QUALITY ASSURANCE PROJECT PLAN

(REVISION 0)

IMPLEMENTATION OF U.S. EPA ASSESSMENT GRANT

FOR PETROLEUM AND HAZARDOUS SUBSTANCE BROWNFIELDS

WASHINGTON COUNTY, WISCONSIN

U.S. EPA COOPERATIVE AGREEMENT NO. BF-00E01347-0

July 10, 2015

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July 10, 2015

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QUALITY ASSURANCE PROJECT PLAN SIGNATURE PAGE
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FOR PETROLEUM AND HAZARDOUS SUBSTANCE BROWNFIELDS
WASHINGTON COUNTY
U.S. EPA COOPERATIVE AGREEMENT NO. BF 00E01347-0
COOPERATIVE AGREEMENT DATE: October 1, 2014 – September 30, 2017

This Quality Assurance Project Plan (QAPP) was prepared by Stantec Consulting Services Inc. (Stantec) on behalf of Washington County for field and laboratory activities to be performed during implementation of the referenced project. This QAPP was developed following the guidance presented in the United States Environmental Protection Agency (U.S. EPA) document CIO 2106-G-05 QAPP *Guidance on Quality Assurance Project Plans*, dated January 2012.

_____ _____
Fred Bartman, U.S. EPA Project Officer Date

_____ _____
Jan Pels, U.S. EPA QA Reviewer Date

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Debora Sielski, Washington County Project Manager Date

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David Holmes, Stantec Consultant Project Manager Date

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Richard Binder, Stantec Consultant QA Manager Date

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Christelle Newsome, CT Laboratories QA Manager Date

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Terese Preston, Test America Laboratories, Inc. QA Manager Date

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Kassandra Bray, EMT, Inc., QA Manager Date

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Kimberly Grandprey, Legend Technical Services, QA Manager Date

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LIST OF ACRONYMS AND ABBREVIATIONS

AAI	All Appropriate Inquiry
ACM	Asbestos Containing Material
ASTM	American Society for Testing and Materials
CT Labs	CT Laboratories, Inc.
COC	Chain of Custody
DQA	Data Quality Assessment
DQO	Data Quality Objectives
E.I.T.	Engineer In Training
ESA	Environmental Site Assessment
HASP	Health and Safety Plan
i.e.	id est (Latin word meaning “that is” or “in other words”)
LBP	Lead Based Paint
LCS	Laboratory Control Samples
Legend	Legend Technical Services, Inc.
MCL	Maximum Contaminant Level
MDL	Method Detection Limits
MS/MSD	Matrix Spike/Matrix Spike Duplicate
NVLAP	National Voluntary Laboratory Accreditation Program
OSHA	Occupational Safety and Health Administration
Test America	Test America Laboratories, Inc.
PARCCS	Precision, Accuracy, Representativeness, Completeness, Comparability and Sensitivity
P.G.	Professional Geologist
PID	Photoionization Detector
QA	Quality Assurance
QAPP	Quality Assurance Project Plan
QC	Quality Control
QLs	Quantitation Limits
REC	Recognized Environmental Condition
RPD	Relative Percent Difference
RSD	Relative Standard Deviation
SA	Spike Added
SAP	Sampling and Analysis Plan
SOPs	Standard Operating Procedures
SR	Sample Result
SRMs	Standard Reference Materials
SSR	Spiked Sample Result
Stantec	Stantec Consulting Services Inc
U.S. EPA	United States Environmental Protection Agency
VOC	Volatile Organic Compound
WAC	Wisconsin Administrative Code
WDNR	Wisconsin Department of Natural Resources

PROJECT PERSONNEL

Contact information for key project personnel is summarized on the table below.

Name, Title	Project Role	Organization	Contact Information
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Name, Title	Project Role	Organization	Contact Information
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Kassandra Bray	Laboratory QA Manager	EMT	8100 N. Austin Avenue Morton Grove, IL 60053-3203 Phone: (847) 324-3341 Fax: (847) 967-6735 kbray@emt.com

SECTION 1.0 PROJECT MANAGEMENT

The purpose of this document is to describe the personnel, procedures, and methods for ensuring the quality, accuracy, and precision of data associated with the Washington County (County) Brownfield Assessment Project. In 2014 the County received a $600,000 United States Environmental Protection Agency (U.S. EPA) grant for assessment of petroleum and hazardous substance brownfields ($300,000 for petroleum brownfields and $300,000 for hazardous substance brownfields). This QAPP addresses both petroleum and hazardous substance contaminants that may be encountered during the assessment of petroleum or hazardous substance brownfield sites.

Following the procedures outlined in this QAPP will ensure that the data collected meet the project objectives. This QAPP will be valid for the life of the cooperative agreement/contract and will be reviewed annually (from the date of approval) to ensure that it remains up to date. This annual review will be documented, and a summary forwarded to all recipients of the QAPP with any updated materials (current laboratory certificates, resumes for new key staff, etc.) for insertion into their copies of the QAPP. If substantial changes are anticipated during the project period (new laboratories, additional analyses, new field methods, etc.), a call will be arranged with all parties that reviewed this QAPP to determine how to revise this document.

1.1 Project Organization and Responsibilities

Responsibilities of key project personnel are outlined below. All lines of communication, management activities and technical direction within this project team will follow this organization arrangement. Any directions or communications from the U.S. EPA will be given to the Grantee Project Manager. The Grantee Project Manager will subsequently communicate directions to the Stantec Project Manager. The U.S. EPA project manager will be notified of all proposed changes in personnel. Resumes for Stantec personnel referenced below are presented in Appendix A. A project organization chart is presented on Figure 1 and a project schedule on Figure 2. All asbestos work will be subcontracted to and performed by a Wisconsin Certified Asbestos Inspector. When asbestos sampling subcontractor(s) are hired for work under the grant, the company and the qualifications of the personnel will be provided to the grantee, EPA project manager and QA reviewer, along with a QAPP update letter for review and incorporation into the grant file.

U.S. EPA Project Officer (Fred Bartman)

1. Direct, review, and approve QAPP and Sampling and Analysis Plans (SAPs).
2. Review and Approve Site Eligibility Determination Outlines.

3. Provide technical consultation services to the Grantee project manager and Stantec project manager.
4. Review progress reports detailing work accomplished.
5. Review all final reports.

U.S. EPA Quality Assurance Reviewer (Jan Pels)

1. Review and approve the QAPP.
2. Assist in review of the SAPs.

Washington County Project Manager (Debora Sielski, Deputy Planning and Parks Administrator)

1. Direct project activities.
2. Prepare and submit progress reports detailing work accomplished, funds spent and the project status.
3. Responsible for review of project deliverables, development of project planning and the overview of project strategies.

Stantec Project Manager (David B. Holmes, P.G., Senior Environmental Scientist)

1. Prepare, review and submit QAPP, SAPs and project Health and Safety Plans (HASPs).
2. Responsible for planning, coordinating, monitoring and evaluating project field activities.
3. Before sampling, meet with the quality assurance (QA) manager, and field staff to discuss and establish sampling purposes, sampling methodology, number of samples, size of samples, sample preservation methods, chain-of-custody (COC) requirements, analyses required and which samples will be duplicated in the field.
4. Resolve technical problems.
5. Meet with team members to discuss and review analytical results prior to completion of reports.
6. Responsible for environmental reports and documents.

Stantec Assistant Project Manager and Quality Assurance Manager (Richard J. Binder, P.G.)

1. Assist the Stantec Project Manager with those responsibilities described above.
2. Oversee assessment activities to ensure that sampling methodology, sample preservation methods and chain of custody (COC) procedures are being followed.
3. Assist in any QA issues with field or laboratory questions, as needed.
4. Conduct Field Audits.
5. Maintain a record of samples submitted to the laboratory, the analyses being performed on each sample, the final analytical results and data validation reports.

6. Prepare Data Assessment Report.
7. Annual review of QAPP.

Stantec Data Manager and Field Team Leader (Chris Hatfield, P.G.)

1. Maintain a record of all samples collected and the sample identification information on each sample.
2. Manage data acquired from field assessments and laboratory analyses.
3. Assemble data into computer format.
4. Assist with competing SAPs and project HASPs prior to the start of monitoring activities.
5. Be responsible for oversight of field activities and ensure that procedures for the field activities related to the QAPP are executed and documented properly.
6. Procuring, coordinating and qualifying all subcontractors.

Stantec Field Technical Staff (Chris Hatfield, Jeff Brand, Andy Swaim, Evan Weber, Nick Heim)

1. Stantec field technical staff will be assigned to the project on an as needed basis, as field investigation activities are initiated.
2. Before sampling, meet with Stantec project manager to discuss and establish sampling purposes, sampling methodology, number of samples, size of samples, sample preservation methods, COC requirements, analyses required and which samples will be duplicated in the field.
3. Be responsible for collection of equipment needed for monitoring activities, which would include personal protective equipment, sampling equipment, sample containers and coolers, water-level meters, monitoring devices and any other equipment deemed necessary.
4. Oversee sampling activities to ensure that proper procedures are followed during each type of monitoring.
5. Monitor any hazardous conditions, if present, while conducting field operations.
6. Submit COC records and field paperwork to field team leader.

CT Laboratories Quality Assurance Manager (Christelle Newsome)

CT Laboratories, LLC (CT Labs) is one of four analytical laboratories selected for work on this project. The responsibilities of the Quality Assurance Coordinator for CT Laboratories include:

1. Assuring the integrity of samples submitted to CT Laboratories, including those released to a subcontracted laboratory (although all analyses currently included in Revision 0 of the QAPP will be performed in-house).
2. Summarizing QA/quality control (QC) requirements for the project.
3. Maintaining laboratory schedule and ensuring that technical requirements are understood by laboratory personnel.

4. Providing technical guidance to Stantec project manager.
5. Ensuring accuracy of the laboratory data.
6. Evaluating adherence to policies and ensuring that systems are in place to provide QA/QC as defined in the QAPP.
7. Initiating and overseeing audits of corrective action procedures.
8. Performing data reviews.
9. Maintaining documentation of training.

Test America Quality Assurance Manager (Terese Preston)

Test America Laboratory, Inc. (Test America) is one of four analytical laboratories selected for work on this project. The responsibilities of the Quality Assurance Manager for Test America include:

1. Assuring the integrity of samples submitted to Test America including those released to a subcontracted laboratory (although all analyses currently included in Revision 0 of the QAPP will be performed in-house).
2. Summarizing QA/QC requirements for the project.
3. Maintaining laboratory schedule and ensure that technical requirements are understood by laboratory personnel.
4. Providing technical guidance to Stantec project manager.
5. Ensuring accuracy of the laboratory data.
6. Evaluating adherence to policies and ensuring that systems are in place to provide QA/QC as defined in the QAPP.
7. Initiating and oversee audits of corrective action procedures.
8. Performing data reviews.
9. Maintaining documentation of training.

Environmental Monitoring and Technologies, Inc. Quality Assurance Manager (Kassandra Bray)

Environmental Monitoring and Technologies, Inc. (EMT, Inc.) is one of four analytical laboratories selected for work on this project. The responsibilities of the Quality Assurance Manager for EMT include:

1. Assuring the integrity of samples submitted to EMT, Inc. including those released to a subcontracted laboratory (although all analyses currently included in Revision 0 of the QAPP will be performed in-house).
2. Summarizing QA/QC requirements for the project.
3. Maintaining laboratory schedule and ensure that technical requirements are understood by laboratory personnel.
4. Providing technical guidance to Stantec project manager.
5. Ensuring accuracy of the laboratory data.
6. Evaluating adherence to policies and ensuring that systems are in place to provide QA/QC as defined in the QAPP.
7. Initiating and oversee audits of corrective action procedures.

8. Performing data reviews.
9. Maintaining documentation of training.

Legend Quality Assurance Manager (Kimberly Grandprey)

Legend Technical Services, Inc. (Legend) is one of four analytical laboratories selected for work on this project. The responsibilities of the Quality Assurance Manager for Legend include:

1. Assuring the integrity of samples submitted to Legend including those released to a subcontracted laboratory (although all analyses currently included in Revision 0 of the QAPP will be performed in-house).
2. Summarizing QA/QC requirements for the project.
3. Maintaining laboratory schedule and ensure that technical requirements are understood by laboratory personnel.
4. Providing technical guidance to Stantec project manager.
5. Ensuring accuracy of the laboratory data.
6. Evaluating adherence to policies and ensuring that systems are in place to provide QA/QC as defined in the QAPP.
7. Initiating and oversee audits of corrective action procedures.
8. Performing data reviews.
9. Maintaining documentation of training.

All Stantec site personnel working at locations where hazardous materials or contaminants may be encountered in sediment or other media will be trained as mandated by the Occupational Safety and Health Administration (OSHA) Act regulations (29 Code of Federal Regulations 1910.120). Additionally, all site personnel will be properly trained in the procedures for collecting, labeling, packaging and shipping of liquid and solid environmental samples. Persons conducting asbestos and lead-based paint surveys will be certified by the Wisconsin Department of Health Services (DHS), Bureau of Environmental and Occupational Health – Asbestos and Lead Program. The Stantec project manager will maintain personnel training records. Field personnel will be trained to use all monitoring devices and other equipment used in the field.

The laboratories selected for the analytical work required for this project are listed in Table 1 which includes their addresses and the list of parameters that each laboratory may perform. Each laboratory is certified for the analyses that they may perform and a copy of their certifications are included in Appendix B.

Test America: The Wisconsin Department of Natural Resources (WDNR) laboratory identification number assigned to the Test America laboratory located in University Park, Illinois is 999580010. Although Test America is a national laboratory with multiple facilities throughout the United States, it is anticipated that the majority of Test America analyses will be performed by the University Park, Illinois laboratory. A listing of analyses and analytes for which the laboratory is certified through August 31, 2015, is presented in Appendix B. As a

State of Wisconsin-certified laboratory, Test America has undergone performance evaluations administered by the State for method accuracy and precision. Laboratory analyses to be performed by Test America as part of this project are summarized on Table 1. Laboratory reporting limits for the Test America University Park, Illinois laboratory for soil, water and vapor samples are summarized on Tables 2A, 2B and 2C, respectively. Copies of Test America's QA Manual and Standard Operating Procedures (SOPs) are presented in Appendix C.

CT Laboratories: The WDNR laboratory identification number assigned to CT Laboratories is 157066030. A listing of analyses and analytes for which the laboratory is certified through August 31, 2015, is presented in Appendix B. As a State of Wisconsin-certified laboratory, CT Laboratories has undergone performance evaluations administered by the State for method accuracy and precision. Laboratory analyses to be performed by CT Laboratories as part of this project are summarized on Table 1. Laboratory reporting limits for CT Laboratories for soil and water samples are summarized on Tables 2D and 2E, respectively. Copies of CT Laboratories' QA Manual and SOPs are presented in Appendix C.

Environmental Monitoring and Technologies, Inc. (EMT): The WDNR laboratory identification number assigned to EMT Inc. is 999888890. A listing of analyses and analytes for which the laboratory is certified through August 31, 2015, is presented in Appendix B. As a State of Wisconsin-certified laboratory, EMT, Inc. has undergone performance evaluations administered by the State for method accuracy and precision. Laboratory analyses to be performed by EMT, Inc. as part of this project are summarized on Table 1. Laboratory reporting limits for EMT, Inc. for soil and water samples are summarized on Tables 2F and 2G, respectively. Copies of the EMT, Inc. QA Manual and SOPs are presented in Appendix C.

Legend: The AIHA Laboratory Accreditation Programs (AIHA-LAP) has approved Legend as an accredited Industrial Hygiene and Environmental Lead laboratory (Laboratory ID #101095). Legend is also accredited with the NVLAP for bulk asbestos analysis (NVLAP Lab Code 102081-0). A listing of analyses and analytes for which the laboratory is certified through March 31, 2016, is presented in Appendix B. As an AIHA-LAP- and NVLAP-certified laboratory, Legend has undergone performance evaluations administered by the Nation Institute of Standards and Technology for method accuracy and precision. Laboratory analyses to be performed by Legend as part of this project are summarized on Table 1. Copies of Legend's QA Manual and SOPs are presented in Appendix C.

The drilling subcontractors have not yet been selected for this project. However, all on-site drilling personnel shall have completed the applicable OSHA training

mandated by 29 Code of Federal Regulations 1910.120. Additionally, drilling personnel will be required to comply with all site safety regulations covered in the site-specific HASP, provided under separate cover to this QAPP.

1.2 Facility History and Background Information

The Washington County Petroleum and Hazardous Substances Brownfield Assessment Grant is part of a community-wide project, meaning that specific sites have not been identified for Phase II Property Assessments. Therefore, once the brownfield sites have been identified for Phase II work, property-specific information will be provided with the SAPs.

1.3 Project Description and Schedule

The Washington County Petroleum and Hazardous Substances Brownfield Assessment Grant is a community-wide grant and well as a coalition grant. The County, and its coalition partners (the Cities of Hartford and West Bend, and the Villages of Jackson, Richfield, and Slinger) have an initial list of potential brownfields sites to be evaluated and will prioritize the sites based on access to the properties, potential environmental issues and redevelopment potential. The sites with the highest priorities will have Phase I and Phase II environmental site assessments (ESAs) conducted as described in the cooperative agreement to understand the extent of environmental problems on a property. All Phase I assessments conducted will be compliant with U.S. EPA's All Appropriate Inquiry (AAI) rule of October 6, 2014. Note that the American Society for Testing and Materials (ASTM) E1527-13 Phase I Environmental Site Assessment Standard is consistent and compliant with the AAI rule. The ASTM Standard E 2247-08, Phase I Environmental Site Assessment for Forested or Rural Properties is also AAI compliant on appropriate properties. In addition, an EPA provided AAI Checklist must be completed by the contractor and signed by the Grantee and be submitted to the EPA with each Phase I ESA completed under this grant. Once the environmental assessments are completed, the County and/or its coalition partners will pursue cleanup and redevelopment, which is not part of these grant projects.

The County will use the U.S. EPA assessment grants to investigate Brownfield properties throughout the County, particularly those properties that have the potential to be immediately redeveloped, properties that are vacant, and/or properties that are tax-delinquent.

