative Percent Difference

Samples will be prepared using Method 3540C (soil/sediment) and analyzed by Method 8270C-SIM as shown on Table 1-21.

Samples will be prepared using Method 3540C, 3550C or 3541 (soil/sediment) and analyzed by Method 8270C

TABLE 1-8
LABORATORY CONTROL SAMPLE ACCURACY AND PRECISION CRITERIA FOR POLYCHLORINATED BIPHENYL ANALYSIS

Spiking Compound	Accuracy (%R)		Precision (RPD)	
	Aqueous	Soil/Sediment	Aqueous	Soil/Sediment
Polychlorinated Biphenyls				
Aroclor 1016	(1)	(1)	(1)	(1)
Aroclor 1260	(1)	(1)	(1)	(1)

(1) See Table 1-21 for updated analytes and their associated accuracy and precision limits.

Laboratory accuracy and precision limits and MDLs are laboratory-specific and subject to change.

N/A - Not applicable
%R - Percent Recovery
RPD - Relative Percent Difference

If any control analyte in the LCS is outside the laboratory established historical control limits, corrective action must occur.

All non-controlling compounds must attain a recovery of 10% or greater if the compound is on the client's list

Samples will be prepared using Method 3540C, 3550C or 3541 (soil/sediment) and 3520C or 3510C (aqueous) and analyzed by Methods 8082.

TABLE 1-9
MS/MSD ACCURACY AND PRECISION CRITERIA FOR POLYCHLORINATED BIPHENYL ANALYSIS

Spiking Compound	Accuracy (%R)		Precision (RPD)	
	Aqueous	Soil/Sediment	Aqueous	Soil/Sediment
Polychlorinated Biphenyls				
Aroclor 1016	(1)	(1)	(1)	(1)
Aroclor 1260	(1)	(1)	(1)	(1)

(1) See Table 1-21 for updated analytes and their associated accuracy and precision limits.

Laboratory accuracy and precision limits and MDLs are laboratory-specific and subject to change.

N/A - Not applicable
%R - Percent Recovery
RPD - Relative Percent Difference

Samples will be prepared using Method 3540C, 3550C or 3541 (soil/sediment) and 3520C or 3510C (aqueous) and analyzed by M

TABLE 1-10
LABORATORY CONTROL SAMPLE ACCURACY AND PRECISION CRITERIA FOR METALS ANALYSIS

Spiking Compound	Accuracy (%R)		Precision (RPD)	
	Aqueous	Soil/Sediment	Aqueous	Soil/Sediment
Aluminum	(1)	(1)	(1)	(1)
Antimony	(1)	(1)	(1)	(1)
Arsenic	(1)	(1)	(1)	(1)
Barium	(1)	(1)	(1)	(1)
Beryllium	(1)	(1)	(1)	(1)
Cadmium	(1)	(1)	(1)	(1)
Calcium	(1)	(1)	(1)	(1)
Chromium	(1)	(1)	(1)	(1)
Cobalt	(1)	(1)	(1)	(1)
Copper	(1)	(1)	(1)	(1)
Iron	(1)	(1)	(1)	(1)
Lead	(1)	(1)	(1)	(1)
Magnesium	(1)	(1)	(1)	(1)
Manganese	(1)	(1)	(1)	(1)
Mercury*	(1)	(1)	(1)	(1)
Nickel	(1)	(1)	(1)	(1)
Potassium	(1)	(1)	(1)	(1)
Selenium	(1)	(1)	(1)	(1)
Silver	(1)	(1)	(1)	(1)
Sodium	(1)	(1)	(1)	(1)
Thallium	(1)	(1)	(1)	(1)
Vanadium	(1)	(1)	(1)	(1)
Zinc	(1)	(1)	(1)	(1)

(1) See Table 1-21 for updated analytes and their associated accuracy and precision limits.

Laboratory accuracy and precision limits and MDLs are laboratory-specific and subject to change.

N/A - Not Applicable
%R - Percent Recovery
RPD - Relative Percent Difference

If any control analyte in the LCS is outside the laboratory established historical control limits, corrective action must oc

All non-controlling compounds must attain a recovery of 10% or greater if the compound is on the client's list

All metals will be prepared by Methods 3050B (soil/sediment) and 3005A or 3010A (aqueous) and analyzed by Methoc

*Prepared and analyzed by Methods 7470A (aqueous) / 7471A (soil/sediment)

TABLE 1-11
MS/MD ACCURACY AND PRECISION CRITERIA FOR METALS ANALYSIS

Spiking Compound	Accuracy (%R)		Precision (RPD)	
	Aqueous	Soil/Sediment	Aqueous	Soil/Sediment
Aluminum	(1)	(1)	(1)	(1)
Antimony	(1)	(1)	(1)	(1)
Arsenic	(1)	(1)	(1)	(1)
Barium	(1)	(1)	(1)	(1)
Beryllium	(1)	(1)	(1)	(1)
Cadmium	(1)	(1)	(1)	(1)
Calcium	(1)	(1)	(1)	(1)
Chromium	(1)	(1)	(1)	(1)
Cobalt	(1)	(1)	(1)	(1)
Copper	(1)	(1)	(1)	(1)
Iron	(1)	(1)	(1)	(1)
Lead	(1)	(1)	(1)	(1)
Magnesium	(1)	(1)	(1)	(1)
Manganese	(1)	(1)	(1)	(1)
Mercury*	(1)	(1)	(1)	(1)
Nickel	(1)	(1)	(1)	(1)
Potassium	(1)	(1)	(1)	(1)
Selenium	(1)	(1)	(1)	(1)
Silver	(1)	(1)	(1)	(1)
Sodium	(1)	(1)	(1)	(1)
Thallium	(1)	(1)	(1)	(1)
Vanadium	(1)	(1)	(1)	(1)
Zinc	(1)	(1)	(1)	(1)

(1) See Table 1-21 for updated analytes and their associated accuracy and precision limits.

Laboratory accuracy and precision limits and MDLs are laboratory-specific and subject to change.

N/A - Not Applicable

%R - Percent Recovery

RPD - Relative Percent Difference

All metals will be prepared by Methods 3050B (soil/sediment) and 3005A or 3010A (aqueous) and analyzed by Methoc

TABLE 1-12
SURROGATE COMPOUND ACCURACY CRITERIA FOR ORGANIC PARAMETERS

Analysis	Spiking Compound	Accuracy	
		Aqueous	Soil/Sediment
VOCs	1,2-Dichloroethane-d_4	(1)	(1)
	4-Bromofluorobenzene	(1)	(1)
	Toluene-d_8	(1)	(1)
SVOCs/PAHs	2,4,6-Tribromophenol	(1)	(1)
	2-Fluorobiphenyl	(1)	(1)
	2-Fluorophenol	(1)	(1)
	Nitrobenzene-d_5	(1)	(1)
	Phenol-d_5	(1)	(1)
	Terphenyl-d_{14}	(1)	(1)
	Tetrachloro-m-xylene	(1)	(1)

(1) See Table 1-21 for updated analytes, surrogates and their associated accuracy and precision limits.
Laboratory accuracy and precision limits and MDLs are laboratory-specific and subject to change.
N/A -Not applicable
PAHs - Polynuclear Aromatic Hydrocarbons
SVOCs - Semivolatile Organic Compounds
VOCs - Volatile Organic Compounds

TABLE 1-13
LABORATORY ANALYTICAL METHODS

Parameter	Analyte List	Preparation Method		Method Reference
		Aqueous	Soil/Sediment	
Volatile Organic Compounds	See QAPP Table 1-21	See QAPP Table 1-21	See QAPP Table 1-21	See QAPP Table 1-21
Semivolatile Organic Compounds	See QAPP Table 1-21	See QAPP Table 1-21	See QAPP Table 1-21	See QAPP Table 1-21
PCBs	See QAPP Table 1-21	See QAPP Table 1-21	See QAPP Table 1-21	See QAPP Table 1-21
Metals	See QAPP Table 1-21	See QAPP Table 1-21	See QAPP Table 1-21	See QAPP Table 1-21

See Table 1-21 for updated groups anaytical methods for all site samples.

TABLE 1-14
METHOD DETECTION LIMITS AND REPORTING LIMITS FOR SOILS AND SEDIMENT SAMPLES ANALYZED FOR VOCs

Volatile Organic Compounds (µg/kg)	MDL	RL
1,1,1-Trichloroethane	(1)	(1)
1,1,2,2-Tetrachloroethane	(1)	(1)
1,1,2-Trichloroethane	(1)	(1)
1,1-Dichloroethane	(1)	(1)
1,1-Dichloroethene	(1)	(1)
1,1,2-Trichloro-1,2,2-trifluoroethane	(1)	(1)
1,2-Dichloroethane	(1)	(1)
1,2-Dichloropropane	(1)	(1)
2-Butanone	(1)	(1)
2-Hexanone	(1)	(1)
4-Methyl-2-Pentanone (MIBK)	(1)	(1)
Acetone	(1)	(1)
Benzene	(1)	(1)
Bromodichloromethane	(1)	(1)
Bromoform	(1)	(1)
Bromomethane	(1)	(1)
Carbon disulfide	(1)	(1)
Carbon tetrachloride	(1)	(1)
Chlorobenzene	(1)	(1)
Chloroethane	(1)	(1)
Chloroform	(1)	(1)
Chloromethane	(1)	(1)
cis-1,2-Dichlorethene	(1)	(1)
cis-1,3-Dichloropropene	(1)	(1)
Dibromochloromethane	(1)	(1)
Dichlorodifluoromethane	(1)	(1)
Ethylbenzene	(1)	(1)
m,p-Xylene	(1)	(1)
Methylene chloride	(1)	(1)
Methyl-tert butyl ether	(1)	(1)
o-Xylene	(1)	(1)
Styrene	(1)	(1)
Tetrachloroethene	(1)	(1)
Toluene	(1)	(1)
trans-1,2-Dichloroethene	(1)	(1)
trans-1,3-Dichloropropene	(1)	(1)
Trichloroethene	(1)	(1)
Vinyl chloride	(1)	(1)

(1) See Table 1-21 for updated analytes, MDLs and RLs.

Notes: 1. Values detected above the MDL and below the RL will be reported as estimated J.
2. The actual RLs may be higher than those listed above. The listed reporting limits will be adjusted for moisture content and sample volume variations inherent from the use of the sampling device.

MDL - Method Detection Limit
N/A - Not Applicable
RL - Reporting Limit
µg/kg - microgram per kilogram
VOCs - Volatile Organic Compounds

TABLE 1-15
METHOD DETECTION LIMITS AND REPORTING LIMITS FOR SOILS AND SEDIMENT SAMPLES ANALYZEDSVOCs

Semivolatile Organic Compounds (ug/kg)	MDL	RL
1,2,4-Trichlorobenzene	(1)	(1)
1,2-Dichlorobenzene	(1)	(1)
1,3-Dichlorobenzene	(1)	(1)
1,4-Dichlorobenzene	(1)	(1)
2,4,5-Trichlorophenol	(1)	(1)
2,4,6-Trichlorophenol	(1)	(1)
2,4-Dichlorophenol	(1)	(1)
2,4-Dimethylphenol	(1)	(1)
2,4-Dinitrophenol	(1)	(1)
2,4-Dinitrotoluene	(1)	(1)
2,6-Dinitrotoluene	(1)	(1)
2-Chloronaphthalene	(1)	(1)
2-Chlorophenol	(1)	(1)
2-Methylnaphthalene	(1)	(1)
2-Methylphenol	(1)	(1)
2-Nitroaniline	(1)	(1)
2-Nitrophenol	(1)	(1)
3,3'-Dichlorobenzidine	(1)	(1)
3-Nitroaniline	(1)	(1)
4,6-Dinitro-2-methylphenol	(1)	(1)
4-Bromophenyl phenyl ether	(1)	(1)
4-Chloro-3-methylphenol	(1)	(1)
4-Chloroaniline	(1)	(1)
4-Chlorophenyl phenyl ether	(1)	(1)
4-Methylphenol	(1)	(1)
4-Nitroaniline	(1)	(1)
4-Nitrophenol	(1)	(1)
Acenaphthylene	(1)	(1)
Acenaphthene	(1)	(1)
Anthracene	(1)	(1)
Benzo(a)anthracene	(1)	(1)
Benzo(a)pyrene	(1)	(1)
Benzo(b)fluoranthene	(1)	(1)
Benzo(g,h,i)perylene	(1)	(1)
Benzo(k)fluoranthene	(1)	(1)
Benzoic acid	(1)	(1)
Benzyl alcohol	(1)	(1)
bis(2-Chloroethoxy) methane	(1)	(1)
bis(2-Chloroethyl) ether	(1)	(1)
bis(2-Chloroisopropyl) ether	(1)	(1)
bis(2-Ethylhexyl) phthalate	(1)	(1)
Butyl benzyl phthalate	(1)	(1)
Carbazole	(1)	(1)
Chrysene	(1)	(1)
Dibenz(a,h)anthracene	(1)	(1)
Dibenzofuran	(1)	(1)
Diethyl phthalate	(1)	(1)
Dimethyl phthalate	(1)	(1)
Di-n-butyl phthalate	(1)	(1)

TABLE 1-15
METHOD DETECTION LIMITS AND REPORTING LIMITS FOR SOILS AND SEDIMENT SAMPLES ANALYZEDSVOCs

Semivolatile Organic Compounds (ug/kg)	MDL	RL
Di-n-octyl phthalate	(1)	(1)
Fluoranthene	(1)	(1)
Fluorene	(1)	(1)
Hexachlorobenzene	(1)	(1)
Hexachlorobutadiene	(1)	(1)
Hexachlorocyclopentadiene	(1)	(1)
Hexachloroethane	(1)	(1)
Indeno(1,2,3-cd)pyrene	(1)	(1)
Isophorone	(1)	(1)
Naphthalene	(1)	(1)
Nitrobenzene	(1)	(1)
N-Nitroso-di-n-propylamine	(1)	(1)
N-Nitrosodiphenylamine	(1)	(1)
Pentachlorophenol	(1)	(1)
Phenanthrene	(1)	(1)
Phenol	(1)	(1)
Pyrene	(1)	(1)

(1) See Table 1-21 for updated analytes, MDLs and RLs.

Notes: 1. Values detected above the MDL and below the RL will be reported as estimated J.
2. The actual RLs may be higher than those listed above. The listed reporting limits will be adjusted for moisture content and sample volume variations inherent from the use of the sampling device.

MDL - Method Detection Limit
N/A - Not Applicable
RL - Reporting Limit
µg/kg - microgram per kilogram

TABLE 1-16
METHOD DETECTION LIMITS AND REPORTING LIMITS FOR SOILS AND SEDIMENT SAMPLES ANALYZED FOR PAHs

Polynuclear Aromatic Hydrocarbons	MDL	RL
Acenaphthylene	(1)	(1)
Acenaphthene	(1)	(1)
Anthracene	(1)	(1)
Benzo(a)anthracene	(1)	(1)
Benzo(a)pyrene	(1)	(1)
Benzo(b)fluoranthene	(1)	(1)
Benzo(g,h,i)perylene	(1)	(1)
Benzo(k)fluoranthene	(1)	(1)
Chrysene	(1)	(1)
Dibenz(a,h)anthracene	(1)	(1)
Fluoranthene	(1)	(1)
Fluorene	(1)	(1)
Indeno(1,2,3-cd)pyrene	(1)	(1)
Naphthalene	(1)	(1)
Phenanthrene	(1)	(1)
Pyrene	(1)	(1)

(1) See Table 1-21 for updated analytes, MDLs and RLs.

Notes: 1. Values detected above the MDL and below the RL will be reported as estimated J.
2. The actual RLs may be higher than those listed above. The listed reporting limits will be adjusted for moisture content and sample volume variations inherent from the use of the sampling device.

MDL - Method Detection Limit
N/A - Not Applicable
RL - Reporting Limit
µg/kg - microgram per kilogram

TABLE 1-17
METHOD DETECTION LIMITS AND REPORTING LIMITS FOR POLYCHLORINATED BIPHENYLS

	MDL	RL
Polychlorinated Biphenyls (ug/kg)		
Aroclor 1016	(1)	(1)
Aroclor 1221	(1)	(1)
Aroclor 1232	(1)	(1)
Aroclor 1242	(1)	(1)
Aroclor 1248	(1)	(1)
Aroclor 1254	(1)	(1)
Aroclor 1260	(1)	(1)

(1) See Table 1-21 for updated analytes, MDLs and RLs.

Notes: 1. Values detected above the MDL and below the RL will be reported as estimated J.
2. The actual RLs may be higher than those listed above. The listed reporting limits will be adjusted for moisture content and sample volume variations inherent from the use of the sampling device.

MDL - Method Detection Limit
N/A - Not Applicable
RL - Reporting Limit
µg/kg - microgram per kilogram

TABLE 1-18
METHOD DETECTION LIMITS AND REPORTING LIMITS FOR AQUEOUS SAMPLES ANALYZED FOR POLYCHLORINATED BIPHENYLS

	MDL	RL
Polychlorinated Biphenyls (µg/L)		
Aroclor 1016	(1)	(1)
Aroclor 1221	(1)	(1)
Aroclor 1232	(1)	(1)
Aroclor 1242	(1)	(1)
Aroclor 1248	(1)	(1)
Aroclor 1254	(1)	(1)
Aroclor 1260	(1)	(1)

(1) See Table 1-21 for updated analytes, MDLs and RLs.

Notes: 1. Values detected above the MDL and below the RL will be reported as estimated J.
2. The actual RLs may be higher than those listed above. The listed reporting limits will be adjusted for moisture content and sample volume variations inherent from the use of the sampling device.

MDL - Method Detection Limit
N/A - Not Applicable
RL - Reporting Limit

TABLE 1-19
METHOD DETECTION LIMITS AND REPORTING LIMITS FOR SOIL/SEDIMENT SAMPLES ANALYZED FOR METALS

Metals (mg/kg)	MDL	RL
Aluminum	(1)	(1)
Antimony	(1)	(1)
Arsenic	(1)	(1)
Barium	(1)	(1)
Beryllium	(1)	(1)
Cadmium	(1)	(1)
Calcium	(1)	(1)
Chromium	(1)	(1)
Cobalt	(1)	(1)
Copper	(1)	(1)
Iron	(1)	(1)
Lead	(1)	(1)
Magnesium	(1)	(1)
Manganese	(1)	(1)
Mercury*	(1)	(1)
Nickel	(1)	(1)
Potassium	(1)	(1)
Selenium	(1)	(1)
Silver	(1)	(1)
Sodium	(1)	(1)
Thallium	(1)	(1)
Vanadium	(1)	(1)
Zinc	(1)	(1)

(1) See Table 1-21 for updated analytes, MDLs and RLs.

Note: Values detected above the MDL and below the RL will be reported as estimated J.

MDL - Method Detection Limit

N/A - Not applicable

RL - Reporting Limit

µg/kg- microgram per kilogram

All metals will be prepared by Method 3010A or 3005A and analyzed by Method

* - Indicates that these metals will be prepared by Method 3010A and analyzed by Method 6020

** - Mercury will be prepared and analyzed by Method 7470A

TABLE 1-20
METHOD DETECTION LIMITS AND REPORTING LIMITS FOR AQUEOUS SAMPLES ANALYZED FOR METALS

Metals (µg/L)	MDL	RL
Aluminum	(1)	(1)
Antimony	(1)	(1)
Arsenic	(1)	(1)
Barium	(1)	(1)
Beryllium	(1)	(1)
Cadmium	(1)	(1)
Calcium	(1)	(1)
Chromium	(1)	(1)
Cobalt	(1)	(1)
Copper	(1)	(1)
Iron	(1)	(1)
Lead	(1)	(1)
Magnesium	(1)	(1)
Manganese	(1)	(1)
Mercury	(1)	(1)
Nickel	(1)	(1)
Potassium	(1)	(1)
Selenium	(1)	(1)
Silver	(1)	(1)
Sodium	(1)	(1)
Thallium	(1)	(1)
Vanadium	(1)	(1)
Zinc	(1)	(1)

(1) See Table 1-21 for updated analytes, MDLs and RLs.

Note: Values detected above the MDL and below the RL will be reported as estimated J.
MDL - Method Detection Limit
N/A - Not applicable
RL - Reporting Limit
µg/L - microgram per liter
All metals will be prepared by Method 3010A or 3005A and analyzed by Method 6010B or
* - Indicates that these metals will be prepared by Method 3010A and analyzed by Method 6020
** - Mercury will be prepared and analyzed by Method 7470A

Table 7-21
Summary of Enbridge Analytes, Analytical Methods, Method Detection and Reporting Limits and QA/QC Accuracy and Precision Limits

Analysis Group Description	Method Description	Method Code
Waters	Volatile Organic Compounds (GC/MS)	8260B

Analyte Description	CAS Number	RL - Limit	MDL - Limit	Units	LCSREC - Recovery Low	LCSREC - Recovery High	LCSREC - Units	LCSRPD - Precision	LCSRPD - Units	MSREC - Recovery Low	MSREC - Recovery High	MSREC - Units	MSRPD - Precision	MSRPD - Units	SUREC - Recovery Low	SUREC - Recovery High	SUREC - Units
1,1,1,2-Tetrachloroethane	630-20-6	1	0.19	ug/L	80	126	%	20	%	80	126	%	20	%			%
1,1,1-Trichloroethane	71-55-6	1	0.18	ug/L	76	127	%	20	%	76	127	%	20	%			%
1,1,2,2-Tetrachloroethane	79-34-5	1	0.29	ug/L	70	123	%	20	%	70	123	%	20	%			%
1,1,2-Trichloroethane	79-00-5	1	0.26	ug/L	70	127	%	20	%	70	127	%	20	%			%
1,1,2-Trichlorotrifluoroethane	76-13-1	1	0.24	ug/L	57	137	%	20	%	57	137	%	20	%			%
1,1-Dichloroethane	75-34-3	1	0.25	ug/L	67	122	%	20	%	67	122	%	20	%			%
1,1-Dichloroethene	75-35-4	1	0.19	ug/L	55	127	%	20	%	55	127	%	20	%			%
1,2,3-Trichloropropane	96-18-4	1	0.48	ug/L	76	121	%	20	%	76	121	%	20	%			%
1,2,4-Trichlorobenzene	120-82-1	1	0.24	ug/L	68	119	%	20	%	68	119	%	20	%			%
1,2,4-Trimethylbenzene	95-63-6	1	0.14	ug/L	78	122	%	20	%	78	122	%	20	%			%
1,2-Dibromo-3-Chloropropane	96-12-8	2	0.96	ug/L	55	126	%	20	%	55	126	%	20	%			%
1,2-Dibromoethane	106-93-4	1	0.37	ug/L	77	123	%	20	%	77	123	%	20	%			%
1,2-Dichlorobenzene	95-50-1	1	0.17	ug/L	80	116	%	20	%	80	116	%	20	%			%
1,2-Dichloroethane	107-06-2	1	0.24	ug/L	71	124	%	20	%	71	124	%	20	%			%
1,2-Dichloroethane-d4 (Surr)	17060-07-0			ug/L			%		%			%		%	80	129	%
1,2-Dichloropropane	78-87-5	1	0.21	ug/L	75	120	%	20	%	75	120	%	20	%			%
1,3,5-Trimethylbenzene	108-67-8	1	0.18	ug/L	77	123	%	20	%	77	123	%	20	%			%
1,3-Dichlorobenzene	541-73-1	1	0.24	ug/L	80	114	%	20	%	80	114	%	20	%			%
1,4-Dichlorobenzene	106-46-7	1	0.21	ug/L	79	113	%	20	%	79	113	%	20	%			%
2-Butanone	78-93-3	5	2.3	ug/L	52	148	%	20	%	52	148	%	20	%			%
2-Hexanone	591-78-6	5	0.8	ug/L	54	140	%	20	%	54	140	%	20	%			%
2-Methylnaphthalene	91-57-6	1	0.45	ug/L			%		%			%		%			%
4-Bromofluorobenzene (Surr)	460-00-4			ug/L			%		%			%		%	80	115	%
4-Methyl-2-pentanone (MIBK)	108-10-1	5	0.84	ug/L	58	134	%	20	%	58	134	%	20	%			%
Acetone	67-64-1	5	1.6	ug/L	42	149	%	20	%	42	149	%	20	%			%
Benzene	71-43-2	1	0.17	ug/L	73	117	%	20	%	73	117	%	20	%			%
Bromochloromethane	74-97-5	1	0.35	ug/L	70	122	%	20	%	70	122	%	20	%			%
Bromodichloromethane	75-27-4	1	0.19	ug/L	79	124	%	20	%	79	124	%	20	%			%
Bromoform	75-25-2	1	0.42	ug/L	59	122	%	20	%	59	122	%	20	%			%
Bromomethane	74-83-9	1	0.38	ug/L	35	181	%	20	%	35	181	%	20	%			%
Carbon disulfide	75-15-0	5	0.55	ug/L	38	123	%	20	%	38	123	%	20	%			%
Carbon tetrachloride	56-23-5	1	0.25	ug/L	66	138	%	20	%	66	138	%	20	%			%
Chlorobenzene	108-90-7	1	0.17	ug/L	78	113	%	20	%	78	113	%	20	%			%
Chloroethane	75-00-3	1	0.36	ug/L	52	150	%	20	%	52	150	%	20	%			%
Chloroform	67-66-3	1	0.15	ug/L	74	121	%	20	%	74	121	%	20	%			%
Chloromethane	74-87-3	1	0.24	ug/L	51	151	%	20	%	51	151	%	20	%			%
cis-1,2-Dichloroethene	156-59-2	1	0.27	ug/L	65	115	%	20	%	65	115	%	20	%			%
cis-1,3-Dichloropropene	10061-01-5	1	0.17	ug/L	66	122	%	20	%	66	122	%	20	%			%
Dibromochloromethane	124-48-1	1	0.25	ug/L	68	122	%	20	%	68	122	%	20	%			%
Dibromofluoromethane	1868-53-7			ug/L			%		%			%		%	80	124	%
Dibromomethane	74-95-3	1	0.3	ug/L	76	121	%	20	%	76	121	%	20	%			%
Dichlorodifluoromethane	75-71-8	1	0.31	ug/L	46	182	%	20	%	46	182	%	20	%			%
Diethyl ether	60-29-7	1	0.75	ug/L	47	122	%	20	%	47	122	%	20	%			%
Ethylbenzene	100-41-4	1	0.18	ug/L	80	116	%	20	%	80	116	%	20	%			%
Isopropylbenzene	98-82-8	1	0.2	ug/L	66	107	%	20	%	66	107	%	20	%			%
m&p-Xylene	179601-23-1	2	0.32	ug/L	79	120	%	20	%	79	120	%	20	%			%