The County has retained Stantec as its consultant to perform Phase I and Phase II ESAs. The Phase I and Phase II ESAs are designed to provide the County and the U.S. EPA with data to facilitate potential redevelopment of each property investigated. These data will be used to determine whether there is a threat from potential contaminants, solutions for any remedial activities and estimated costs for site redevelopment. The Phase I ESA is predominantly a fact-finding

investigation. The Phase II ESAs may consist of one or more of the following tasks:

- Collection and analysis of soil samples
- Collection and analysis of sediment samples
- Collection and analysis of groundwater samples
- Collection and analysis of soil vapor samples
- Collection and analysis of surface water samples
- Collection and analysis of asbestos containing material (ACM) samples
- Collection and analysis of lead based paint (LBP) samples
- Installation of groundwater monitoring wells
- Aquifer testing and evaluation of aquifer characteristics
- Test pits or trenching
- Evaluation of geophysical survey results
- Evaluation of natural bio-attenuation processes
- Evaluation of active remedial technologies.

Details of the property-specific sampling activities will be addressed in the individual SAPs. The findings of each Phase II will be presented in a Phase II ESA report, as discussed in later sections of this QAPP.

Stantec estimates that it will take approximately 3 to 7 months to perform a Phase II for each property. In general, it will take 1 to 2 weeks to prepare a SAP and HASP, 3 to 10 weeks to perform fieldwork including laboratory analyses, 4 weeks to gather any additional necessary data and 4 to 6 weeks to prepare a Phase II report. The time is dependent on field conditions and laboratory data requirements. Once all of the assessments for a priority site are complete, the Phase II ESA report will be prepared. Table 2 presents the estimated time frames for this project.

For the Project Schedule, please note that Phase I ESAs and Phase II ESAs may be conducted concurrently for different sites. The Phase I and Phase II work will not follow in succession. Based on an ongoing evaluation of the County's Site Revitalization Program and the priorities established by the County's Site Revitalization Program (SRP) Advisory Committee, additional properties may have Phase I ESAs started while Phase II activities have already begun on other properties.

WDNR or NELAP-certified laboratories will be used to ensure overall analytical quality for the chemical analyses and NVLAP laboratories will be used for the analysis of asbestos containing materials. The laboratories that will be used for this project are listed in Table 1. Documentation of the certifications for each laboratory is provided in Appendix B.

1.4 Data Quality Objectives

Data Quality Objectives (DQOs) are qualitative and quantitative statements that clearly state the objective of a proposed project, define the most appropriate type of data to collect, determine the appropriate conditions for data collection and specify acceptable decision error limits that establish the quantity and quality of data needed for decision making. The DQOs are based on the use of the data that will be generated. Different data uses may require different quantities of data and levels of quality.

1.4.1 Analytical Quality Objectives

Analytical quality objectives are used to ensure that the analysis will accurately and adequately identify the contaminants of concern, and to ensure that the analysis selected will be able to achieve the quantitation limits less than or equal to the target cleanup levels.

1.4.1.1 Field Screening

Field-screening instruments provide a lower quality of analytical data compared to laboratory equipment in a controlled environment. However, field methods provide rapid "real-time" results for field personnel in order to help guide field decision-making processes. These techniques are often used for health and safety monitoring, initial site characterization to locate areas for detailed assessment and preliminary comparison of remedial objectives. This type of field-screening data can include measurements of pH, temperature, conductivity, turbidity or similar monitoring data. Field measurements of pH, temperature, conductivity and turbidity will be collected during groundwater and surface water sampling activities. During sampling and other property assessment activities, the breathing space of site personnel will be monitored for the presence of volatile organic compounds (VOCs) using a photoionization detector (PID). The PID will also be used to perform field screening of soil and sediment samples in order to assist in the selection of samples to be submitted for laboratory analysis. Generally, the soil interval with the highest PID readings at a boring or sampling location will be submitted to the laboratory. If no VOCs are detected by the PID, samples will be selected for laboratory analysis based on the following:

- Obvious discoloration, odor or other visible signs of contamination.
- If no visible or odorous signs of contamination are evident, a sample from the zone directly above the water table will be submitted.
- A sample from a depth corresponding to the zone in the subsurface expected to contain the greatest concentration of contaminants will be submitted. This selection will be based on the type of release and the history of the area being investigated and will be determined by the Stantec project manager.

The collection of natural attention parameters such as sulfate, alkalinity, nitrate, etc. is anticipated and included in the QAPP. The parameters are being collected and analyzed for field screening and as an indicator of attenuation. They will not be compared to any established standard. Sample collection may be performed up gradient, within and down gradient of an identified contaminant plume.

1.4.1.2 Wisconsin Chapter NR700 Rule Series

Analyses of soil, groundwater, soil vapor and other types of samples will be performed in a manner consistent with the requirements of Chapters NR700 rule series of the Wisconsin Administrative Code (WAC) to assure that data collected as part of Phase II ESAs or site investigations can be used to satisfy the requirements of these chapters for obtaining case closure from the WDNR and/or certificates of completion from the WDNR under the State of Wisconsin Voluntary Party Liability Exemption Program. Table 1 provides a summary of the analyses to be performed by the four analytical laboratories assigned to this project. Documentation of the laboratories certifications is provided in Appendix B. The first page of Appendix B contains a list of the laboratories, each laboratory's certifications that are included in the appendix, and the expiration dates for each of these certificates. The laboratory certifications are 1-2 years in length, and the laboratories must maintain satisfactory performance in order to be issued new certificates after they expire. These new/current certificates will be included in the annual QAPP updates provided to EPA after approval of this QAPP to document that the laboratories have maintained their certifications throughout the life of this grant. All analyses for this project will be analyzed by the laboratories at the locations listed in Table 1, which is a summary of each of the analyses (including method number) that may be that may be performed by each laboratory. As discussed in Section 1.1, a State of Wisconsin-certified laboratory is one that has undergone performance evaluations by the WDNR Bureau of Integrated Science Services Laboratory Certification and Registration Program (per Chapter NR149 WAC) for method accuracy and precision.

1.4.2 Project Quality Objectives

The project quality objectives process is a series of planning steps designed to ensure that the type, quantity and quality of environmental data used in decision making are appropriate for their intended application. There are five steps in the project quality objectives process that include problem statement, decision identification, decision inputs, assessment boundary and the decision process. The details of these steps are provided in the following sections.

1.4.2.1 Problem Statement

The County intends to use the U.S. EPA Brownfields Assessment Grant funds primarily to environmentally assess and investigate tax-delinquent and other brownfields properties having redevelopment potential. Sites of limited

redevelopment potential but otherwise identified by project stakeholders as being priority sites for assessment may also be investigated. Based on the prioritization, the balance of the funds will be used to conduct Phase I and Phase II ESAs. The intention of the Phase I ESA's will be to identify environmental conditions that may cause threats to redevelopment. The property-specific work plans will detail the proposed methods for identifying contaminants and assessing the hazards posed by these contaminants. Exposure assessments and proposed redevelopment use of each of the properties are discussed in the property-specific SAPs.

1.4.2.2 Decision Identification

Available information will be used to determine if the subject properties have been contaminated. To assess the feasibility of property redevelopment, the County will ask the following questions:

- Do contaminant levels exceed applicable standards such as WDNR groundwater standards in Chapter NR140 WAC and/or soil cleanup standards in NR720 WAC?
- Can the contaminants be managed by eliminating exposure pathways through engineering and institutional controls?
- Will the property require remediation prior to redevelopment?
- If remediation is too costly based on the expected land use, can the property be developed for another use?

1.4.2.3 Decision Inputs

Samples of soil, sediment, groundwater, soil gas, indoor air, surface water, ACM and/or paint chips for lead testing will be collected for analysis as described in the SAPs in order to assess the level of contamination. Samples will be collected to either assess the data gaps identified from work previously completed or assess Recognized Environmental Conditions (RECs) noted during the Phase Is. An REC is the presence or likely presence of any petroleum or petroleum products on a property under conditions that indicate an existing release, a past release or a material threat of a release of any petroleum or petroleum products into structures on the property or into the ground, groundwater or surface water of the property or nearby properties. Such data gaps or environmental conditions may answer the following:

- What is the level of potential exposure to surface or subsurface soils at the property?
- What is the level of potential exposure to surface water and associated sediments at the property?
- What is the level of potential exposure to groundwater at the property?
- Have past uses of the property (or adjacent properties) impacted the soil, sediment, surface water, or groundwater?

- Did past petroleum handling or storage activities, if any, impact the property?
- If any former underground storage tanks existed on the property, does contamination exist near the area of the identified tank?
- Have former aboveground storage tanks impacted the surrounding media at the property?
- Does fill material (such as slag) used at the property contain contaminants that may impact soil, sediment, surface water or groundwater?
- Have uncontrolled dumping or landfilling activities occurred at the property, and if so, have they impacted the soil, sediment, surface water or groundwater?

1.4.2.4 Assessment Boundary

A site map showing the assessment boundary will be provided in each SAP. Because target properties will be selected based on the results of Phase I ESAs and the nature of environmental impacts will be property-specific, detailed information regarding the assessment boundaries cannot be determined currently. However, once the target properties are identified, information regarding the assessment boundaries will be included in the associated SAPs. The assessment boundary information in each SAP will include the property boundaries, potential exposure areas and sample locations and depths.

Based on current Wisconsin environmental regulations, the vertical assessment boundary will likely not vary based on the end use of the subject property, as full delineation of both the horizontal and vertical extent of contamination is generally required for all sites where releases of petroleum or other contaminants have occurred to the environment.

1.4.2.5 The County Decision Process

Soils will be compared to risk based soil cleanup standards calculated in accordance to Chapter NR720 WAC concentrations will be compared to standards applicable to direct contact at industrial and non-industrial properties based on existing and anticipated future land use and zoning. Both sets of standards (industrial and non-industrial) will be considered for sites where future land use is unknown or undetermined at the time of the assessment. The results will also be compared to residual contaminant level values established for the protection of groundwater.

Contaminant levels in sediment will be compared to the Threshold Effect Concentration, Midpoint Effect Concentration, and Probable Effect Concentration values listed in WDNR publication no. WT-732-2003 titled *Consensus Based Sediment Quality Guidelines Recommendations for Use and Application Interim Guidance* used for evaluation of sediment data.

Contaminant levels in groundwater will be compared to the Enforcement Standards and Preventive Action Limits contained in Chapter NR140 WAC. The collection of natural attention parameters such as methane/ethane/ethane/carbon dioxide, phosphorous and alkalinity, etc. is anticipated and included in the QAPP. The parameters are being collected and laboratory analyzed and will be used as an indicator of natural attenuation and will not be compared to any established standard.

Indoor air analytical results will be compared to the U.S. EPA Region IX carcinogen and non-carcinogen RSLs, revised in November 2014. Non-carcinogen RAL table values are based on a Hazard Index (HI) = 1, which is consistent with Wisconsin standards; therefore, no multiple was applied to the non-carcinogen RSL table values. Carcinogen RSL (cRSL) table values are listed for 1-in-1,000,000 excess lifetime cancer risk. However, in Wisconsin, 1-in-100,000 excess lifetime cancer risk is used for screening indoor air. Therefore, the cRSLs listed in Table 2C are the more stringent value obtained by comparing the cRSL*10 to the non-carcinogen RSL. Both residential and industrial RSLs are presented (note: an attenuation factor of 0.1 [residential/small commercial buildings] or 0.01 [large commercial/industrial buildings] is applied to the indoor air U.S. EPA Region IX when evaluating sub-slab sample results).

If sample results collected as part of the property assessment are below the applicable reference standards, then the redevelopment project will proceed as planned. If sample results exceed the applicable land-use specific reference standards, the following options may be considered:

- Site-specific soil RCLs may be calculated as an additional screening step using the U.S. EPA's RSL Web-Calculator. The site-specific RCL calculations will be based on both direct-contact risk and protection of groundwater.
- If contaminant levels exceed applicable standards, then specific locations associated with the elevated contaminant levels may be resampled. If any of the resample results confirm the original data the second option listed below may be considered. If all the resample results are below the applicable soil and groundwater quality reference standards no further remedial action will be pursued at the property.
- If contaminant levels exceeding applicable reference standards are associated with a specific exposure pathway, then a property-specific risk assessment may be conducted in order to pursue the exclusion of exposure pathways through the use of engineering and institutional controls. The controls may be implemented through an Operation and Maintenance Agreement with the WDNR.

1.5 Quality Assurance Objectives for Measurement

The overall QA objective for each project is to develop and implement procedures for field sampling, COC, laboratory analysis and reporting in accordance with State of Wisconsin protocol for physical or chemical parameters subject to regulatory authority of the WDNR associated with land and waters of the State of Wisconsin. Specific procedures for sampling, COC, laboratory instrument calibration, laboratory analysis, reporting of data, internal quality control, audits, preventative maintenance of field equipment and corrective action are described in other sections of this QAPP.

DQOs for measurements during this project will be addressed in terms of precision, accuracy, representativeness, completeness, comparability and sensitivity (PARCCS). The numerical PARCCS parameters will be determined from the project DQOs to ensure that they are met. The DQOs and resulting PARCCS parameters will require that the sampling be performed using standard methods with properly operated and calibrated equipment and conducted by trained personnel.

1.5.1 PRECISION

Precision is the degree of agreement among repeated measurements of the same parameter under the same or similar conditions. Precision is reported as either relative percent difference (RPD) or relative standard deviation (RSD), depending on the end use of the data.

1.5.1.1 FIELD PRECISION OBJECTIVES

Field precision will be assessed through the collection and analysis of field duplicate samples. RPDs will be calculated for the detected analytes from investigative and field duplicate samples. Water matrix samples can be readily duplicated due to their homogeneous nature; conversely, the duplication of soil and sediment samples is much more difficult due to their non-homogeneous nature. Due to this difficulty, RPDs of ±35 percent and ±50 percent for water and soil sample field duplicates, respectively, will be used as advisory limits for analytes detected in both investigative and field duplicate samples at concentrations greater than or equal to five times its quantitation limit. A summary of duplicate samples to be collected is presented in Table 3 (presented at the end of the QAPP), along with the other quality control samples. Per WDNR requirements or guidance, field duplicate samples must be provided for each matrix (sediment, surface water, etc.) sampled. The minimum number of field duplicate samples required for each round of sampling is one for every 20 samples. If there are fewer than 20 samples per matrix, one field duplicate per matrix will be submitted.

Field sampling for ACM will follow Asbestos Hazard Emergency Response Act sampling protocols. Asbestos sampling procedures are documented in Stantec's SOP for bulk asbestos sampling included in Appendix E of this QAPP.

1.5.1.2 LABORATORY PRECISION OBJECTIVES

For the analytical laboratories to be used for this project, precision of laboratory analyses will be based upon laboratory matrix spike/matrix spike duplicate (MS/MSD) analyses. Precision is reported as RPD or RSD, and the equation to be used to determine precision is presented in Section 4.3.1. MS/MSD analyses will be either at a rate of one per 20 samples per matrix received by the laboratory or in accordance with laboratory SOPs. Tables 2A through 2G list the MSD and RPDs used by the laboratories for the specific parameters they may test (see Table 1).

Legend's (the asbestos testing laboratory) analyst and laboratory accuracy is assessed by re-analysis of known reference and proficiency test samples. Those samples containing any asbestos are subjected to a statistical analysis wherein the analyst and laboratory bias is assessed and the accuracy of the analysis is entered into control charts for the individual analyst and for the laboratory as a whole. A similar analysis is performed on the comparative data between visual estimates of asbestos content and point count determinations. Legend's QA Manual dated October 2014 is included in Appendix C of this QAPP.

1.5.2 ACCURACY

Accuracy is the extent of agreement between an observed or measured value and the accepted reference, or true, value of the parameter being measured.

1.5.2.1 FIELD ACCURACY OBJECTIVES

The objective for accuracy of the field sample collection procedures will be to ensure that samples are not affected by sources external to the sample, such as sample contamination by ambient conditions or inadequate equipment decontamination procedures. Sampling accuracy will be assessed by evaluating the results of equipment and trip blank samples for contamination.

A trip blank will consist of a laboratory-prepared sample of reagent-grade water. Trip blanks will accompany sample containers and be subjected to the same handling procedures as the field samples, but will not be opened and will be shipped back to the laboratory with the samples. Trip blanks are required only when VOCs will be analyzed. Trip blanks will be submitted at the rate of one trip blank per shipping container containing field samples for laboratory VOC analysis. The trip blank samples will provide a measure of potential cross contamination of samples by VOCs during shipment and handling.

Equipment blanks will be collected by pouring laboratory-prepared water or distilled water over or through the field sampling equipment and collecting the rinsate in the proper analytical containers. Equipment blanks must be submitted to the laboratory with investigative samples and analyzed for the same parameters as the investigative samples. The minimum required under the U.S.

EPA is one per 20 field samples per matrix or, if less than 20 samples are collected, one equipment blank per day per sample matrix.

Trip and equipment blanks will be analyzed during monitoring activities in order to assess potential problems as they occur.

1.5.2.2 Laboratory Accuracy Objectives

Laboratory accuracy for the four laboratories will be assessed by determining percent recoveries from the analysis of laboratory control samples (LCSs) or standard reference materials (SRMs). The analyses of MS/MSD samples are also utilized to determine laboratory accuracy by determining percent recoveries from the analysis of MS/MSD samples. MS/MSD samples will be collected for organic and inorganic analyses at a minimum frequency of one per 20 or fewer samples per matrix. The equation used to determine the analytical accuracy for this project is presented in Section 4.3.2.3.

The accuracy of any organics analyses performed also will be monitored through analysis of surrogate compounds. Surrogate compounds are added to each sample, standard, blank and QC sample prior to sample preparation and analysis. Surrogate compounds are not expected to be found occurring naturally in the samples, but behave analytically similar to the compounds of interest. Consequently, surrogate compound percent recoveries will provide information on the effect that the sample matrix exhibits on the accuracy of the analyses.

In addition, please see the QA Manuals presented in Appendix C of this QAPP, for the QA objectives for each laboratory.

Specific details of Legend's (the asbestos testing laboratory) QA methodologies are included in their Quality Manual dated October 2014 located in Appendix C of this QAPP.

1.5.3 Representativeness

Representativeness is a qualitative term that describes the extent to which a sampling design adequately reflects the environmental conditions of the site. It also reflects the ability of the sample team to collect samples and laboratory personnel to analyze those samples in such manners that the data are generated accurately and precisely reflect the conditions at the site.