Table 7-21
Summary of Enbridge Analytes, Analytical Methods, Method Detection and Reporting Limits and QA/QC Accuracy and Precision Limits

Methyl iodide	74-88-4	2.5	0.62	ug/L	67	142	%	20	%	67	142	%	20	%			%
Methyl tert-butyl ether	1634-04-4	1	0.24	ug/L	65	122	%	20	%	65	122	%	20	%			%
Methylene Chloride	75-09-2	2	0.67	ug/L	62	127	%	20	%	62	127	%	20	%			%
Naphthalene	91-20-3	1	0.44	ug/L	57	130	%	20	%	57	130	%	20	%			%
N-Propylbenzene	103-65-1	1	0.19	ug/L	74	124	%	20	%	74	124	%	20	%			%
o-Xylene	95-47-6	1	0.38	ug/L	80	117	%	20	%	80	117	%	20	%			%
Styrene	100-42-5	1	0.15	ug/L	80	120	%	20	%	80	120	%	20	%			%
Tetrachloroethene	127-18-4	1	0.22	ug/L	76	116	%	20	%	76	116	%	20	%			%
Toluene	108-88-3	1	0.19	ug/L	76	119	%	20	%	76	119	%	20	%			%
Toluene-d8 (Surr)	2037-26-5			ug/L			%		%			%		%	80	115	%
trans-1,2-Dichloroethene	156-60-5	1	0.32	ug/L	67	125	%	20	%	67	125	%	20	%			%
trans-1,3-Dichloropropene	10061-02-6	1	0.24	ug/L	66	110	%	20	%	66	110	%	20	%			%
trans-1,4-Dichloro-2-butene	110-57-6	10	2.2	ug/L			%		%			%		%			%
Trichloroethene	79-01-6	1	0.24	ug/L	77	118	%	20	%	77	118	%	20	%			%
Trichlorofluoromethane	75-69-4	1	0.2	ug/L	69	142	%	20	%	69	142	%	20	%			%
Vinyl acetate	108-05-4	5	0.8	ug/L	37	159	%	20	%	37	159	%	20	%			%
Vinyl chloride	75-01-4	1	0.2	ug/L	56	128	%	20	%	56	128	%	20	%			%
Xylenes, Total	1330-20-7	2	0.32	ug/L	79	120	%	20	%	79	120	%	20	%			%

Waters	Purge and Trap	5030B
Waters	Semivolatile Compounds by Gas Chromatography/Mass Spectrometry (GC/MS)	8270C

Analyte Description	CAS Number	RL - Limit	MDL - Limit	Units	LCSREC - Recovery Low	LCSREC - Recovery High	LCSREC - Units	LCSRPD - Precision	LCSRPD - Units	MSREC - Recovery Low	MSREC - Recovery High	MSREC - Units	MSRPD - Precision	MSRPD - Units	SUREC - Recovery Low	SUREC - Recovery High	SUREC - Units
1,2,4-Trichlorobenzene	120-82-1	2	0.26	ug/L	51	100	%	20	%	51	100	%	20	%			%
1,2-Dichlorobenzene	95-50-1	2	0.25	ug/L	35	100	%	20	%	35	100	%	20	%			%
1,3-Dichlorobenzene	541-73-1	2	0.21	ug/L	33	100	%	20	%	33	100	%	20	%			%
1,4-Dichlorobenzene	106-46-7	2	0.24	ug/L	33	100	%	20	%	33	100	%	20	%			%
2,4,5-Trichlorophenol	95-95-4	10	1.8	ug/L	54	110	%	20	%	54	110	%	20	%			%
2,4,6-Tribromophenol	118-79-6			ug/L			%		%			%		%	41	134	%
2,4,6-Trichlorophenol	88-06-2	5	1.1	ug/L	54	103	%	20	%	54	103	%	20	%			%
2,4-Dichlorophenol	120-83-2	10	1	ug/L	57	102	%	20	%	57	102	%	20	%			%
2,4-Dimethylphenol	105-67-9	10	1.6	ug/L	44	103	%	20	%	44	103	%	20	%			%
2,4-Dinitrophenol	51-28-5	20	7.8	ug/L	40	124	%	20	%	40	124	%	20	%			%
2,4-Dinitrotoluene	121-14-2	1	0.28	ug/L	56	119	%	20	%	56	119	%	20	%			%
2,6-Dinitrotoluene	606-20-2	0.5	0.13	ug/L	60	111	%	20	%	60	111	%	20	%			%
2-Chloronaphthalene	91-58-7	2	0.22	ug/L	48	100	%	20	%	48	100	%	20	%			%
2-Chlorophenol	95-57-8	5	1.1	ug/L	58	100	%	20	%	58	100	%	20	%			%
2-Fluorobiphenyl	321-60-8			ug/L			%		%			%		%	37	102	%
2-Fluorophenol	367-12-4			ug/L			%		%			%		%	20	100	%
2-Methylnaphthalene	91-57-6	0.5	0.15	ug/L	44	100	%	20	%	44	100	%	20	%			%
2-Methylphenol	95-48-7	2	0.25	ug/L	49	100	%	20	%	49	100	%	20	%			%
2-Nitroaniline	88-74-4	5	1.4	ug/L	71	113	%	20	%	71	113	%	20	%			%
2-Nitrophenol	88-75-5	10	1.4	ug/L	53	103	%	20	%	53	103	%	20	%			%
3 & 4 Methylphenol	15831-10-4	2	0.25	ug/L	47	100	%	20	%	47	100	%	20	%			%
3,3'-Dichlorobenzidine	91-94-1	5	1.3	ug/L	60	127	%	20	%	60	127	%	20	%			%
3-Nitroaniline	99-09-2	10	1.9	ug/L	49	116	%	20	%	49	116	%	20	%			%
4,6-Dinitro-2-methylphenol	534-52-1	20	5	ug/L	58	116	%	20	%	58	116	%	20	%			%
4-Bromophenyl phenyl ether	101-55-3	5	1.4	ug/L	51	112	%	20	%	51	112	%	20	%			%
4-Chloro-3-methylphenol	59-50-7	10	1.4	ug/L	58	106	%	20	%	58	106	%	20	%			%
4-Chloroaniline	106-47-8	10	1.3	ug/L	54	100	%	20	%	54	100	%	20	%			%

Table 1-21
Summary of Enbridge Analytes, Analytical Methods, Method Detection and Reporting Limits and QA/QC Accuracy and Precision Limits

	4-Chlorophenyl phenyl ether	7005-72-3	5	1.3	ug/L	51	102	%	20	%	51	102	%	20	%			%
	4-Nitroaniline	100-01-6	10	2	ug/L	48	122	%	20	%	48	122	%	20	%			%
	4-Nitrophenol	100-02-7	20	3.7	ug/L	22	100	%	20	%	22	100	%	20	%			%
	Acenaphthene	83-32-9	1	0.091	ug/L	48	100	%	20	%	48	100	%	20	%			%
	Acenaphthylene	208-96-8	1	0.1	ug/L	48	100	%	20	%	48	100	%	20	%			%
	Anthracene	120-12-7	1	0.12	ug/L	50	111	%	20	%	50	111	%	20	%			%
	Benzo[a]anthracene	56-55-3	0.2	0.054	ug/L	66	121	%	20	%	66	121	%	20	%			%
	Benzo[a]pyrene	50-32-8	0.2	0.045	ug/L	61	137	%	20	%	61	137	%	20	%			%
	Benzo[b]fluoranthene	205-99-2	0.2	0.069	ug/L	60	143	%	20	%	60	143	%	20	%			%
	Benzo[g,h,i]perylene	191-24-2	1	0.11	ug/L	57	152	%	20	%	57	152	%	20	%			%
	Benzo[k]fluoranthene	207-08-9	0.2	0.093	ug/L	50	145	%	20	%	50	145	%	20	%			%
	bis (2-chloroisopropyl) ether	108-60-1	2	0.26	ug/L	44	100	%	20	%	44	100	%	20	%			%
	Bis(2-chloroethoxy)methane	111-91-1	2	0.26	ug/L	61	100	%	20	%	61	100	%	20	%			%
	Bis(2-chloroethyl)ether	111-44-4	2	0.45	ug/L	43	106	%	20	%	43	106	%	20	%			%
	Bis(2-ethylhexyl) phthalate	117-81-7	10	1.2	ug/L	71	125	%	20	%	71	125	%	20	%			%
	Butyl benzyl phthalate	85-68-7	2	0.3	ug/L	72	129	%	20	%	72	129	%	20	%			%
	Carbazole	86-74-8	5	1.3	ug/L	58	112	%	20	%	58	112	%	20	%			%
	Chrysene	218-01-9	0.5	0.11	ug/L	61	127	%	20	%	61	127	%	20	%			%
	Dibenz(a,h)anthracene	53-70-3	0.3	0.12	ug/L	60	146	%	20	%	60	146	%	20	%			%
	Dibenzofuran	132-64-9	2	0.28	ug/L	53	100	%	20	%	53	100	%	20	%			%
	Diethyl phthalate	84-66-2	2	0.31	ug/L	59	110	%	20	%	59	110	%	20	%			%
	Dimethyl phthalate	131-11-3	2	0.74	ug/L	57	108	%	20	%	57	108	%	20	%			%
	Di-n-butyl phthalate	84-74-2	5	1.2	ug/L	57	118	%	20	%	57	118	%	20	%			%
	Di-n-octyl phthalate	117-84-0	10	1.6	ug/L	56	146	%	20	%	56	146	%	20	%			%
	Fluoranthene	206-44-0	1	0.1	ug/L	54	120	%	20	%	54	120	%	20	%			%
	Fluorene	86-73-7	1	0.12	ug/L	53	103	%	20	%	53	103	%	20	%			%
	Hexachlorobenzene	118-74-1	0.5	0.094	ug/L	52	115	%	20	%	52	115	%	20	%			%
	Hexachlorobutadiene	87-68-3	5	1.5	ug/L	30	100	%	20	%	30	100	%	20	%			%
	Hexachlorocyclopentadiene	77-47-4	20	5.5	ug/L	18	100	%	20	%	18	100	%	20	%			%
	Hexachloroethane	67-72-1	5	1.2	ug/L	31	100	%	20	%	31	100	%	20	%			%
	Indeno[1,2,3-cd]pyrene	193-39-5	0.2	0.066	ug/L	60	151	%	20	%	60	151	%	20	%			%
	Isophorone	78-59-1	2	0.26	ug/L	60	100	%	20	%	60	100	%	20	%			%
	Naphthalene	91-20-3	1	0.14	ug/L	43	100	%	20	%	43	100	%	20	%			%
	Nitrobenzene	98-95-3	1	0.37	ug/L	56	100	%	20	%	56	100	%	20	%			%
	Nitrobenzene-d5	4165-60-0			ug/L			%		%			%		%	38	109	%
	N-Nitrosodi-n-propylamine	621-64-7	0.5	0.15	ug/L	53	110	%	20	%	53	110	%	20	%			%
	N-Nitrosodiphenylamine	86-30-6	1	0.25	ug/L	46	118	%	20	%	46	118	%	20	%			%
	Pentachlorophenol	87-86-5	20	3.2	ug/L	48	121	%	20	%	48	121	%	20	%			%
	Phenanthrene	85-01-8	1	0.078	ug/L	52	112	%	20	%	52	112	%	20	%			%
	Phenol	108-95-2	5	0.77	ug/L	21	100	%	20	%	21	100	%	20	%			%
	Phenol-d5	4165-62-2			ug/L			%		%			%		%	20	100	%
	Pyrene	129-00-0	1	0.095	ug/L	61	130	%	20	%	61	130	%	20	%			%
	Terphenyl-d14	1718-51-0			ug/L			%		%			%		%	47	120	%
Waters	Liquid-Liquid Extraction (Separatory Funnel)	3510C																
Waters	Polychlorinated Biphenyls (PCBs) by Gas Chromatography	8082																

Analyte Description	CAS Number	RL - Limit	MDL - Limit	Units	LCSREC - Recovery Low	LCSREC - Recovery High	LCSREC - Units	LCSRPD - Precision	LCSRPD - Units	MSREC - Recovery Low	MSREC - Recovery High	MSREC - Units	MSRPD - Precision	MSRPD - Units	SUREC - Recovery Low	SUREC - Recovery High	SUREC - Units
PCB-1016	12674-11-2	0.5	0.2	ug/L	62	110	%	20	%	62	110	%	20	%			%
PCB-1221	11104-28-2	0.5	0.27	ug/L			%		%			%		%			%

Table 7-21
Summary of Enbridge Analytes, Analytical Methods, Method Detection and Reporting Limits and QA/QC Accuracy and Precision Limits

	PCB-1232	11141-16-5	0.5	0.19	ug/L			%		%			%		%			%
	PCB-1242	53469-21-9	0.5	0.18	ug/L	60	110	%	20	%	60	110	%	20	%			%
	PCB-1248	12672-29-6	0.5	0.05	ug/L			%		%			%		%			%
	PCB-1254	11097-69-1	0.5	0.083	ug/L	60	110	%	20	%	60	110	%	20	%			%
	PCB-1260	11096-82-5	0.5	0.072	ug/L	60	110	%	20	%	60	110	%	20	%			%
	Tetrachloro-m-xylene	877-09-8			ug/L			%		%			%		%	52	116	%
	DCB Decachlorobiphenyl	2051-24-3			ug/L			%		%			%		%	22	136	%
	Polychlorinated biphenyls, Total	1336-36-3	0.5	0.05	ug/L			%		%			%		%			%

Waters — Liquid-Liquid Extraction (Separatory Funnel) — 3510C

Waters — Nonhalogenated Organics using GC/FID - Modified (Gasoline Range Organics) — 8015C_GRO

Analyte Description	CAS Number	RL - Limit	MDL - Limit	Units	LCSREC - Recovery Low	LCSREC - Recovery High	LCSREC - Units	LCSRPD - Precision	LCSRPD - Units	MSREC - Recovery Low	MSREC - Recovery High	MSREC - Units	MSRPD - Precision	MSRPD - Units	SUREC - Recovery Low	SUREC - Recovery High	SUREC - Units
a,a,a-Trifluorotoluene	98-08-8			ug/L			%		%			%		%	80	120	%
4-Bromofluorobenzene	460-00-4			ug/L			%		%			%		%	80	120	%
Gasoline Range Organics (GRO)-C6-C10	8006-61-9	50	20	ug/L	80	120	%	20	%	80	120	%	20	%			%

Waters — Purge and Trap — 5030C

Waters — Nonhalogenated Organics using GC/FID - Modified (Diesel Range Organics) — 8015C_DRO

Analyte Description	CAS Number	RL - Limit	MDL - Limit	Units	LCSREC - Recovery Low	LCSREC - Recovery High	LCSREC - Units	LCSRPD - Precision	LCSRPD - Units	MSREC - Recovery Low	MSREC - Recovery High	MSREC - Units	MSRPD - Precision	MSRPD - Units	SUREC - Recovery Low	SUREC - Recovery High	SUREC - Units
2-Fluorobiphenyl	321-60-8			mg/L			%		%			%		%	28	110	%
o-Terphenyl (Surr)	84-15-1			mg/L			%		%			%		%	42	115	%
C10-C20	STL00115	500	250	ug/L	65	110	%	20	%	65	110	%	20	%			%
C20-C34	STL00272	1000	500	ug/L	65	110	%	20	%	65	110	%	20	%			%

Waters — Liquid-Liquid Extraction (Separatory Funnel) — 3510C

Waters — Metals (ICP/MS) — 6020

Analyte Description	CAS Number	RL - Limit	MDL - Limit	Units	LCSREC - Recovery Low	LCSREC - Recovery High	LCSREC - Units	LCSRPD - Precision	LCSRPD - Units	MSREC - Recovery Low	MSREC - Recovery High	MSREC - Units	MSRPD - Precision	MSRPD - Units	SUREC - Recovery Low	SUREC - Recovery High	SUREC - Units
Aluminum	7429-90-5	100	11.5	ug/L	80	120	%	20	%	75	125	%	20	%			
Antimony	7440-36-0	3	0.2	ug/L	80	120	%	20	%	75	125	%	20	%			
Arsenic	7440-38-2	1	0.15	ug/L	80	120	%	20	%	75	125	%	20	%			
Barium	7440-39-3	2.5	0.51	ug/L	80	120	%	20	%	75	125	%	20	%			
Beryllium	7440-41-7	1	0.25	ug/L	80	120	%	20	%	75	125	%	20	%			
Cadmium	7440-43-9	0.5	0.12	ug/L	80	120	%	20	%	75	125	%	20	%			
Calcium	7440-70-2	200	42.2	ug/L	80	120	%	20	%	75	125	%	20	%			
Chromium	7440-47-3	5	0.5	ug/L	80	120	%	20	%	75	125	%	20	%			
Cobalt	7440-48-4	1	0.1	ug/L	80	120	%	20	%	75	125	%	20	%			
Copper	7440-50-8	2	0.33	ug/L	80	120	%	20	%	75	125	%	20	%			
Iron	7439-89-6	100	24.2	ug/L	80	120	%	20	%	75	125	%	20	%			
Lead	7439-92-1	0.5	0.16	ug/L	80	120	%	20	%	75	125	%	20	%			
Magnesium	7439-95-4	200	26.6	ug/L	80	120	%	20	%	75	125	%	20	%			
Manganese	7439-96-5	2.5	0.34	ug/L	80	120	%	20	%	75	125	%	20	%			

Table 7-21
Summary of Enbridge Analytes, Analytical Methods, Method Detection and Reporting Limits and QA/QC Accuracy and Precision Limits

	Nickel	7440-02-0	2	0.31	ug/L	80	120	%	20	%	75	125	%	20	%
	Potassium	7440-09-7	500	54.5	ug/L	80	120	%	20	%	75	125	%	20	%
	Selenium	7782-49-2	2.5	0.41	ug/L	80	120	%	20	%	75	125	%	20	%
	Silver	7440-22-4	0.5	0.056	ug/L	80	120	%	20	%	75	125	%	20	%
	Sodium	7440-23-5	200	35.8	ug/L	80	120	%	20	%	75	125	%	20	%
	Thallium	7440-28-0	2	0.2	ug/L	80	120	%	20	%	75	125	%	20	%
	Vanadium	7440-62-2	5	0.5	ug/L	80	120	%	20	%	75	125	%	20	%
	Zinc	7440-66-6	20	5.3	ug/L	80	120	%	20	%	75	125	%	20	%

Waters	Preparation, Total Recoverable or Dissolved Metals	3005A
Waters	Mercury (CVAA)	7470A

Analyte Description	CAS Number	RL - Limit	MDL - Limit	Units	LCSREC - Recovery Low	LCSREC - Recovery High	LCSREC - Units	LCSRPD - Precision	LCSRPD - Units	MSREC - Recovery Low	MSREC - Recovery High	MSREC Units	MSRPD Precision	MSRPD Units	SUREC - Recovery Low	SUREC - Recovery High	SUREC - Units
Mercury	7439-97-6	0.2	0.06	ug/L	80	120	%	20	%	75	125	%	20	%			

Waters	Preparation, Mercury	7470A_Prep
Soils/Sediments	Volatile Organic Compounds (GC/MS)	8260B

Analyte Description	CAS Number	RL - Limit	MDL - Limit	Units	LCSREC - Recovery Low	LCSREC - Recovery High	LCSREC - Units	LCSRPD - Precision	LCSRPD - Units	MSREC - Recovery Low	MSREC - Recovery High	MSREC Units	MSRPD Precision	MSRPD Units	SUREC - Recovery Low	SUREC - Recovery High	SUREC - Units
1,1,1,2-Tetrachloroethane	630-20-6	100	10.85	ug/Kg	80	121	%	30	%	80	121	%	30	%			%
1,1,1-Trichloroethane	71-55-6	50	14.6	ug/Kg	75	123	%	30	%	75	123	%	30	%			%
1,1,2,2-Tetrachloroethane	79-34-5	50	15.75	ug/Kg	76	118	%	30	%	76	118	%	30	%			%
1,1,2-Trichloroethane	79-00-5	50	21.85	ug/Kg	79	121	%	30	%	79	121	%	30	%			%
1,1,2-Trichlorotrifluoroethane	76-13-1	100	30.95	ug/Kg	50	138	%	30	%	50	138	%	30	%			%
1,1-Dichloroethane	75-34-3	50	9.55	ug/Kg	69	119	%	30	%	69	119	%	30	%			%
1,1-Dichloroethene	75-35-4	50	14.9	ug/Kg	54	123	%	30	%	54	123	%	30	%			%
1,2,3-Trichloropropane	96-18-4	100	33.7	ug/Kg	79	117	%	30	%	79	117	%	30	%			%
1,2,4-Trichlorobenzene	120-82-1	100	16	ug/Kg	70	116	%	30	%	70	116	%	30	%			%
1,2,4-Trimethylbenzene	95-63-6	100	12.55	ug/Kg	80	117	%	30	%	80	117	%	30	%			%
1,2-Dibromo-3-Chloropropane	96-12-8	100	29.3	ug/Kg	60	126	%	30	%	60	126	%	30	%			%
1,2-Dibromoethane	106-93-4	100	34.1	ug/Kg	79	120	%	30	%	79	120	%	30	%			%
1,2-Dichlorobenzene	95-50-1	100	21.8	ug/Kg	80	114	%	30	%	80	114	%	30	%			%
1,2-Dichloroethane	107-06-2	50	11.65	ug/Kg	71	120	%	30	%	71	120	%	30	%			%
1,2-Dichloroethane-d4 (Surr)	17060-07-0			ug/Kg			%		%			%		%	80	129	%
1,2-Dichloropropane	78-87-5	50	15.35	ug/Kg	75	118	%	30	%	75	118	%	30	%			%
1,3,5-Trimethylbenzene	108-67-8	100	15	ug/Kg	80	118	%	30	%	80	118	%	30	%			%
1,3-Dichlorobenzene	541-73-1	100	18.8	ug/Kg	80	111	%	30	%	80	111	%	30	%			%
1,4-Dichlorobenzene	106-46-7	100	17	ug/Kg	80	110	%	30	%	80	110	%	30	%			%
2-Butanone	78-93-3	250	93.5	ug/Kg	51	150	%	30	%	51	150	%	30	%			%
2-Hexanone	591-78-6	250	46.85	ug/Kg	55	140	%	30	%	55	140	%	30	%			%
2-Methylnaphthalene	91-57-6	100	38.6	ug/Kg			%		%			%		%			%
4-Bromofluorobenzene (Surr)	460-00-4			ug/Kg			%		%			%		%	80	115	%
4-Methyl-2-pentanone (MIBK)	108-10-1	250	55	ug/Kg	64	133	%	30	%	64	133	%	30	%			%
Acetone	67-64-1	250	117.5	ug/Kg	46	149	%	30	%	46	149	%	30	%			%
Benzene	71-43-2	12.5	5.55	ug/Kg	72	114	%	30	%	72	114	%	30	%			%
Bromochloromethane	74-97-5	100	41.25	ug/Kg	69	120	%	30	%	69	120	%	30	%			%
Bromodichloromethane	75-27-4	100	19.4	ug/Kg	80	122	%	30	%	80	122	%	30	%			%

Table 1-21
Summary of Enbridge Analytes, Analytical Methods, Method Detection and Reporting Limits and QA/QC Accuracy and Precision Limits

Bromoform	75-25-2	100	25.75	ug/Kg	61	115	%	30	%	61	115	%	30	%			%
Bromomethane	74-83-9	100	33.15	ug/Kg	44	160	%	30	%	44	160	%	30	%			%
Carbon disulfide	75-15-0	250	19.7	ug/Kg	33	119	%	30	%	33	119	%	30	%			%
Carbon tetrachloride	56-23-5	50	22.4	ug/Kg	63	134	%	30	%	63	134	%	30	%			%
Chlorobenzene	108-90-7	50	11	ug/Kg	79	111	%	30	%	79	111	%	30	%			%
Chloroethane	75-00-3	100	29.5	ug/Kg	50	158	%	30	%	50	158	%	30	%			%
Chloroform	67-66-3	50	7.35	ug/Kg	75	118	%	30	%	75	118	%	30	%			%
Chloromethane	74-87-3	100	21.9	ug/Kg	54	147	%	30	%	54	147	%	30	%			%
cis-1,2-Dichloroethene	156-59-2	50	14.85	ug/Kg	64	112	%	30	%	64	112	%	30	%			%
cis-1,3-Dichloropropene	10061-01-5	50	8.2	ug/Kg	69	115	%	30	%	69	115	%	30	%			%
Dibromochloromethane	124-48-1	100	20.45	ug/Kg	67	122	%	30	%	67	122	%	30	%			%
Dibromofluoromethane	1868-53-7			ug/Kg			%		%			%		%	80	124	%
Dibromomethane	74-95-3	100	39.45	ug/Kg	80	114	%	30	%	80	114	%	30	%			%
Dichlorodifluoromethane	75-71-8	100	36.3	ug/Kg	42	160	%	30	%	42	160	%	30	%			%
Diethyl ether	60-29-7	100	44.4	ug/Kg	52	120	%	30	%	52	120	%	30	%			%
Ethylbenzene	100-41-4	12.5	4.9	ug/Kg	80	114	%	30	%	80	114	%	30	%			%
Isopropylbenzene	98-82-8	100	16.9	ug/Kg	70	103	%	30	%	70	103	%	30	%			%
m&p-Xylene	179601-23-1	25	11.3	ug/Kg	80	119	%	30	%	80	119	%	30	%			%
Methyl iodide	74-88-4	200	63.5	ug/Kg	57	145	%	30	%	57	145	%	30	%			%
Methyl tert-butyl ether	1634-04-4	100	14.85	ug/Kg	66	120	%	30	%	66	120	%	30	%			%
Methylene Chloride	75-09-2	100	29.95	ug/Kg	64	120	%	30	%	64	120	%	30	%			%
Naphthalene	91-20-3	100	17.65	ug/Kg	60	128	%	30	%	60	128	%	30	%			%
N-Propylbenzene	103-65-1	100	10.55	ug/Kg	80	120	%	30	%	80	120	%	30	%			%
o-Xylene	95-47-6	12.5	2.5	ug/Kg	80	116	%	30	%	80	116	%	30	%			%
Styrene	100-42-5	50	15.6	ug/Kg	80	117	%	30	%	80	117	%	30	%			%
Tetrachloroethene	127-18-4	50	14.1	ug/Kg	72	114	%	30	%	72	114	%	30	%			%
Toluene	108-88-3	12.5	4	ug/Kg	79	114	%	30	%	79	114	%	30	%			%
Toluene-d8 (Surr)	2037-26-5			ug/Kg			%		%			%		%	80	115	%
trans-1,2-Dichloroethene	156-60-5	50	17.3	ug/Kg	69	120	%	30	%	69	120	%	30	%			%
trans-1,3-Dichloropropene	10061-02-6	50	17.65	ug/Kg	68	108	%	30	%	68	108	%	30	%			%
trans-1,4-Dichloro-2-butene	110-57-6	800	215	ug/Kg			%		%			%		%			%
Trichloroethene	79-01-6	12.5	4.93	ug/Kg	76	115	%	30	%	76	115	%	30	%			%
Trichlorofluoromethane	75-69-4	100	18.3	ug/Kg	66	141	%	30	%	66	141	%	30	%			%
Vinyl acetate	108-05-4	100	45.2	ug/Kg	44	152	%	30	%	44	152	%	30	%			%
Vinyl chloride	75-01-4	12.5	4.09	ug/Kg	56	127	%	30	%	56	127	%	30	%			%
Xylenes, Total	1330-20-7	50	2.5	ug/Kg	80	119	%	30	%	80	119	%	30	%			%

Soils/Sediments	Closed System Purge and Trap	5035A_FM
Soils/Sediments	Volatile Organic Compounds (GC/MS)	8260B

Analyte Description	CAS Number	RL - Limit	MDL - Limit	Units	LCSREC - Recovery Low	LCSREC - Recovery High	LCSREC - Units	LCSRPD - Precision	LCSRPD - Units	MSREC - Recovery Low	MSREC - Recovery High	MSREC Units	MSRPD - Precision	MSRPD Units	SUREC - Recovery Low	SUREC - Recovery High	SUREC - Units
1,1,1,2-Tetrachloroethane	630-20-6	5	0.92	ug/Kg	69	116	%	30	%	69	116	%	30	%			%
1,1,1-Trichloroethane	71-55-6	5	0.83	ug/Kg	63	115	%	30	%	63	115	%	30	%			%
1,1,2,2-Tetrachloroethane	79-34-5	5	0.73	ug/Kg	77	119	%	30	%	77	119	%	30	%			%
1,1,2-Trichloroethane	79-00-5	5	0.96	ug/Kg	68	118	%	30	%	68	118	%	30	%			%
1,1,2-Trichlorotrifluoroethane	76-13-1	5	1.08	ug/Kg	43	125	%	30	%	43	125	%	30	%			%
1,1-Dichloroethane	75-34-3	5	0.61	ug/Kg	72	109	%	30	%	72	109	%	30	%			%
1,1-Dichloroethene	75-35-4	5	1.1	ug/Kg	51	111	%	30	%	51	111	%	30	%			%
1,2,3-Trichloropropane	96-18-4	5	0.78	ug/Kg	80	117	%	30	%	80	117	%	30	%			%
1,2,4-Trichlorobenzene	120-82-1	5	1.39	ug/Kg	63	111	%	30	%	63	111	%	30	%			%

Table 7-21
Summary of Enbridge Analytes, Analytical Methods, Method Detection and Reporting Limits and QA/QC Accuracy and Precision Limits

1,2,4-Trimethylbenzene	95-63-6	5	0.95	ug/Kg	80	115	%	30	%	80	115	%	30	%			%
1,2-Dibromo-3-Chloropropane	96-12-8	5	0.84	ug/Kg	55	116	%	30	%	55	116	%	30	%			%
1,2-Dibromoethane	106-93-4	5	0.81	ug/Kg	73	115	%	30	%	73	115	%	30	%			%
1,2-Dichlorobenzene	95-50-1	5	0.8	ug/Kg	80	113	%	30	%	80	113	%	30	%			%
1,2-Dichloroethane	107-06-2	5	0.8	ug/Kg	80	116	%	30	%	80	116	%	30	%			%
1,2-Dichloroethane-d4 (Surr)	17060-07-0			ug/Kg			%		%			%		%	75	140	%
1,2-Dichloropropane	78-87-5	5	0.74	ug/Kg	80	114	%	30	%	80	114	%	30	%			%
1,3,5-Trimethylbenzene	108-67-8	5	0.91	ug/Kg	80	115	%	30	%	80	115	%	30	%			%
1,3-Dichlorobenzene	541-73-1	5	0.9	ug/Kg	79	108	%	30	%	79	108	%	30	%			%
1,4-Dichlorobenzene	106-46-7	5	0.9	ug/Kg	78	107	%	30	%	78	107	%	30	%			%
2-Butanone	78-93-3	5	2.3	ug/Kg	60	141	%	30	%	60	141	%	30	%			%
2-Hexanone	591-78-6	5	2.46	ug/Kg	59	142	%	30	%	59	142	%	30	%			%
2-Methylnaphthalene	91-57-6	5	0.6	ug/Kg			%		%			%		%			%
4-Bromofluorobenzene (Surr)	460-00-4			ug/Kg			%		%			%		%	70	130	%
4-Methyl-2-pentanone (MIBK)	108-10-1	5	1.01	ug/Kg	68	133	%	30	%	68	133	%	30	%			%
Acetone	67-64-1	5	2.11	ug/Kg	26	160	%	30	%	26	160	%	30	%			%
Benzene	71-43-2	5	0.72	ug/Kg	80	110	%	30	%	80	110	%	30	%			%
Bromochloromethane	74-97-5	5	0.84	ug/Kg	60	113	%	30	%	60	113	%	30	%			%
Bromodichloromethane	75-27-4	5	0.77	ug/Kg	62	118	%	30	%	62	118	%	30	%			%
Bromoform	75-25-2	5	0.81	ug/Kg	54	110	%	30	%	54	110	%	30	%			%
Bromomethane	74-83-9	5	1.86	ug/Kg	30	160	%	30	%	30	160	%	30	%			%
Carbon disulfide	75-15-0	5	0.85	ug/Kg	30	100	%	30	%	30	100	%	30	%			%
Carbon tetrachloride	56-23-5	5	1.16	ug/Kg	50	129	%	30	%	50	129	%	30	%			%
Chlorobenzene	108-90-7	5	0.83	ug/Kg	80	106	%	30	%	80	106	%	30	%			%
Chloroethane	75-00-3	5	1.38	ug/Kg	34	153	%	30	%	34	153	%	30	%			%
Chloroform	67-66-3	5	0.71	ug/Kg	75	111	%	30	%	75	111	%	30	%			%
Chloromethane	74-87-3	5	0.99	ug/Kg	47	131	%	30	%	47	131	%	30	%			%
cis-1,2-Dichloroethene	156-59-2	5	0.75	ug/Kg	70	101	%	30	%	70	101	%	30	%			%
cis-1,3-Dichloropropene	10061-01-5	5	0.5	ug/Kg	64	100	%	30	%	64	100	%	30	%			%
Dibromochloromethane	124-48-1	5	0.73	ug/Kg	58	113	%	30	%	58	113	%	30	%			%
Dibromofluoromethane	1868-53-7			ug/Kg			%		%			%		%	74	140	%
Dibromomethane	74-95-3	5	0.71	ug/Kg	80	112	%	30	%	80	112	%	30	%			%
Dichlorodifluoromethane	75-71-8	5	1.42	ug/Kg	34	150	%	30	%	34	150	%	30	%			%
Diethyl ether	60-29-7	5	1.24	ug/Kg	44	116	%	30	%	44	116	%	30	%			%
Ethylbenzene	100-41-4	5	0.8	ug/Kg	80	110	%	30	%	80	110	%	30	%			%
Isopropylbenzene	98-82-8	5	0.95	ug/Kg	66	100	%	30	%	66	100	%	30	%			%
m&p-Xylene	179601-23-1	10	1.54	ug/Kg	80	115	%	30	%	80	115	%	30	%			%
Methyl iodide	74-88-4	10	2.45	ug/Kg	54	130	%	30	%	54	130	%	30	%			%
Methyl tert-butyl ether	1634-04-4	5	0.87	ug/Kg	62	112	%	30	%	62	112	%	30	%			%
Methylene Chloride	75-09-2	5	1.77	ug/Kg	64	115	%	30	%	64	115	%	30	%			%
Naphthalene	91-20-3	5	2.33	ug/Kg	66	115	%	30	%	66	115	%	30	%			%
N-Propylbenzene	103-65-1	5	0.85	ug/Kg	76	119	%	30	%	76	119	%	30	%			%
o-Xylene	95-47-6	5	0.87	ug/Kg	80	120	%	30	%	80	120	%	30	%			%
Styrene	100-42-5	5	0.82	ug/Kg	80	114	%	30	%	80	114	%	30	%			%
Tetrachloroethene	127-18-4	5	0.91	ug/Kg	75	109	%	30	%	75	109	%	30	%			%
Toluene	108-88-3	5	0.71	ug/Kg	79	112	%	30	%	79	112	%	30	%			%
Toluene-d8 (Surr)	2037-26-5			ug/Kg			%		%			%		%	80	126	%
trans-1,2-Dichloroethene	156-60-5	5	0.86	ug/Kg	65	113	%	30	%	65	113	%	30	%			%
trans-1,3-Dichloropropene	10061-02-6	5	0.73	ug/Kg	59	101	%	30	%	59	101	%	30	%			%
trans-1,4-Dichloro-2-butene	110-57-6	10	0.9	ug/Kg			%		%			%		%			%
Trichloroethene	79-01-6	5	0.76	ug/Kg	75	107	%	30	%	75	107	%	30	%			%
Trichlorofluoromethane	75-69-4	5	1.03	ug/Kg	56	129	%	30	%	56	129	%	30	%			%
Vinyl acetate	108-05-4	5	1.51	ug/Kg	43	122	%	30	%	43	122	%	30	%			%

Table 1-21
Summary of Enbridge Analytes, Analytical Methods, Method Detection and Reporting Limits and QA/QC Accuracy and Precision Limits

	Vinyl chloride	75-01-4	5	0.94	ug/Kg	47	114	%	30	%	47	114	%	30	%		%
	Xylenes, Total	1330-20-7	10	0.87	ug/Kg	80	120	%	30	%	80	120	%	30	%		%
Soils/Sediments	Closed System Purge and Trap	5035A_FP															
Soils/Sediments	Semivolatile Compounds by Gas Chromatography/Mass Spectrometry (GC/MS)	8270C															

Analyte Description	CAS Number	RL - Limit	MDL - Limit	Units	LCSREC - Recovery Low	LCSREC - Recovery High	LCSREC - Units	LCSRPD - Precision	LCSRPD - Units	MSREC - Recovery Low	MSREC - Recovery High	MSREC - Units	MSRPD - Precision	MSRPD - Units	SUREC - Recovery Low	SUREC - Recovery High	SUREC - Units
1,2,4-Trichlorobenzene	120-82-1	167	16.4	ug/Kg	57	108	%	30	%	57	108	%	30	%			%
1,2-Dichlorobenzene	95-50-1	167	16.5	ug/Kg	56	101	%	30	%	56	101	%	30	%			%
1,3-Dichlorobenzene	541-73-1	167	17.3	ug/Kg	54	100	%	30	%	54	100	%	30	%			%
1,4-Dichlorobenzene	106-46-7	167	18.1	ug/Kg	54	100	%	30	%	54	100	%	30	%			%
2,4,5-Trichlorophenol	95-95-4	330	46.5	ug/Kg	56	113	%	30	%	56	113	%	30	%			%
2,4,6-Tribromophenol	118-79-6			ug/Kg			%		%			%		%	30	132	%
2,4,6-Trichlorophenol	88-06-2	330	33.5	ug/Kg	53	114	%	30	%	53	114	%	30	%			%
2,4-Dichlorophenol	120-83-2	330	35.5	ug/Kg	62	112	%	30	%	62	112	%	30	%			%
2,4-Dimethylphenol	105-67-9	330	61.2	ug/Kg	59	107	%	30	%	59	107	%	30	%			%
2,4-Dinitrophenol	51-28-5	670	182	ug/Kg	10	125	%	30	%	10	125	%	30	%			%
2,4-Dinitrotoluene	121-14-2	167	17.8	ug/Kg	58	114	%	30	%	58	114	%	30	%			%
2,6-Dinitrotoluene	606-20-2	167	17.7	ug/Kg	58	113	%	30	%	58	113	%	30	%			%
2-Chloronaphthalene	91-58-7	167	15.2	ug/Kg	52	102	%	30	%	52	102	%	30	%			%
2-Chlorophenol	95-57-8	167	29	ug/Kg	58	105	%	30	%	58	105	%	30	%			%
2-Fluorobiphenyl	321-60-8			ug/Kg			%		%			%		%	22	110	%
2-Fluorophenol	367-12-4			ug/Kg			%		%			%		%	30	110	%
2-Methylnaphthalene	91-57-6	167	18.9	ug/Kg	56	102	%	30	%	56	102	%	30	%			%
2-Methylphenol	95-48-7	167	33	ug/Kg	54	108	%	30	%	54	108	%	30	%			%
2-Nitroaniline	88-74-4	167	18.2	ug/Kg	59	129	%	30	%	59	129	%	30	%			%
2-Nitrophenol	88-75-5	330	40.4	ug/Kg	58	111	%	30	%	58	111	%	30	%			%
3 & 4 Methylphenol	15831-10-4	167	30.8	ug/Kg	60	116	%	30	%	60	116	%	30	%			%
3,3'-Dichlorobenzidine	91-94-1	167	48.8	ug/Kg	22	102	%	30	%	22	102	%	30	%			%
3-Nitroaniline	99-09-2	330	65.1	ug/Kg	25	100	%	30	%	25	100	%	30	%			%
4,6-Dinitro-2-methylphenol	534-52-1	330	40.2	ug/Kg	11	127	%	30	%	11	127	%	30	%			%
4-Bromophenyl phenyl ether	101-55-3	167	13.2	ug/Kg	56	111	%	30	%	56	111	%	30	%			%
4-Chloro-3-methylphenol	59-50-7	330	81.3	ug/Kg	59	114	%	30	%	59	114	%	30	%			%
4-Chloroaniline	106-47-8	670	128	ug/Kg	16	100	%	30	%	16	100	%	30	%			%
4-Chlorophenyl phenyl ether	7005-72-3	167	13.8	ug/Kg	56	108	%	30	%	56	108	%	30	%			%
4-Nitroaniline	100-01-6	330	71.3	ug/Kg	51	108	%	30	%	51	108	%	30	%			%
4-Nitrophenol	100-02-7	670	58	ug/Kg	41	122	%	30	%	41	122	%	30	%			%
Acenaphthene	83-32-9	33	4.2	ug/Kg	54	101	%	30	%	54	101	%	30	%			%
Acenaphthylene	208-96-8	33	3.5	ug/Kg	55	102	%	30	%	55	102	%	30	%			%
Anthracene	120-12-7	33	3.9	ug/Kg	54	101	%	30	%	54	101	%	30	%			%
Benzo[a]anthracene	56-55-3	33	4.2	ug/Kg	60	119	%	30	%	60	119	%	30	%			%
Benzo[a]pyrene	50-32-8	33	3.1	ug/Kg	58	125	%	30	%	58	125	%	30	%			%
Benzo[b]fluoranthene	205-99-2	33	7.3	ug/Kg	52	132	%	30	%	52	132	%	30	%			%
Benzo[g,h,i]perylene	191-24-2	33	5.7	ug/Kg	58	139	%	30	%	58	139	%	30	%			%
Benzo[k]fluoranthene	207-08-9	33	7.1	ug/Kg	50	128	%	30	%	50	128	%	30	%			%
bis (2-chloroisopropyl) ether	108-60-1	167	17.4	ug/Kg	41	112	%	30	%	41	112	%	30	%			%
Bis(2-chloroethoxy)methane	111-91-1	167	20.5	ug/Kg	58	107	%	30	%	58	107	%	30	%			%
Bis(2-chloroethyl)ether	111-44-4	167	21.7	ug/Kg	45	122	%	30	%	45	122	%	30	%			%
Bis(2-ethylhexyl) phthalate	117-81-7	167	28.2	ug/Kg	64	118	%	30	%	64	118	%	30	%			%

Table 1-21
Summary of Enbridge Analytes, Analytical Methods, Method Detection and Reporting Limits and QA/QC Accuracy and Precision Limits

	Butyl benzyl phthalate	85-68-7	167	14.7	ug/Kg	64	121	%	30	%	64	121	%	30	%			%
	Carbazole	86-74-8	167	12.6	ug/Kg	58	106	%	30	%	58	106	%	30	%			%
	Chrysene	218-01-9	33	5.2	ug/Kg	59	118	%	30	%	59	118	%	30	%			%
	Dibenz(a,h)anthracene	53-70-3	33	4.1	ug/Kg	60	128	%	30	%	60	128	%	30	%			%
	Dibenzofuran	132-64-9	167	12.4	ug/Kg	57	102	%	30	%	57	102	%	30	%			%
	Diethyl phthalate	84-66-2	167	17	ug/Kg	58	108	%	30	%	58	108	%	30	%			%
	Dimethyl phthalate	131-11-3	167	12.8	ug/Kg	57	106	%	30	%	57	106	%	30	%			%
	Di-n-butyl phthalate	84-74-2	167	13.2	ug/Kg	59	108	%	30	%	59	108	%	30	%			%
	Di-n-octyl phthalate	117-84-0	167	15	ug/Kg	53	125	%	30	%	53	125	%	30	%			%
	Fluoranthene	206-44-0	33	4.3	ug/Kg	60	107	%	30	%	60	107	%	30	%			%
	Fluorene	86-73-7	33	3.5	ug/Kg	57	105	%	30	%	57	105	%	30	%			%
	Hexachlorobenzene	118-74-1	67	4.8	ug/Kg	54	114	%	30	%	54	114	%	30	%			%
	Hexachlorobutadiene	87-68-3	167	19.3	ug/Kg	56	113	%	30	%	56	113	%	30	%			%
	Hexachlorocyclopentadiene	77-47-4	670	113	ug/Kg	27	100	%	30	%	27	100	%	30	%			%
	Hexachloroethane	67-72-1	167	17.6	ug/Kg	50	102	%	30	%	50	102	%	30	%			%
	Indeno[1,2,3-cd]pyrene	193-39-5	33	4.3	ug/Kg	60	135	%	30	%	60	135	%	30	%			%
	Isophorone	78-59-1	167	13.5	ug/Kg	51	101	%	30	%	51	101	%	30	%			%
	Naphthalene	91-20-3	33	3.4	ug/Kg	58	103	%	30	%	58	103	%	30	%			%
	Nitrobenzene	98-95-3	33	6.1	ug/Kg	53	112	%	30	%	53	112	%	30	%			%
	Nitrobenzene-d5	4165-60-0			ug/Kg			%		%			%		%	24	110	%
	N-Nitrosodi-n-propylamine	621-64-7	167	23.1	ug/Kg	53	114	%	30	%	53	114	%	30	%			%
	N-Nitrosodiphenylamine	86-30-6	167	9.9	ug/Kg	56	111	%	30	%	56	111	%	30	%			%
	Pentachlorophenol	87-86-5	670	122	ug/Kg	26	117	%	30	%	26	117	%	30	%			%
	Phenanthrene	85-01-8	33	2.9	ug/Kg	56	109	%	30	%	56	109	%	30	%			%
	Phenol	108-95-2	167	29.3	ug/Kg	52	111	%	30	%	52	111	%	30	%			%
	Phenol-d5	4165-62-2			ug/Kg			%		%			%		%	26	110	%
	Pyrene	129-00-0	33	3.9	ug/Kg	60	117	%	30	%	60	117	%	30	%			%
	Terphenyl-d14	1718-51-0			ug/Kg			%		%			%		%	36	117	%
Soils/Sediments	Automated Soxhlet Extraction	3541																
Soils/Sediments	Polychlorinated Biphenyls (PCBs) by Gas Chromatography	8082																

Analyte Description	CAS Number	RL - Limit	MDL - Limit	Units	LCSREC - Recovery Low	LCSREC - Recovery High	LCSREC - Units	LCSRPD - Precision	LCSRPD - Units	MSREC - Recovery Low	MSREC - Recovery High	MSREC - Units	MSRPD - Precision	MSRPD - Units	SUREC - Recovery Low	SUREC - Recovery High	SUREC - Units
PCB-1016	12674-11-2	16.7	4	ug/Kg	47	115	%	30	%	47	115	%	30	%			%
PCB-1221	11104-28-2	16.7	6.3	ug/Kg			%		%			%		%			%
PCB-1232	11141-16-5	16.7	5.8	ug/Kg			%		%			%		%			%
PCB-1242	53469-21-9	16.7	5.1	ug/Kg	50	110	%	30	%	50	110	%	30	%			%
PCB-1248	12672-29-6	16.7	5.7	ug/Kg			%		%			%		%			%
PCB-1254	11097-69-1	16.7	5.2	ug/Kg	50	110	%	30	%	50	110	%	30	%			%
PCB-1260	11096-82-5	16.7	5.4	ug/Kg	63	114	%	30	%	63	114	%	30	%			%
Tetrachloro-m-xylene	877-09-8			ug/Kg			%		%			%		%	32	110	%
DCB Decachlorobiphenyl	2051-24-3			ug/Kg			%		%			%		%	38	140	%
Polychlorinated biphenyls, Total	1336-36-3	16.7	4	ug/Kg			%		%			%		%			%
Soils/Sediments	Automated Soxhlet Extraction	3541															
Soils/Sediments	Nonhalogenated Organics using GC/FID - Modified (Gasoline Range Organics)	8015C_GRO															

Table 7-21
Summary of Enbridge Analytes, Analytical Methods, Method Detection and Reporting Limits and QA/QC Accuracy and Precision Limits

Analyte Description	CAS Number	RL - Limit	MDL - Limit	Units	LCSREC - Recovery Low	LCSREC - Recovery High	LCSREC - Units	LCSRPD - Precision	LCSRPD - Units	MSREC - Recovery Low	MSREC - Recovery High	MSREC - Units	MSRPD - Precision	MSRPD - Units	SUREC - Recovery Low	SUREC - Recovery High	SUREC - Units
a,a,a-Trifluorotoluene	98-08-8			ug/Kg			%		%			%		%	70	130	%
4-Bromofluorobenzene	460-00-4			ug/Kg			%		%			%		%	70	130	%
Gasoline Range Organics (GRO)-C6-C10	8006-61-9	2500	1250	ug/Kg	70	130	%	30	%	70	130	%	30	%			%

Soils/Sediments Closed System Purge and Trap 5035A_M

Soils/Sediments Nonhalogenated Organics using GC/FID - Modified (Diesel Range Organics) 8015C_DRO

Analyte Description	CAS Number	RL - Limit	MDL - Limit	Units	LCSREC - Recovery Low	LCSREC - Recovery High	LCSREC - Units	LCSRPD - Precision	LCSRPD - Units	MSREC - Recovery Low	MSREC - Recovery High	MSREC - Units	MSRPD - Precision	MSRPD - Units	SUREC - Recovery Low	SUREC - Recovery High	SUREC - Units
2-Fluorobiphenyl	321-60-8			mg/Kg			%		%			%		%	24	127	%
o-Terphenyl (Surr)	84-15-1			mg/Kg			%		%			%		%	44	124	%
C10-C20	STL00115	8300	8300	ug/Kg	63	122	%	30	%	63	122	%	30	%			%
C20-C34	STL00272	16700	8400	ug/Kg	63	122	%	30	%	63	122	%	30	%			%

Soils/Sediments Automated Soxhlet Extraction 3541

Soils/Sediments Metals (ICP) 6010B

Analyte Description	CAS Number	RL - Limit	MDL - Limit	Units	LCSREC - Recovery Low	LCSREC - Recovery High	LCSREC - Units	LCSRPD - Precision	LCSRPD - Units	MSREC - Recovery Low	MSREC - Recovery High	MSREC - Units	MSRPD - Precision	MSRPD - Units	SUREC - Recovery Low	SUREC - Recovery High	SUREC - Units
Aluminum	7429-90-5	20000	1660	ug/Kg	80	120	%	20	%	75	125	%	20	%			
Antimony	7440-36-0	2000	220	ug/Kg	80	120	%	20	%	75	125	%	20	%			
Arsenic	7440-38-2	1000	180	ug/Kg	80	120	%	20	%	75	125	%	20	%			
Barium	7440-39-3	1000	62	ug/Kg	80	120	%	20	%	75	125	%	20	%			
Beryllium	7440-41-7	400	23	ug/Kg	80	120	%	20	%	75	125	%	20	%			
Cadmium	7440-43-9	200	22	ug/Kg	80	120	%	20	%	75	125	%	20	%			
Calcium	7440-70-2	20000	980	ug/Kg	80	120	%	20	%	75	125	%	20	%			
Chromium	7440-47-3	1000	210	ug/Kg	80	120	%	20	%	75	125	%	20	%			
Cobalt	7440-48-4	500	50	ug/Kg	80	120	%	20	%	75	125	%	20	%			
Copper	7440-50-8	1000	280	ug/Kg	80	120	%	20	%	75	125	%	20	%			
Iron	7439-89-6	20000	4910	ug/Kg	80	120	%	20	%	75	125	%	20	%			
Lead	7439-92-1	500	230	ug/Kg	80	120	%	20	%	75	125	%	20	%			
Magnesium	7439-95-4	10000	1740	ug/Kg	80	120	%	20	%	75	125	%	20	%			
Manganese	7439-96-5	1000	68	ug/Kg	80	120	%	20	%	75	125	%	20	%			
Nickel	7440-02-0	1000	82	ug/Kg	80	120	%	20	%	75	125	%	20	%			
Potassium	7440-09-7	50000	3380	ug/Kg	80	120	%	20	%	75	125	%	20	%			
Selenium	7782-49-2	1000	230	ug/Kg	80	120	%	20	%	75	125	%	20	%			
Silver	7440-22-4	500	78	ug/Kg	80	120	%	20	%	75	125	%	20	%			
Sodium	7440-23-5	100000	4790	ug/Kg	80	120	%	20	%	75	125	%	20	%			
Thallium	7440-28-0	1000	320	ug/Kg	80	120	%	20	%	75	125	%	20	%			
Vanadium	7440-62-2	500	110	ug/Kg	80	120	%	20	%	75	125	%	20	%			
Zinc	7440-66-6	2000	220	ug/Kg	80	120	%	20	%	75	125	%	20	%			