1.5.3.1 Measures to Ensure Representativeness of Field Data

Representativeness will be achieved by establishing the level of allowable uncertainty in the data and then statistically determining the number of samples needed to characterize the population through the DQO process. It will also be achieved by ensuring that sampling locations are properly selected. Representativeness is dependent upon the proper design of the sampling program and will be accomplished by ensuring that this QAPP, the property-

specific SAPs and standard procedures are followed. The QA goal will be to have all samples and measurements representative of the media sampled. Field testing for pH, temperature, and specific conductivity stabilization prior to groundwater sampling will ensure that representative samples are collected. Soil intervals will be homogenized for all analyses except VOCs to help ensure that representative soil samples are collected. Sufficient suspected ACM and LBP samples will be collected to accurately represent the bulk sample.

1.5.3.2 Measures to Ensure Representativeness of Laboratory Data

Representativeness of laboratory data cannot be quantified. However, adherence to the prescribed analytical methods and procedures, including holding times, blanks and duplicates, will ensure that the laboratory data are representative.

1.5.4 Completeness

Completeness is defined as the measure of the quantity of valid data obtained from a measurement system compared to the quantity that was expected under normal conditions. While a completeness goal of 100 percent is desirable, an overall completeness goal of 90 percent may be realistically achieved under normal field sampling and laboratory analysis conditions.

1.5.4.1 Field Completeness Objectives

The field-sampling team will take measures to have data generated in the field be valid data. However, some samples or sample containers may be lost or broken during handling and transit. Therefore, field completeness goals for this project will be to have 90 percent of all samples be valid data. The equation for calculating completeness is presented in Section 4.3.5.

1.5.4.2 Laboratory Completeness Objectives

Laboratory completeness will be a measure of the quantity of valid data measurements and analyses obtained from all the measurements and analyses completed for the project. The laboratory completeness goal is for 90 percent of the samples analyzed to be valid data. The procedure for determining laboratory data validity is provided in Section 4.2.2. The equation for calculating completeness is presented in Section 4.3.5.

1.5.5 Comparability

The confidence with which one data set can be compared to another is a measure of comparability. The ability to compare data sets is particularly critical when a set of data for a specific parameter is compared to historical data for determining trends.

1.5.5.1 Measures to Ensure Comparability of Field Data

Ensuring that this QAPP and the property-specific SAPs are adhered to and that all samples are properly handled and analyzed will satisfy the comparability of

field data. Additionally, efforts will be made to have sampling completed in a consistent manner by the same sampling team.

1.5.5.2 MEASURES TO ENSURE COMPARABILITY OF LABORATORY DATA

Analytical data are comparable when the data are collected and preserved in the same manner followed by analysis with the same standard method and reporting limits. Data comparability is limited to data from the same environmental media. Analytical method quality specifications have been established to help ensure that the data will produce comparable results. Tables 2A through 2G summarize the laboratory reporting limits.

1.5.6 SENSITIVITY

Sensitivity is the ability of a method or instrument to detect a parameter to be measured at a level of interest.

1.5.6.1 MEASURES TO ENSURE FIELD SENSITIVITY

The sensitivity of the field instruments selected to measure pH, conductivity, DO, temperature and turbidity of groundwater for this project will be measured by analyzing calibration check solutions, where appropriate, that equate to the lower end of the expected concentration range. The sensitivity of the PID used to screen samples for organic vapors is relative to background readings in ambient air.

1.5.6.2 MEASURES TO ENSURE LABORATORY SENSITIVITY

The sensitivity requirements for laboratory analyses are to be such to an extent as to meet any applicable State of Wisconsin or WDNR standards for the environmental media sampled, Wisconsin Department of Health Services ACM standard of 1% and the U.S Department of Housing and Urban Development standard for LPB of 0.5 percent by weight. If analytical methods are deemed to be insufficiently sensitive, alternative analytical methods may be utilized. Additionally, minimum laboratory detection limits which exceed applicable State of Wisconsin or WDNR standards will be evaluated in the following manner:

Is the compound expected to be a chemical of concern, or, if the reporting limit exceeds WDNR groundwater standards, was the compound detected in the surrounding soils? If the compound is not an expected chemical of concern or detected in the soils, then the compound will be considered non-detect. If the compound is considered a chemical of concern or was detected in the surrounding soils, the compound will be evaluated in a human health risk assessment using half the detection limit.

If the reported detection limit exceeds WDNR groundwater standards, does the compound have an established Federal maximum contaminant level (MCL), and if so, does the reporting limit meet the MCL? If the reporting limit meets the MCL, the compound will be considered non-detect. If the reporting limit

exceeds the MCL, the compound will be evaluated as part of a human health risk assessment using half the reported laboratory detection limit.

Tables 2A through 2G present the laboratory reporting limits.

1.6 Documentation and Records

Records generated during Phase II ESA, site investigation and monitoring activities will be critical to performing the property assessments. Records to be used for project documentation include field forms, field books, laboratory data sheets, COC forms and technical papers. Both Stantec and the County will retain the records generated during this project for a minimum of 3 years following the completion of the last expenditure report/ Federal Financial Report per 40 CFR 31.42. At that time, the Grantee Project Manager will be contacted prior to disposal of these records.

At a minimum, the REVISION 0 and final Phase II Site Assessment report submittal packages will include the following:

- Text describing field-sampling methodologies, analytical results, conclusions and recommendations.
- Figures showing property location, property boundaries, sampling locations and summaries of impacted areas.
- Tables comparing all laboratory data to the applicable standards.
- Tables summarizing QA/QC analytical results.
- Complete laboratory data reports, including copies of all COC records.
- Copies of soil boring, groundwater, sediment and surface water sampling logs.
- Other relevant material needed to support property redevelopment.
- Data Assessment Report that discusses and compares overall field duplicate precision data from multiple data sets collected for the project for each matrix, analytical parameter and concentration level.

Per Stantec's ISO 9001:2008 registered Quality Management System; each product completed under this grant will undergo a quality review by an experienced staff member and a final review by an independent senior reviewer prior to submittal to EPA or discussion with outside stakeholders. Corrective action will be implemented in response to deficiencies that are encountered during product or deliverable assessments. Any reviewer who detects a deficiency or non-conforming situation will be responsible for reporting the deficiency to the author/reviewer. A closed-loop corrective action system will be used to address these types of needed corrections.

SECTION 2.0 DATA GENERATION AND ACQUISITION

The purpose of the QAPP is to produce reliable data that will be generated throughout the project by:

- Ensuring the validity and integrity of the data;
- Ensuring and providing mechanisms for ongoing control of data quality;
- Evaluating data quality in terms of PARCCS; and
- Providing usable, quantitative data for analysis, interpretation and decision making.

2.1 Sampling Process Design

Sample locations, analytical parameters, and frequency of sampling are discussed in the property-specific SAPs. SAPs will include the following: reference to this QAPP for the applicable QA requirements, lab qualifications/SOPs, field sampling SOPs, etc.; brief history of the property use; proposed reuse/redevelopment, if know; identification of the applicable state standards being used (i.e., commercial/industrial, residential, recreational, etc.); description of any RECs as identified in a Phase I; direction of groundwater flow and source/reference for groundwater flow direction; rational for sample locations/relationship to RECs; parameters to be tested, media, depth of sampling, rational for sampling depth; table showing samples to be collected, media, analyses, field QC/lab QC samples, total number of samples for each media, laboratory being used; site location map; site features map (showing all site features, including building/former building locations/loading docks/concrete slabs/former transformers, locations of known spills, known/existing monitoring wells, grass, waste piles, etc.); locations of RECs and proposed sample locations, and including locations of RECs on adjacent properties as identified in the Phase I as well as any adjacent/off site sensitive receptors (e.g., schools, daycare centers, etc.).

Laboratory test parameters for the sampling program will include analysis for one or more of the parameters listed in the Lab Analyses Table (Table 1). The laboratory SOPs for these analytical parameters are presented in Appendix C.

Analytical parameters will be chosen based on representative contaminants most commonly associated with the former activities and/or identified areas at each property.

Sampling will occur as a stepwise process. As described in Section 1.4.1.1, appropriate, field screening methods will be utilized to direct the investigation and select samples for laboratory analysis; thereby minimizing future field deployments. During initial sampling activities, it is expected that a variety of chemicals of concern will be analyzed. The initial results may indicate that only certain chemicals of concern are present. Therefore, later rounds of sampling will

include only those specific compounds or class of compounds present in the initial sampling events.

QA/QC samples will be submitted in accordance with the QAPP protocols presented in the following sections. Requirements for QA/QC samples are presented in Table 3.

2.2 Analytical Methods Requirements

In order to preserve the integrity of samples both before and during analyses, specific analytical methods and requirements for those methods will be followed. Samples will be collected, prepared, and analyzed in accordance with the analytical methods outlined in the individual laboratory SOPs (Appendix C). The laboratories listed in Table 1 will coordinate all analytical services for this assessment. The specific analytical methods and reporting limits for each parameter for each laboratory are presented on Tables 2A through 2G. Preparatory methods for analytical parameters are discussed in the laboratory SOPs included in Appendix C.

Proper sample containers, preservation, holding times, and volumes for each analytical parameter are outlined in Table 4 (presented at the end of the QAPP). Each laboratory used will provide all sample containers and preservatives for soil, sediment, and surface water samples collected for this project. Sample containers for groundwater VOC and metals analysis will be pre-preserved with acid by the laboratory. In addition, sample containers for groundwater cyanide analysis will be pre-preserved with sodium hydroxide and pH paper will be used to verify that pH is >12 for the preserved samples. Soil samples to be analyzed for VOCs will be preserved in the field with laboratory prepared pre-preserved containers containing methanol.

Soil samples to be analyzed for VOCs, petroleum volatile organic compounds or gasoline range organics will be collected using pre-cleaned, disposable, small-diameter Terra Core samplers that produce soil plugs weighing approximately 5-grams. For soil samples to be analyzed by Test America, EMT, Inc., and/or CT Laboratories, the Terra Core samplers will be used to fill one 40-mL pre-tared amber glass VOA vials pre-preserved with 10 mL of methanol. Two plugs of soil (weighing a combined total of approximately 10 grams) will be added to each vial. If a larger volume of soil is required for analysis, a larger Terra Core sampler will be obtained to eliminate the need to collect multiple smaller volume plugs of soil. Low-level VOC sampling using sodium bisulfate as a preservative will not be conducted during this investigation.

All sample containers supplied by the laboratories will be cleaned according to U.S. EPA standards. QC documentation will be supplied with the sample containers and preservatives in order to verify their purity. The containers and preservatives can be traced back to their certificate of analysis from their lot

number. The QC documentation/certificate of analysis shall be maintained on file with the project laboratories. Additionally, the project laboratories shall provide the field team with trip blanks for any VOC analyses and laboratory-grade deionized water for rinsing field equipment and instruments.

2.3 Sample Handling and Custody Requirements

Proper sample handling and custody procedures are crucial to ensuring the quality and validity of data obtained through field and laboratory analyses. For example, the admissibility of environmental data as evidence in a court of law is dependent on the custody of the data. Custody procedures will be used to document the authenticity of data collected during this Brownfields Assessment Project. The data requiring custody procedures include field samples and data files that can include field books, logs and laboratory reports. An item is considered in custody if it is:

- In a person's possession;
- In view of the person after being in their possession;
- Sealed in a manner that it cannot be tampered with after having been in physical possession; or
- In a secure area restricted to authorized personnel.

2.3.1 Sample Collection Documentation

Sample-handling procedures include field documentation, COC documentation, sample shipment and laboratory sample tracking. Various aspects of sample handling and shipment, as well as the proposed sample identification system and documentation, are discussed in the following sections.

2.3.1.1 Field Books

Detailed records of the field activities will be maintained in field books dedicated to this Brownfields Assessment Project. Entries will be dated and signed by personnel recording the data. The entries will be made in ink. Each field book will have a unique numerical identifier permanently attached, and each page will be numbered, permitting indexing of key data. At a minimum, information recorded in the field books will include documentation of sample locations, sampling times, types of samples collected, weather conditions and any other information pertinent to the assessment or monitoring activity.

2.3.1.2 Field Identification System

Each sample collected during monitoring activities will be given a unique identification code. Each unique sample identification will consist of the following:

- *Project Identification Code.* A two- or four- digit designation will be used to identify the property or water body from which the sample was collected. Examples of this include the following:
  MRMS – Menomonee River (Main Stem)
  SG – Smith's Gas Station
- *Sample Matrix Code.* Field, equipment, and duplicate samples will be further identified by a code corresponding to the sample matrix:
  TB – trip blank sample
  EB –equipment blank sample
  FD – field duplicate sample
- *Location Code.* Lastly, each sample will be identified by a location code and interval as follows:
  MW## - monitoring well location
  GP## - location of Geoprobe® or other direct-push boring
  B## - location of borings completed by methods other than direct-push
- *Examples:*
  SGMW01 = groundwater sample from Monitoring Well 1 Smith's Gas Station property
  SGMW01FD = field duplicate groundwater from MW 1

Sample bottle labels appropriate for the size and type of containers shall be provided by each laboratory. The sample containers will be labeled at the time of sample collection but prior to being filled. Each label will indicate at a minimum:

- Sample identification
- Date/time of sample collection
- Sampler's initials
- Required analyses
- Type of preservative

All labels will be completed in waterproof ink. An example of a sample label is included in Appendix D.

2.3.1.3 FIELD SAMPLE HANDLING

The possession and handling of samples will be documented from the time of collection to delivery to the laboratory. Stantec field personnel are responsible for ensuring that COC procedures are followed. Field personnel will maintain custody of all samples until they are relinquished to another custodian, the laboratory or to the freight shipper.

All samples must be catalogued on a COC form using sample identification codes. A copy of the COC form is included in Appendix D. The date and time

of collection will be recorded on the form, as well as the number of each type of sample, the method of preservation and the type of analysis. The Stantec SOP for COC procedures is presented in Appendix E.

2.3.1.4 FIELD SAMPLE PACKAGING AND SHIPPING

Samples will be packaged and transported in a manner that maintains the integrity of the samples and permits the subsequent analyses to be performed within the prescribed holding times. Prior to shipment, each sample container will be inspected for a label with the proper sample identification code.

Samples will be either couriered or shipped via overnight mail to the specified laboratories in Table 1 that will be performing the analyses for each property assessed. The laboratories will be contacted in advance to expect shipment so that holding times of the samples will be conserved. The COC forms will be sealed in a plastic bag and transported inside the sample cooler. In addition, any shipping receipts will be incorporated into the COC documentation. Samples will be packed in the cooler using bubble-wrap packing materials and ice will be sealed in a Ziploc®-type bag. Any samples suspected of being highly contaminated will additionally be sealed in a Ziploc®-type bag. The cooler will be taped closed using custody seals provided by the corresponding laboratories to prevent tampering during transport. Upon relinquishing the sample cooler to the project laboratory, Stantec field personnel will sign custody of the samples over to the laboratory by signing and dating the bottom of the COC form. One copy of the COC documentation will be retained by the Stantec data manager and a second copy will be retained by the laboratory. The integrity of the custody seals shall be noted by the laboratory on the COC form upon arrival. In addition, the shipping label will be included with the COC form retained by the Stantec data manager.

2.3.1.5 FIELD DOCUMENTATION

Field COC procedures will ensure the proper documentation of each sample from collection in the field to delivery at the laboratory. Custody of samples shall be maintained and documented at all times. The documentation for each sample will include the following information:

- COC form
- Sample label with sample identification code
- Shipping documents

This documentation will allow for proper identification and verification of all samples upon arrival at the project laboratories performing the analyses on a particular set of samples.

2.3.2 Laboratory Chain of Custody

The laboratories used in this project will perform laboratory custody procedures for sample receiving and log-in, sample storage, tracking during sample preparation and analysis and storage of data in accordance with their SOPs. The laboratory project managers will be responsible for ensuring that laboratory custody protocol is maintained. The laboratory procedures related to sample custody are presented in the QA Manuals for each laboratory (Appendix C).

2.3.3 Final Evidence Files Custody Procedure

Stantec will be responsible for the custody of the evidence files and maintain and update the contents of the files during the project. The evidence files will include all records relevant to sampling and analysis activities such as field books, photographs, subcontractor reports, laboratory data deliverables, COC forms and data reviews. Stantec will retain this file for a period of at least 5 years following the formal completion date for the project as a whole.

2.4 Quality Control Requirements

The quality control requirements ensure that the environmental data collected is of the highest standard feasible as appropriate for the intended application. Facets of the quality control requirements are provided in the following sections.

2.4.1 Field Quality Control Requirements

Where applicable, QC checks will be strictly followed during the assessment through the use of replicate measurements, equipment calibration checks and data verification by Stantec field personnel. Field-sampling precision and data quality will be evaluated through the use of sample duplicates, equipment blanks and trip blanks. Sample duplicates provide precision information regarding homogeneity, handling, transportation, storage and analysis. Equipment blanks will be used to ensure that proper decontamination procedures have been performed and that no cross contamination has occurred during sampling or transportation. Trip blanks will be used with VOCs only, to ensure that transportation of samples has not contaminated the samples. If there is any discrepancy in the sample data, the Stantec project manager will be notified and, if deemed necessary, resampling of the questionable point scheduled. Requirements for field QA/QC samples are listed in Table 3. QA/QC sample quantities are also identified in the property-specific SAPs.

2.4.2 Laboratory QC Requirements

The laboratory QA managers will be responsible for ensuring that each laboratory's data precision and accuracy are maintained in accordance with specifications. Internal laboratory duplicates and calibration checks are performed on one of every 20 samples submitted for analysis. Other internal

laboratory QA/QC is performed according to individual laboratory SOPs. Soil, sediment and water samples that are submitted for laboratory MS/MSD or spike and duplicate analyses will have an additional set of samples collected from the sample locations. In the case of VOCs, double the amount will be collected. Typically laboratories require two to three sample containers for each sample location, therefore, four to six sample containers will be collected for laboratory MS/MSD analyses (i.e., six TerraCore® or EnCore® sample tubes will be collected if TerraCore® or EnCore® samplers will be used). If soil or sediment samples to be analyzed for VOCs are preserved in the field with methanol, additional sample volume is not required for the MS/MSD analyses. For water analyses of SVOCs, Pesticides/PCBs/Herbicides the laboratory requirements will be confirmed prior to sampling since these analyses typically require at a minimum two to three times the amount of water for the MS/MSD analyses.