Soils/Sediments Preparation, Metals 3050B

Soils/Sediments Mercury (CVAA) 7471A

Table 7-21
Summary of Enbridge Analytes, Analytical Methods, Method Detection and Reporting Limits and QA/QC Accuracy and Precision Limits

	Analyte Description	CAS Number	RL - Limit	MDL - Limit	Units	LCSREC - Recovery Low	LCSREC - Recovery High	LCSREC - Units	LCSRPD - Precision	LCSRPD - Units	MSREC - Recovery Low	MSREC - Recovery High	MSREC - Units	MSRPD - Precision	MSRPD - Units	SUREC - Recovery Low	SUREC - Recovery High	SUREC - Units
	Mercury	7439-97-6	16.7	8.2	ug/Kg	80	120	%	20	%	75	125	%	20	%			
Soils/Sediments	Preparation, Mercury	7471A_Prep																
Oils	Volatile Organic Compounds (GC/MS)	8260B																

Analyte Description	CAS Number	RL - Limit	MDL - Limit	Units	LCSREC - Recovery Low	LCSREC - Recovery High	LCSREC - Units	LCSRPD - Precision	LCSRPD - Units	MSREC - Recovery Low	MSREC - Recovery High	MSREC - Units	MSRPD - Precision	MSRPD - Units	SUREC - Recovery Low	SUREC - Recovery High	SUREC - Units
1,1,1,2-Tetrachloroethane	630-20-6	100	10.85	ug/Kg	80	121	%	30	%	80	121	%	30	%			%
1,1,1-Trichloroethane	71-55-6	50	14.6	ug/Kg	75	123	%	30	%	75	123	%	30	%			%
1,1,2,2-Tetrachloroethane	79-34-5	50	15.75	ug/Kg	76	118	%	30	%	76	118	%	30	%			%
1,1,2-Trichloroethane	79-00-5	50	21.85	ug/Kg	79	121	%	30	%	79	121	%	30	%			%
1,1,2-Trichlorotrifluoroethane	76-13-1	100	30.95	ug/Kg	50	138	%	30	%	50	138	%	30	%			%
1,1-Dichloroethane	75-34-3	50	9.55	ug/Kg	69	119	%	30	%	69	119	%	30	%			%
1,1-Dichloroethene	75-35-4	50	14.9	ug/Kg	54	123	%	30	%	54	123	%	30	%			%
1,2,3-Trichloropropane	96-18-4	100	33.7	ug/Kg	79	117	%	30	%	79	117	%	30	%			%
1,2,4-Trichlorobenzene	120-82-1	100	16	ug/Kg	70	116	%	30	%	70	116	%	30	%			%
1,2,4-Trimethylbenzene	95-63-6	100	12.55	ug/Kg	80	117	%	30	%	80	117	%	30	%			%
1,2-Dibromo-3-Chloropropane	96-12-8	100	29.3	ug/Kg	60	126	%	30	%	60	126	%	30	%			%
1,2-Dibromoethane	106-93-4	100	34.1	ug/Kg	79	120	%	30	%	79	120	%	30	%			%
1,2-Dichlorobenzene	95-50-1	100	21.8	ug/Kg	80	114	%	30	%	80	114	%	30	%			%
1,2-Dichloroethane	107-06-2	50	11.65	ug/Kg	71	120	%	30	%	71	120	%	30	%			%
1,2-Dichloroethane-d4 (Surr)	17060-07-0			ug/Kg			%		%			%		%	80	129	%
1,2-Dichloropropane	78-87-5	50	15.35	ug/Kg	75	118	%	30	%	75	118	%	30	%			%
1,3,5-Trimethylbenzene	108-67-8	100	15	ug/Kg	80	118	%	30	%	80	118	%	30	%			%
1,3-Dichlorobenzene	541-73-1	100	18.8	ug/Kg	80	111	%	30	%	80	111	%	30	%			%
1,4-Dichlorobenzene	106-46-7	100	17	ug/Kg	80	110	%	30	%	80	110	%	30	%			%
2-Butanone	78-93-3	250	93.5	ug/Kg	51	150	%	30	%	51	150	%	30	%			%
2-Hexanone	591-78-6	250	46.85	ug/Kg	55	140	%	30	%	55	140	%	30	%			%
2-Methylnaphthalene	91-57-6	100	38.6	ug/Kg			%		%			%		%			%
4-Bromofluorobenzene (Surr)	460-00-4			ug/Kg			%		%			%		%	80	115	%
4-Methyl-2-pentanone (MIBK)	108-10-1	250	55	ug/Kg	64	133	%	30	%	64	133	%	30	%			%
Acetone	67-64-1	250	117.5	ug/Kg	46	149	%	30	%	46	149	%	30	%			%
Benzene	71-43-2	12.5	5.55	ug/Kg	72	114	%	30	%	72	114	%	30	%			%
Bromochloromethane	74-97-5	100	41.25	ug/Kg	69	120	%	30	%	69	120	%	30	%			%
Bromodichloromethane	75-27-4	100	19.4	ug/Kg	80	122	%	30	%	80	122	%	30	%			%
Bromoform	75-25-2	100	25.75	ug/Kg	61	115	%	30	%	61	115	%	30	%			%
Bromomethane	74-83-9	100	33.15	ug/Kg	44	160	%	30	%	44	160	%	30	%			%
Carbon disulfide	75-15-0	250	19.7	ug/Kg	33	119	%	30	%	33	119	%	30	%			%
Carbon tetrachloride	56-23-5	50	22.4	ug/Kg	63	134	%	30	%	63	134	%	30	%			%
Chlorobenzene	108-90-7	50	11	ug/Kg	79	111	%	30	%	79	111	%	30	%			%
Chloroethane	75-00-3	100	29.5	ug/Kg	50	158	%	30	%	50	158	%	30	%			%
Chloroform	67-66-3	50	7.35	ug/Kg	75	118	%	30	%	75	118	%	30	%			%
Chloromethane	74-87-3	100	21.9	ug/Kg	54	147	%	30	%	54	147	%	30	%			%
cis-1,2-Dichloroethene	156-59-2	50	14.85	ug/Kg	64	112	%	30	%	64	112	%	30	%			%
cis-1,3-Dichloropropene	10061-01-5	50	8.2	ug/Kg	69	115	%	30	%	69	115	%	30	%			%
Dibromochloromethane	124-48-1	100	20.45	ug/Kg	67	122	%	30	%	67	122	%	30	%			%
Dibromofluoromethane	1868-53-7			ug/Kg			%		%			%		%	80	124	%

Table 1-21
Summary of Enbridge Analytes, Analytical Methods, Method Detection and Reporting Limits and QA/QC Accuracy and Precision Limits

Dibromomethane	74-95-3	100	39.45	ug/Kg	80	114	%	30	%	80	114	%	30	%			%
Dichlorodifluoromethane	75-71-8	100	36.3	ug/Kg	42	160	%	30	%	42	160	%	30	%			%
Diethyl ether	60-29-7	100	44.4	ug/Kg	52	120	%	30	%	52	120	%	30	%			%
Ethylbenzene	100-41-4	12.5	4.9	ug/Kg	80	114	%	30	%	80	114	%	30	%			%
Isopropylbenzene	98-82-8	100	16.9	ug/Kg	70	103	%	30	%	70	103	%	30	%			%
m&p-Xylene	179601-23-1	25	11.3	ug/Kg	80	119	%	30	%	80	119	%	30	%			%
Methyl iodide	74-88-4	200	63.5	ug/Kg	57	145	%	30	%	57	145	%	30	%			%
Methyl tert-butyl ether	1634-04-4	100	14.85	ug/Kg	66	120	%	30	%	66	120	%	30	%			%
Methylene Chloride	75-09-2	100	29.95	ug/Kg	64	120	%	30	%	64	120	%	30	%			%
Naphthalene	91-20-3	100	17.65	ug/Kg	60	128	%	30	%	60	128	%	30	%			%
N-Propylbenzene	103-65-1	100	10.55	ug/Kg	80	120	%	30	%	80	120	%	30	%			%
o-Xylene	95-47-6	12.5	2.5	ug/Kg	80	116	%	30	%	80	116	%	30	%			%
Styrene	100-42-5	50	15.6	ug/Kg	80	117	%	30	%	80	117	%	30	%			%
Tetrachloroethene	127-18-4	50	14.1	ug/Kg	72	114	%	30	%	72	114	%	30	%			%
Toluene	108-88-3	12.5	4	ug/Kg	79	114	%	30	%	79	114	%	30	%			%
Toluene-d8 (Surr)	2037-26-5			ug/Kg			%		%			%		%	80	115	%
trans-1,2-Dichloroethene	156-60-5	50	17.3	ug/Kg	69	120	%	30	%	69	120	%	30	%			%
trans-1,3-Dichloropropene	10061-02-6	50	17.65	ug/Kg	68	108	%	30	%	68	108	%	30	%			%
trans-1,4-Dichloro-2-butene	110-57-6	800	215	ug/Kg			%		%			%		%			%
Trichloroethene	79-01-6	12.5	4.93	ug/Kg	76	115	%	30	%	76	115	%	30	%			%
Trichlorofluoromethane	75-69-4	100	18.3	ug/Kg	66	141	%	30	%	66	141	%	30	%			%
Vinyl acetate	108-05-4	100	45.2	ug/Kg	44	152	%	30	%	44	152	%	30	%			%
Vinyl chloride	75-01-4	12.5	4.09	ug/Kg	56	127	%	30	%	56	127	%	30	%			%
Xylenes, Total	1330-20-7	50	2.5	ug/Kg	80	119	%	30	%	80	119	%	30	%			%

Oils	Closed System Purge and Trap	5035A_M_Calc
Oils	Semivolatile Compounds by Gas Chromatography/Mass Spectrometry (GC/MS)	8270C

Analyte Description	CAS Number	RL - Limit	MDL - Limit	Units	LCSREC - Recovery Low	LCSREC - Recovery High	LCSREC - Units	LCSRPD - Precision	LCSRPD - Units	MSREC - Recovery Low	MSREC - Recovery High	MSREC - Units	MSRPD - Precision	MSRPD - Units	SUREC - Recovery Low	SUREC - Recovery High	SUREC - Units
1,2,4-Trichlorobenzene	120-82-1	50600	25000	ug/Kg	57	108	%	30	%	57	108	%	30	%			%
1,2-Dichlorobenzene	95-50-1	50600	25000	ug/Kg	56	101	%	30	%	56	101	%	30	%			%
1,3-Dichlorobenzene	541-73-1	50600	25000	ug/Kg	54	100	%	30	%	54	100	%	30	%			%
1,4-Dichlorobenzene	106-46-7	50600	25000	ug/Kg	54	100	%	30	%	54	100	%	30	%			%
2,4,5-Trichlorophenol	95-95-4	100000	50000	ug/Kg	56	113	%	30	%	56	113	%	30	%			%
2,4,6-Tribromophenol	118-79-6			ug/Kg			%		%			%		%	30	132	%
2,4,6-Trichlorophenol	88-06-2	100000	50000	ug/Kg	53	114	%	30	%	53	114	%	30	%			%
2,4-Dichlorophenol	120-83-2	100000	50000	ug/Kg	62	112	%	30	%	62	112	%	30	%			%
2,4-Dimethylphenol	105-67-9	100000	50000	ug/Kg	59	107	%	30	%	59	107	%	30	%			%
2,4-Dinitrophenol	51-28-5	202000	101000	ug/Kg	10	125	%	30	%	10	125	%	30	%			%
2,4-Dinitrotoluene	121-14-2	50600	25000	ug/Kg	58	114	%	30	%	58	114	%	30	%			%
2,6-Dinitrotoluene	606-20-2	50600	25000	ug/Kg	58	113	%	30	%	58	113	%	30	%			%
2-Chloronaphthalene	91-58-7	50600	25000	ug/Kg	52	102	%	30	%	52	102	%	30	%			%
2-Chlorophenol	95-57-8	50600	25000	ug/Kg	58	105	%	30	%	58	105	%	30	%			%
2-Fluorobiphenyl	321-60-8			ug/Kg			%		%			%		%	22	110	%
2-Fluorophenol	367-12-4			ug/Kg			%		%			%		%	30	110	%
2-Methylnaphthalene	91-57-6	50600	25000	ug/Kg	56	102	%	30	%	56	102	%	30	%			%
2-Methylphenol	95-48-7	50600	25000	ug/Kg	54	108	%	30	%	54	108	%	30	%			%
2-Nitroaniline	88-74-4	50600	25000	ug/Kg	59	129	%	30	%	59	129	%	30	%			%
2-Nitrophenol	88-75-5	100000	50000	ug/Kg	58	111	%	30	%	58	111	%	30	%			%
3 & 4 Methylphenol	15831-10-4	50600	25000	ug/Kg	60	116	%	30	%	60	116	%	30	%			%

Table 7-21
Summary of Enbridge Analytes, Analytical Methods, Method Detection and Reporting Limits and QA/QC Accuracy and Precision Limits

3,3'-Dichlorobenzidine	91-94-1	50600	25000	ug/Kg	22	102	%	30	%	22	102	%	30	%			%
3-Nitroaniline	99-09-2	100000	50000	ug/Kg	25	100	%	30	%	25	100	%	30	%			%
4,6-Dinitro-2-methylphenol	534-52-1	100000	50000	ug/Kg	11	127	%	30	%	11	127	%	30	%			%
4-Bromophenyl phenyl ether	101-55-3	50600	25000	ug/Kg	56	111	%	30	%	56	111	%	30	%			%
4-Chloro-3-methylphenol	59-50-7	100000	50000	ug/Kg	59	114	%	30	%	59	114	%	30	%			%
4-Chloroaniline	106-47-8	100000	50000	ug/Kg	16	100	%	30	%	16	100	%	30	%			%
4-Chlorophenyl phenyl ether	7005-72-3	50600	25000	ug/Kg	56	108	%	30	%	56	108	%	30	%			%
4-Nitroaniline	100-01-6	100000	50000	ug/Kg	51	108	%	30	%	51	108	%	30	%			%
4-Nitrophenol	100-02-7	202000	101000	ug/Kg	41	122	%	30	%	41	122	%	30	%			%
Acenaphthene	83-32-9	10000	5000	ug/Kg	54	101	%	30	%	54	101	%	30	%			%
Acenaphthylene	208-96-8	10000	5000	ug/Kg	55	102	%	30	%	55	102	%	30	%			%
Anthracene	120-12-7	10000	5000	ug/Kg	54	101	%	30	%	54	101	%	30	%			%
Benzo[a]anthracene	56-55-3	10000	5000	ug/Kg	60	119	%	30	%	60	119	%	30	%			%
Benzo[a]pyrene	50-32-8	10000	5000	ug/Kg	58	125	%	30	%	58	125	%	30	%			%
Benzo[b]fluoranthene	205-99-2	10000	5000	ug/Kg	52	132	%	30	%	52	132	%	30	%			%
Benzo[g,h,i]perylene	191-24-2	10000	5000	ug/Kg	58	139	%	30	%	58	139	%	30	%			%
Benzo[k]fluoranthene	207-08-9	10000	5000	ug/Kg	50	128	%	30	%	50	128	%	30	%			%
bis (2-chloroisopropyl) ether	108-60-1	50600	25000	ug/Kg	41	112	%	30	%	41	112	%	30	%			%
Bis(2-chloroethoxy)methane	111-91-1	50600	25000	ug/Kg	58	107	%	30	%	58	107	%	30	%			%
Bis(2-chloroethyl)ether	111-44-4	50600	25000	ug/Kg	45	122	%	30	%	45	122	%	30	%			%
Bis(2-ethylhexyl) phthalate	117-81-7	50600	25000	ug/Kg	64	118	%	30	%	64	118	%	30	%			%
Butyl benzyl phthalate	85-68-7	50600	25000	ug/Kg	64	121	%	30	%	64	121	%	30	%			%
Carbazole	86-74-8	50600	25000	ug/Kg	58	106	%	30	%	58	106	%	30	%			%
Chrysene	218-01-9	10000	5000	ug/Kg	59	118	%	30	%	59	118	%	30	%			%
Dibenz(a,h)anthracene	53-70-3	10000	5000	ug/Kg	60	128	%	30	%	60	128	%	30	%			%
Dibenzofuran	132-64-9	50600	25000	ug/Kg	57	102	%	30	%	57	102	%	30	%			%
Diethyl phthalate	84-66-2	50600	25000	ug/Kg	58	108	%	30	%	58	108	%	30	%			%
Dimethyl phthalate	131-11-3	50600	25000	ug/Kg	57	106	%	30	%	57	106	%	30	%			%
Di-n-butyl phthalate	84-74-2	50600	25000	ug/Kg	59	108	%	30	%	59	108	%	30	%			%
Di-n-octyl phthalate	117-84-0	50600	25000	ug/Kg	53	125	%	30	%	53	125	%	30	%			%
Fluoranthene	206-44-0	10000	5000	ug/Kg	60	107	%	30	%	60	107	%	30	%			%
Fluorene	86-73-7	10000	5000	ug/Kg	57	105	%	30	%	57	105	%	30	%			%
Hexachlorobenzene	118-74-1	20200	10100	ug/Kg	54	114	%	30	%	54	114	%	30	%			%
Hexachlorobutadiene	87-68-3	50600	25000	ug/Kg	56	113	%	30	%	56	113	%	30	%			%
Hexachlorocyclopentadiene	77-47-4	202000	101000	ug/Kg	27	100	%	30	%	27	100	%	30	%			%
Hexachloroethane	67-72-1	50600	25000	ug/Kg	50	102	%	30	%	50	102	%	30	%			%
Indeno[1,2,3-cd]pyrene	193-39-5	10000	5000	ug/Kg	60	135	%	30	%	60	135	%	30	%			%
Isophorone	78-59-1	50600	25000	ug/Kg	51	101	%	30	%	51	101	%	30	%			%
Naphthalene	91-20-3	10000	5000	ug/Kg	58	103	%	30	%	58	103	%	30	%			%
Nitrobenzene	98-95-3	10000	5000	ug/Kg	53	112	%	30	%	53	112	%	30	%			%
Nitrobenzene-d5	4165-60-0			ug/Kg			%		%			%		%	24	110	%
N-Nitrosodi-n-propylamine	621-64-7	50600	25000	ug/Kg	53	114	%	30	%	53	114	%	30	%			%
N-Nitrosodiphenylamine	86-30-6	50600	25000	ug/Kg	56	111	%	30	%	56	111	%	30	%			%
Pentachlorophenol	87-86-5	202000	101000	ug/Kg	26	117	%	30	%	26	117	%	30	%			%
Phenanthrene	85-01-8	10000	5000	ug/Kg	56	109	%	30	%	56	109	%	30	%			%
Phenol	108-95-2	50600	25000	ug/Kg	52	111	%	30	%	52	111	%	30	%			%
Phenol-d5	4165-62-2			ug/Kg			%		%			%		%	26	110	%
Pyrene	129-00-0	10000	5000	ug/Kg	60	117	%	30	%	60	117	%	30	%			%
Terphenyl-d14	1718-51-0			ug/Kg			%		%			%		%	36	117	%

Oils	Waste Dilution	3580A
Oils	Polychlorinated Biphenyls (PCBs) by Gas Chromatography	8082

Table 1-21
Summary of Enbridge Analytes, Analytical Methods, Method Detection and Reporting Limits and QA/QC Accuracy and Precision Limits

Analyte Description	CAS Number	RL - Limit	MDL - Limit	Units	LCSREC - Recovery Low	LCSREC - Recovery High	LCSREC - Units	LCSRPD - Precision	LCSRPD - Units	MSREC - Recovery Low	MSREC - Recovery High	MSREC - Units	MSRPD - Precision	MSRPD - Units	SUREC - Recovery Low	SUREC - Recovery High	SUREC - Units
PCB-1016	12674-11-2	500	250	ug/Kg	47	115	%	30	%	47	115	%	30	%			%
PCB-1221	11104-28-2	500	250	ug/Kg			%		%			%		%			%
PCB-1232	11141-16-5	500	250	ug/Kg			%		%			%		%			%
PCB-1242	53469-21-9	500	250	ug/Kg	50	110	%		%	50	110	%		%			%
PCB-1248	12672-29-6	500	250	ug/Kg			%		%			%		%			%
PCB-1254	11097-69-1	500	250	ug/Kg	50	110	%		%	50	110	%		%			%
PCB-1260	11096-82-5	500	250	ug/Kg	63	114	%	30	%	63	114	%	30	%			%
Tetrachloro-m-xylene	877-09-8			ug/Kg			%		%			%		%	32	110	%
DCB Decachlorobiphenyl	2051-24-3			ug/Kg			%		%			%		%	38	140	%
Polychlorinated biphenyls, Total	1336-36-3	500	250	ug/Kg			%		%			%		%			%

Oils	Waste Dilution	3580A
Oils	Nonhalogenated Organics using GC/FID - Modified (Gasoline Range Organics)	8015C_GRO

Analyte Description	CAS Number	RL - Limit	MDL - Limit	Units	LCSREC - Recovery Low	LCSREC - Recovery High	LCSREC - Units	LCSRPD - Precision	LCSRPD - Units	MSREC - Recovery Low	MSREC - Recovery High	MSREC - Units	MSRPD - Precision	MSRPD - Units	SUREC - Recovery Low	SUREC - Recovery High	SUREC - Units
a,a,a-Trifluorotoluene	98-08-8			ug/Kg			%		%			%		%	70	130	%
4-Bromofluorobenzene	460-00-4			ug/Kg			%		%			%		%	70	130	%
Gasoline Range Organics (GRO)-C6-C10	8006-61-9	2500	1250	ug/Kg	70	130	%	30	%	70	130	%	30	%			%

Oils	Waste Dilution	3580A
Oils	Nonhalogenated Organics using GC/FID - Modified (Diesel Range Organics)	8015C_DRO

Analyte Description	CAS Number	RL - Limit	MDL - Limit	Units	LCSREC - Recovery Low	LCSREC - Recovery High	LCSREC - Units	LCSRPD - Precision	LCSRPD - Units	MSREC - Recovery Low	MSREC - Recovery High	MSREC - Units	MSRPD - Precision	MSRPD - Units	SUREC - Recovery Low	SUREC - Recovery High	SUREC - Units
2-Fluorobiphenyl	321-60-8			mg/Kg			%		%			%		%	24	127	%
o-Terphenyl (Surr)	84-15-1			mg/Kg			%		%			%		%	44	124	%
C10-C20	STL00115	500000	250000	ug/Kg	63	122	%	30	%	63	122	%	30	%			%
C20-C34	STL00272	1000000	500000	ug/Kg	63	122	%	30	%	63	122	%	30	%			%

Oils	Waste Dilution	3580A
Oils	Metals (ICP)	6010B

Analyte Description	CAS Number	RL - Limit	MDL - Limit	Units	LCSREC - Recovery Low	LCSREC - Recovery High	LCSREC - Units	LCSRPD - Precision	LCSRPD - Units	MSREC - Recovery Low	MSREC - Recovery High	MSREC - Units	MSRPD - Precision	MSRPD - Units	SUREC - Recovery Low	SUREC - Recovery High	SUREC - Units
Aluminum	7429-90-5	20000	1660	ug/Kg	80	120	%	20	%	75	125	%	20	%			
Antimony	7440-36-0	2000	220	ug/Kg	80	120	%	20	%	75	125	%	20	%			
Arsenic	7440-38-2	1000	180	ug/Kg	80	120	%	20	%	75	125	%	20	%			
Barium	7440-39-3	1000	62	ug/Kg	80	120	%	20	%	75	125	%	20	%			
Beryllium	7440-41-7	400	23	ug/Kg	80	120	%	20	%	75	125	%	20	%			
Cadmium	7440-43-9	200	22	ug/Kg	80	120	%	20	%	75	125	%	20	%			
Calcium	7440-70-2	20000	980	ug/Kg	80	120	%	20	%	75	125	%	20	%			
Chromium	7440-47-3	1000	210	ug/Kg	80	120	%	20	%	75	125	%	20	%			
Cobalt	7440-48-4	500	50	ug/Kg	80	120	%	20	%	75	125	%	20	%			

Table 1-21
Summary of Enbridge Analytes, Analytical Methods, Method Detection and Reporting Limits and QA/QC Accuracy and Precision Limits

	Copper	7440-50-8	1000	280	ug/Kg	80	120	%	20	%	75	125	%	20	%
	Iron	7439-89-6	20000	4910	ug/Kg	80	120	%	20	%	75	125	%	20	%
	Lead	7439-92-1	500	230	ug/Kg	80	120	%	20	%	75	125	%	20	%
	Magnesium	7439-95-4	10000	1740	ug/Kg	80	120	%	20	%	75	125	%	20	%
	Manganese	7439-96-5	1000	68	ug/Kg	80	120	%	20	%	75	125	%	20	%
	Nickel	7440-02-0	1000	82	ug/Kg	80	120	%	20	%	75	125	%	20	%
	Potassium	7440-09-7	50000	3380	ug/Kg	80	120	%	20	%	75	125	%	20	%
	Selenium	7782-49-2	1000	230	ug/Kg	80	120	%	20	%	75	125	%	20	%
	Silver	7440-22-4	500	78	ug/Kg	80	120	%	20	%	75	125	%	20	%
	Sodium	7440-23-5	100000	4790	ug/Kg	80	120	%	20	%	75	125	%	20	%
	Thallium	7440-28-0	1000	320	ug/Kg	80	120	%	20	%	75	125	%	20	%
	Vanadium	7440-62-2	500	110	ug/Kg	80	120	%	20	%	75	125	%	20	%
	Zinc	7440-66-6	2000	220	ug/Kg	80	120	%	20	%	75	125	%	20	%

Oils	Preparation, Metals	3050B
Oils	Mercury (CVAA)	7471A

Analyte Description	CAS Number	RL - Limit	MDL - Limit	Units	LCSREC - Recovery Low	LCSREC - Recovery High	LCSREC - Units	LCSRPD - Precision	LCSRPD - Units	MSREC - Recovery Low	MSREC - Recovery High	MSREC - Units	MSRPD - Precision	MSRPD - Units	SUREC - Recovery Low	SUREC - Recovery High	SUREC - Units
Mercury	7439-97-6	16.7	8.2	ug/Kg	80	120	%	20	%	75	125	%	20	%			

Oils	Preparation, Mercury	7471A_Prep

TABLE 2-1
SAMPLE CONTAINERS, PRESERVATION AND HOLDING TIMES

	Parameter	Container	Preservative	Holding Time
Aqueous Samples	Volatile Organic Compounds	(3) 40 mL VOA glass vials	4°C, HCL	14 days to analysis
	GRO	(2) 40 mL VOA glass vials	4°C, HCL	14 days to analysis
	DRO/ORO	(2) 1 Liter Amber bottles	4°C	7 days to extract, 40 days to analysis
	PCB's	(1) 1 Liter Amber bottle	4°C	7 days to extract, 40 days to analysis
	Semivolatile Organic Compounds	(1) 1 Liter Amber bottle	4°C	7 days to extract, 40 days to analysis
	Metals and Mercury	500 mL HDPE bottle	4°C, HNO3	Mercury 28 days to analysis, all other Metals 180 days to analysis
Soil / Sediment Samples	Volatile Organic Compounds	(5) 40 mL Tared VOA vials	4°C, two vials 5mls NaBisu	laboratory may freeze reagent water at < -7°C, 14 days to analysi
	GRO	(1) 40 mL Tared VOA vial	4°C, one vial 10 mls metha	14 days to analysis
	DRO/ORO	16 oz jar	4°C	14 days to extract, 40 days to analysis
	PCB's	Taken from 16 ox jar above	4°C	14 days to extract, 40 days to analysis
	Semivolatile Organic Compounds	Taken from 16 ox jar above	4°C	14 days to extract, 40 days to analysis
	Metals and Mercury	Taken from 16 ox jar above	4°C	Mercury 28 days to analysis, all other Metals 180 days to analysis

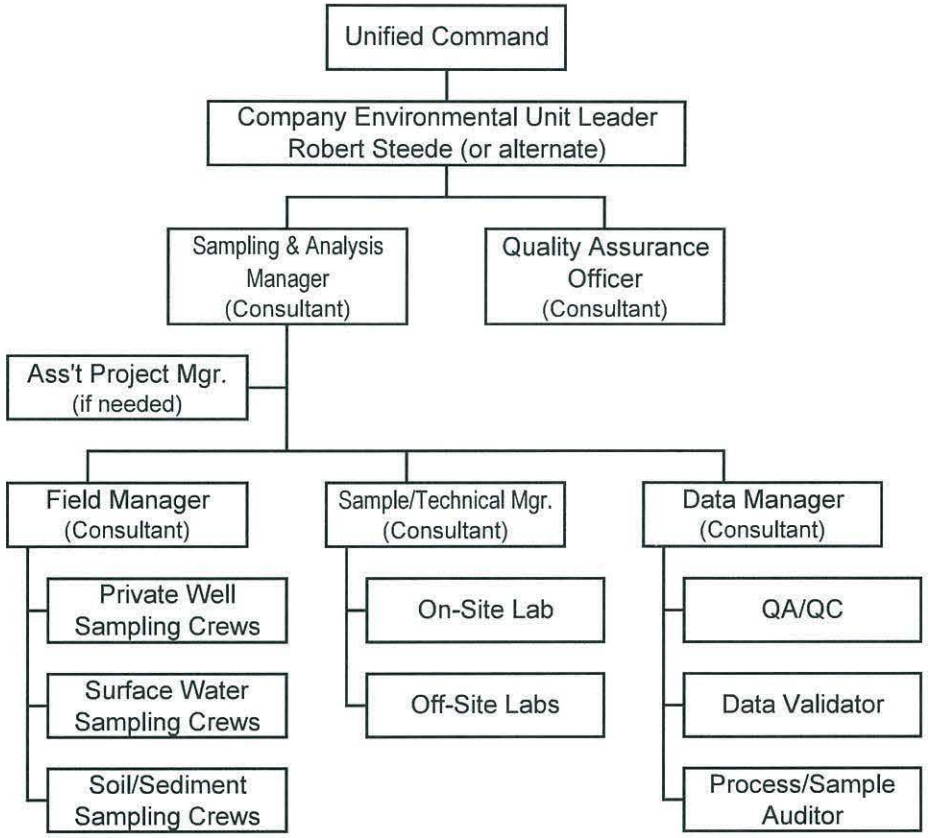
Sample containers will arrive on site already prepared with the appropriate preservative.
HDPE - High-Density Polyethylene
HNO3 - Nitric acid

VOA - Volatile Organic Anlaysis

Figures

Figure 1

Enbridge Line 6B, MP 608
Quality Assurance Project Plan
Organization Chart



Appendix A

Air Sampling and Monitoring Plan
Dated July 31, 2010 (Air Sampling QAPP)

CTEH
Center for Toxicology and Environmental Health, L.L.C.
5120 N. Shore Drive, North Little Rock, AR 72118 Phone: 501.801.8500 www.cteh.com

AIR SAMPLING AND MONITORING PLAN

ENBRIDGE ENERGY OIL SPILL

MARSHALL, MICHIGAN

JULY 31, 2010

Revised August 15, 2010

PREPARED BY:

CENTER FOR TOXICOLOGY AND ENVIRONMENTAL HEALTH, L.L.C.
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Table of Contents

1. Purpose 3
2. Air Monitoring 3
2.1 Sampling Frequency and Coverage 5
3. Air Sampling 5
4. Odor Investigation 9
5. Decision Tree and Action Levels 9
6. Sample Station Locations 9
7. Data Quality and Management 9
8. Project Organization 12
10. Calibration and Maintenance of Field Instruments 12
11. Chain of Custody (COC) 12
12. Sample Labels 12
14. Packaging and Shipping 12

Appendix A - GPS Coordinates
Appendix B - CTEH QAPP
Appendix C - CTEH DMP
Appendix D - Equipment SOPs

Table of Tables

Table 1 4
Table 2 6
Table 3 6
Table 4 6

1. Purpose

Center for Toxicology and Environmental Health, L.L.C. (CTEH®) was requested to respond in support of site operations for the Enbridge Energy crude oil release on Monday, July 27, 2010. CTEH® is providing air monitoring, air sampling, and toxicology support to address public health concerns resulting from the crude oil spill. CTEH® has been conducting community air monitoring and sampling in communities t protect human health.

This work plan addresses air monitoring and sampling in communities potentially affected by fumes from the crude oil spill. The purpose of this sampling includes the following:

- Air monitoring and sampling in the community potentially impacted by the presence of crude oil vapors and/or fumes from the spill.
- Air monitoring and sampling throughout the community during mitigation activities to evaluate the potential for exposure.
- Perform air monitoring and sampling in response to reports of odors in the community.
- Provide personnel monitoring for CTEH and EPA contractors performing air sampling and monitoring to protect against overexposure to chemicals in crude oil vapors and/or fumes.

CTEH® will conduct community air monitoring in support of Unified Command actions. Data from air monitoring and sampling will be evaluated to make decisions regarding the need for additional monitoring and sampling. Data will be reported to Unified Command, Enbridge representatives and USEPA, as soon as available.

Two types of air monitoring will be conducted, analytical and real-time. These are discussed at greater length in the following sections of this report.

2. Air Monitoring

Air monitoring will be conducted using a number of real-time instruments including the MultiRAE Plus, AreaRAE, Gastec colorimetric detector tubes, and/or UltraRAE/ UltraRAE 3000 throughout impacted communities. The major sampling routes are show in Figure 1. Monitoring locations may be modified based on operational requirements. The air monitoring equipment used is listed in Table 1.

Figure 1
Major Sampling Routes for Air Monitoring

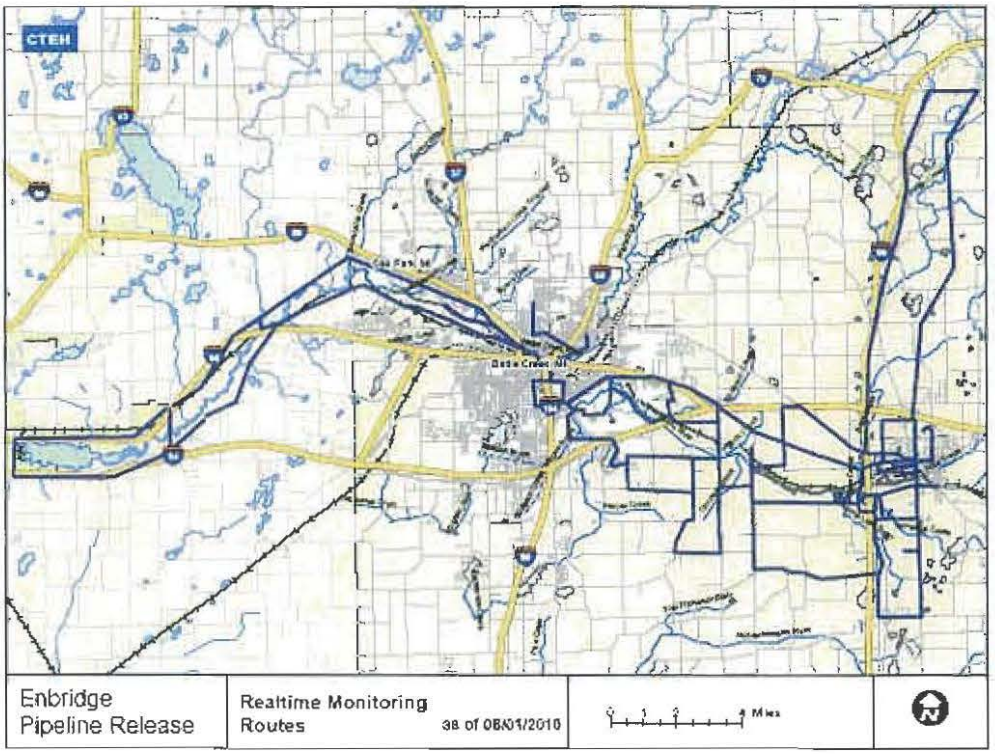


Table 1
Real-Time Air Monitoring Equipment

Instrument	Chemical	Detection Limit
AreaRAE	VOCs	0.1 ppm
AreaRAE	H_2S	1.0 ppm
MultiRAE PID	VOCs	0.1 ppm
MultiRAE H_2S electrochemical sensor	H_2S	1 ppm
MultiRAE SO_2 electrochemical sensor	SO_2	0.1 ppm
UltraRAE/UltraRAE 3000 PID with benzene sep filters	Benzene	0.05 - 0. 1 ppm
Gastec detector tube with pump	Benzene	0.05 ppm*

* Gastec detection limits are based upon detector tubes used

CTEH personnel will perform continuous air monitoring in the community using an AreaRAE or MultiRAE Plus. Real-time data using these instruments will be collected for volatile organic compounds (VOCs), hydrogen sulfide (H_2S), oxygen (O_2) and lower explosive limit (LEL). Benzene levels will be monitored using an UltraRAE, UltraRAE 3000 and/or benzene specific colorimetric tubes.

2.1 Sampling Frequency and Coverage

Roaming vehicles in the community will operate 24 hours per day. Air monitoring will be conducted throughout the communities near affected waterways. In addition, real-time air monitoring will be conducted as needed to respond to potential concerns raised on or off-site, and for air quality during operations performed by Fish and Wildlife or first responders.

Two readings will be taken at locations along the length of the spill, returning multiple times to monitor areas with detectable VOCs or benzene levels. Multiple readings in the same location will be used as one method to determine if VOC and/or benzene detects from instantaneous readings from real-time instrumentation are due to transient elevations or spikes in air concentration or if the elevated air concentrations are sustained. If sustained, further air monitoring and/or sampling would be initiated. Benzene readings will also be taken in all areas with detectable VOCs or where an odor is present.

AreaRAEs with data-logging capabilities may also be used at some fixed locations and in roaming to supplement analytical data.

3. Air Sampling

Analytical air sampling will be conducted in community areas close to the waterways impacted by the spill. Analytical samples will be taken in fixed locations (Figure 2) in the community, at locations selected to represent background (Figure 3), at community receptors near oil collection points (Figure 4) and as needed due to changing site conditions, odor complaints, wind direction, and evaluation of benzene or oil-related other air concentrations for possible evacuation and re-entry. Background stations may be eliminated after sufficient data are collected to establish background VOC concentrations. The GPS coordinates of initial analytical stations is included in Appendix A. Methods may include either NIOSH Method 1500/1501 and/or EPA TO-15.

Initial fixed community sampling and background locations were chosen with input from Unified Command representatives and Enbridge industrial hygienist, Daniel Lu, PhD, CIH. Air samples will be collected 2 -3 times per day at each location during a 24-hour period (sorbent tubes or regulated evacuated canisters) or for a 24-hour sampling interval (regulated evacuated canisters) each day. The criteria that will be used to select sampling locations will include proximity to residences, areas of oil

collection, and areas downwind of the oil release point. Air samples collected using sorbent tubes will be analyzed for aromatic hydrocarbons using NIOSH method 1500/1501 (Table 2). Canister samples will be analyzed for VOCs using EPA Method TO-15 (Table 3). Methods are summarized in Table 4.

Table 2

Aromatic Hydrocarbons Detected using NIOSH 1500/1501

Group A	Group B
Benzene	Cumene
Toluene	Styrene
Ethylbenzene	p-tert butyl toluene
Xylene	methyl styrene

Table 3

Predominant Crude Oil VOCs Detected by TO-15

Benzene	Heptane, n-
Butane, 2-methyl-*	Hexane, n-
Cyclohexane	Naphthalene
Cyclohexane, 1,3-dimethyl-*	Nonane*
Cyclohexane, 1,3-dimethyl-, cis-*	Octane*
Cyclohexane, butyl-*	Octane, 4-methyl-*
Cyclohexane, ethyl-*	Pentane, 2-methyl-*
Cyclohexane, methyl-*	Toluene
Cyclohexane, propyl-*	Trimethylbenzene, 1,2,4-
Decane*	Trimethylbenzene, 1,3,5-
Dodecane*	Undecane*
Ethylbenzene	Xylene, m&p-
Ethyltoluene, 4-	Xylene, o-

***- Tentatively identified compound (TIC)**

Table 4

Summary of Integrated Air Sampling Method

Analyte	Analytical Method	Sample Media	*Flow Rate (ml/min)*
VOCs	EPA TO-15	Canisters	NA

Aromatic hydrocarbons	NIOSH 1500/1501	Coconut shell charcoal	200

Figure 2
Location of Fixed Analytical Stations

Figure 3
Background Locations

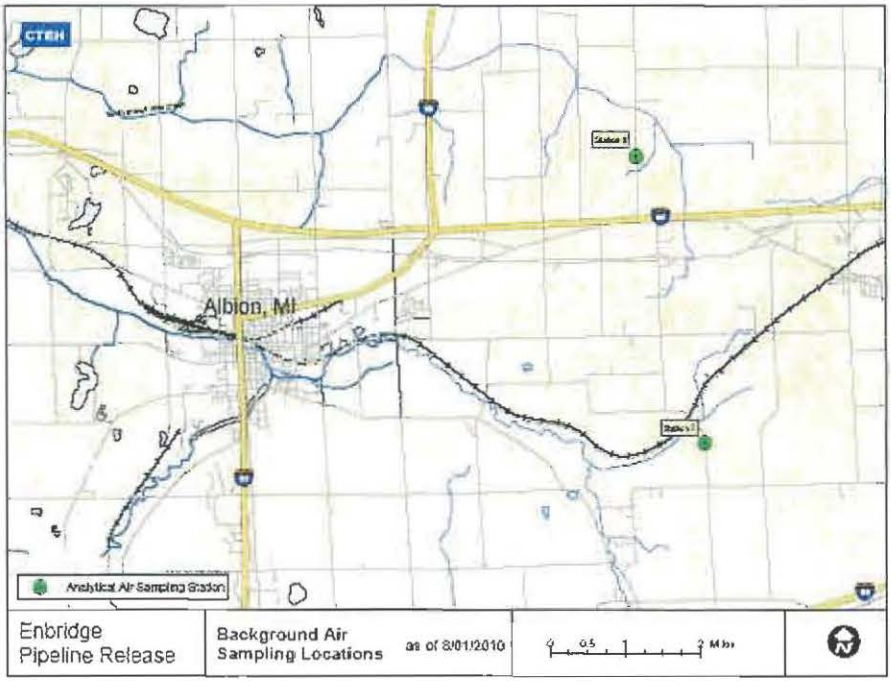
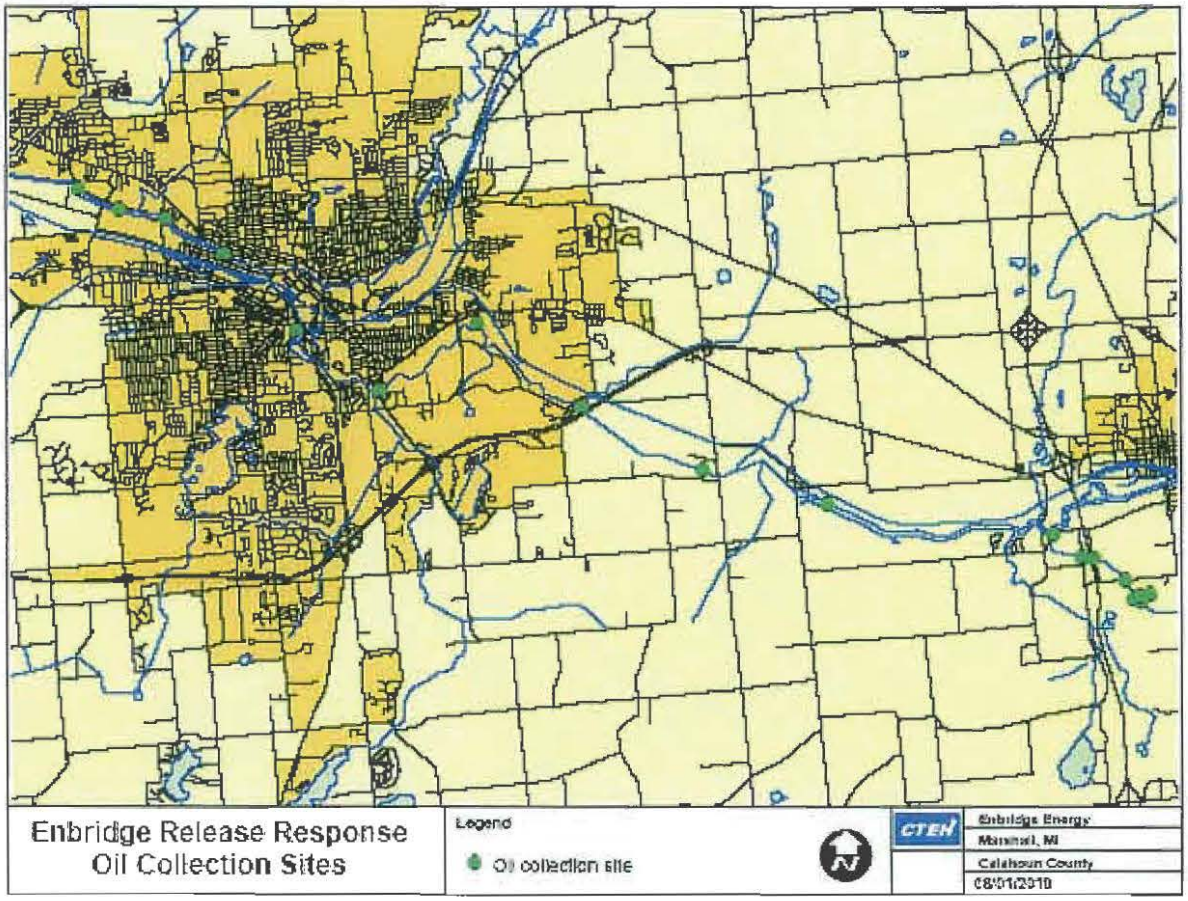


Figure 4
Location of Oil Collection Sites



Evacuated canisters may also be used to collect air samples to address community concerns about odors. Canister samples will consist of either grab or regulated 12 or 24-hour collections. The collection time will be based on monitoring needs. For instance, a grab sample will be collected for confirmatory purposes in response to data from real-time instruments. Longer sampling times may be appropriate for evaluation of air concentrations over time. A 12-hour sampling period would be used for analysis of air concentrations during mitigation activities over a work shift, while 24-hour sampling would be appropriate for evaluating the potential for exposure at certain receptor sites like homes and daycare centers.

All collected air samples will be sent to Galson Laboratories, an American Industrial Hygiene Association (AIHA) accredited laboratory, in East Syracuse, New York. Samples will be expedited for shipping and analysis. A 1 – 2 days turnaround is anticipated for data is anticipated.

4. Odor Investigation

A CTEH team will be designated as the Odor Response Team. The Odor Response Team will be deployed as soon as possible after receiving odor complaints/concerns referred by the hotline, Enbridge, and Unified Command staff. The response team will additionally include representatives USEPA and the Calhoun County Public Health Department, as available. Air monitoring equipment (e.g. MultiRAE Plus, AreaRAE, Gastec colorimetric detector tubes, and/or UltraRAE) will be used to evaluate the levels of VOCs and specific oil-related chemicals in the air. The evaluation of the results should follow the decision process described below.

5. Decision Tree and Action Levels

A decision process has been developed for the evaluation of air monitoring results for VOCs, NIOSH 1500/1501, and real-time detections for benzene. For VOC detections, a trigger level of 1 ppm will be used to designate the need for chemical-specific sampling. The decision process for the evaluation of benzene levels from Ultra RAE, GASTEC, NIOSH 1500/1501, and HAP analysis (Tedlar bag collection) is summarized in Figure 5. If benzene levels are detected above 200 ppb, then confirmation with the HAP instrument should be employed. If benzene levels exceed 60 ppb, then an 8-24 hr time-weighted sample should be collected. The target for longer-term exposures to benzene has been set at 6 ppbv. Air sampling will be performed as need to meet requirements established by the Public Health Unit.

6. Sample Station Locations

Real-time and integrated sampling locations will be selected based on the presence of communities near impacted waterways (Figure 1) and in addressing specific community concerns. Mobile AreaRAE data will be mapped using GPS coordinates. Additional, manually logged real-time data will be collected and reported on CTEH® electronic field and/or paper forms.

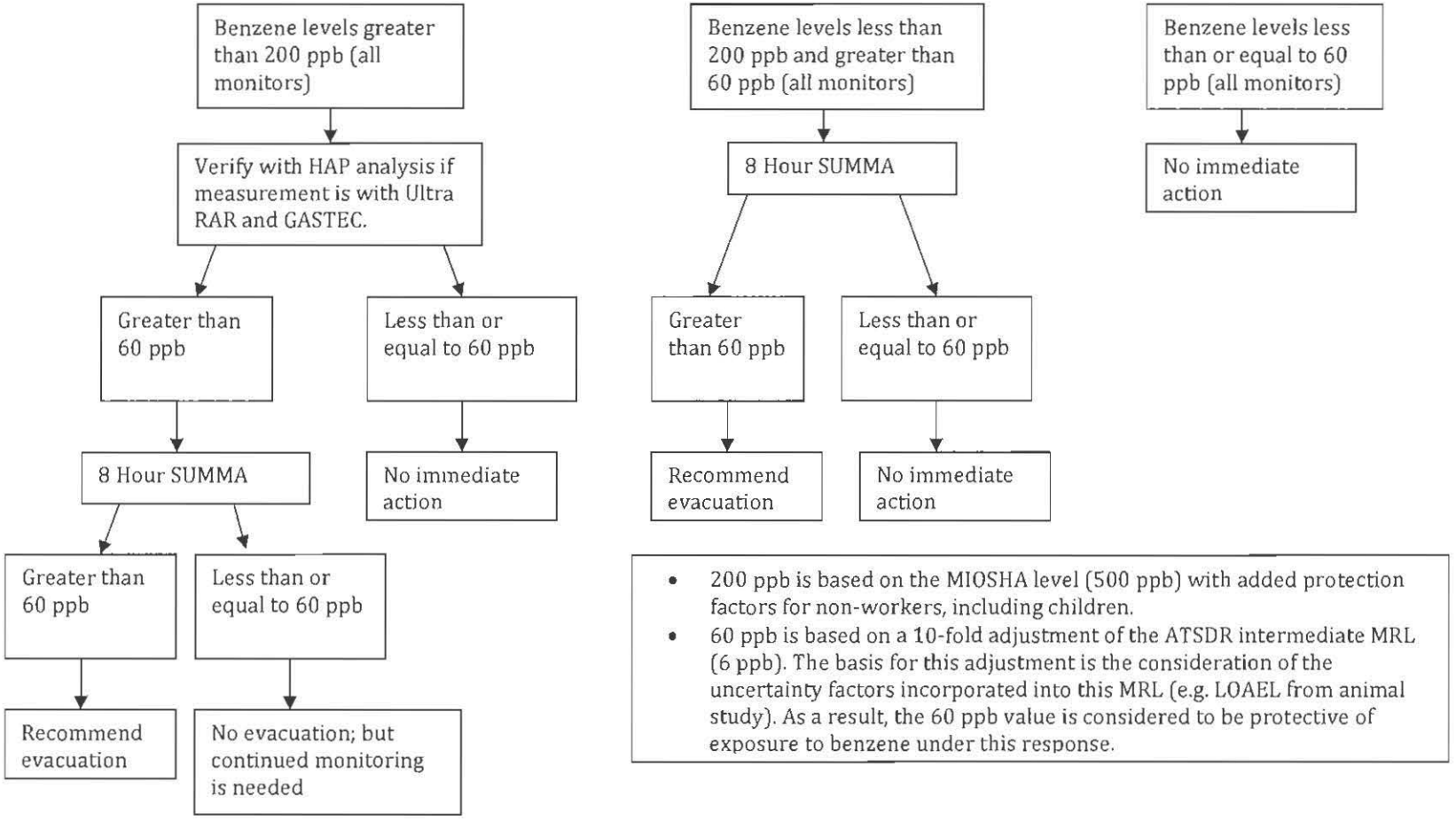
7. Data Quality and Management

Integrated air samples will be sent to Galson Laboratories located in Syracuse, N.Y. Air sampling preliminary results will be provided to Enbridge Energy's designated representative and the USEPA within 1-2 days of receipt by the laboratory. The expedited turnaround time for Galson is one business day. All data will undergo a

Level II data validation by eDATApro prior to release to the EPA SCRIBE data base. The CTEH QAPP is included as Appendix B of this report.