2.5 Instrument Calibration and Frequency

The calibration procedures to be employed for both the field and laboratory instruments used during the Project are referenced in this section. Measuring and test equipment used in the field and laboratory will be subjected to a formal calibration program. The program will require equipment of the proper type, range, accuracy and precision to provide data compatible with the specified requirements and the desired results. Calibration of measuring and test equipment may be performed internally using in-house reference standards, or externally by agencies or manufacturers.

The responsibility for the calibration of laboratory equipment rests with the laboratories performing the analyses. Stantec field personnel are responsible for the calibration of Stantec field equipment and field equipment provided by subcontractors.

Documented and approved procedures will be used for calibrating measuring and testing equipment. Widely accepted procedures, such as those published by U.S. EPA and the ASTM, or procedures provided by manufacturers in equipment manuals will be adopted.

Calibrated equipment will be uniquely identified by the manufacturer's serial number, a Stantec equipment identification number, or by other means. This identification, along with a label indicating when the next calibration is due (only for equipment not requiring daily calibration), will be attached to the equipment. If this is not possible, records traceable to the equipment will be readily available for reference. It will be the responsibility of all equipment operators to check the calibration status from the due date labels or records prior to using the equipment.

Measuring and testing equipment will be calibrated at prescribed intervals and/or as part of operational use. Frequency will be based on the type of equipment, inherent stability, manufacturer's recommendations and values given in national standards, intended use and experience. Equipment will be calibrated whenever possible using reference standards having known relationships to nationally recognized standards or accepted values of physical constants. If national standards do not exist, the basis for calibration will be documented.

Physical and chemical reference standards will be used only for calibration. Equipment that fails calibration or becomes inoperable during use will be removed from service, segregated to prevent inadvertent use and tagged to indicate the fault. Such equipment will be recalibrated and repaired to the satisfaction of the laboratory personnel or Stantec field personnel, as applicable. Equipment that cannot be repaired will be replaced.

Records will be prepared and maintained for each piece of calibrated measuring and test equipment to document that established calibration procedures have been followed. Records for subcontractor field equipment and Stantec equipment used only for this specific project will be kept in the project files. The project laboratories will maintain their individual laboratory calibration records.

2.5.1 Field Instrument Calibration

Instruments used to gather, generate or measure field environmental data will be calibrated with sufficient frequency and in such manner that accuracy and reproducibility of results are consistent with the manufacturer's specifications. Field measurement instruments may include, but are not limited to, PID units used to detect VOCs, pH meters, conductivity meters and temperature probes. As applicable, field instruments will be calibrated daily prior to use. The calibration will be consistent with the standard procedure. The field calibration procedures are presented in the field SOPs located in Appendix E.

Calibration procedures will be documented in the field logbook and field sampling sheets. Documentation will include the following:

- Date and time of calibration
- Identity of the person performing the calibration
- Reference standard used, if applicable
- Reading taken and adjustments to attain proper reading
- Any corrective action

Trained personnel will operate field measurement equipment in accordance with the appropriate standard procedures or manufacturer's specifications. Stantec field technical staff members will examine field measurement equipment used during field sampling to verify that they are in operating

condition. The Stantec field team leader will periodically audit the calibration and field performance of the field equipment to ensure that the system of field calibration meets the manufacturer's specifications.

2.5.2 Laboratory Instrument Calibration

The proper calibration of laboratory equipment is a key element in the quality of the analysis done by the laboratory. Each type of instrumentation and each U.S. EPA-approved method have specific requirements for the calibration procedures, depending on the analytes of interest and the sample medium.

The calibration procedures and frequencies of the equipment used to perform the analyses will be in accordance with requirements established in the SOPs. The laboratory QA managers will be responsible for ensuring that the laboratory instrumentation is maintained in accordance with specifications. Individual laboratory SOPs will be followed for corrective actions and preventative maintenance frequencies. Laboratory quality control, calibration, corrective action and instrument preventative maintenance procedures are discussed in the QA Manuals for each laboratory (Appendix C).

2.6 Data Management

Stantec field technical staff members will manage raw data during field activities. Data such as geologic profiles, pH readings and pump test results, will be recorded on the appropriate field forms or in field logbooks. The Stantec data manager will periodically collect data gathered during assessment activities in order to maintain results. As appropriate, the Stantec data manager will coordinate transfer of raw data to computer formats such as Microsoft® Excel or Microsoft® Access to better organize and track incoming data. This will enable the Stantec data manager to identify any data gaps. Any flaws in field QA/QC will be brought to the attention of the Stantec QA manager.

The project managers at the individual laboratories will be responsible for laboratory data management. Procedures for data review and data reporting are discussed in the individual laboratories QA Manuals, located in Appendix C. Analytical data reports generated by the laboratories will present all sample results, including all QA/QC samples. The data reports will include:

- A laboratory narrative for the data set describing any out of control analyses and their effect on sample results.
- An explanation of all laboratory applied data qualifiers.
- All sample results including the % moisture content for soil samples.
- The spike and duplicate analysis results (or MS/MDS results) including the % recoveries and RPDs
- Surrogate results including % recoveries (as applicable per analysis).
- Method blank results.

- Lab control sample results including % recoveries

The following data must be available upon request from the laboratory on a case by case basis, if data issues arise:

- Summaries of daily calibration check samples (including notation of any outliers).
- Calibration blank results.

Soil results will be reported on a dry weight basis. All data, including QA/QC results, will become part of the project files and will be maintained by the Stantec data manager. Upon report delivery, Stantec personnel will analyze laboratory data in accordance with accepted statistical methodologies and will be supervised by the Stantec data manager.

SECTION 3.0 ASSESSMENT AND OVERSIGHT

Performance and system audits will be completed to ensure that the field sampling activities and laboratory analyses are performed following the procedures established in this QAPP, including the attached SOPs and the property-specific SAPs. The audits may be both internally and externally led, as further described below.

3.1 Technical Systems Audits

Generally, system audits are a qualitative measure of adherence to sampling QA measures overall, including sample collection handling, decontamination procedures, COC and recording requirements in the field, as well as sample receiving, log-in and instrument operating records in the laboratory.

3.1.1 Field Data

A Stantec field technical staff member (most of who are trained as geologists, hydrogeologists or engineers) will be present at the site during sampling activities. The field technical staff member will provide the on-site supervision required during the project. The field technical staff member will be in daily contact with the Stantec field team leader, who will then review compliance with the project objectives and sampling protocol outlined in this QAPP. Any anticipated modifications to the sampling or measuring procedures will be reported to the Project Manager and U.S. EPA project manager. Stantec field technical staff members will report modifications to the Stantec project manager, and document the modification in the field logbook.

Sample data precision will be determined by the collection and subsequent analysis of sample duplicates, equipment blanks, and trip blanks to verify reproducibility.

3.1.2 Field Screening Instruments

Stantec field technical staff members will audit and maintain the performance field-screening instruments. Instruments will be calibrated according to the standard procedures located in Appendix E, and regular preventative maintenance will be performed as described in Table 6 (located at the end of the QAPP).

3.1.3 Report Preparation

Prior to submittal to the County and U.S. EPA, all reports will undergo a peer review conducted by a project team within Stantec. All components of the report will be checked and initialed by a designated team member. The County will also review all reports prior to submittal to U.S. EPA.

3.1.4 Laboratory Data

Laboratory results will be reviewed for compliance against the DQO criteria for the level of reporting required.

3.2 Performance Evaluation Audits

Generally, performance audits are a quantitative measure of field sample collection and laboratory analyses quality.

3.2.1 Field Audits

The Stantec QA manager will conduct audits of field activities. U.S. EPA may also conduct an independent field audit. At least one field audit will be completed near the beginning of the sample collection activities for each project. If more than a six month gap in field data collection activities occurs during implementation of the grant, following the initial phase, then a second field audit will be completed. Field audits may also be utilized when personnel new to the project are performing initial field investigation activities.

The field audit will include the following checklist:

Item	Description of Field Audit Activities	QA Manager Initials
1.	Review of field-sampling records	
2.	Review of field-measurement procedures	
3.	Examination of the application of sample identifications following the specified protocol	
4.	Review of field instrument calibration records and procedures	
5.	Recalibration of field instruments to verify calibration to the manufacturer's specifications	
6.	Review of the sample handling and packaging procedures	
7.	Review of COC procedures	

If any deficiencies are observed during the audit, each deficiency shall be noted in writing and a follow-up audit may be completed if deemed necessary by the project QA manager. Corrective action procedures may need to be

implemented due to the findings from the audit. Such actions will be documented in the field logbook.

3.2.2 Laboratory Audits

Four laboratories may be utilized to perform analytical services required during the assessments. As discussed in Section 1.4.1.2, all laboratories are State of Wisconsin-certified or NVLAP-certified, with documentation presented in Appendix B of this QAPP. The laboratory QA managers will be responsible for ensuring that the laboratory data precision and accuracy are maintained in accordance with specifications and laboratory SOPs.

3.3 Reports to Management

For the duration of the project, quarterly financial and progress reports will be prepared by the Stantec project manager and submitted to the Project Manager and U.S. EPA project manager. These reports will serve to inform the Project Manager and U.S. EPA of the project progress and any significant interim findings that have been identified. This will streamline the process of addressing issues as they arise and adjusting the program to better define the environmental concerns. At the completion of the assessment, REVISION 0 and final project reports will be issued.

SECTION 4.0 DATA VALIDATION AND USABILITY

This section describes the QA activities that will be performed to ensure that the collected data are scientifically defensible, properly documented, of known quality and meet project objectives.

The following three steps will be followed to ensure that project data quality needs are met.

1. **Data Verification** – Data verification is a process of evaluating the completeness, correctness and contractual compliance of a data set against the method standard, SOP or contract requirements. Data verification will be performed internally by the analytical group or laboratory generating the data. Additionally, data may be checked by an entity external to the analytical group or fixed laboratory. Data verification may result in accepted, qualified or rejected data.
2. **Data Validation** – Data validation is an analyte- and sample-specific process that extends the qualification of data beyond method, procedural, or contractual compliance (i.e., data verification) to determine the analytical quality of specific data sets. Data validation criteria are based on the measurement performance criteria of the project QAPP. The group that generates the data will perform data validation. Data validation results are accepted, qualified or rejected data.
3. **Data Usability Assessment** – Data usability assessment is the process of evaluating validated data to determine if the data can be used for purpose of the project (i.e., to answer the environmental questions regarding the project results and/or to make environmental decisions). Data usability will include the following sequence of evaluation:
   - First, individual data sets will be evaluated to identify the measurement performance/usability issues or problems affecting the ultimate achievement of project DQOs.
   - Second, an overall evaluation of all data generated for the project will be performed.
   - Finally, the project-specific measurement performance criteria and data validation criteria will be evaluated to determine if they were appropriate for meeting project DQOs.

In order to perform the data evaluation steps above, the reported data will be supported by complete data packages which include sample receipt and tracking information, COC records, tabulated data summary forms and raw analytical data for all field samples, standards, QC checks and QC samples and all other project-specific documents that are generated.

4.1 Instructions for Data Review, Validation and Verification Requirements

This section describes the process for documenting the degree to which the collected data meet the project objectives, individually and collectively. Stantec will estimate the potential effect that each deviation from this QAPP may have on the usability of associated data items, its contribution to the quality of reduced and analyzed data, and its effects on the decision.

The following procedures will be implemented to verify and validate data collected during the project:

- *Sampling Design* – How closely a measurement represents the actual environment at a given time and location is a complex issue. Each sample will be checked for compliance with the specifications, including type and location. Stantec will note deviations from the specifications, and discuss them with the U.S. EPA project manager.
- *Sample Collection Procedures* – Sample collection procedures identified in this QAPP will be followed. If field conditions require deviations, they will be discussed with the U.S. EPA project manager.
- *Sample Handling* – Deviations from the planned sample handling procedures will be noted on the COC forms and in the field logbooks. Data collection activities will indicate the events that occur during sample handling affecting the integrity of the samples.

Stantec field technical staff members will evaluate the sample containers and the preservation methods used and ensure that they are appropriate to the nature of the sample and the type of data generated from the sample. Checks on the identity of the sample will be made to ensure that the sample continues to be representative of its native environment as it moves through the analytical process.

- *Analytical Procedures* – Each sample will be verified to ensure that the procedures used to generate the data were implemented as specified. Data validation activities will be used to determine how seriously a sample deviated beyond the acceptance limit so that the potential effects of the deviation can be evaluated.
- *Quality Control* – QC checks that are to be performed during sample collection, handling and analysis are specified in an earlier section of this QAPP. For each specified QC check, the procedures, acceptance criteria and corrective action should be specified. During data validation, the corrective actions that were taken, which samples were affected, and the potential effect of the actions on the validity of the data will be documented.

- *Calibration* – Field and laboratory instrument calibrations will be documented to ensure that calibrations:
  - Were performed within an acceptance time prior to generation of measurement data;
  - Were performed in proper sequence;
  - Included the proper number of calibration points;
  - Were performed using a standard that bracketed the range of reported measurement results;
  - Had acceptable linearity checks and other checks to ensure that the measurement system was stable when calibration was performed.

  When calibration problems are identified, any data produced between the suspect calibration event and any subsequent recalibration will be flagged to alert data users.
- *Data Reduction and Processing* – Checks on data integrity will be performed to evaluate the accuracy of raw data and include the comparison of important events and duplicate rekeying of data to identify data entry errors. The QA Manuals for the four analytical laboratories (Appendix C) discusses their respective data.

4.2 Instructions for Validation and Verification Methods

This section describes the process that will be followed to verify and validate the project data.

4.2.1 VERIFICATION

Field data will be verified by the Stantec QA manager by reviewing field documentation and chain-of-custody records. Data from direct-reading instruments used to measure conductivity, dissolved oxygen and other field parameters will be internally verified by reviewing calibration and operating records. The laboratory data will be verified in respect to the COC, units of measure, and citation of analytical methods. Data verification procedures will include reviewing and documenting sample receipt, sample preparation, sample analysis (including internal QC checks), data reduction and reporting. Any deviations from the acceptance criteria corrective actions taken, and data determined to be of limited usability (i.e., laboratory-qualified data) will be noted in the case narrative of the laboratory report. The QA manager will also verify the use of blanks and duplicates. All applicable reference and identification codes and numbers will be reviewed as part of the documentation.

4.2.2 VALIDATION

Data validation will be conducted by Stantec consistent with the procedure identified in Section 1.5 of this QAPP. The data verification/validation procedure

will identify data as being acceptable, of limited usability, qualified or estimated, or rejected. The conditions that result in data being qualified or estimated or rejected are identified in Section 1.5 of this QAPP. The results of the data verification/validation will be provided in data validation memoranda that are provided to Stantec's Project Manager and are included in the QA Management Reports. All sampling, handling, field analytical data and laboratory data will be validated by entities external to the data generator. The validation procedure will specify the verification process of every quality control measure used in the field and laboratory. Data validation procedures followed by the four analytical laboratories are discussed in respective QA Manuals (Appendix C).

Each analytical report will be reviewed for compliance with the applicable method and for the quality of the data reported.

Data determined to be unusable may require that corrective action be taken. Potential types of corrective action may include resampling by the field team or reanalysis of the samples by the laboratory. The corrective actions taken are dependent upon the ability to mobilize the field team and whether the data are critical for the project DQOs to be achieved. Should Stantec's QA Officer identify a situation requiring corrective action during data verification/validation, Stantec's Project Manager will be responsible for approving the implementation of the corrective action.

4.3 Instructions for Reconciliation with Data Quality Objectives

This section describes the scientific and statistical procedures/methods that will be used to determine whether data are of the right type, quality and quantity to support environmental decision making for the project.

The Data Quality Assessment (DQA) process is described in *Guidance for the Data Quality Assessment Process: Practical Methods for Data Analysis*, EPA QA/G-9, July 1996 (U.S. EPA, 1996). EPA QA/G-9 will be used to guide the data assessment on this project. The DQA process will consist of five steps:

1. Review DQOs and sampling design
2. Conduct preliminary data review
3. Select statistical test
4. Verify assumptions
5. Draw conclusions from the data

While the formal DQA process presented in the guidance may not be followed in its entirety, a systematic assessment of the data quality will be performed. This process will include a preliminary data review. Data will be presented in tables and figures to identify the trends, relationships and anomalies.

The overall usability of the data for the project will be assessed by evaluating the PARCCS of the data set to the measurement performance criteria in Section 1.5 of this QAPP using statistical quantities as applicable. The procedures and statistical formulas to be used for these evaluations are presented in the following sections.

4.3.1 PRECISION

In order to meet the needs of the project, data must meet the measurement performance criteria for precision. Project precision will be evaluated by assessing the RPD data from the field duplicate samples. Analytical precision will be evaluated by assessing the RPD data from either duplicate spiked sample analyses or duplicate sample analyses.

The RPD between two measurements is calculated using the following simplified formula:

$$\text{RPD} = \frac{R_1 - R_2}{(R_1 + R_2)/2} \times 100$$

where: R_1 = value of first result

R_2 = value of second result.

Overall precision for the sampling programs will be determined by calculating the mean RPD for all field duplicates in a given sampling program. This will provide an evaluation of the overall variability attributable to the sampling procedure, sample matrix and laboratory procedures in each sampling program.

The overall precision requirement will be the same as the project precision. It should be noted that the RPD of two measurements can be very high when the data approach the quantitation limit of an analysis. The calculation of the mean RPD will include only the RPD values for field duplicate sample analyte data that are greater than or equal to five times the quantitation limit for an analysis.

Poor overall precision may be the result of one or more of the following:

- Field instrument variation
- Analytical measurement variation
- Poor sampling technique
- Sample transport problems
- Heterogeneous matrices

In order to identify the cause of the imprecision, the field-sampling design rationale and sampling techniques should be evaluated by the reviewer and both field and analytical duplicate/replicate sample results should be reviewed. If poor precision is indicated in both the field and analytical duplicates/

replicates, then the laboratory may be the source of error. If poor precision is limited to the field duplicate/replicate results, then the sampling technique, field instrument variation, sample transport or heterogeneous sample matrices may be the source of error.