All air sampling and air monitoring data will be provided in a format compatible with SCRIBE. The data management plan can be found in data management plan (Appendix C).

Figure 5
Real-time monitoring for benzene (Ultra RAE, GASTEC, NIOSH 1500/1501, and HAP Analysis) (ppb)



8. Project Organization

CTEH will be responsible for the following:

- Toxicological support
- Air data quality assurance/quality control
- Data evaluation and reporting

10. Calibration and Maintenance of Field Instruments

The calibration and maintenance of field equipment and instrumentation will be in accordance with each manufacturer's specifications or applicable test/method specifications, and will be recorded in CTEH calibration logs. Standard operating procedures for each type of instrument are in Appendix D.

11. Chain of Custody (COC)

Each sample will be identified on a chain of custody record. The integrated sample numbering system will include site name, date, analyte, and identification code unique to each sample.

12. Sample Labels

Sample labels will be securely affixed to the sample container. They will clearly identify the particular sample and should include the following information:

- Sampling location
- Date and time the sample was collected.
- Analysis requested.
- Unique identifier

14. Packaging and Shipping

Packaging and hipping of samples will vary depending upon sample media, contaminant concentration, preservation technique, and sample container. The person packaging the samples is responsible to ensure that the sample packaging is in suitable condition for shipping.

Appendix A

GPS Coordinates

Table 1

GPS Coordinates at Fixed Analytical Locations

station_name	latitude	longitude	type
Station 1	42.24643	-84.9762	analytical
Station 2	42.25891	-85.0074	analytical
Station 3	42.24675	-84.9809	analytical
Station 4	42.2547	-84.9855	analytical
Station 5	42.25024	-84.9885	analytical
Station 6	42.28166	-84.6543	background
Station 7	42.22631	-84.6379	background

Table 2
GPS Coordinates at Oil Collection Sites

Site Name	Division	Boom	X	Y
Approx Release Site	Division A		-84.97153654	42.24328227
608	Division A		-84.97595329	42.24275523
A1 Release Site	Division A		-84.97404082	42.24220305
B1 MP 0.0	Division B		-84.97420968	42.24318202
B2 MP 0.3	Division B	Y	-84.97747813	42.24652001
B3 MP 0.9	Division B	Y	-84.98531523	42.2513746
B4 MP 1.00	Division B	Y	-84.98831667	42.25165
B5 MP 1.7	Division B	Y	-84.99537766	42.25689902
C1 MP 5.1 (Add Boom)	Division C		-85.05361235	42.26667246
C2 MP 7.0 (Add Boom)	Division C		-85.08484296	42.27576335
C3 MP 8.9	Division C	Y	-85.11479057	42.29010592
C4 MP 11.1 (Add Boom)	Division C		-85.14015217	42.30864478
C5 MP 13.1 (Add Boom)	Division C		-85.16711736	42.29720573
C6 MP 14.8 (Add Boom)	Division C		-85.18716213	42.3102401
C7 MP 16.4 (Add Boom)	Division C		-85.20406232	42.32651713
E 3.0 MP 33.8	Division C		-85.41261846	42.28422964
E1 MP 25.5	Division E		-85.32282535	42.35359682
E2 MP 28.9	Division E	Y	-85.35818541	42.32421571
Sheen Limit (5:30pm EST 7/27)	Division E		-85.3856568	42.30063438
E2.5 MP 33.3	Division E		-85.40592243	42.28830782
River Oaks County Park Access	Division E		-85.44507052	42.28831395
E4 MP 36.4	Division E		-85.45037364	42.27698084
Sheen Location (9:30 am EST 7-28)	Division E		-85.44282317	42.27655843
E5 MP 38.5	Division E		-85.49021375	42.28348629
D1 MP 17.4	Division D	Y	-85.21820616	42.33452887
D2 MP 17.9	Division D	Y	-85.23023889	42.33697579
D3 MP 18.7	Division D		-85.24040801	42.34165021
D4 MP 19.8 (Add Boom)	Division D		-85.26219413	42.34642123
D5 MP 20.6	Division D		-85.27544835	42.35048898
E1 MP 25.5 Priority 3	Division E		-85.3228204	42.35358879
E2 MP 28.9 Custer Boat Launch (400' boom, 1 Vac Truck, 1 Skimmer)	Division E		-85.35818046	42.3242077
Sheen Limit (5:30 pm EST 7/27)	Division E		-85.38565184	42.30062637
E 2.5 MP 33.3	Division E		-85.40591746	42.28829981
River Oaks County Park Access	Division E		-85.44506554	42.28830594
E4 MP 36.4 Priority 1 Morrow Lake Boat Launch (10500' available boom, 2 Vac Tankers)	Division E		-85.45036866	42.27697283
Sheen Location (9:30 am EST 7-28)	Division E		-85.44281819	42.27655042
E5 MP 38.5 Priority 1A	Division E		-85.49020876	42.28347829

Appendix B

CTEH QAPP

CTEH
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Quality Assurance Project Plan
Enbridge Pipeline Crude Release

July 29, 2010

Prepared For:
Incident Command

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Table of Contents

1. Purpose 3
2. SCOPE AND OBJECTIVES 3
3. Project Organization and Responsibility 3
   - 3.1. Project Organization 4
   - 3.2. Responsibility for Quality Assurance and Quality Control 4
   - 3.3. Qualified Individual 4
   - 3.4. Project Manager 4
   - 3.5. Laboratory Subcontractors 5
   - 3.6. DATA QUALITY OBJECTIVES 5
   - 3.7. Intended Data Use and Objectives 5
   - 3.8. Data Quality/Measurement Objectives 5
   - 3.9. Representativeness 6
   - 3.10. Precision and Accuracy ..... Error! Bookmark not defined.
   - 3.11. Completeness 6
   - 3.12. Comparability 6
   - 3.13. Analytical Methods and DQOs 6
4. SAMPLING PROCEDURES AND FIELD MEASUREMENTS 7
5. SAMPLE HANDLING, DOCUMENTATION, AND CUSTODY 7
6. QUALITY ASSURANCE PROCEDURES FOR LABORATORY ACTIVITIES 7
7. QUALITY ASSURANCE PROCEDURES FOR FIELD ACTIVITIES 8
   - 7.1. Internal Quality Control 8
   - 7.2. Equipment 8
   - 7.3. Sampling Equipment Decontamination 9
   - 7.4. Calibration, Operation and Maintenance 9
   - 7.5. Supplies and Consumables ..... Error! Bookmark not defined.
   - 7.6. Field Documentation 9
   - 7.7. Procedures to Assess Precision, Accuracy, Completeness and Comparability 9
   - 7.8. Corrective Action 9
8. DATA REDUCTION, ASSESSMENT AND VALIDATION 9
   - 8.1. Laboratory Data 9
   - 8.2. Field Measurement Data 10
   - 8.3. Data Management 10
   - 8.4. Data Validations 10
9. AUDITS 10
   - 9.1. Field Systems Audit 10
   - 9.2. Laboratory Audit 11
10. CORRECTIVE ACTION 11
   - 10.1. Immediate Corrective Action 11
   - 10.2. Long-Term Corrective Action 11

1. Purpose

This Quality Assurance Project Plan ("QAPP") has been prepared to provide assurance that community air monitoring and sampling activities conducted as part of the response to the Enbridge Pipeline crude oil release meet performance goals. In addition, the methods and procedures described herein were developed in general accordance with conventionally-accepted Quality Assurance and Quality Control (QA/QC) objectives.

2. SCOPE AND OBJECTIVES

This QAPP represents the foundation of QA/QC that will be utilized to assess and verify that sampling, testing, and analysis activities are executed in a manner consistent with applicable guidance and conventional QA/QC objectives. The procedures described in the QAPP are intended to assess the data generated in terms of representativeness, precision, accuracy, completeness and comparability.

Details about the sampling methodologies can be found in the individual work plans prepared for each activity type. Much of the field sampling QA/QC methodology and rationale is described in the individual work plans and, for conciseness, is not reproduced herein. Rather, this QAPP presents the following:

- Project Organization and Responsibility
- Data Quality Objectives
- Sampling Procedures and Field Measurements
- Sample Handling, Documentation and Custody
- Quality Assurance Procedures for Laboratory Activities
- Quality Assurance Procedures for Field Activities
- Data Reduction, Assessment and Validation
- Audits
- Corrective Action

This QAPP is applicable to the work plans approved as of the date of this document. To the extent that other work plans are written and approved that this QAPP is applicable to, those activities will be incorporated by reference to the scope of the QAPP herein.

3. Project Organization and Responsibility

This section describes the project organization and specifies personnel responsibilities. The project organization presented in this section has been developed to guide and assess the quality of sampling and testing procedures for obtaining reliable data, and to facilitate effective communication and decision-making during the project.

3.1. Project Organization

The principal entities relevant to this QAPP that are involved in activities related to the -Enbridge Pipeline Crude Release, and their respective roles, include the following:

- *Enbridge Energy* – Responsible Party
- *Unified Command Health and Environmental Representatives* – review and approval for procedures and deliverables
- *Center for Toxicology and Environmental Health* (CTEH) – complete all site investigation work, including data validation.
- *Sampling Manager* - CTEH project manager responsible for sampling activities

3.2. Responsibility for Quality Assurance and Quality Control

The responsibilities of key members of the project team are summarized in the following subsections.

3.3. Qualified Individual (QI)

Enbridge Energy and their representatives will have full authority to direct, supervise, and coordinate the project team, and to commit resources as deemed necessary. One or more Enbridge Energy designates will be the focal point of communications for contractual matters with the Project Managers and all subcontractors. The QI will oversee all project planning and will review and approve project specifications, plans, and procedures. The QI will have ultimate project responsibility for assuring that the project is completed according to plan.

3.4. Project Manager

CTEH Sampling Managers will be responsible for the preparation of project plans, specifications, and reports within their defined scope of work. The PMs will attend meetings and conferences between Unified Command and any other project participants. They will ensure that the necessary equipment, facilities, and staffing are available to implement their portion of the project.

Sampling Managers are responsible for maintaining the schedule of the work and will regularly advise the QI of the progress of the project. Each PM will provide direction to the field staff and subcontractors involved in field sampling activities within his scope so that the project is completed in accordance with the Work Plans and QAPP. The PM will consult with any subcontractors to discuss compliance with the relevant Work Plans and QAPP, and to evaluate corrective measures if problems occur.

The PM will also be responsible for the development and execution of QA/QC activities in all phases of the project, including plan design, execution, data reduction, and reporting for the scope of work. Each PM will serve as an in-house consultant to the QI in the development of a project-specific internal QC system, as well as providing an independent review of the project approach, methods and design.

3.5. Laboratory Subcontractors

Integrated air samples will be sent to Galson Laboratories and, if resource limitations require, Pace Analytical Services, Inc. and Air Toxics Ltd located in Syracuse. NY, Minneapolis, MN, , and Folsom, CA, respectively. Galson Laboratories is AIHA Accredited, and Pace and Air Toxics are NELAP certified.

3.6. DATA QUALITY OBJECTIVES

This section on Data Quality Objectives (DQOs) presents the intended data usage and QA objectives for the sampling and ana ysis that will be performed during the project. The overarching DQO is to generate validated data that is suitable for its intended use.

3.7. Intended Data Use and Objectives

The data collected during field activities will be used to characterize the chemical properties of media collected during the response. The data collected during field activities will be used to characterize potential exposures of members of the public to constituents potentially related to the release of oil from the Enbridge Energy pipeline, by reporting on chemical constituents found in the environment at the time and location of sample collection. The data may also be used to inform decisions related to appropriate protective actions necessary to ensure health and safety of members of the community.

3.8. Data Quality/Measurement Objectives

The purpose of DQOs is to establish a target level that can be measured against whether data that is collected (through the sampling and analysis program) are of appropriate quality to produce documented, consistent, and technically defensible results. These results ultimately will define the characteristics and chemical constituent concentrations present at the Site.

The quality of measurements made and the data generated will be evaluated in terms of the following characteristics:

1. Representativeness
2. Precision and Accuracy
3. Completeness
4. Comparability

Specific objectives for each characteristic are established to develop sampling protocols and identify applicable documentation, sample handling procedures, and measurement system procedures. These objectives are established based on Site conditions, objectives of the project, and knowledge of available measurement systems. In addition, the following criteria for chemical sample handling and analysis will help attain the DQOs:

- Standard chain-of-custody procedures
- Analytical testing will be performed according to approved laboratory methods with data packages prepared that are consistent with Level 2 protocol (a Level 3 and 4 CLP protocol may be required in some instances).

3.9. Representativeness

Measurements will be made so that analytical results are as representative as practical of the actual field conditions. Sampling protocols will be utilized to help assure that samples collected are reasonably representative of the media present in the field. Appropriate sample handling protocols, including such tasks as storage, transportation, and preservation, will be used to protect the representativeness of the samples gathered during the project. Proper documentation in the field and the laboratory will verify whether protocols have been followed, and whether sample identification *and integrity* have been preserved.

Representativeness will be assessed also by comparing the results of co-located samples to determine the spread in the analytical results. The results of QC blanks will be examined for evidence of contamination unrelated to the Site on sampling activities. Such contamination may be cause for invalidation or qualification of affected samples. Sample analytical data classified as "questionable" or "qualitative" by any of the above criteria may be invalidated.

It is also anticipated that CTEH sampling activities in some instances may be conducted in cooperation with EPA or other agency personnel. If available, results of co-located samples may be evaluated to address representativeness of samples.

3.10. Completeness

The characteristic of completeness is a measure of the amount of valid data (or samples) obtained as compared with the amount that was specified to be obtained under normal conditions. The objective for completeness is to provide enough valid data to ensure the goals of the field investigation are met. Completeness will be evaluated for each sampling event specified relative to each activity on an individual basis.

3.11. Comparability

The characteristic of comparability expresses the confidence that one set of analytical data may be compared with another. Data sets that can be used for comparison include results of studies conducted previously in the area. Comparability is maintained by use of standard analytical methods, and units consistent with those used in previous studies. Also, the personnel involved in data acquisition and reduction must operate measurement systems within the calibrated range of the particular instrument as well as utilize analytical methodologies that produce comparable results. The comparability of field investigation tasks will be maintained by following the applicable EPA Technical Guidance documents, and/or the applicable Work Plan.

3.12. Analytical Methods and DQOs

Analytical testing will be performed according to the methods outlined in the approved Work Plans.

4. SAMPLING PROCEDURES AND FIELD MEASUREMENTS

The objectives of air sampling procedures and field measurements are to obtain samples and measurements that are representative of the environment being investigated. Through the use of proper sampling tools, sampling techniques, and equipment decontamination procedures, the potential for cross contamination due to trace levels of chemicals will be reduced. These procedures are described further in the individual Work Plans.

5. SAMPLE HANDLING, DOCUMENTATION, AND CUSTODY

The purpose of specific procedures for sample handling, documentation and custody is to maintain the integrity of samples during collection, transportation, analysis and reporting. These procedures are necessary to validate the history of sample data, from collection through reporting, by providing adequate documentation. The sampling handling, documentation and custody procedures are provided in the individual Work Plans. QA/QC checks will be performed during the field activities to assess whether the procedures elaborated in the Work Plans are followed. An appointed representative will perform the QA/QC check prior to packaging the samples and transportation to the designated laboratory.

6. QUALITY ASSURANCE PROCEDURES FOR LABORATORY ACTIVITIES

Qualified laboratories will perform chemical sample analyses of samples collected under the direction of CTEH. Each laboratory maintains an internal *Quality Assurance Plan*. These plans include the respective laboratory's internal QA/QC procedures that cover all aspects of QA/QC during implementation of laboratory procedures. The technical quality systems that are described in the *Quality Assurance Plans* include the following:

- Personnel Qualifications and Training
- Demonstration of Capability
- Standard Operating Procedures
- Documentation and Record-Keeping
- Analytical Test Methods and Procedures
- Method Detection Limits
- Method Quantitation Limits and Reporting Limits
- Traceability, Preparation of Standards, and Reference Materials
- Measurement Process
- QC Samples
- Control Charting
- Performance Evaluation
- Corrective Action
- Preventative Maintenance
- Sample Handling and Management

In addition, the plan includes the following information that will be utilized for this project:

- Test Procedures and Standard Operating Procedures Performed
- Data Quality Acceptance Criteria
- Calibration and QC Requirements
- Containers, Preservation, and Holding Times
- Instrumentation, Software, and Applications
- Preventative Maintenance Schedule
- Training Certification Statements

The Galson Laboratories QAPP has been reviewed and are available from the lab upon request.

7. QUALITY ASSURANCE PROCEDURES FOR FIELD ACTIVITIES

This section describes the general QA/QC procedures related to field activities during the collection, handling, labeling, packaging, preservation, and custody of samples for chemical analysis. Specific procedures for field activities are described in the individual Work Plans. Field QA/QC samples will be used to verify that the sample collection and handling process has not affected the quality of samples that will be subjected to chemical analyses. This section discusses the preparation and collection frequency of field QA/QC samples constituting of blanks and duplicates. This section also provides a general guidance on maintaining QA/QC on the subsequent activities to ensure the goals of the field activities are met.

7.1. Internal Quality Control

Field QA/QC samples will follow the procedures set forth below and in accordance with the individual Work Plans. The required analyses and the amount of sample needed to complete the analyses will be evaluated prior to the initiation of the sampling event. The required quantity of sample matrix to perform all the analyses will be collected.

Co-located Samples – True duplicates of many media types are not typically possible because chemical constituents are rarely distributed uniformly in the media, even within small volumes. For this reason, duplicate samples collected during this project will be referred to as co-located samples. They are samples that are collected at the same time and place.

Co-located samples will be collected for each media type at a rate of approximately 10% of samples collected or at least 1 duplicate sample per day per media type, whichever is greater. USEPA region 5 has been invited to shadow field operations and will collect co-located samples at a rate that they determine necessary.

7.2. Equipment

Appropriate tools and equipment will be utilized for collecting samples during the field investigations. Using the correct equipment for sampling is important in meeting

the objectives of QA/QC. Laboratory supplied equipment such as sample containers are generally uncontaminated. However, a simple visual QA/QC check of any containers in cases that were opened may identify certain potential issues. Sample labels will be clearly printed in waterproof, indelible ink and placed directly on the sample container(s).

7.3. Sampling Equipment Decontamination

No sample equipment decontamination procedures are anticipated for this project.

7.4. Calibration, Operation and Maintenance

Instruments and equipment utilized for field measurements will be calibrated in accordance with the frequency requirements and instrument manufacturer's instructions. More frequent calibration may be performed if deemed appropriate. Appropriate methods and calibration material (gases, etc.) will be used and the procedures documented in the field records. The field measurement instruments will be operated and maintained in accordance with the manufacturer's instructions and industry standard specifications/procedures in order to maintain the consistency and reliance of the measurement capacity of each instrument.

7.5. Field Documentation

Field logs, documentation forms, and calculation work sheets utilized during the field investigations will be maintained accurately and in accordance with the requirements of the individual Work Plans. Field logs and form may be collected in electronic format, if deemed appropriate. Copies of paper field logs will be included in the project reports as appropriate.

7.6. Procedures to Assess Precision, Accuracy, Completeness and Comparability

No quantitative levels for precision and accuracy have been specified for field measurements. However, proper maintenance and operation of instruments will be followed to ensure instrument accuracy so that reliable results will be obtained. Multiple readings and analysis of duplicate samples will be performed to measure the precision of field measurements.

7.7. Corrective Action

If QA audits of data result in identification of unacceptable data, the field sampling project manager will be responsible for developing and initiating corrective action. Corrective action for sampling procedures may include evaluating and amending sampling procedures or re-sampling.

8. DATA REDUCTION, ASSESSMENT AND VALIDATION

8.1. Laboratory Data

Reduction of laboratory measurements and laboratory reporting of analytical parameters will be in accordance with the procedures specified for each analytical

method (i.e., perform laboratory calculations in accordance with the method-specified procedure). Upon receipt of the laboratory data, the data will be processed according to the Data Management Plan (DMP) included as Appendix B.

8.2. Field Measurement Data

Project data personnel will perform assessment of field measurement data. Data assessment will be performed (as appropriate) by checking calibration procedures utilized in the field, evaluating duplicate and control sample analyses, and by comparing the data to previous measurements obtained at the specific location. Large variations, depending on matrix type, will be examined in association with changes in local conditions and general trends. In some instances, instrument drift or malfunction may be detected. If this is apparent, the data may be disregarded, but a record of the evaluation will be maintained in the project records. If variations in data cannot be explained, the data will be qualified and will be used for appropriate purposes.

8.3. Data Management

Upon successful completion of the data assessment process, the data generated for the investigations will be stored in a central location and/or database. Data summaries and results will be submitted in accordance with the DMP. Further data management details are provided in the DMP.

8.4. Data Validations

All data packages will receive a data package completion check from the corresponding laboratory generating the data package to ensure that the deliverable requirements specified for this project have been satisfied. A Level II data validation will be performed on all sample delivery groups prior to release of the data. Third party data reviews will be conducted on all data as the data are received to assess whether the QC criteria established for the associated analytical methods established for this project have been met. In addition, third party data Level IV validation will be conducted on a minimum of 10 percent of the data packages generated. Further details about data validation are included in the DMP.

9. AUDITS

Quality assurance audits will be performed to assess whether the QA/QC measures are being utilized to provide data of acceptable quality. Further, audits will be completed to verify that subsequent calculation, interpretation, and other project outputs are checked and validated.

9.1. Field Systems Audit

Field auditors will visit field sampling teams periodically to observe the designated control procedures that are set forth in this document and in the individual Work Plans. These audits will address whether field tools, analytical instruments, and reporting processes are selected and used to meet the requirements specified by the project objectives stated in this plan and other project Work Plans. Equipment and

facilities provided for personnel health and safety will also be evaluated. Calibration and documentation procedures for instruments used in the field will receive special attention. Field documentation and sample custody records will be reviewed. During the audit, the sampling manager will review data handling procedures with the appropriate personnel. Accuracy, consistency, documentation, and appropriate selection of methodologies will be discussed.

9.2. Laboratory Audit

Laboratory audit procedures are described in the DMP.

10. CORRECTIVE ACTION

Corrective or preventive action is required when potential or existing conditions are identified that may have an adverse impact on data quality. Corrective action can be immediate or long term. In general, any member of the project staff who identifies a condition adversely affecting quality can initiate corrective action by notifying in writing their supervisor or the sampling manager. The written communication will identify the condition and explain how it may affect data quality.

Corrective action in the field is the responsibility of the on-site staff. This includes reviewing the procedures to be followed prior to sampling events and checking the procedures taking place after the sampling event is completed. Corrective action with regard to laboratory analyses are the responsibility of the selected laboratory.

10.1. Immediate Corrective Action

This type of corrective action is usually applied to spontaneous, nonrecurring problems, such as instrument malfunction. The individual who detects or suspects nonconformance to previously established criteria or protocol in equipment, instruments, data, methods, etc., will immediately notify his/her supervisor. The supervisor and the appropriate task leader will then investigate the extent of the problem, if any, and take necessary corrective steps.

If a large quantity of data is affected, the sampling manager must prepare a memorandum to the QI. These individuals will collectively decide on a course of action to correct the deficiencies while the project continues to proceed. If the problem is limited in scope, the task leaders will decide on a corrective action measure, document the solution, and notify the sampling manager.

10.2. Long-Term Corrective Action

Long-term corrective action procedures are devised and implemented to reduce the potential for the recurrence of a potentially serious problem. The sampling manager and the QI will be notified of the problem and will conduct an investigation to determine the severity and extent of the problem. Corrective actions may be initiated as a result of other activities such as audits.

The sampling manager will be responsible for documenting all notification, recommendations, final decisions, and notifying project staff and implementing the agreed upon course of action. The development and implementation of preventive and corrective actions will be timed, to the extent possible, to minimize any adverse impact on project schedules and subsequent data generation/processing activities. However, scheduling delays will not override the decision to correct the data collection deficiencies before proceeding with additional data collection. The sampling manager also will be responsible for developing and implementing routine program controls to minimize the need for corrective action.

Appendix C

CTEH DMP

Data Management Plan

Table of Contents

Data Management Plan 1
1. Executive Summary 3
2. General Information 3
2.1 Background 3
2.2 Special Considerations 3
2.3 Data Management Plan (DMP) Revision History 3
3.1 Real-Time Monitoring Data 3
3.2 Sampling and Analytical Data 4
3.3 SIERA Data 4
3.4 EPA Data 4
3.5 Roles and Responsibilities 4
3.6 Backup 5
4. Data Collection 5
4.1 Field Data Collection Methodology and Data Deliverables 5
4.2 Data Collection SOP's and Checklists 6
5.1 Data Processing 6
5.2 Scribe Import Mappings 7
5.3 Data Element Dictionary 7
5.3 Entity Relationship Diagram 8
5.4 Database Inventory 8
7. Data Verification and Validation 10
7.1 Verification SOP's and Checklists 10
7.2 Data Verification 10
7.2.1 Level II Laboratory Data Report 10
8. Data Analysis and Reporting 11
8.1 Data deliverables 11
8.2 Reporting Requirements 11
8.3 Reporting SOP's and Procedures 11
8.4 SQL Reporting Queries: 11
8.5 GIS / Spatial Data Visualization Requirements 11
8.6 Site Specific Requirements 11
Appendix A 12
Appendix B 15
Appendix C 1

Table of Tables

Table 1 Field Data Collection Methodology and Data Deliverables 5
Table 2 Data Processing 6
Table 3 Monitoring Data Elements 7
Table 4 Air Sampling Data Elements 8
Table 5 Database Inventory 8
Table 6 Data Communication 9

Enbridge Pipeline Release
Environmental Sampling Data Management Plan

1. Executive Summary

This plan describes the initial data management needs and workflow for the air sampling activities being conducted by CTEH for the Enbridge Pipeline Release in Marshall, MI.

2. General Information

2.1 Background

Center for Toxicology and Environmental Health, L.L.C. (CTEH®) was requested to respond in support of site operations for the Enbridge Energy crude oil release on Monday, July 27, 2010. CTEH® is providing air monitoring, air sampling, and toxicology support to address public health concerns resulting from the crude oil spill. CTEH® has been conducting community air monitoring and sampling in communities to protect human health.

2.2 Special Considerations

CTEH is collecting approximately 1,000 data points per day, spanning a geographic area along the Kalamazoo River from Marshall, MI to Greater Galesburg, MI. There are over 10 teams working around the clock collecting samples in this area. Managing data in this scenario requires consistent communications to the project managers, field teams, and data management team.

Currently EPA Region 5 is independently managing their data. CTEH will also operate in this fashion, maintaining a local master Scribe database which is published to the merged Scribe.NET.

2.3 Data Management Plan (DMP) Revision History

Document Version	Date of Revision	Author	Description of Changes
Initial Release (1.0)	8/1/2010	Anton Avguchenko	NA

3. Data Workflow and Warehousing

3.1 Real-Time Monitoring Data

CTEH field personnel retrieve readings from hand-held air monitoring devices and enter them into their Motorola MC-55 Enterprise Digital Assistant (MC-55 EDA). After each monitoring data point is entered they are synchronized to CTEH's off-site data warehouse.

3.2 Sampling and Analytical Data

Field analytical data is collected on paper forms and entered directly into Scribe. Meta information about each sample is collected and synchronized using MC-55's (sample ID, latitude, longitude, station name, sample date/time).

3.3 SIERA Data

Sample Instrument Event Receptor Awareness (SIERA) is a program developed by CTEH to provide situational awareness to a project. Field personnel utilize SIERA to geographically tag photographs, establish sampling locations, and document important events. SIERA data points are collected on a MC-55 and synchronized to CTEH's off-site data warehouse.

3.4 EPA Data

EPA Region V is individually maintaining on-site Scribe databases. Their data is published to the centralized Scribe.NET database being maintained by EPA's Environmental Response Team (ERT).

3.5 Roles and Responsibilities

Field Sampling Personnel:

- Operate and maintain the sampling and monitoring equipment
- Collect samples
- Input data into MC-55 EDA.

Sample Handling Personnel:

- Package and ship samples to laboratory
- Generate Chain of Custody (COC)
- Input field sample data into on-site Scribe database

Site Data Manager(s):

- Maintain on-site Scribe database by importing lab EDD's
- Monitoring and field sampling data from CTEH Data Warehouse and SIERA data.

QAQC Team:

- Assist with data processing
- Perform quality control by checking for completeness and accuracy
- Interviewing field personnel to resolve data issues.

3.6 Backup

Daily backups are performed on-site to a removable storage drive using off-the-shelf commercial backup hardware and software. Every evening an off-site dump is performed to CTEH's corporate file server over the network. Nightly, CTEH's fileserver is backed up to tape and stored off-site.

4. Data Collection

4.1 Field Data Collection Methodology and Data Deliverables

Table 1 Field Data Collection Methodology and Data Deliverables

Monitoring/ Sampling/ Analytical Type	Instrument or Method	Data Collection Tool	Data Collection Instructions	File Type	Comments
Real-Time Air Monitoring	MultiRAE	Input direct read-out into MC-55 EDA	Download from CTEH Data Warehouse, import into Scribe	.csv	
Real-Time Air Monitoring	Gastec Colormetric Tubes	Input direct read-out into MC-55 EDA	Download from CTEH Data Warehouse, import into Scribe	.csv	
Real-Time Air Monitoring	UltraRAE	Input direct read-out into MC-55 EDA	Download from CTEH Data Warehouse, import into Scribe	.csv	
Air Sampling	Summa	Input field sampling data into MC-55 EDA, fill out paper field forms	Download from CTEH Data Warehouse, import into Scribe	.csv	
Air Sampling	Passive Dosimeter	Fill out paper forms	Download from CTEH Data Warehouse, import into Scribe	.csv	
Air Sampling	Sorbent Tube	Input field sampling data into MC-55 EDA, fill out paper forms	Download from CTEH Data Warehouse, import into Scribe	.csv	
Photos	Digital Image	MC-55 EDA	Synchronized to CTEH Data Warehouse	.jpg	Available through CTEH Data Warehouse

4.2 Data Collection SOP's and Checklists

See Table 1 for data collection SOP's. Additional data streams will be added to the table as they are identified.

5. Data Management

5.1 Data Processing

Table 2 Data Processing

Monitoring, Sampling, or Analytical Type	Instrument or Method	Data Collection Tool	Data Processing Instructions	File Type	Comments
Real-Time Air Monitoring	MultiRAE	Input direct read-out into MC-55 EDA	Download daily CSV in Scribe format, import using custom Scribe import for Monitoring Data.	.csv	
Real-Time Air Monitoring	Gastec Color metric Tubes	Input direct read-out into MC-55 EDA	Download daily CSV in Scribe format, import using custom Scribe import for Monitoring Data.	.csv	
Real-Time Air Monitoring	UltraRAE	Input direct read-out into MC-55 EDA	Download daily CSV in Scribe format, import using custom Scribe import for Monitoring Data.	.csv	
Air Sampling	Summa	Input field sampling data into MC-55 EDA, fill out paper forms	Enter sample ID, date/time and location information directly into Scribe GUI.	.csv	Handwritten field forms are faxed/emailed by field personnel to site data manager.
Air Sampling	Sorbent Tube	input field sampling data into MC-55 EDA, fill out paper forms	Enter sample ID, date/time and location information directly into Scribe GUI.	.csv	Handwritten field forms are faxed/emailed by field personnel to site data manager.

Monitoring, Sampling, or Analytical Type	Instrument or Method	Data Collection Tool	Data Processing Instructions	File Type	Comments
Photos	Digital Image	MC-55 EDA		.jpg	Photos are geographically tagged as well as associated with specific samples and instrument locations

5.2 Scribe Import Mappings

Real-time air monitoring data is exported from the CTEH Data Warehouse using a custom designed format with native Scribe field names. Analytical results from each laboratory are imported after verification and/or validation using a custom import mapping. See appendix A for mapping.

5.3 Data Element Dictionary

The tables below identify what should be considered the minimum data requirements for the identified data source. These elements may increase or have their description changed as a result of a change in operational requirements. A complete list of all data elements in Scribe can be found at http://www.epaosc.org/scribe.

Table 3 Monitoring Data Elements

Scribe Fields	Description	Type	Length	Primary Key?	Req?
Mon_Time	Monitoring Time (hh:mm:ss)	Text	30	PK	Yes
Mon_Parameter	Pollutant	Text	30	PK	Yes
Mon_Date	Monitoring Date (Required)	DateTime	0	PK	Yes
Location	Monitoring Location Code (Required)	Text	30	PK	Yes
InstrumentID	Instrument ID (Required)	Text	50	PK	Yes
Mon_Operator	Organization That Collected the Sampling	Text	50	No	No
Mon_Measurement	Monitoring Measurement	Numeric	0	No	No
Mon_Meas_Units	Monitoring Measurement Units	Text	40	No	No
EventID	Identifies the date of the reporting period and the start/stop time a value is associated with	Text	50	No	No
Latitude	Latitude	Numeric	0	No	No
Longitude	Longitude	Numeric	0	No	No
Coord_Sys_Desc	Coordinate System				
Mon_Qualifier	Monitoring Criteria such as detection limit; action limit or other criteria	Text	10	No	No
Mon_Remark	Monitoring Data Remark	Text	255	No	No
Mon_Source	Describes the averaging period of the result (ie 1-hr avg)	Text	50	No	No

Table 4 Air Sampling Data Elements

Scribe Fields	Description	Type	Length	Primary Key?	Req?
Samp_No	Sample Number. Scribe requires a unique sample number (Required)	Text	25	PK	Yes
Location	Sampling Location Code (Required)	Text	30	No	Yes
EventID	EventID. Use to group data by sampling events. Defaults to 'Sampling' (i.e. EOC; Site Assessment)	Text	50	No	No
Latitude	Latitude	Numeric	0	No	No
Longitude	Longitude	Numeric	0	No	No
Matrix	Sample Matrix (i.e. Air; Vapor)	Text	40	No	No
SampleCollection	Sample Collection Method (i.e. Grab; Composite; Discrete Interval)	Text	30	No	No
SampleDate	Date Sample Taken	DateTime	0	No	No
SampleMedia	Sampling Media (i.e. Summa Canister)	Text	30	No	No
Sampler	Sampler Name	Text	30	No	No
SampleTime	Time Sample Taken (hh:mm)	Text	5	No	No
SampleType	Sample Type (i.e. Field Sample; Field Duplicate; Lab QC; Spike; Trip Blank)	Text	30	No	No
Total_Time	Total Sampling time	Numeric	0	No	No
Volume	Air Sampling Volume. Wipe Sampling Area.	Numeric	0	No	No
Volume_Units	Volume Units	Text	20	No	No

5.3 Entity Relationship Diagram

See Appendix B

5.4 Database Inventory

Table 5 Database Inventory

Name	Database Type	Description	Manager
Enbridge_Oil_Spill.MDB	Scribe	Community/Area Air Monitoring, Air Sampling Data	Anton Avguchenko
Enbridge_Oil_Spill_personnel.MDB	Scribe	Personnel Sampling	Anton Avguchenko
Enbridge_arearae.mdb	MS Access	Community AreaRAE sampling from initial response phase	Anton Avguchenko
Enbridge_Oil_Spill_reporting.MDB	MS Access	Staging/Reporting for Community/Area Air Monitoring, Air Sampling Data	Anton Avguchenko

6. Data Communication

Table 6 Data Communication

Data Source	Owner	Contains	Communication Method	Data Release Frequency	Comments
Real-Time Air Monitoring	MultiRAE	Input direct read-out into MC-55 EDA	Download daily CSV in Scribe format, import using custom Scribe import for Monitoring Data.	.csv	
Real-Time Air Monitoring	Gastec Color metric Tubes	input field sampling data into MC-55 EDA	Download daily CSV in Scribe format, import using custom Scribe import for Monitoring Data.	.csv	
Real-Time Air Monitoring	UltraRAE	Input direct read-out into MC-55 EDA	Download daily CSV in Scribe format, import using custom Scribe import for Monitoring Data.	.csv	
Air Sampling	Summa	Input field sampling data into MC-55 EDA, fill out field forms	Enter sample ID, date/time and location information directly into Scribe GUI.	.csv	Handwritten field forms are hand delivered by field personnel to site data manager.
Air Sampling	Sorbent Tube	Input field sampling data into MC-55 EDA, fill out field forms	Enter sample ID, date/time and location information directly into Scribe GUI.	.csv	Handwritten field forms are hand delivered by field personnel to site data manager.

Data Source	Owner	Contains	Communication Method	Data Release Frequency	Comments
Photos	Digital Image	MC-55 EDA		.jpg	Photos are geographically tagged as well as associated with specific samples and instrument locations

7. Data Verification and Validation

7.1 Verification SOP's and Checklists

See Appendix C

7.2 Data Verification

Prior to import into Scribe, all analytical data will go through level II data verification by third party. The following Quality Assurance/Quality Control (QA/QC) parameters are reviewed during level II:

Chain-of custody: completeness and sample custody

Holding time: time of collection to time of sample preparation and analysis

Preservation: temperature and chemical

Blank Contamination: laboratory and field blanks

Matrix: precision and recovery of matrix spikes, laboratory control samples, duplicates and system monitoring compounds (Organics)

7.2.1 Level II Laboratory Data Report

Level II data reports will also be delivered with the EDD's from the laboratories. The project laboratory will provide reports as a deliverable suitable for data verification. Each data validation package will include, but is not limited to, the following information for review:

- Case Narrative,
- Chain-of-Custody,
- Method blank summary,
- Matrix spike/matrix spike duplicate summary,
- Laboratory control sample recovery summary,

- System monitoring compounds recovery (Organics)

A hard copy and an electronic disk deliverable of the analytical results, consistent with the format specified by the data validator, will be issued by the laboratory. The samples to be included in each SDG will be efficiently grouped such that holding times are not jeopardized for any of the analyses.

8. Data Analysis and Reporting

8.1 Data deliverables

Unified Command (UC), EPA ERT, Enbridge representatives

8.2 Reporting Requirements

Monitoring, sampling, and analytical data will be stored in a normal fashion. All report and map products will identify exceedances of action levels setup in the CTEH's Air Sampling Plan.

8.3 Reporting SOP's and Procedures

Developing these will be the responsibility of the initial site data manager and remote support personnel.

8.4 SQL Reporting Queries:

Developing these will be the responsibility of the initial site data manager

8.5 GIS / Spatial Data Visualization Requirements

Map products are produced using an Arc-Scribe OLE Database Connection to the On-Site Scribe database.

8.6 Site Specific Requirements

Required Tools:

- Scribe (3.8.0)
- Computer/Laptop running Windows XP, Vista, Windows 7 OS
- Network connection to internet (for Scribe.NET subscriptions)
- ArcGIS
- Microsoft Access
- Microsoft Excel
- Web Browser (Chrome, Mozilla Firefox, Safari etc.)

Reference Files:

- CTEH Analytical Results to Scribe Import Data Map
- CTEH Real-Time Air Monitoring to Scribe Import Data Map

Appendix A

Lab Result EDD to Scribe

Data Mappings

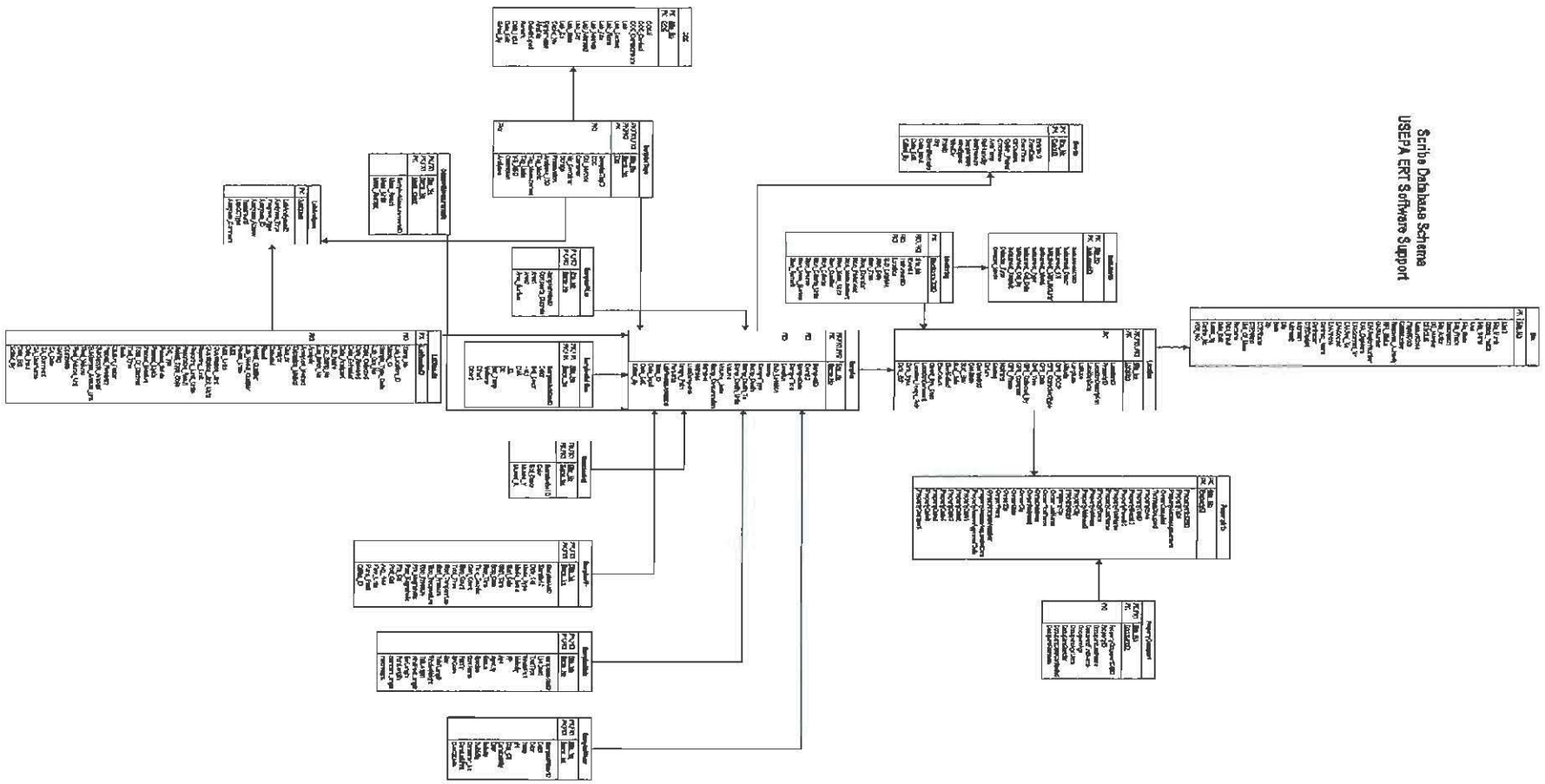
Global Lab EDD to Scribe Data Mapping

Scribe Fields (Destination)	Import Fields (Source)
Analysis	Analytical_Fraction
Analyte	Parameter_Name
Result_Units	Result_Units
Samp_No	Sample_Point_ID
Analytical_Method	Analytical_Method
Basis	
CAS_NO	CAS_Number_Equivalent
CLP_Sample_No	Project_ID
Comments	Field_Sample_Classification
Date_Analyzed	Analysis_Date_Time
Date_Collected	Sampling_Date_Time
Date_Extracted	Extraction_Date_Time
Date_Received	Preparation_Date_Time
Detected	
Dilution_Factor	Dilution_Factor
Extraction_Method	
Final_Volume	Retention_Time
Final_Volume_Unit	
Lab_Batch_No	Instrument_ID
Lab_Coc_No	SDG_ID
Lab_Location_ID	Site_Sample_ID
Lab_Name	Laboratory_ID
Lab_Result_Qualifier	Laboratory_Qualifier
Lab_Samp_No	Lab_Sample_ID
Matrix_ID	Matrix
MDL	
MDL_Units	
Percent_Lipids	
Percent_Moisture	Percent_Moisture
Percent_Recovery	
Percent_Solids	
QA_Comment	Top_Depth
QA_Date	Middle_Depth
QA_UserName	Bottom_Depth
QAFlag	
QC_Type	
Quantitation_Limit	
Quantitation_Limit_Units	
Reportable_Result	
Reporting_Limit	Reporting_Limit
Reporting_Limit_Units	
Result	Laboratory_Result
Result_Qualifier	

Scribe Fields (Destination)	Import Fields (Source)
Result_Type_Code	Analyte_Type
Sample_Type_Code	Lab_Sample_Type
SubSample_Amount	
SubSample_Amount_Unit	
Test_Type	
Total_Or_Disolved	Filtration_Method

Appendix B

Entity Relationship Diagram



Appendix C

Data Management SOP's and Checklists

Data Quality Control for Real-Time Air Monitoring QA/QC SOP

- Log into Samples.cteh.com
- Click "Projects" on the left panel
- Click "40005" on the project list
- Click "Realtime Readings" on the left panel
- Click on QAQC Next (#### remaining)

This brings you to your first reading. Review all fields for accuracy. When complete, click Mark QAQC Complete and Next.

Primary fields that require information are:

- Project number
- Reading date (Date should make sense. If a reading has been taken in 2006, this needs to be corrected.)
- Latitude, Longitude
- Region
- Location Category (description of type of monitoring/work being done)
- Indoor/Outdoor (should always be Outdoor)
- Matrix (should always be Air)
- Instrument – Barcode (make sure it is the instrument serial number, not CTEH ID)
- Analyte (VOC, SO2, H2S, PM2.5, Benzene)
- Concentration (only when positive detection) with Units
- Detection flag (always "<") & Limit - both of these fields should be populated when there is no positive detection
- Initials
- Comments (will not always be filled, but this is where personnel should note visible oil or crude oil odor)

MultiRAE Detection Limits

Analyte	Detection Limit	Unit
VOC	<0.1	ppm
H2S	<1.0	ppm
SO2	<0.1	ppm

UltraRAE Detection Limits

Analyte	Detection Limit	Unit
Benzene	<0.1	ppm

Gastec Tube Detection Limits

Analyte	Tube #	Detection Limit	Volume	Unit
Benzene	121L	<0.05	500mL	ppm
Benzene	121SP	<0.1	300mL	ppm

If a chemical does not have a positive detection, the concentration should never be reported as "0.0." Instead, the detection limit for that chemical should be used based on the sampling equipment used. Particulate matter should always have a concentration.

Enbridge QA

This is a selection on the main page under each project number in Samples. It will take you to a site that has been designed to display the readings for that day that fit certain parameters, such as being VOC detections, incorrect detection limits and missing barcodes. These readings should be the top priority for the QA/QC for that day, although all readings should be QA/QC'd on a daily basis if at all possible.

Changing/Adding information in records:

Information will sometimes need to be changed and/or added during the QA/QC process. When this occurs please note what information was changed or added in the QA/QA comments box. You should also add what prompted the change (ie talked with personnel to correct information).

Quality Flag:

Sometimes a reading will be determined to be not of good quality due to equipment problems, personnel error or some other issue. This drop down box will add a qualifier that will make that reading not included in the reportable data.

There are classifications, for not usable, drift, non-sustained, or sustained. These will cover various scenarios.

Calling field personnel/supervisors:

We will often need to contact the field personnel and/or supervisors to obtain more information or to clarify certain information. The phone numbers for personnel can be found in the Dabble database or on the various organizational charts. Please note in the QA/QC comments that the information was obtained from an interview with field personnel and/or supervisors.

Load Failures:

Occasionally the readings will get hung up in the samples system due to an entry that is not recognized by the system. These will be placed into the Load Failures section on the main page. These readings will need to be opened, then scroll to the bottom to see the reason for the load failure. This will need to be corrected and then the reading will be processed along with the other samples from that day. This should be checked several times a day.

Appendix D

Equipment SOPs

CENTER FOR TOXICOLOGY AND ENVIRONMENTAL HEALTH, L.L.C.

Toxicology Emergency Response Program (June 3, 2008)
STANDARD OPERATING PROCEDURE NO. (Version 1.1)

SUBJECT: SKC Universal Pump Model 224-PCXR8 (5 to 5,000 mL/min)

Description of the SOP: This procedure is intended to provide instruction on the proper use of SKC Universal Sample Pump Model #224-PCXRA for analytical air sampling.

Calibration Instructions:

1. There are two settings for the pump, high flow (≥500 mL per minute) and low flow (<500 mL per minute). To adjust it to high flow or low flow un-screw the smaller copper colored screw located on top of the pump (Figure 1 #18) and you will see a slotted screw (set screw).

2. For high flow sampling:

    a) Turn the set screw (Figure 1 # 18) in a clockwise position all the way down and replace the copper colored screw to the top of the pump.

    b) Attach an approximately 3 foot piece of plain Tygon tubing to the pump intake (Figure 1 #13) on the right hand side of the pump.

    c) Place air sampling media on the end of the tubing not attached to the pump (insure proper directionality of sampling media), with the arrow on the media pointing towards the tubing.

    d) Use a Bios Drycal or DC- Lite to attach to the open end of the air sampling media.

    e) Turn on the SKC pump using the black toggle switch (Figure 1 #8) on the front of the pump.

    f) Adjust the flow rate using the small set screw on the front of the SKC pump labeled "flow adjust" (Figure 1 #11) to the desired flow rate. To increase the flow rate, turn the set screw clockwise. To decrease the flow rate, turn the set screw counterclockwise. Continue to adjust flow rate until calculated flow rate has been achieved. Write your pre-cal on the analytical data sheet (see example).

3. For low flow sampling:

a) Without any Tygon tubing attached to the pump, turn the set screw (Figure 1 #18) in a clockwise position all the way down.

b) Using the set screw (Figure 1 #11) and the flow indicator on the front of the SKC pump (Figure 1 #17); adjust the ball so that it is approximately at 1.5.

c) Turn the set screw on top of the pump (Figure 1 #18) counterclockwise 5 full turns and replace the copper colored screw.

d) Attach a piece of Tygon tubing to the pump intake (Figure 1 # 13) located on the right hand side of the pump.

e) An "adjustable low flow holder," (Cat. No. 224-26-01, 224-26-02, 224-26-03, 224-26-04 for single, dual, tri, and quad, respectively) should be attached to the free end of the Tygon tubing.

Cat. No. 224-26-01

Cat. No. 224-26-02

Cat. No. 224-26-03

f) Place air sampling media on the end of the tubing not attached to the pump (Insure proper directionality of sampling media).

g) Use a Bios Drycal or DC-Lite to attach to the open end of the air sampling media.

h) Turn on the SKC pump using the black toggle switch on the front of the pump (Figure 1 #8).

i) Adjust the air sampling flow rate using the set screw located on the adjustable low flow holder to the desired flow rate. To increase the flow rate, turn the set screw clockwise. To decrease the flow rate, turn the set screw counterclockwise. Continue to adjust flow rate until calculated flow rate has been achieved. Write your pre-cal on the analytical data sheet (see example).