If the Data Validation Report indicates that analytical imprecision exists for a particular data set, then the impact of that imprecision on data usability must be discussed in the Data Assessment Report. It should be noted that the Data Validation Report is considered to be the QA/QC report supplied by the analytical laboratory and the Data Assessment Report will be prepared by Stantec and submitted as part of the Phase II ESA report document.

When project-required precision is not achieved and project data are not usable to adequately address environmental questions and to support project decision making, then the Data Assessment Report should address how this problem will be resolved and discuss the need for resampling.

4.3.2 Accuracy and Bias

In order to meet the needs of the data users, project data will follow the measurement performance criteria for accuracy and bias as described in Section 1.5.2.

4.3.2.1 Sample Contamination

Data for QC check samples will be reviewed to evaluate the accuracy and potential bias of sample results. If field contamination exists, then the impact of field contamination on data usability will be discussed in the Data Assessment Report, and the Stantec project manager and field team leader should be notified. Stantec will seek to use the data to differentiate between possible contamination introduced during field sample collection and transport, and contamination introduced at the time of sample preparation and analysis. It should be noted that sample contamination may result in either a negative or a positive bias. For example, improperly cleaned sample containers for metals analysis may result in the retention of metals on interior container walls. This would result in lower metals concentrations being reported than are actually present in the environmental sample, which is a negative bias. A positive bias would occur when sample container contamination results in an additive effect, meaning that reported analyte concentrations are higher than the true sample concentrations for that analyte.

4.3.2.2 Analytical Accuracy/Bias

The data from method/preparation blank samples, field blank samples, trip blank sample, surrogate spikes, MS/MSD samples and LCSs will be used to determine accuracy and potential bias of the sample data. If the Data Validation Reports indicate that contamination and/or analytical inaccuracies/bias exist for a particular data set, then the impact of that

contamination and/or analytical inaccuracies/bias on data usability will be discussed on the Data Assessment Report.

4.3.2.3 Overall Accuracy/Bias

The data from the method/preparation blank samples provide an indication of laboratory contamination that may result in bias of sample data. Sample data associated with method/preparation blank contamination will have been identified during the data verification/validation process. Sample data associated with method/preparation blank contamination are evaluated during the data validation procedure to determine if analytes detected in the samples and the associated method/preparation blanks are "real" or are the result of laboratory contamination. The procedure for this evaluation involves comparing the concentration of the analyte in the sample to the concentration of the method/preparation blank taking into account adjustments for sample dilution and dry-weight reporting. In general, the sample data are qualified as not detected if the sample concentration is less than five times (ten times for common laboratory contaminants) the method/preparation blank concentration. Typically, the common quantitation limit for the affected analyte is elevated to the concentration detected in the sample.

The data from the field blanks and trip blanks provide an indication of field and transportation conditions that may result in bias of sample data. Sample data associated with contaminated field and trip blank samples have been identified during the data verification/validation process. The evaluation procedure and qualification of sample data associated with field blank and trip blank contamination is performed in the same manner as the evaluation procedure for method blank sample contamination, taking into account the difference in units for aqueous field blank samples collected during soil sampling programs.

Surrogate spike recoveries provide information regarding the accuracy/bias of the organic analyses on an individual sample bias. Surrogate compounds are not expected to be found in the samples and are added to every sample prior to sample preparation/purging. The percent recovery data provide an indication of the effect that the sample matrix may have on the preparation and analysis procedure. Sample data exhibiting matrix effects will have been identified during data verification/validation process.

Matrix spike sample data can provide information regarding the accuracy/bias of the analytical methods relative to the sample matrix. Matrix spike samples are field samples that have been fortified with target analytes prior to sample preparation and analysis. The percent recovery data provide an indication of the effect that the sample matrix may have on the preparation and analysis procedure. Sample data exhibiting matrix effects will have been identified during data verification/validation process.

Analytical accuracy/bias will be determined by evaluating the percent recovery data of LCSs. LCSs are artificial samples prepared in the laboratory using a blank matrix that is fortified with analytes from a standard reference material that is independent of the calibration standards. LCSs are prepared and analyzed in the same manner as the field samples. The data from LCS analyses will provide an indication of the accuracy and bias of the analytical method for each target analyte.

Percent recovery is calculated using the following formula:

$$\% \text{ Recovery} = \frac{SSR - SR}{SA} X\ 100$$

where: SSR = Spiked Sample Result
SR = Sample Result or Background
SA = Spike Added.

The percent recovery of LCSs is determined by dividing the measured value by the true value and multiplying by 100.

Overall accuracy/bias for the sampling events will be determined by calculating the percent accuracy measurements that meet the measurement performance criteria specified in Section 1.5.2 of this QAPP. Overall accuracy will be considered acceptable if the surrogate percent recoveries are met for at least 75 percent of the samples and the LCS percent recoveries are met for all samples and the MS/MSD percent recoveries are met for at least 75 percent of the samples.

The Data Assessment Report will discuss and compare overall contamination and accuracy/bias data from multiple data sets collected for the project for each matrix, analytical parameter and concentration level. The Data Assessment Report will describe the limitations on the use of the project data if extensive contamination and/or inaccuracy/bias exist or when it is limited to a specific sampling or laboratory analytical group, data set, analytical parameter, or concentration level. The Data Assessment Report will identify qualitative and/or quantitative bias trends in multiple performance evaluation sample results for each matrix, analytical parameter and concentration level. The impact of any qualitative and/or quantitative trends in bias on the sample data will be discussed. Any performance evaluation samples that have false positive and/or false negative results should be reported and the impact on data usability will be discussed in the Data Assessment Report.

When project-required accuracy/bias is not achieved and project data are not usable to adequately address environmental questions and to support project decision making, then the Data Assessment Report will address how this problem will be resolved and the potential need for resampling.

4.3.3 Sample Representativeness

In order to meet the needs of the data users, project data must meet the measurement performance criteria to sample representativeness specified in Section 1.5.3.

Representativeness of the samples will be assessed by reviewing the results of field audits and the data from field duplicate samples. If field duplicate precision checks indicate potential spatial variability, then this may trigger additional scoping meetings and subsequent resampling in order to collect data that are more representative of a non-homogeneous site. Overall sample representativeness will be determined by calculating the percent of field duplicate sample data that achieved the RPD criteria specified in Section 1.5.3 of this QAPP. Overall sample representativeness will be considered acceptable if the results of the field audits indicate that the approved sampling methods or alternate acceptable sampling methods were used to collect the samples, and the field duplicates RPD data are acceptable for at least 75 percent of the samples.

The Data Assessment Report will discuss and compare overall representativeness for each matrix, parameter and concentration level. Data Assessment Reports will describe the limitations on the use of project data when overall non-representative sampling has occurred or when non-representative sampling is limited to a specific sampling group, data set, matrix, analytical parameter or concentration level. If data are not usable to adequately address environmental questions and/or support project decision making, then the Data Assessment Report will address how this problem will be resolved and discuss potential need for resampling.

4.3.4 Sensitivity and Quantitation Limits

In order to meet the needs of the data user, project data must meet the measurement performance criteria for sensitivity as specified. Low point calibration standards should produce a signal at least ten times the background noise levels and should be part of a linear calibration curve. Document the procedures for calculating method detection limits (MDLs) and quantitation limits (QLs).

The quantitation limits for the sample data will be reviewed to ensure that the sensitivity of the analyses was sufficient to achieve any applicable State of Wisconsin or WDNR standards. The method/preparation blank sample data and LCSs percent recovery data will be reviewed to assess compliance with the measurement performance criteria specified in Section 1.5.6 of this QAPP.

Overall sensitivity will be assessed by comparing the sensitivity for each monitoring program to the detectability requirements for the analyses. Overall

sensitivity will be considered acceptable if quantitation limits for samples are less than the acceptable evaluation criteria.

It should be noted that quantitation limits may be elevated as a result of high concentrations of target compounds, non-target compounds and matrix interferences (collectively known as sample matrix effects). In these cases, the sensitivity of the analyses will be evaluated on an individual sample basis relative to the applicable evaluation criteria. The need to investigate the use of alternate analytical methods may be required if the sensitivity of the analytical methods identified in this QAPP cannot achieve the evaluation criteria because of sample matrix interference.

If Data Validation Reports indicate that sensitivity and/or QLs were not achieved, then the impact of that lack of sensitivity and/or higher QLs on data usability will be discussed in the Data Assessment Report.

The Data Assessment Report will discuss and compare overall sensitivity and QLs from multiple data sets collected for the project for each matrix, analytical parameter and concentration level. The Data Assessment Report will describe the limitations on the use of the project data if project-required sensitivity and QLs were not achieved for all project data or when it is limited to a specific sampling or laboratory/analytical group, data set, matrix, analytical parameter or concentration level.

When project-related QLs are not achieved and project data are not usable to adequately address environmental questions and to support project decision making, then the Data Assessment Report will address how this problem will be resolved and discuss the potential need for resampling. In this case, the Data Assessment Report will clearly differentiate between usable and unusable data for the users.

4.3.5 COMPLETENESS

In order to meet the needs of the data users, project data will follow the measurement performance criteria for data completeness outlined in Section 1.5.4.

Completeness will be assessed by comparing the number of valid (usable) sample results to the total possible number of results within a specific sample matrix and/or analysis. Percent completeness will be calculated using the following formula:

$$\% \text{ Completeness} = \frac{\text{Number of Valid (usable) measurements}}{\text{Number of Measurements Planned}} \text{ X } 100$$

Overall completeness will be assessed by calculating the mean percent completeness for the entire set of data obtained for each sampling program. The overall completeness for the project will be calculated when all sampling

and analysis is concluded. Overall completeness will be considered acceptable if at least 90 percent of the data are determined to be valid.

The Data Assessment Report will discuss and compare overall completeness of multiple data sets collected for the project for each matrix, analytical parameter and concentration level. The Data Assessment Report will describe the limitation on the use of the project data if project-required completeness was not achieved for the overall project or when it is limited to a specific sampling or laboratory/analytical group, data set, analytical parameter or concentration level.

When project-required completeness is not achieved and sufficient data are not available to adequately address environmental questions and support project decision making, then the Data Assessment Report will address how this problem will be resolved and discuss the potential need for additional resampling.

4.3.6 COMPARABILITY

In order to meet the needs of the data users, project data will follow the measurement performance criteria for comparability outlined in Section 1.5.5.

The comparability of data sets will be evaluated by reviewing the sampling and analysis methods used to generate the data for each data set. Project comparability will be determined to be acceptable if the sampling and analysis methods specified in this QAPP and any approved QAPP revisions or amendments are used for generating the soil, groundwater, sediment and surface water data.

The Data Assessment Report will discuss and compare overall comparability between multiple data sets collected for the project for each matrix, analytical parameter and concentration level. The Data Assessment Report will describe the limitation on the use of project data when project-required data comparability is not achieved for the overall project or when it is limited to a specific sampling or laboratory/analytical group, data set, matrix, analytical parameter or concentration level.

For long-term monitoring projects, data comparability is extremely important. Project data will be compared to previously generated data to determine the possibility of false positives and/or false negatives. Variations detected in the data may reflect a changing environment or indicate sampling and/or analytical error. Comparability criteria will be established to evaluate these data sets in order to identify statistical outliers to trigger resampling as verified.

If it is determined that long-term monitoring data are not comparable, the Data Assessment Report will address whether the data indicate a changing environment or the anomalies are a result of sampling and/or analytical error. If

data are not usable to adequately address environmental questions and/or support project decision making, then the Data Assessment Report will address how this problem will be resolved.

Overall comparability of data from split samples (samples that are collected at the same time from the same location and split equally between two parties using sample containers from the same source or vendor) will be evaluated by determining the RPD of detected analytes in both samples following data verification/validation. Analytes that are detected in only one of the two samples will be assessed by reviewing the data verification/validation reports for both data sets and determining the cause of the discrepancy. Overall comparability of split sample data will be considered acceptable if the RPD for detected analytes with concentrations greater than or equal to five times their respective quantitation limits does not exceed RPD acceptance criteria for field duplicate samples.

If screen/confirmatory comparability criteria are not met, then this will be documented in the Data Assessment Report and the effect on data usability will be discussed. If oversight split-sampling comparability criteria are not met, then this will be documented in the Data Assessment Report and the effect on data usability will be discussed. If data are not usable to adequately address environmental questions and/or support project decision making, then the Data Assessment Report will address how this problem will be resolved and discuss potential need for resampling.

Overall comparability of data from the monitoring program will be assessed by evaluating analyte concentrations over time. The data from monitoring events will be evaluated for trends, if necessary, using the Mann-Kendall test described in Section 4.3.4.1 of EPA QA/G-9. Suspected outliers will be assessed using the Extreme Value Test described in Section 4.4.3 of EPA QA/G-9. As the monitoring database becomes larger, it may be necessary to use different statistical methods to determine trends and outliers. Any changes to the statistical methods used for this project will be communicated to the U.S. EPA prior to initiating the change.

4.3.7 Data Limitations and Actions

Sources of sampling and analytical error will be identified and corrected as early as possible to the onset of sample collection activities. An ongoing data assessment process will be incorporated during the project, rather than just as a final step, to facilitate the early detection and correction of problems, ensuring that project quality objectives are met.

Data that do not meet the measurement performance criteria specified in this QAPP will be identified and the impact on the project quality objectives will be assessed and discussed within the final project report. Specific actions for data

that do not meet the measurement performance criteria depend on the use of the data and may require that additional samples are collected or the use of the data to be restricted.

SECTION 5.0 REFERENCES

U.S. EPA. 1994. *Guidance for Data Quality Assessments*. EPA QA/G-5, Office of Research and Development, Washington DC.

U.S. EPA. 1996. *Guidance for the Data Quality Assessment Process: Practical Methods for Data Analysis*. EPA QA/G-9, Office of Research and Development, Washington DC.

U.S. EPA. 2012. *Guidance on Quality Assurance Project Plans,* CIO 2106-G-05 QAPP, Office of Environmental Information Washington DC.

WDNR. 2003. *Consensus Based Sediment Quality Guidelines Recommendations for Use and Application Interim Guidance*. WDNR Publication No. WT-732-2003.

WDNR. 2010 (December). *Addressing Vapor Intrusion at Remediation & Redevelopment Sites in Wisconsin*. WDNR Publication No. RR-800.

WDNR. 2012 (July). *Addressing Vapor Intrusion at Remediation & Redevelopment Sites in Wisconsin*. WDNR Publication No. RR-800 Update.

FIGURES

FIGURE 1
PROJECT ORGANIZATION CHART
QUALITY ASSURANCE PROJECT PLAN
WASHINGTON COUNTY, WI
U.S. EPA BROWNFIELDS ASSESSMENT PROJECT

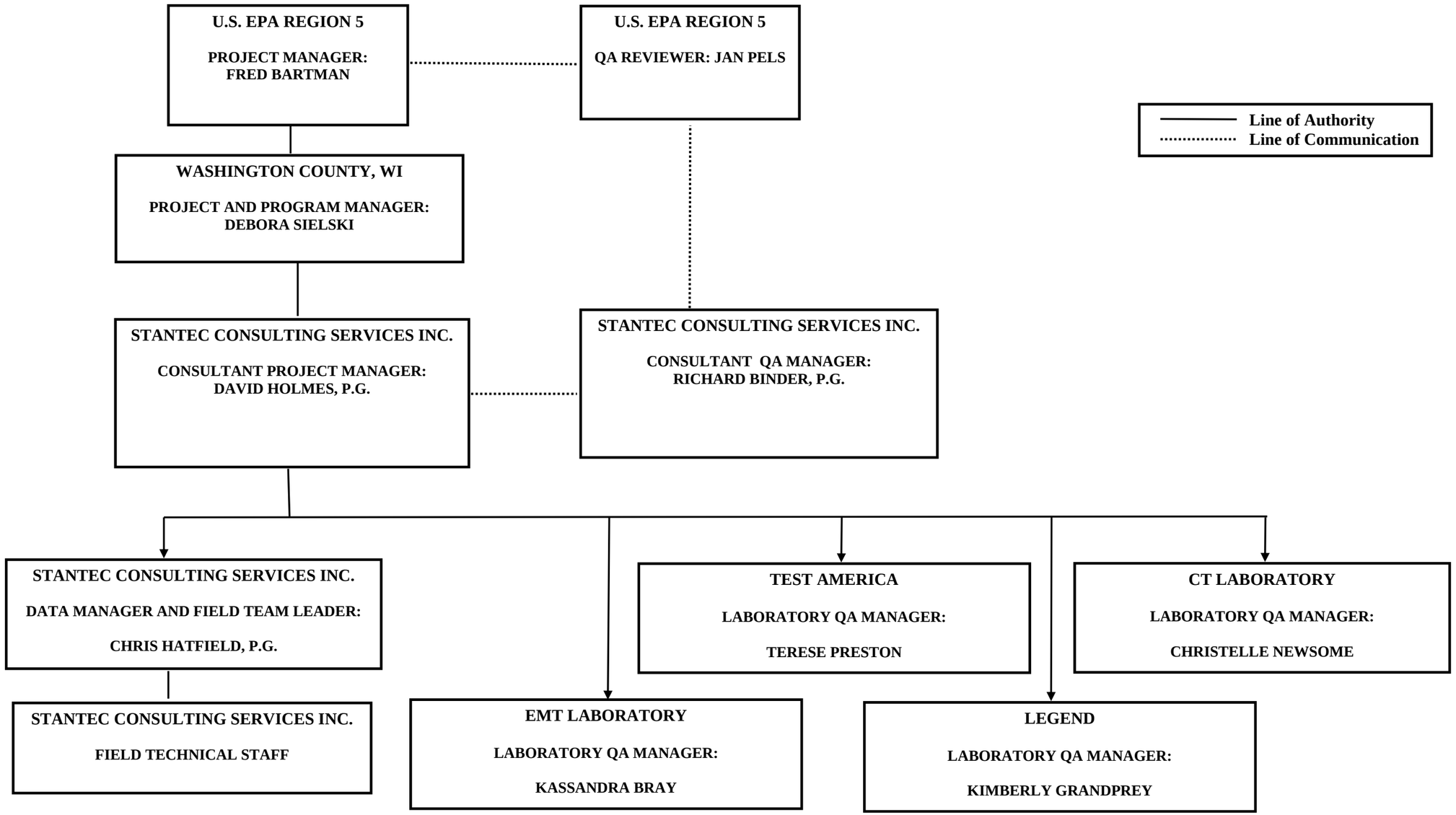

FIGURE 2
SCHEDULE

Task No.	Task Name	Activity Description	Start Date	End Date	Fiscal Year 2015												Fiscal Year 2016												Fiscal Year 2017											
					Quarter 1			Quarter 2			Quarter 3			Quarter 4			Quarter 1			Quarter 2			Quarter 3			Quarter 4			Quarter 1			Quarter 2			Quarter 3			Quarter 4		
					Oct-14	Nov-14	Dec-14	Jan-15	Feb-15	Mar-15	Apr-15	May-15	Jun-15	Jul-15	Aug-15	Sep-15	Oct-15	Nov-15	Dec-15	Jan-16	Feb-16	Mar-16	Apr-16	May-16	Jun-16	Jul-16	Aug-16	Sep-16	Oct-16	Nov-16	Dec-16	Jan-17	Feb-17	Mar-17	Apr-17	May-17	Jun-17	Jul-17	Aug-17	Sep-17
1	Consultant Selection	Issue Consultant RFQ	6/28/2013																																					
		Deadline for consultants to respond to RFQ		7/31/2013																																				
		Review proposals and select consultant	7/31/2013	10/1/2013																																				
		Execute initial agreement with consultant	10/1/2013	10/23/2013																																				
		Execute updated agreement with consultant		2/1/2015																																				
2	Initial Grant Administration	Grant Award Announcement Date	5/28/2014																																					
		Official Start Date for Grant	10/1/2014																																					
		Execute MOUs with Coalition partners	3/19/2015	4/24/2015																																				
3	Brownfields Inventory	Data collection																																						
		Compile initial list of potential sites																																						
4	Prioritize and Screen Sites and Determine Site Eligibility	Prioritize Sites for Assessment and Screen Sites																																						
		Prepare Eligibility Determination Request Forms																																						
		Obtain WDNR Eligibility Letters (for Petroleum Sites)																																						
5	Execute Property Access Agreements	Execute Property Access Agreements																																						
6	Conduct Phase I ESAs	Conduct Phase I ESAs																																						
7	Conduct Phase II ESAs, Site Investigations, and Remedial Planning Activities	Prepare a Quality Assurance Project Plan																																						
		EPA Review, Approval, and Finalization																																						
		Prepare Site-Specific Sampling and Analysis Plans																																						
		Prepare OSHA-compliant Health and Safety Plans																																						
		Conduct Phase II ESAs																																						
		Prepare Remedial Action Option Reports																																						
		Prepare tank closure reports																																						
8	Community Outreach and Involvement	Media Partnerships																																						
		Education Partnerships																																						
		Stakeholder Group Meetings																																						
9	Assessment Oversight and Grant Reporting	Brownfield Advisory Committee Meeting																																						
		Budget Period per Cooperative Agreement																																						
		Project Oversight																																						
		Prepare Quarterly Reports																																						
		Maintain & Update ACRES Database																																						
		Prepare Annual Financial Reports																																						
		Prepare Semi-Annual DBE Reports																																						
		Other correspondence with EPA as necessary																																						

Note: DBE = disadvantaged business enterprise
ESA = environmental site assessment
MOU = memorandum of understanding
OSHA = Occupational Safety and Health Administration
RFQ = request for qualifications
WDNR = Wisconsin Department of Natural Resources

TABLES

TABLE 1 - Analytical Methods

Laboratory Name	Soil	Water
TestAmerica – Chicago; Terese Preston, Laboratory QA Manager; 2417 Bond Street; University Park, IL 60484; Phone: 708-534-5200; Terese.preston@testamericainc.com TestAmerica – Canton; Dee Shepperd, Laboratory QA Manager; 4101 Shuffel Street NW; North Canton, OH 44720; Phone: 330-497-9396; Dee.shepperd@testamericainc.com	VOCs (8260B); SVOCs (8270D); PAHs (8270D); Pesticides (SW846 8081A); PCBs (8082A); GRO/DRO (WI Mod.); Metals (6010C); TCLP Metals (6010 TCLP); Mercury (7471B); Cyanide (9014); pH (9045); TOC (Walkley Black); Flash Point (1010A); Free Liquid (9095A); Hex. Chromium (7196A); TCLP Extraction [TCLP Metals, TCLP SVOC, TCLP VOC, TCLP PCBs, TCLP Pesticides] (1311)	VOCs (8260C); SVOCs (8270D); PAHs (8270 SIM); Pesticides (8081B); PCBs (8082A); GRO/DRO (WI Mod. Method); Metals (6020A); Mercury (7470); Alkalinity (2320B); Cyanide (4500CNE); Nitrate (300.0); Sulfate (300.0); Hex. Chromium (3500-CrB); pH (4500H+); Total Phosphorous (4500PE);
CT Laboratories Christelle Newsome, Quality Assurance Coordinator 1230 Lange Court Baraboo, WI 53913 Phone: 404-356-5357 Cnewsome@ctlaboratories.com	VOCs (8260C); PVOCs (8021B); SVOCs (8270D); PAHs (8310); Pesticides (8081B); PCBs (8082A); GRO/DRO (WI Mod.); Metals (6010C); Metals GFAA [Sb, As, Se, Pb, Ag, Tl] (7010); Hex. Chromium (7196A); Mercury (7471B); Cyanide (9012); Flash Point (1010A); TOC (9060A); Total Phosphorous (365.4); Reactive Cyanide (D5049); Reactive Sulfide (D4978)	VOCs (8260C); PVOCs (8021B); SVOCs (8270D); PAHs (8310); Pesticides (8081B); PCBs (8082A); DRO/DRO (WI Mod.); Metals (6010C); Metals GFAA [Sb, As, Se, Pb, Ag, Tl] (7010); Hex. Chromium (7196A); Mercury (7470A); Alkalinity (310.2); Cyanide (9012); Flash Point (1010A); Nitrate (300); Oil & Grease (1664); TOC (9060A); Total Phosphorous (365.4); Reactive Cyanide (5049); Reactive Sulfide (D4978); Sulfate (300); ethane/ethane/ ethene/carbon dioxide (RSK175)
Environmental Monitoring & Technologies, Inc.; Kassandra Bray, QA Manager; 8100 N. Austin Ave, Morton Grove, IL 60053; 847-324-3341; kbray@emt.com	VOCs (WI Mod.); PVOCs (WI Mod.); SVOCs (8270D); PAHs (8310); Metals (6010B/6020A); PCBs (8082A); DRO/GRO (WI Mod.); Pesticides (8081B); Herbicides (8321A); Mercury (7471B); Cyanide (9014); pH (9045); Flash point (D92-90); Hex. Chromium (7196A); % moisture (2540G); Free liquids (9095A); Sulfur (300-5050); Phosphorus (4500); Sulfide (9030); TCLP extraction [Metals, SVOCs, VOCs, PCBs, Pesticides] (1311)	VOCs (8260B); SVOCs (8270D); PAHs (8310); Metals (6020A); PCBs (8082A); DRO/GRO (WI Mod.); Pesticides (8081B); Herbicides (8321A); Mercury (7470); Cyanide (4500); Hex. Chromium (3500); Alkalinity (2320); Nitrate (300/9056); Sulfate (300/9056); COD (8000); BOD (5210); Oil and Grease (1664)
TestAmerica; Kevin McGee, Laboratory QA Manager ; 5815 Middlebrook Pike, Knoxville, TN 37921; 865-291-3000; Kevin.McGee@testamericainc.com	VOCs in air (TO-15)	
Legend Technical Services; Kimberly Grandprey, QA Coordinator; 1324 W. Clairemont Ave., Suite 12, Eau Claire, WI 54701, Phone: (651) 221-4083 kgrandprey@legend-group.com	Asbestos - bulk (600/R-93/11); Lead (paint chip samples - 6010)	

Notes: Ag = silver; As = arsenic; Cr = chromium; DRO = diesel range organic; GRO = gasoline range organic; Hex = hexavalent; PAH = polynuclear aromatic hydrocarbon; Pb = lead; PCB = polychlorinated biphenyl; QA = quality assurance; Sb = antimony; Se = selenium; SVOC = semi-volatile organic compound; TCLP = toxicity characteristic leaching procedure; Tl = thallium; TN = Tennessee; TO = toxic organics; TOC = total organic carbon; VOC = volatile organic compound; WI = Wisconsin

Laboratory	Analyte Group	Analyte	CAS #	Matrix	Analytical Method	Prep Method	WI Soil Standard	MDL	LOQ/RL	Units	LCL % Recovery	UCL % Recovery	RPD
TestAmerica Chicago	VOCs	1,1,1,2-Tetrachloroethane	630-20-6	Soil	8260B	5035A_FM	0.0534	0.346	2.00	µg/kg	75	122	30
		1,1,1-Trichloroethane	71-55-6	Soil	8260B	5035A_FM	0.1402	0.201	1.00	µg/kg	72	130	30
		1,1,2,2-Tetrachloroethane	79-34-5	Soil	8260B	5035A_FM	0.0002	0.234	1.00	µg/kg	72	130	30
		1,1,2-Trichloroethane	79-00-5	Soil	8260B	5035A_FM	0.0032	0.279	1.00	µg/kg	75	120	30
		1,1-Dichloroethane	75-34-3	Soil	8260B	5035A_FM	0.4828	0.185	1.00	µg/kg	75	120	30
		1,1-Dichloroethene	75-35-4	Soil	8260B	5035A_FM	NE	0.307	1.00	µg/kg	69	120	30
		1,1-Dichloropropene	563-58-6	Soil	8260B	5035A_FM	NE	0.344	1.00	µg/kg	75	130	30
		1,2,3-Trichlorobenzene	87-61-6	Soil	8260B	5035A_FM	48.9	0.350	2.00	µg/kg	69	131	30
		1,2,3-Trichloropropane	96-18-4	Soil	8260B	5035A_FM	NE	0.574	2.00	µg/kg	65	132	30
		1,2,4-Trichlorobenzene	120-82-1	Soil	8260B	5035A_FM	0.408	0.378	2.00	µg/kg	73	130	30
		1,2,4-Trimethylbenzene	95-63-6	Soil	8260B	5035A_FM	1.3821	0.211	2.00	µg/kg	75	121	30
		1,2-Dibromo-3-Chloropropane	96-12-8	Soil	8260B	5035A_FM	0.0002	0.871	2.00	µg/kg	62	130	30
		1,2-Dibromoethane	106-93-4	Soil	8260B	5035A_FM	2.82E-05	0.314	2.00	µg/kg	78	122	30
		1,2-Dichlorobenzene	95-50-1	Soil	8260B	5035A_FM	0.584	0.205	2.00	µg/kg	75	120	30
		1,2-Dichloroethane	107-06-2	Soil	8260B	5035A_FM	0.0028	0.285	1.00	µg/kg	69	130	30
		1,2-Dichloroethane-d4 (Surr)	17060-07-0	Soil	8260B	5035A_FM	NA			µg/kg			
		1,2-Dichloropropane	78-87-5	Soil	8260B	5035A_FM	0.0033	0.196	1.00	µg/kg	75	120	30
		1,3,5-Trimethylbenzene	108-67-8	Soil	8260B	5035A_FM	1.3821	0.206	2.00	µg/kg	75	121	30
		1,3-Dichlorobenzene	541-73-1	Soil	8260B	5035A_FM	0.5764	0.257	2.00	µg/kg	75	120	30
		1,3-Dichloropropane	142-28-9	Soil	8260B	5035A_FM	1490	0.134	1.00	µg/kg	77	124	30
		1,4-Dichlorobenzene	106-46-7	Soil	8260B	5035A_FM	0.144	0.174	2.00	µg/kg	75	120	30
		2,2-Dichloropropane	594-20-7	Soil	8260B	5035A_FM	527	0.316	1.00	µg/kg	65	132	30
		2-Chlorotoluene	95-49-8	Soil	8260B	5035A_FM	907	0.207	1.00	µg/kg	75	120	30
		4-Bromofluorobenzene (Surr)	460-00-4	Soil	8260B	5035A_FM	NA			µg/kg			
		4-Chlorotoluene	106-43-4	Soil	8260B	5035A_FM	253	0.197	1.00	µg/kg	75	120	30
		Benzene	71-43-2	Soil	8260B	5035A_FM	0.0051	0.0742	0.250	µg/kg	75	120	30
		Bromobenzene	108-86-1	Soil	8260B	5035A_FM	354	0.425	2.00	µg/kg	75	120	30
		Bromochloromethane	74-97-5	Soil	8260B	5035A_FM	NE	0.378	2.00	µg/kg	76	120	30
		Bromodichloromethane	75-27-4	Soil	8260B	5035A_FM	0.39	0.338	2.00	µg/kg	77	121	30
		Bromoform	75-25-2	Soil	8260B	5035A_FM	0.0023	0.441	2.00	µg/kg	68	126	30
		Bromomethane	74-83-9	Soil	8260B	5035A_FM	NE	0.682	2.00	µg/kg	45	169	30
		Carbon tetrachloride	56-23-5	Soil	8260B	5035A_FM	0.0039	0.257	1.00	µg/kg	70	130	30
		Chlorobenzene	108-90-7	Soil	8260B	5035A_FM	392	0.143	1.00	µg/kg	75	120	30
		Chloroethane	75-00-3	Soil	8260B	5035A_FM	0.2266	0.435	2.00	µg/kg	58	147	30
		Chloroform	67-66-3	Soil	8260B	5035A_FM	0.0033	0.205	1.00	µg/kg	76	120	30
		Chloromethane	74-87-3	Soil	8260B	5035A_FM	0.0155	0.462	2.00	µg/kg	63	133	30
		cis-1,2-Dichloroethene	156-59-2	Soil	8260B	5035A_FM	NE	0.123	1.00	µg/kg	75	120	30
		cis-1,3-Dichloropropene	10061-01-5	Soil	8260B	5035A_FM	NE	0.178	1.00	µg/kg	78	130	30
		Dibromochloromethane	124-48-1	Soil	8260B	5035A_FM	0.032	0.346	2.00	µg/kg	71	126	30
		Dibromofluoromethane	1868-53-7	Soil	8260B	5035A_FM	NE			µg/kg			
		Dibromomethane	74-95-3	Soil	8260B	5035A_FM	NE	0.480	2.00	µg/kg	75	120	30
		Dichlorodifluoromethane	75-71-8	Soil	8260B	5035A_FM	3.0863	0.513	2.00	µg/kg	41	146	30
		Ethylbenzene	100-41-4	Soil	8260B	5035A_FM	1.57	0.126	0.250	µg/kg	75	120	30
		Hexachlorobutadiene	87-68-3	Soil	8260B	5035A_FM	6.22	0.346	2.00	µg/kg	71	131	30
		Isopropyl ether	108-20-3	Soil	8260B	5035A_FM	2260	0.147	2.00	µg/kg	50	150	
		Isopropylbenzene	98-82-8	Soil	8260B	5035A_FM	268	0.251	2.00	µg/kg	75	121	30
		m&p-Xylene	179601-23-1	Soil	8260B	5035A_FM	3.94*	0.161	0.500	µg/kg	75	120	30
		Methyl tert-butyl ether	1634-04-4	Soil	8260B	5035A_FM	0.027	0.430	2.00	µg/kg	75	130	30
		Methylene Chloride	75-09-2	Soil	8260B	5035A_FM	0.0026	0.683	5.00	µg/kg	73	130	30
		Naphthalene	91-20-3	Soil	8260B	5035A_FM	0.6582	0.494	2.00	µg/kg	69	135	30