Equipment Use Instructions (step by step)

This instrument has six keys on the front that perform a variety of functions. The following is a review of each key function:

1. The top left hand key is labeled "START/HOLD." When the pump is turned on, push the "START/HOLD" key to pause the pump, the screen will say hold (no air will be pulled through the sampling media). To restart the pump, push the key again.

2. With the pump on hold, press the SET-UP key to enter the "Delayed Start" mode. Enter the number of minutes delay before the sampling period begins by pressing the DIGIT SELECT and DIGIT SET keys. The DIGIT SELECT key advances the flashing digit and the DIGIT SET key increases the value of the flashing digit.

3. Press the MODE key to enter the "Sample Period" mode. Press the DIGIT SELECT and DIGIT SET keys to enter the sampling time period in minutes.

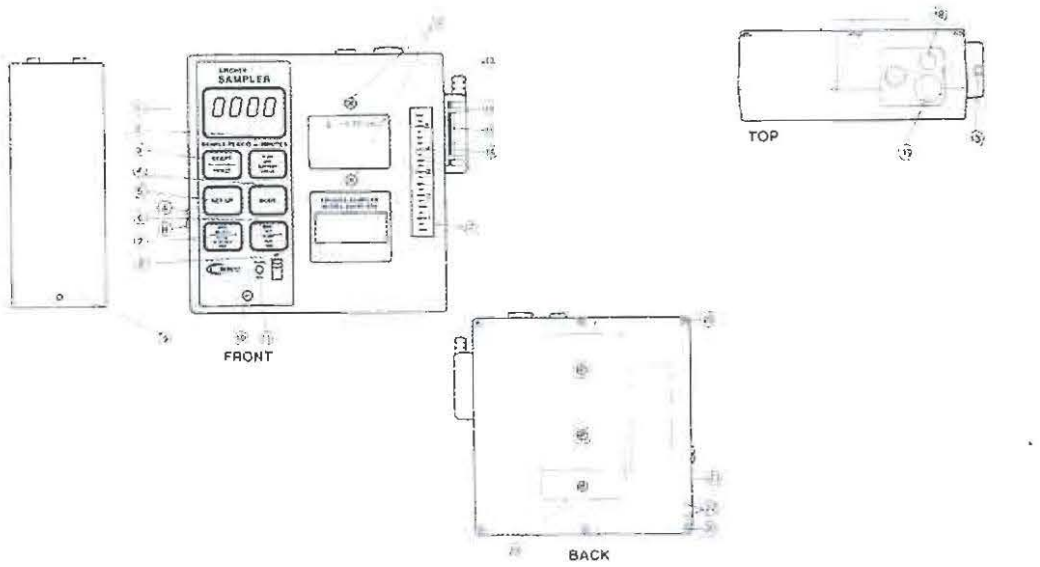
NOTE: The sample period is the *total* time of the sampling event.

4. Press the MODE key to enter the "Pump Period" mode. This is the actual running time of the pump. Use the DIGIT SELECT and DIGIT SET keys to enter the pump run time in minutes. If intermittent sampling is not desired, set the sampling period equal to the pump period.

NOTE: The pump period is the time in which the pump is actually pulling air through the media. Pump period is always equal to or less than the sample period.

5. Press the start button to begin sampling.

Figure 1



Cassette Notes: When using cassettes, the calibration will require a hose with an adaptor tip to insert into the cassette. The cassettes generally require holders, make sure the side of the cassette the air comes in through says inlet.

Placement Notes:

-Pump should be set up so the media is at breathing level.

-Tubing should not be pinched or crimped by position.

-Media should be horizontal to maximize exposure.

-Media should be facing downwards to discourage moisture build up.

-Always cover the pumps if rain is likely. However, media should still be exposed to the outside air. Be sure to tape the sample tag and use a tube cover if applicable.

-If not at an AreaRAE station, make sure to GPS the location for later mapping.

Media Note:

-Some analytes require the use of a tube and a cassette.

-Example: PAH sampling. The air is first pulled through a cassette, which is connected to a tube.

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-Some analytes are sensitive to UV rays, these must be handled a certain way after sampling.

-Example: PAH. The tube must be wrapped in foil. The cassette must be pried open using the crescent-ended tool in the media bag. The cassette filter must be picked up with forceps (also in media bag) and placed into an amber bottle. It helps to make double labels for the media. One set on the media, and one set for the bottle and the wrapped tube.

Labeling Note: Especially if rain is expected, using clear tape over the labels will keep the number from smearing. Always make the sample number is as easy to read as possible, do not confuse the letter o from the number zero, etc...

Additional Media Needed for This Equipment:

Air sampling media appropriate for the analyte of concern.

Notification Procedures for Equipment Failure:

1. Tiffani Ray
2. Contact SKC Gulf Coast at 1-800-225-1309 and request a Return Authorization form. Fill it out and ship the damaged equipment with the included form to:

   SKC, Inc
   Attn: Repair Department
   863 Valley View Road
   Eighty Four, PA 15330
   1-800-752-8472

Specialized Training Required or Recommended:

Chemical specific sampling techniques

References and Further Assistance:

1. SKC Universal Sample Pump Operating Instructions for Cat. No. 224-PCXR8
2. SKC 2004 Comprehensive Catalog & Air Sampling Guide
3. http://www.skcgulfcoast.com/
4. Jack Shriver
   9827 Whithorn Drive
   Houston, TX 77095
   1-800-225-1309

Review Date for this SOP

Emily Schmitz and Ben Gehring; June 3, 2008

CTEH

CENTER FOR TOXICOLOGY AND ENVIRONMENTAL HEALTH, L.L.C.

Toxicology Emergency Response Program (6/17/08)
STANDARD OPERATING PROCEDURE NO. (Version 1.1)

SUBJECT: MultiRAE Plus

Description of the SOP. This SOP describes the set-up and use of the MultiRAE Plus.

Calibration Instructions: Calibration should be done at least once a shift.

To get to Calibration Screen

1) Turn on MultiRAE by pressing and holding the MODE button. Wait for the instrument to warm up.
2) To get to the calibration screen press the MODE and "No" buttons at the same time. Hold until screen says "Calibrate Monitor", press Y/+.
3) When the message "Fresh Air Calibration?" appears, make sure before pressing Y/+ you have either a fresh air environment or are using zero grade air. When calibrating sensors for the first time, do not Fresh Air calibrate.

For Multiple Sensor Calibration

1) To calibrate multiple sensors at the same time in the MulitRAE, select Y/+ at the multiple sensor calibration screen.
2) To accept these chemicals for multiple sensor calibration, press Y/+
3) To change the chemicals for the multiple sensor calibration, press N/- at the "OK?" screen
4) The "Pick" screen will appear. To choose other sensors, press MODE scroll from one sensor to the next and press Y/+ to select a sensor and N/- to deselect a sensor.
5) An asterisk (*) will appear by the sensors that are selected to be calibrated with the multiple sensor calibration.
6) The instrument will recognize the Calibration gas and begin counting down from 59 seconds.
7) After 59 seconds, the instrument will show "Calibration Complete"

NOTE: Quad gas allows for the calibration of CO, H_2S, O_2, and LEL.

For Single Sensor Calibration

1) To calibrate single sensors, select y/+ at the single sensor calibration screen.
2) Use the MODE button to navigate between sensors. Press Y/+ to select the sensor.

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3) After pressing Y/+ on the VOC sensor, the MultiRAE will ask you to Apply Gas = Isobutylene.
4) When you apply the calibration gas to MultiRae, it will begin a countdown from 59 sec.
5) At the end of the 59 sec., the instrument will show "Calibration Complete, Turn off cal gas"

NOTE: The MultiRae is set to calibrate to a specific concentration of calibration gas. For each sensor, the calibration gas and concentration will be different.

Using a Different Calibration Gas: If you need to calibrate your instrument with a calibration gas that is not sold to you by Rae Systems, you will need to check the span gas value which should equal concentration of the calibration gas.

1) To modify span gas value, press Y/+ when the "Modify Span Gas Value" screen appears.
2) Use the MODE button to scroll from digit to digit and the Y/+ and N/- buttons to adjust values.
3) Before calibration, the span gas values need to represent the calibration gas concentrations.

Bump Calibration: This is done to check a sensor's function; this does not take the place of a standard calibration.

1) Can be done in either diagnostic mode in the raw screen or in standard mode in the readings screen.
2) Attach the calibration gas that coincides with that sensor to the MultiRAE
3) Expose the instrument to the gas (example: isobutylene to check VOCs)
4) Watch the readings and make sure they reach the correct value. (RAW values have an acceptable range. The ranges for the most commonly used sensors will be provided at the end of the SOP)

NOTE: Always record a calibration in the calibration log, there will be an example form at the end of the SOP.

NOTE: Always calibrate the instrument in the environment it will be used in. If there is too large a change in humidity and temperature, the instrument will not react properly

NOTE: There are special case calibrations for some sensors.
Example: HCl and HF sensors. These sensors have a 4 minute calibration time.

NOTE: Some sensors need to be "burned in" for a period before fully operable.
Example: Cl2, HCL, HF, NO, NH3 sensors: There "burn in" periods are recommended to be between 12-24 hours.

Equipment Use Instructions (step by step)

Battery Replacement and Monitor Start Up

1) Remove the water trap, if applicable, from the inlet. (replace water trap if there is visible dirt or it has been in humid environment)
2) Remove the instrument from its casing.
3) Loosen the screws on the backside of the instrument and remove the front cover.
4) Replace the batteries, and screw the cover back on.
5) Press and hold the mode button until the monitor comes on.
6) Place the instrument back into its protective cover and put the water trap back on unless you are using chemical sensors which call for the water trap to be left off (see MultiRAE handbook for list of sensors).
7) Allow the MultiRAE to go through its startup procedures.

User Mode- Main Screen Menus

1) While the Instrument is showing readings, press MODE to scroll through the main screens.
2) Press MODE once to view the PEAK value.
3) Press MODE again to view the MINIMUM value.
4) Press MODE again for the STEL values. STEL values are only shown for TOX1, VOC, and TOX2.
5) Press MODE again for TWA values. TWA values are also only shown for TOX1, VOC, and TOX2.
6) Press MODE again to view the Battery Power screen.
7) Press Mode once again to view the Date, Time, Temperature, and Time the instrument was turned on.
8) Pressing MODE again will take you to the "Start Datalog?" Screen. Press Y/+ to Start Datalog then the screen will display Stop Datalog. When you stop the datalog, this will complete one event.
9) Press mode once to view the LEL gas= screen. This tells you what calibration gas your LEL is set.
10) Press MODE once more to view the calibration gas to which the PID is set.
11) Press MODE again for the "Print Reading?" Screen.
12) Press MODE again for the "Communicate with PC?" screen. To download information off of the Multi Rae to your computer, press Y/+.

Program Mode - to go into Program Mode, PRESS and HOLD MODE and N/- for 5 seconds. (It is sometimes easier to hold the N/- button first then hold MODE)

Change Alarm Limits

1) All sensors come from Rae Systems with a default alarm limit.
2) These limits can be found in the "Change Alarm Limits" screen on the Multi Rae.
3) Press mode and no at the same time. Use the mode button to scroll through the menu.
4) When the "Change Alarm Limits" screen appears, select Y/+.
5) You will have the option of changing the High alarm, Low alarm, STEL alarm, and the Average alarm limits.
6) Press N/- to scroll to the Alarm limit that you would like to change.
7) Select Y/+ on the alarm limit that you intend to change.
8) Use the MODE button to scroll from digit to digit and the Y/+ and N/- buttons to select digits.
9) To save your changes, hold down the MODE button.

Change Real Time Clock

1) Hit MODE when the command Monitor Setup? appears on the screen.
2) Select "Change Real Time Clock?" to adjust the date and time showing on the MultiRae, then use Y/+ and N/- to adjust the time.

NOTE: ALWAYS do this, and double check it, before you start a datalog.

View or Change Datalog

1) Press MODE and N+/ at the same time. Scroll through the menu by pressing the MODE button.
2) To view or change the Datalog function, press Y/+ at the "View or Change Datalog?" screen.
3) The first option will be to "Clear all Data?"
4) Select Y/+ to clear all of the data in the datalog memory.
5) The next option is to "Reset the Peak and Minimum?"
6) When you select Y/+ to "Reset the Peak and Minimum?" the Multi Rae will prompt "Are you sure?"
7) Select Y/+ to reset your values that you see when scrolling the main menu.
8) The next option is to Enable/Disable datalog? If a * is displayed next to a sensor name, data will be recorded. Use mode to move from sensor to sensor. An asterisk (*) means

the sensor is enabled; no asterisk means the sensor is disabled. Press Y/+ to select, and N/- to deselect. To save changes, press MODE until Save? appears. Then press Y/+ to accept. Otherwise, hold MODE to escape and cancel changes.

NOTE: Do not datalog an instrument that is in diagnostic mode, it will record RAW values. Always restart first then begin datalog.

Change Backlight

1) You can change the backlight mode by pressing Y/+ at the "Change Backlight Mode?" screen.
2) To turn on the backlight, hold the N/- button down.

Change Pump Speed

1) To change Pump Speed continue until Change Pump Speed? appears on screen. Press Y+/ or N+/ to change speed different than what it is previously set. Once you determine which speed you prefer then hold the Y+/ to save.
2) Low pump speed- (default) used when operating conditions that are slow to change, prolongs pump motor life, LEL sensor life and battery run time.
3) High pump speed- use for long lengths of tubing or when rapid changes in input conditions are expected, such as HazMat response or when used for measuring heavy, low vapor pressure compounds like jet fuel.

NOTE: Make sure to note it somewhere on an equipment tag when you have changed the pump speed from a default setting, include your initials and date

NOTE: When using tubing as an extension, we must use Teflon tubing. Tygon tubing readily absorbs volatiles, especially benzene.

Sensor Configuration

1) Hit MODE and N/+ at the same time.
2) Change LEL/VOC Gas Selection?
3) Enable/Disable Sensors?
4) Sensors have assigned sockets. These are identified on the PCB. High bias toxic in socket 1/A.
5) Change PID Lamp Type? This only applies to PID monitors. The PID sensor can utilize either a 10.6 eV or an 11.7 eV UV. Since each lamp type has a different correction factor table, it is important to select the correct lamp type.

NOTE: 11.7 lamps have a much shorter lifespan, be aware of the expiration date and leave Tiffani a note when you mobilize with them.

Using the MultiRAE

1) After recognizing your chemical of concern, look in the technical and application notes and locate the correction factor for that chemical that corresponds with the lamp in your MultiRAE
2) When two or more chemicals of concern need to be monitored, a general rule of thumb is to use the highest correction factor and the chemical with the lowest PEL for action level purposes.

NOTE: Correction factors are very important, for both the VOC and LEL sensors. Look through both TN-106 (PID) and TN-156 (LEL).

NOTE: The new NH3 sensors are un-biased. However the NO sensors are still high-bias.

How to clean a lamp

1) Acquire a lamp cleaning kit. Make sure it includes cotton swabs, methanol, tweezers. Gloves can be found in the ER GO BAG if there are none in the kit.
2) Remove the front cover from the instrument.
3) Remove the metal casing from the PID using the tweezers and wearing gloves. Set it aside.
4) Using the tweezers carefully remove the top of the PID housing, it is usually fairly secure, do not use too much force. Set it aside.
5) Carefully remove the lamp from the base, and securely hold it while you swab with cotton soaked in the methanol. Be careful not to allow cotton fibers to stick to the lamp.
6) Give the lamp a few seconds to dry, then place back into base.
7) Carefully swab the metal screen in the top of the PID housing, and give it a few seconds to dry before replacing.
8) Replace metal casing. If it appears dirty, swab with methanol also.
9) Replace cover on the instrument.

NOTE: If replacing an expired or faulty lamp, please place the old lamp in box the new lamp came out of. Mark the box with the serial number and date removed, and return to Tiffani. It may not have expired yet and be available for replacement.

NOTE: Other than lamp cleaning/replacement or sensor changes, do not manipulate the other components within the instrument. Red tag the unit and return to Tiffani.

Additional media needed for this equipment: (i.e. calibration gas or chemcassettes)

MultiRAE technical and application notes; MultiRAE users manual

Calibration gases appropriate to the sensors being used.

Lamp cleaning kit.

Notification Procedures for Equipment Failure (i.e. Rae Systems tech support number and CTEH contact)

RAE Systems 408.723.4800 CTEH- Tiffani Ray 801.501.8580

RED TAG inoperable equipment properly, example following SOP

References and Further Assistance

Review Date for this SOP

Emily Schmitz and Ben Gehring June 17, 2008

Attachments

Excerpt from TN-123
Calibration Log example
Red Equipment Tag example

CENTER FOR TOXICOLOGY AND ENVIRONMENTAL HEALTH, L.L.C.

Toxicology Emergency Response Program April 14, 2009
STANDARD OPERATING PROCEDURE NO. (1)

SUBJECT: *MiniCan* or Mini-canister

Description of the SOP. The purpose of this SOP is to instruct the user about proper methods and operation for collecting a Mini-Can air sample. Upon completion of this manual the user should be able to collect both a grab sample and a time released air sample using a Mini-Can air sampling instrument.

Calibration Instructions

1. All cleaning and calibration should be conducted at the laboratory by authorized personnel.

Grab Sample Equipment Use Instructions (step by step)

1. Ensure that the sampler is not wearing any of perfume, cologne, or aerosol. These products may affect the sample.

2. Remove protective cap from the Mini-Can sampler tip..

3. Using a grab sample regulator, slide the connection collar back.

4. Position the canister on its side in the direction of the area intended to sample.

5. Insert the sampler tip into the regulator and release the collar. ***NOTE: There should not be a gap between the regulator and the canister.***

6. Allow the canister ample time to fill (20-30 seconds)

7. Once the canister has been successfully filled with sample air pull back on the connection collar to release the regulator.

8. Place protective cap on sampler tip.

9. Complete a Chain of Custody form and ship sample in accordance to laboratories shipment instruction.

Additional media needed for this equipment:

Quick Grab Sample Regulator

Time Released Equipment Use Instructions (step by step)

1. Ensure the sampler is not wearing any sort of perfume, cologne, or aerosol. These products may affect the sample.

2. Remove protective cap from the Mini-Can sampler tip.

3. Using a time release regulator, slide the connection collar back.

4. Place canister in area intended for sampling and insert sampler tip into regulator. ***NOTE: For stationary sampling the canister should be placed on its side. For personnel sampling the canister should be fastened using a holster belt with a sampling tube attached to the regulator and clipped to the collar of the individual that is being sampled.***

5. Release the connection collar. ***Note: There should not be any gap between the regulator and the canister.***

6. Allow the sample canister ample time to fill. ***NOTE: Progress can be monitored by checking the vacuum gauge located on the regulator. The pressure should decrease over time.***

7. Once sample time is complete and canister has been successfully filled with sample air pull back the connection collar to release the regulator.

8. Place protective cap back on the Mini-Can sampler tip.

9. Complete a Chain of Custody form and ship sample in accordance to laboratories shipment instruction.

Additional media needed for this equipment:

Time Released Grab Sample Regulator

Belt holster (depending on sample)

Sample tubing (depending on sample)

Notification Procedures for Equipment Failure

Galson Laboratories
6601 Kirkville Road
East Syracuse, NY 13057

Phone: 315-432-LABS (5227)
Toll Free: 888-432-LABS (5227)
www.galsonlabs.com
mail@galsonlabs.com

Center for Toxicology and Environmental Health (CTEH)
5120 North Shore Drive
North Little Rock, AR 72118
Phone: 501-801-8500
Emergency: 1-866-TOX-CTEH (869-2834)
Fax: 501-801-8501
www.cteh.com

References and Further Assistance.

Centek Laboratories, LLC
143 Midler Park Drive
Syracuse, New York 13206
Phone: 315-431-9730
Fax: 315-431-9731

Review Date for this SOP

Chris Talley

04-14-09

CENTER FOR TOXICOLOGY AND ENVIRONMENTAL HEALTH, L.L.C.

Toxicology Emergency Response Program (June 3, 2008)
STANDARD OPERATING PROCEDURE NO. (Version 1.1)

SUBJECT: Gastec GV-100 and Colorimetric Detector Tubes

Description of the SOP: This procedure is intended to provide instruction on the proper use of the Gastec piston pump (GV-100) with real-time colorimetric detector tubes for a wide range of analytes.

Calibration Instructions:

Factory Calibrated.

Equipment Use Instructions (step by step):

1. Determine your analyte of concern.
2. Pick out a box of detector tubes and insure the following items (The following instructions assume you have picked out a previously un-opened box):
   a) The box of detector tubes is not expired (Expiration date is printed on the top of the box).
   b) The measuring range is appropriate for the sampling you are performing.
3. Determine if the analyte you are sampling for is a single tube method or a dual tube method. To determine this, look on the front of the detector tube box and look at the number of tests. If it says 10 tests, it is a single tube method, if it says 5 tests; it is a dual tube method (example: Benzene 121L).
4. Assuming it is a single tube method:
   a) Break off both ends of the glass detector tube in the tip breaker located on the Gastec pump.
   b) Insert the glass tube in the end of the Gastec pump with the arrow on the glass detector tube pointing towards the pump.
5. Assuming it is a dual tube method:
   a) There will be ten glass tubes in the box, 5 pre-treatment tubes and 5 detector tubes.
   b) Locate a pre-treatment tube (usually in the back row of the box and is identified as a tube with no measuring scale printed on it), a detector tube (usually in the

front row of the box and is identified as a glass tube with a measuring range printed on it), and a pink piece of tubing located between the two rows of tubes.

c) Break off both ends of both tubes using the tip breaker on the side of the Gastec pump.

d) The pretreatment tube should be placed in-line with the measuring tube using the pink piece of tubing. The pretreatment tube should be in front of the detector tube for sampling. The detector tube has the measuring range delineated on it, and should be the one inserted into the pump while the other, pretreatment tube, filters the air before it reaches it.

Note: The arrows on both glass tubes should be pointing towards the Gastec pump.

e) Insert the measuring tube in the Gastec pump.

6. To determine the appropriate number of pump strokes, look at the instructions located in the detector tube box. There are two types of pump strokes, a full stroke (100 mL) and a half stroke (50 mL). To pull a full stroke or a half stroke line up the arrow on the Gastec pump handle with the appropriate volume (either 100 mL or 50 mL). Every analyte has a different measuring range, but generally the more pump strokes that are pulled, the lower the detection limits.

   NOTE: Insure that you are pulling enough pump strokes to get below the particular standard or guideline with which you are comparing your results. Also, the "number of pump strokes" in the directions refers to full (100 mL) pump strokes.

7. The pump stroke is complete when the "Flow Finish Indicator" is visible on the end of the pump handle. The "Flow Finish Indicator" is a white disc that becomes visible after pulling the pump stroke anywhere from 30 seconds to 5 minutes depending on the analyte.

8. To read the airborne concentration of the analyte of concern, look at the measuring scale on the detector tube. Consult the instructions for the appropriate reagent color change that you should expect if the analyte is present in the air at detectable levels. There is a statement on every detector tube such as "n=X", this indicates the number of full pump strokes that you must pull to read the concentration directly from the

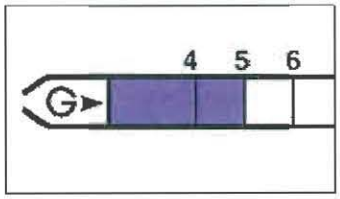
detector tube. If you pull more or less than this number, you must apply a correction factor that you will find in the instructions.

9. Note that all colorimetric detector tubes have chemical interferences as well as corrections for humidity, pressure, and temperature. Consult the instructions for details.

10. Do not re-use a detector tube or pretreatment tube if you have a color change in the reagent (a detection).

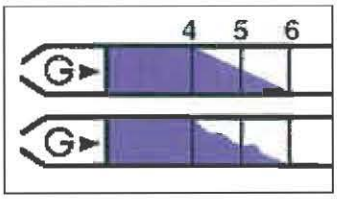
Tips for detector tube reading

When the end of the color change layer is flat, simply read the value at the end.



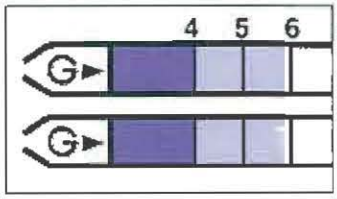
In this case, the reading would be 5%.

When the end of the color change layer is slanted, read the value in the middle of the slant.



In this exaggerated case, the reading would be 5%.

When the demarcation of the color change layer is pale, the mean value between the dark and the pale layer ends is taken.



In this exaggerated case, the reading would be 5%.

Tip for easier reading

When you mark the color change with a pen as soon as the sampling is complete, it is more convenient to read.

Note: It is possible to have a positive detection that is not measurable. This occurs when there is a positive color change, but it is not within the marked, measurable part of the tube. To record this properly you would state that the reading was above the detection limit, but below the measuring range. Example, >1 ppm ,<5 ppm.

11. Dispose of the pretreatment and detector tube according to local governmental standards.

Additional media needed for this equipment:

Detector tubes are available for a wide variety of analytes. We have at least one box of most of the detector tubes that are manufactured by Gastec.

Notification Procedures for Equipment Failure:

Notify: Tiffani Ray

Specialized Training Required or Recommended:

None

References and Further Assistance:

1. Refer to the Gastec Handbook 2nd Edition or later

2. Nextteq, LLC
   8406 Benjamin Road, Suite J
   Tampa, FL 33634
   Phone: 877-312-2333
   Fax: 877-312-2444
   http://www.nextteq.com/

3. http://www.gastec.co.jp/english/index.php

Review Date for this SOP:

Emily Schmitz and Ben Gehring 6/3/2008

Attachment 1

Laboratory Quality Assurance Manual(s)

Will be supplied under separate cover on a CD-ROM

Attachment 2

Laboratory Analytical Standard Operating Procedures

Will be supplied under separate cover on a CD-ROM