Laboratory	Analyte Group	Analyte	CAS #	Matrix	Analytical Method	Prep Method	WI Soil Standard	MDL	LOQ/RL	Units	LCL % Recovery	UCL % Recovery	RPD
TestAmerica Chicago	VOCs (cont'd)	n-Butylbenzene	104-51-8	Soil	8260B	5035A_FM	NE	0.129	1.00	µg/kg	75	121	30
		N-Propylbenzene	103-65-1	Soil	8260B	5035A_FM	264	0.175	2.00	µg/kg	75	120	30
		o-Xylene	95-47-6	Soil	8260B	5035A_FM	3.94*	0.0684	0.250	µg/kg	75	120	30
		p-Isopropyltoluene	99-87-6	Soil	8260B	5035A_FM	162	0.185	2.00	µg/kg	75	121	30
		sec-Butylbenzene	135-98-8	Soil	8260B	5035A_FM	NE	0.154	1.00	µg/kg	75	120	30
		Styrene	100-42-5	Soil	8260B	5035A_FM	NE	0.0988	1.00	µg/kg	75	120	30
		tert-Butylbenzene	98-06-6	Soil	8260B	5035A_FM	NE	0.136	1.00	µg/kg	75	123	30
		Tetrachloroethene	127-18-4	Soil	8260B	5035A_FM	0.0045	0.167	1.00	µg/kg	75	120	30
		Toluene	108-88-3	Soil	8260B	5035A_FM	1.1072	0.115	0.250	µg/kg	75	120	30
		Toluene-d8 (Surr)	2037-26-5	Soil	8260B	5035A_FM	NA			µg/kg			
		trans-1,2-Dichloroethene	156-60-5	Soil	8260B	5035A_FM	NE	0.250	1.00	µg/kg	77	120	30
		trans-1,3-Dichloropropene	10061-02-6	Soil	8260B	5035A_FM	NE	0.208	1.00	µg/kg	74	130	30
		Trichloroethene	79-01-6	Soil	8260B	5035A_FM	0.0036	0.186	0.500	µg/kg	75	120	30
		Trichlorofluoromethane	75-69-4	Soil	8260B	5035A_FM	1120	0.415	2.00	µg/kg	71	130	30
		Vinyl chloride	75-01-4	Soil	8260B	5035A_FM	0.0001	0.104	0.250	µg/kg	72	123	30
		Xylenes, Total	1330-20-7	Soil	8260B	5035A_FM	3.94*	0.0684	0.500	µg/kg	75	120	30
TestAmerica Chicago	TCLP VOCs	1,1-Dichloroethene	75-35-4	Soil	8260B	5030B_Leach	-	0.000500	0.00100	mg/L	58	122	20
		1,2-Dichloroethane	107-06-2	Soil	8260B	5030B_Leach	0.0028	0.000500	0.00100	mg/L	69	120	20
		1,2-Dichloroethane-d4 (Surr)	17060-07-0	Soil	8260B	5030B_Leach	-			mg/L			
		4-Bromofluorobenzene (Surr)	460-00-4	Soil	8260B	5030B_Leach	-			mg/L			
		Benzene	71-43-2	Soil	8260B	5030B_Leach	0.0051	0.000500	0.00100	mg/L	70	120	20
		Carbon tetrachloride	56-23-5	Soil	8260B	5030B_Leach	0.0039	0.000500	0.00100	mg/L	70	125	20
		Chlorobenzene	108-90-7	Soil	8260B	5030B_Leach	392	0.000500	0.00100	mg/L	70	120	20
		Chloroform	67-66-3	Soil	8260B	5030B_Leach	0.0033	0.000500	0.00100	mg/L	70	120	20
		Dibromofluoromethane	1868-53-7	Soil	8260B	5030B_Leach	-			mg/L			
		Methyl Ethyl Ketone	78-93-3	Soil	8260B	5030B_Leach	-	0.00250	0.00500	mg/L	54	138	20
		Tetrachloroethene	127-18-4	Soil	8260B	5030B_Leach	0.0045	0.000500	0.00100	mg/L	70	123	20
		Toluene-d8 (Surr)	2037-26-5	Soil	8260B	5030B_Leach	-			mg/L			
		Trichloroethene	79-01-6	Soil	8260B	5030B_Leach	0.0036	0.000500	0.00100	mg/L	70	120	20
		Vinyl chloride	75-01-4	Soil	8260B	5030B_Leach	0.0001	0.000500	0.00100	mg/L	62	138	20
TestAmerica Chicago	SVOCs	1,2,4-Trichlorobenzene	120-82-1	Soil	8270D	3541	0.408	35.8	167	µg/kg	48	113	30
		1,2-Dichlorobenzene	95-50-1	Soil	8270D	3541	0.584	39.7	167	µg/kg	48	110	30
		1,3-Dichlorobenzene	541-73-1	Soil	8270D	3541	0.5764	37.4	167	µg/kg	45	110	30
		1,4-Dichlorobenzene	106-46-7	Soil	8270D	3541	0.144	42.6	167	µg/kg	46	110	30
		1-Methylnaphthalene	90-12-0	Soil	8270D	3541	15.6	8.11	33.0	µg/kg	50	110	30
		2,2'-oxybis[1-chloropropane]	108-60-1	Soil	8270D	3541	NE	38.5	167	µg/kg	32	117	30
		2,4,5-Trichlorophenol	95-95-4	Soil	8270D	3541	NE	75.8	330	µg/kg	49	123	30
		2,4,6-Tribromophenol (Surr)	118-79-6	Soil	8270D	3541	NA			µg/kg			
		2,4,6-Trichlorophenol	88-06-2	Soil	8270D	3541	NE	114	330	µg/kg	43	127	30
		2,4-Dichlorophenol	120-83-2	Soil	8270D	3541	NE	78.9	330	µg/kg	54	118	30
		2,4-Dimethylphenol	105-67-9	Soil	8270D	3541	NE	126	330	µg/kg	50	125	30
		2,4-Dinitrophenol	51-28-5	Soil	8270D	3541	NE	585	670	µg/kg	10	110	30
		2,4-Dinitrotoluene	121-14-2	Soil	8270D	3541	NE	52.8	167	µg/kg	55	123	30
		2,6-Dinitrotoluene	606-20-2	Soil	8270D	3541	NE	65.3	167	µg/kg	54	121	30
		2-Chloronaphthalene	91-58-7	Soil	8270D	3541	NE	36.7	167	µg/kg	51	113	30
		2-Chlorophenol	95-57-8	Soil	8270D	3541	NE	56.7	167	µg/kg	50	118	30
		2-Fluorobiphenyl	321-60-8	Soil	8270D	3541	NE			µg/kg			
		2-Fluorophenol (Surr)	367-12-4	Soil	8270D	3541	NA			µg/kg			
		2-Methylnaphthalene	91-57-6	Soil	8270D	3541	229	6.11	33.0	µg/kg	49	110	30
		2-Methylphenol	95-48-7	Soil	8270D	3541	NE	53.3	167	µg/kg	48	120	30

Laboratory	Analyte Group	Analyte	CAS #	Matrix	Analytical Method	Prep Method	WI Soil Standard	MDL	LOQ/RL	Units	LCL % Recovery	UCL % Recovery	RPD
TestAmerica Chicago	SVOCs (cont'd)	2-Nitroaniline	88-74-4	Soil	8270D	3541	NE	44.7	167	µg/kg	51	124	30
		2-Nitrophenol	88-75-5	Soil	8270D	3541	NE	78.5	330	µg/kg	42	129	30
		3 & 4 Methylphenol	15831-10-4	Soil	8270D	3541	NE	55.4	167	µg/kg	48	122	30
		3,3'-Dichlorobenzidine	91-94-1	Soil	8270D	3541	NE	46.5	167	µg/kg	35	113	30
		3-Nitroaniline	99-09-2	Soil	8270D	3541	NE	103	330	µg/kg	43	113	30
		4,6-Dinitro-2-methylphenol	534-52-1	Soil	8270D	3541	NE	267	330	µg/kg	10	110	30
		4-Bromophenyl phenyl ether	101-55-3	Soil	8270D	3541	NE	43.8	167	µg/kg	55	122	30
		4-Chloro-3-methylphenol	59-50-7	Soil	8270D	3541	NE	113	330	µg/kg	56	117	30
		4-Chloroaniline	106-47-8	Soil	8270D	3541	NE	156	670	µg/kg	23	114	30
		4-Chlorophenyl phenyl ether	7005-72-3	Soil	8270D	3541	NE	38.8	167	µg/kg	54	120	30
		4-Nitroaniline	100-01-6	Soil	8270D	3541	NE	139	330	µg/kg	31	135	30
		4-Nitrophenol	100-02-7	Soil	8270D	3541	NE	316	670	µg/kg	25	143	30
		Acenaphthene	83-32-9	Soil	8270D	3541	3440	5.97	33.0	µg/kg	47	110	30
		Acenaphthylene	208-96-8	Soil	8270D	3541	NE	4.38	33.0	µg/kg	51	113	30
		Anthracene	120-12-7	Soil	8270D	3541	197.7273	5.55	33.0	µg/kg	53	121	30
		Benzo[a]anthracene	56-55-3	Soil	8270D	3541	0.148	4.47	33.0	µg/kg	52	113	30
		Benzo[a]pyrene	50-32-8	Soil	8270D	3541	0.015	6.43	33.0	µg/kg	52	110	30
		Benzo[b]fluoranthene	205-99-2	Soil	8270D	3541	0.148	7.17	33.0	µg/kg	49	118	30
		Benzo[g,h,i]perylene	191-24-2	Soil	8270D	3541	NE	10.7	33.0	µg/kg	53	115	30
		Benzo[k]fluoranthene	207-08-9	Soil	8270D	3541	1.48	9.79	33.0	µg/kg	46	115	30
		Benzoic acid	65-85-0	Soil	8270D	3541	NE	373	1670	µg/kg	10	100	30
		Benzyl alcohol	100-51-6	Soil	8270D	3541	NE	99.6	330	µg/kg	40	110	30
		Bis(2-chloroethoxy)methane	111-91-1	Soil	8270D	3541	NE	33.9	167	µg/kg	50	110	30
		Bis(2-chloroethyl)ether	111-44-4	Soil	8270D	3541	NE	49.8	167	µg/kg	41	112	30
		Bis(2-ethylhexyl) phthalate	117-81-7	Soil	8270D	3541	NE	60.7	167	µg/kg	52	129	30
		Butyl benzyl phthalate	85-68-7	Soil	8270D	3541	NE	63.2	167	µg/kg	54	126	30
		Carbazole	86-74-8	Soil	8270D	3541	NE	85.8	167	µg/kg	56	123	30
		Chrysene	218-01-9	Soil	8270D	3541	0.1446	9.06	33.0	µg/kg	51	112	30
		Dibenz(a,h)anthracene	53-70-3	Soil	8270D	3541	0.015	6.42	33.0	µg/kg	48	113	30
		Dibenzofuran	132-64-9	Soil	8270D	3541	NE	38.9	167	µg/kg	52	115	30
		Diethyl phthalate	84-66-2	Soil	8270D	3541	NE	56.3	167	µg/kg	47	129	30
		Dimethyl phthalate	131-11-3	Soil	8270D	3541	NE	43.4	167	µg/kg	55	116	30
		Di-n-butyl phthalate	84-74-2	Soil	8270D	3541	NE	50.6	167	µg/kg	53	121	30
		Di-n-octyl phthalate	117-84-0	Soil	8270D	3541	NE	54.2	167	µg/kg	44	137	30
		Fluoranthene	206-44-0	Soil	8270D	3541	88.8778	6.16	33.0	µg/kg	53	122	30
		Fluorene	86-73-7	Soil	8270D	3541	14.8027	4.67	33.0	µg/kg	51	119	30
		Hexachlorobenzene	118-74-1	Soil	8270D	3541	NE	7.70	67.0	µg/kg	55	121	30
		Hexachlorobutadiene	87-68-3	Soil	8270D	3541	6.22	52.2	167	µg/kg	45	119	30
		Hexachlorocyclopentadiene	77-47-4	Soil	8270D	3541	NE	191	670	µg/kg	10	134	30
		Hexachloroethane	67-72-1	Soil	8270D	3541	NE	50.5	167	µg/kg	42	111	30
		Indeno[1,2,3-cd]pyrene	193-39-5	Soil	8270D	3541	0.148	8.61	33.0	µg/kg	49	113	30
		Isophorone	78-59-1	Soil	8270D	3541	NE	37.3	167	µg/kg	46	110	30
		Naphthalene	91-20-3	Soil	8270D	3541	0.6582	5.11	33.0	µg/kg	49	110	30
		Nitrobenzene	98-95-3	Soil	8270D	3541	NE	8.29	33.0	µg/kg	49	110	30
		Nitrobenzene-d5 (Surr)	4165-60-0	Soil	8270D	3541	NA			µg/kg			
		N-Nitrosodi-n-propylamine	621-64-7	Soil	8270D	3541	NE	40.6	167	µg/kg	44	112	30
		N-Nitrosodiphenylamine	86-30-6	Soil	8270D	3541	NE	39.2	167	µg/kg	48	113	30
		Pentachlorophenol	87-86-5	Soil	8270D	3541	NE	533	670	µg/kg	10	152	30
		Phenanthrene	85-01-8	Soil	8270D	3541	NE	4.63	33.0	µg/kg	54	120	30
		Phenol	108-95-2	Soil	8270D	3541	NE	73.8	167	µg/kg	50	117	30

Laboratory	Analyte Group	Analyte	CAS #	Matrix	Analytical Method	Prep Method	WI Soil Standard	MDL	LOQ/RL	Units	LCL % Recovery	UCL % Recovery	RPD
TestAmerica Chicago	SVOCs (cont'd)	Phenol-d5 (Surr)	4165-62-2	Soil	8270D	3541	NA			µg/kg			
		Pyrene	129-00-0	Soil	8270D	3541	54.1322	6.60	33.0	µg/kg	54	119	30
		Terphenyl-d14 (Surr)	1718-51-0	Soil	8270D	3541	NA			µg/kg			
TestAmerica Nashville	PAH SIM	1-Methylnaphthalene	90-12-0	Soil	8270D	3541	15.6	0.9	3.33	µg/kg	50	110	30
		2-Fluorobiphenyl	321-60-8	Soil	8270D	3541	NE			µg/kg			
		2-Methylnaphthalene	91-57-6	Soil	8270D	3541	229	1.6	3.33	µg/kg	49	110	30
		Acenaphthene	83-32-9	Soil	8270D	3541	3440	0.5	3.33	µg/kg	47	110	30
		Acenaphthylene	208-96-8	Soil	8270D	3541	NE	0.7	3.33	µg/kg	51	113	30
		Anthracene	120-12-7	Soil	8270D	3541	197.7273	1.2	3.33	µg/kg	53	121	30
		Benzo[a]anthracene	56-55-3	Soil	8270D	3541	0.148	1.2	3.33	µg/kg	52	113	30
		Benzo[a]pyrene	50-32-8	Soil	8270D	3541	0.015	1.8	3.33	µg/kg	52	110	30
		Benzo[b]fluoranthene	205-99-2	Soil	8270D	3541	0.148	1.5	3.33	µg/kg	49	118	30
		Benzo[g,h,i]perylene	191-24-2	Soil	8270D	3541	NE	1.9	3.33	µg/kg	53	115	30
		Benzo[k]fluoranthene	207-08-9	Soil	8270D	3541	1.48	1	3.33	µg/kg	46	115	30
		Chrysene	218-01-9	Soil	8270D	3541	0.1446	1.8	3.33	µg/kg	51	112	30
		Dibenz(a,h)anthracene	53-70-3	Soil	8270D	3541	0.015	1.9	3.33	µg/kg	48	113	30
		Fluoranthene	206-44-0	Soil	8270D	3541	88.8778	1.8	3.33	µg/kg	53	122	30
		Fluorene	86-73-7	Soil	8270D	3541	14.8027	0.7	3.33	µg/kg	51	119	30
		Indeno[1,2,3-cd]pyrene	193-39-5	Soil	8270D	3541	0.148	1.8	3.33	µg/kg	49	113	30
		Naphthalene	91-20-3	Soil	8270D	3541	0.6582	1.2	3.33	µg/kg	49	110	30
		Nitrobenzene-d5 (Surr)	4165-60-0	Soil	8270D	3541	NE			µg/kg			
		Phenanthrene	85-01-8	Soil	8270D	3541	NE	1	3.33	µg/kg	54	120	30
		Pyrene	129-00-0	Soil	8270D	3541	54.1322	1.8	3.33	µg/kg	54	119	30
		Terphenyl-d14 (Surr)	1718-51-0	Soil	8270D	3541	NE			µg/kg			
TestAmerica Chicago	TCLP SVOCs	1,4-Dichlorobenzene	106-46-7	Soil	8270D	3510C	0.144	0.0200	0.0200	mg/L	33	100	20
		2,4,5-Trichlorophenol	95-95-4	Soil	8270D	3510C	-	0.100	0.100	mg/L	63	110	20
		2,4,6-Tribromophenol (Surr)	118-79-6	Soil	8270D	3510C	-			mg/L			
		2,4,6-Trichlorophenol	88-06-2	Soil	8270D	3510C	-	0.0500	0.0500	mg/L	63	110	20
		2,4-Dinitrotoluene	121-14-2	Soil	8270D	3510C	-	0.0100	0.0100	mg/L	62	119	20
		2-Fluorobiphenyl	321-60-8	Soil	8270D	3510C	-			mg/L			
		2-Fluorophenol (Surr)	367-12-4	Soil	8270D	3510C	-			mg/L			
		2-Methylphenol	95-48-7	Soil	8270D	3510C	-	0.0200	0.0200	mg/L	42	100	20
		3 & 4 Methylphenol	15831-10-4	Soil	8270D	3510C	-	0.0200	0.0200	mg/L	38	110	20
		Hexachlorobenzene	118-74-1	Soil	8270D	3510C	-	0.00500	0.00500	mg/L	60	110	20
		Hexachlorobutadiene	87-68-3	Soil	8270D	3510C	6.22	0.0500	0.0500	mg/L	28	110	20
		Hexachloroethane	67-72-1	Soil	8270D	3510C	-	0.0500	0.0500	mg/L	29	100	20
		Nitrobenzene	98-95-3	Soil	8270D	3510C	-	0.0100	0.0100	mg/L	52	110	20
		Nitrobenzene-d5 (Surr)	4165-60-0	Soil	8270D	3510C	-			mg/L			
		Pentachlorophenol	87-86-5	Soil	8270D	3510C	-	0.200	0.200	mg/L	42	127	20
		Phenol-d5 (Surr)	4165-62-2	Soil	8270D	3510C	-			mg/L			
		Pyridine	110-86-1	Soil	8270D	3510C	-	0.200	0.200	mg/L	10	100	20
		Terphenyl-d14 (Surr)	1718-51-0	Soil	8270D	3510C	-			mg/L			
TestAmerica Chicago	Pesticides	4,4'-DDD	72-54-8	Soil	8081B	3541	NE	0.333	1.70	µg/kg	66	110	30
		4,4'-DDE	72-55-9	Soil	8081B	3541	NE	0.277	1.70	µg/kg	64	110	30
		4,4'-DDT	50-29-3	Soil	8081B	3541	NE	0.880	1.70	µg/kg	50	115	30
		Aldrin	309-00-2	Soil	8081B	3541	NE	0.693	1.70	µg/kg	54	110	30
		alpha-BHC	319-84-6	Soil	8081B	3541	NE	0.424	1.70	µg/kg	53	110	30
		alpha-Chlordane	5103-71-9	Soil	8081B	3541	NE	0.845	1.70	µg/kg	61	110	30
		beta-BHC	319-85-7	Soil	8081B	3541	NE	0.518	1.70	µg/kg	65	110	30
		DCB Decachlorobiphenyl	2051-24-3	Soil	8081B	3541	NE			µg/kg			

Laboratory	Analyte Group	Analyte	CAS #	Matrix	Analytical Method	Prep Method	WI Soil Standard	MDL	LOQ/RL	Units	LCL % Recovery	UCL % Recovery	RPD
TestAmerica Chicago	Pesticides (cont'd)	delta-BHC	319-86-8	Soil	8081B	3541	NE	0.526	1.70	µg/kg	50	110	30
		Dieldrin	60-57-1	Soil	8081B	3541	NE	0.229	1.70	µg/kg	63	110	30
		Endosulfan I	959-98-8	Soil	8081B	3541	NE	0.731	1.70	µg/kg	51	110	30
		Endosulfan II	33213-65-9	Soil	8081B	3541	NE	0.271	1.70	µg/kg	56	110	30
		Endosulfan sulfate	1031-07-8	Soil	8081B	3541	NE	0.305	1.70	µg/kg	63	120	30
		Endrin	72-20-8	Soil	8081B	3541	NE	0.231	1.70	µg/kg	59	110	30
		Endrin aldehyde	7421-93-4	Soil	8081B	3541	NE	0.281	1.70	µg/kg	56	110	30
		Endrin ketone	53494-70-5	Soil	8081B	3541	NE	0.378	1.70	µg/kg	59	120	30
		gamma-BHC (Lindane)	58-89-9	Soil	8081B	3541	NE	0.362	1.70	µg/kg	55	110	30
		gamma-Chlordane	5103-74-2	Soil	8081B	3541	NE	0.438	1.70	µg/kg	62	110	30
		Heptachlor	76-44-8	Soil	8081B	3541	NE	0.701	1.70	µg/kg	50	110	30
		Heptachlor epoxide	1024-57-3	Soil	8081B	3541	NE	0.594	1.70	µg/kg	50	122	30
		Methoxychlor	72-43-5	Soil	8081B	3541	NE	0.324	8.30	µg/kg	52	119	30
		Tetrachloro-m-xylene	877-09-8	Soil	8081B	3541	NE			µg/kg			
		Toxaphene	8001-35-2	Soil	8081B	3541	NE	7.04	16.7	µg/kg			
TestAmerica Chicago	TCLP Pesticides	Chlordane (technical)	57-74-9	Soil	8081B	3510C	NE	0.00500	0.0100	mg/L			20
		DCB Decachlorobiphenyl	2051-24-3	Soil	8081B	3510C	NE			mg/L			20
		Endrin	72-20-8	Soil	8081B	3510C	NE	0.00250	0.00500	mg/L	73	121	20
		gamma-BHC (Lindane)	58-89-9	Soil	8081B	3510C	NE	0.00250	0.00500	mg/L	72	118	20
		Heptachlor	76-44-8	Soil	8081B	3510C	NE	0.00250	0.00500	mg/L	60	110	20
		Heptachlor epoxide	1024-57-3	Soil	8081B	3510C	NE	0.00250	0.00500	mg/L	80	119	20
		Methoxychlor	72-43-5	Soil	8081B	3510C	NE	0.00500	0.0100	mg/L	64	126	20
		Tetrachloro-m-xylene	877-09-8	Soil	8081B	3510C	NE			mg/L			20
		Toxaphene	8001-35-2	Soil	8081B	3510C	NE	0.0250	0.0500	mg/L	50	150	20
TestAmerica Chicago	TCLP PCBs	PCB-1016	12674-11-2	Soil	8082A	3510C	NE	0.0250	0.0500	mg/L	64	110	20
		PCB-1221	11104-28-2	Soil	8082A	3510C	NE	0.0250	0.0500	mg/L			
		PCB-1232	11141-16-5	Soil	8082A	3510C	NE	0.0250	0.0500	mg/L			
		PCB-1242	53469-21-9	Soil	8082A	3510C	NE	0.0250	0.0500	mg/L	60	120	20
		PCB-1248	12672-29-6	Soil	8082A	3510C	NE	0.0250	0.0500	mg/L	60	120	20
		PCB-1254	11097-69-1	Soil	8082A	3510C	NE	0.0250	0.0500	mg/L	60	120	20
		PCB-1260	11096-82-5	Soil	8082A	3510C	NE	0.0250	0.0500	mg/L	51	110	20
		Tetrachloro-m-xylene	877-09-8	Soil	8082A	3510C	NE			mg/L			
		DCB Decachlorobiphenyl	2051-24-3	Soil	8082A	3510C	NE			mg/L			
TestAmerica Chicago	PCBs	PCB-1016	12674-11-2	Soil	8082A	3541	NE	5.90	16.7	µg/kg	59	110	30
		PCB-1221	11104-28-2	Soil	8082A	3541	NE	7.34	16.7	µg/kg			
		PCB-1232	11141-16-5	Soil	8082A	3541	NE	7.27	16.7	µg/kg			
		PCB-1242	53469-21-9	Soil	8082A	3541	NE	5.48	16.7	µg/kg	50	120	30
		PCB-1248	12672-29-6	Soil	8082A	3541	NE	6.57	16.7	µg/kg	50	120	30
		PCB-1254	11097-69-1	Soil	8082A	3541	NE	3.60	16.7	µg/kg	50	120	30
		PCB-1260	11096-82-5	Soil	8082A	3541	NE	8.19	16.7	µg/kg	69	120	30
		Tetrachloro-m-xylene	877-09-8	Soil	8082A	3541	NE			µg/kg			
		DCB Decachlorobiphenyl	2051-24-3	Soil	8082A	3541	NE			µg/kg			
TestAmerica Chicago	GRO & DRO	WI Gasoline Range Organics (C5-C10)	STL00215	Soil	WI GRO	5035A_FM	NE	500	1500	µg/kg	80	120	20
		WI Diesel Range Organics (C10-C28)	STL00143	Soil	WI DRO	WI_DRO_S_Prep	NE	1.60	4.00	mg/kg	70	120	20
		n-Nonane	111-84-2	Soil	WI DRO	WI_DRO_S_Prep	NE			mg/kg			
TestAmerica Chicago	Metals	Aluminum	7429-90-5	Soil	6010C	3050B	NE	4.92	20	mg/kg	80	120	20
		Antimony	7440-36-0	Soil	6010C	3050B	NE	0.415	2.00	mg/kg	80	120	20
		Arsenic	7440-38-2	Soil	6010C	3050B	8	0.462	1.00	mg/kg	80	120	20
		Barium	7440-39-3	Soil	6010C	3050B	164.8	0.183	1.00	mg/kg	80	120	20
		Beryllium	7440-41-7	Soil	6010C	3050B		0.0866	0.4	mg/kg	80	120	20

Laboratory	Analyte Group	Analyte	CAS #	Matrix	Analytical Method	Prep Method	WI Soil Standard	MDL	LOQ/RL	Units	LCL % Recovery	UCL % Recovery	RPD
TestAmerica Chicago	Metals (cont'd)	Cadmium	7440-43-9	Soil	6010C	3050B	1	0.0434	0.200	mg/kg	80	120	20
		Calcium	7440-70-2	Soil	6010C	3050B	NE	6.44	20	mg/kg	80	120	20
		Chromium	7440-47-3	Soil	6010C	3050B	360,000 if no Cr-VI	0.172	1.00	mg/kg	80	120	20
		Cobalt	7440-48-4	Soil	6010C	3050B	NE	0.113	0.5	mg/kg	80	120	20
		Copper	7440-50-8	Soil	6010C	3050B	NE	0.217	1.00	mg/kg	80	120	20
		Iron	7439-89-6	Soil	6010C	3050B	NE	7.71	20	mg/kg	80	120	20
		Lead	7439-92-1	Soil	6010C	3050B	52	0.249	0.500	mg/kg	80	120	20
		Magnesium	7439-95-4	Soil	6010C	3050B	NE	4.06	10	mg/kg	80	120	20
		Manganese	7439-96-5	Soil	6010C	3050B	NE	0.198	1.00	mg/kg	80	120	20
		Nickel	7440-02-0	Soil	6010C	3050B	NE	0.271	1.00	mg/kg	80	120	20
		Potassium	9/7/7440	Soil	6010C	3050B	NE	8.16	50	mg/kg	80	120	20
		Selenium	7782-49-2	Soil	6010C	3050B	0.52	0.495	1.00	mg/kg	80	120	20
		Silver	7440-22-4	Soil	6010C	3050B	0.85	0.117	0.500	mg/kg	80	120	20
		Sodium	7440-23-5	Soil	6010C	3050B	NE	13.1	100	mg/kg	80	120	20
		Thallium	7440-28-0	Soil	6010C	3050B	NE	0.365	1.00	mg/kg	80	120	20
		Vanadium	7440-62-2	Soil	6010C	3050B	NE	0.109	0.5	mg/kg	80	120	20
		Zinc	7440-66-6	Soil	6010C	3050B	NE	0.633	2.00	mg/kg	80	120	20
		Mercury	7439-97-6	Soil	7471B	7471B_Prep	0.208	0.00583	16.7	mg/kg	80	120	20
TestAmerica Chicago	TCLP Metals	Arsenic	7440-38-2	Soil	6010C	3010A_L	8	0.0100	0.0500	mg/L	80	120	20
		Barium	7440-39-3	Soil	6010C	3010A_L	164.8	0.0500	0.500	mg/L	80	120	20
		Cadmium	7440-43-9	Soil	6010C	3010A_L	1	0.00200	0.00500	mg/L	80	120	20
		Chromium	7440-47-3	Soil	6010C	3010A_L	360,000 if no Cr-VI	0.0100	0.0250	mg/L	80	120	20
		Lead	7439-92-1	Soil	6010C	3010A_L	52	0.00750	0.0500	mg/L	80	120	20
		Selenium	7782-49-2	Soil	6010C	3010A_L	0.52	0.0200	0.0500	mg/L	80	120	20
		Silver	7440-22-4	Soil	6010C	3010A_L	0.85	0.0100	0.0250	mg/L	80	120	20
		Mercury	7439-97-6	Soil	7470A	7470A_Prep_L	0.208	0.000200	0.000200	mg/L	80	120	20
TestAmerica Chicago	Misc	Cyanide, Total	57-12-5	Soil	9014	9010B	NE	0.165	0.500	mg/kg	80	120	20
		pH	STL00204	Soil	9045D	NA	NE	0.200	0.200	SU			
		Flashpoint	STL00152	Soil	1010	NA	NE	40.0	40.0	Degrees F			
		Percent Moisture	STL00177	Soil	Moisture	NA	NE	0.100	0.100	%			
		Percent Solids	STL00234	Soil	Moisture	NA	NE	0.100	0.100	%			
TestAmerica Canton		Total Organic Carbon	7440-44-0	Soil	Walkley Black	NA	NE	250	1000	mg/kg	51	126	20

Note:
Indicates MDL exceeds the WI Soil Standard

CAS = Chemical Abstracts Service
DRO = diesel range organic
F = Fahrenheit
GRO = gasoline range organic
LCL = lower control limit
LOQ = limit of quantification
MDL = method detection limit
mg/kg = milligrams per kilogram
mg/L = milligrams per liter
NA = not applicable
NE = not established
PAH = polynuclear aromatic hydrocarbon
PCB = polychlorinated biphenyl
RL = reporting limit
RPD = Relative Percent Difference
TCLP = toxicity characteristic leaching procedure
SIM = selected ion monitoring
SU = standard units
Surr = surrogate
SVOC = semi-volatile organic compound
UCL = upper control limit
µg/kg = micrograms per kilogram
VOC = Volatile Organic Compound
WI = Wisconsin

Laboratory	Analyte Group	Analyte	CAS #	Matrix	Analytical Method	Prep Method	WI Groundwater Preventive Action Limits	MDL	LOQ/RL	Units	LCL % Recovery	UCL % Recovery	RPD
TestAmerica Chicago	VOCs	1,1,1,2-Tetrachloroethane	630-20-6	Water	8260B	5030B	7	0.250	1.00	µg/L	75	122	20
		1,1,1-Trichloroethane	71-55-6	Water	8260B	5030B	40	0.200	1.00	µg/L	72	130	20
		1,1,2,2-Tetrachloroethane	79-34-5	Water	8260B	5030B	0.02	0.230	1.00	µg/L	72	130	20
		1,1,2-Trichloroethane	79-00-5	Water	8260B	5030B	0.5	0.280	1.00	µg/L	75	120	20
		1,1-Dichloroethane	75-34-3	Water	8260B	5030B	85	0.190	1.00	µg/L	75	120	20
		1,1-Dichloroethene	75-35-4	Water	8260B	5030B	0.7	0.310	1.00	µg/L	69	120	20
		1,1-Dichloropropene	563-58-6	Water	8260B	5030B	NE	0.340	1.00	µg/L	75	130	20
		1,2,3-Trichlorobenzene	87-61-6	Water	8260B	5030B	NE	0.240	1.00	µg/L	69	131	20
		1,2,3-Trichloropropane	96-18-4	Water	8260B	5030B	12	0.450	1.00	µg/L	65	132	20
		1,2,4-Trichlorobenzene	120-82-1	Water	8260B	5030B	14	0.310	1.00	µg/L	73	130	20
		1,2,4-Trimethylbenzene	95-63-6	Water	8260B	5030B	96	0.140	1.00	µg/L	75	121	20
		1,2-Dibromo-3-Chloropropane	96-12-8	Water	8260B	5030B	0.02	0.870	2.00	µg/L	62	130	20
		1,2-Dibromoethane	106-93-4	Water	8260B	5030B	0.005	0.360	1.00	µg/L	78	122	20
		1,2-Dichlorobenzene	95-50-1	Water	8260B	5030B	60	0.270	1.00	µg/L	75	120	20
		1,2-Dichloroethane	107-06-2	Water	8260B	5030B	0.5	0.280	1.00	µg/L	69	130	20
		1,2-Dichloroethane-d4 (Surr)	17060-07-0	Water	8260B	5030B	NA			µg/L			
		1,2-Dichloropropane	78-87-5	Water	8260B	5030B	0.5	0.200	1.00	µg/L	75	120	20
		1,3,5-Trimethylbenzene	108-67-8	Water	8260B	5030B	96	0.180	1.00	µg/L	75	121	20
		1,3-Dichlorobenzene	541-73-1	Water	8260B	5030B	120	0.150	1.00	µg/L	75	120	20
		1,3-Dichloropropane	142-28-9	Water	8260B	5030B	NE	0.130	1.00	µg/L	77	124	20
		1,4-Dichlorobenzene	106-46-7	Water	8260B	5030B	NE	0.150	1.00	µg/L	75	120	20
		2,2-Dichloropropane	594-20-7	Water	8260B	5030B	NE	0.320	1.00	µg/L	65	132	20
		2-Chlorotoluene	95-49-8	Water	8260B	5030B	NE	0.210	1.00	µg/L	75	120	20
		4-Bromofluorobenzene (Surr)	460-00-4	Water	8260B	5030B	NA			µg/L			
		4-Chlorotoluene	106-43-4	Water	8260B	5030B	NE	0.200	1.00	µg/L	75	120	20
		Benzene	71-43-2	Water	8260B	5030B	0.5	0.0740	0.500	µg/L	75	120	20
		Bromobenzene	108-86-1	Water	8260B	5030B	NE	0.250	1.00	µg/L	75	120	20
		Bromochloromethane	74-97-5	Water	8260B	5030B	NE	0.400	1.00	µg/L	76	120	20
		Bromodichloromethane	75-27-4	Water	8260B	5030B	0.06	0.170	1.00	µg/L	77	121	20
		Bromoform	75-25-2	Water	8260B	5030B	0.44	0.280	1.00	µg/L	68	126	20
		Bromomethane	74-83-9	Water	8260B	5030B	1	0.310	1.00	µg/L	45	169	20
		Carbon tetrachloride	56-23-5	Water	8260B	5030B	0.5	0.260	1.00	µg/L	70	130	20
		Chlorobenzene	108-90-7	Water	8260B	5030B	20	0.140	1.00	µg/L	75	120	20
		Chloroethane	75-00-3	Water	8260B	5030B	80	0.340	1.00	µg/L	58	147	20
		Chloroform	67-66-3	Water	8260B	5030B	0.6	0.200	1.00	µg/L	76	120	20
		Chloromethane	74-87-3	Water	8260B	5030B	3	0.180	1.00	µg/L	63	133	20
		cis-1,2-Dichloroethene	156-59-2	Water	8260B	5030B	7	0.120	1.00	µg/L	75	120	20
		cis-1,3-Dichloropropene	10061-01-5	Water	8260B	5030B	0.04	0.180	1.00	µg/L	78	130	20
		Dibromochloromethane	124-48-1	Water	8260B	5030B	6	0.320	1.00	µg/L	71	126	20
		Dibromofluoromethane	1868-53-7	Water	8260B	5030B	NE			µg/L			

Laboratory	Analyte Group	Analyte	CAS #	Matrix	Analytical Method	Prep Method	WI Groundwater Preventive Action Limits	MDL	LOQ/RL	Units	LCL % Recovery	UCL % Recovery	RPD
TestAmerica Chicago	VOCs (cont'd)	Dibromomethane	74-95-3	Water	8260B	5030B	NE	0.330	1.00	µg/L	75	120	20
		Dichlorodifluoromethane	75-71-8	Water	8260B	5030B	200	0.200	1.00	µg/L	41	146	20
		Ethylbenzene	100-41-4	Water	8260B	5030B	140	0.130	0.500	µg/L	75	120	20
		Hexachlorobutadiene	87-68-3	Water	8260B	5030B	NE	0.260	1.00	µg/L	71	131	20
		Isopropyl ether	108-20-3	Water	8260B	5030B	NE	0.150	1.00	µg/L	50	150	
		Isopropylbenzene	98-82-8	Water	8260B	5030B	NE	0.140	1.00	µg/L	75	121	20
		m&p-Xylene	179601-23-1	Water	8260B	5030B	400	0.260	1.00	µg/L	75	120	20
		Methyl tert-butyl ether	1634-04-4	Water	8260B	5030B	12	0.240	1.00	µg/L	75	130	20
		Methylene Chloride	75-09-2	Water	8260B	5030B	0.5	0.680	5.00	µg/L	73	130	20
		Naphthalene	91-20-3	Water	8260B	5030B	10	0.160	1.00	µg/L	69	135	20
		n-Butylbenzene	104-51-8	Water	8260B	5030B	NE	0.130	1.00	µg/L	75	121	20
		N-Propylbenzene	103-65-1	Water	8260B	5030B	400	0.130	1.00	µg/L	75	120	20
		o-Xylene	95-47-6	Water	8260B	5030B	NE	0.0680	0.500	µg/L	75	120	20
		p-Isopropyltoluene	99-87-6	Water	8260B	5030B	NE	0.170	1.00	µg/L	75	121	20
		sec-Butylbenzene	135-98-8	Water	8260B	5030B	NE	0.150	1.00	µg/L	75	120	20
		Styrene	100-42-5	Water	8260B	5030B	10	0.100	1.00	µg/L	75	120	20
		tert-Butylbenzene	98-06-6	Water	8260B	5030B	NE	0.140	1.00	µg/L	75	123	20
		Tetrachloroethene	127-18-4	Water	8260B	5030B	0.5	0.170	1.00	µg/L	75	120	20
		Toluene	108-88-3	Water	8260B	5030B	160	0.110	0.500	µg/L	75	120	20
		Toluene-d8 (Surr)	2037-26-5	Water	8260B	5030B	NA			µg/L			
		trans-1,2-Dichloroethene	156-60-5	Water	8260B	5030B	20	0.250	1.00	µg/L	77	120	20
		trans-1,3-Dichloropropene	10061-02-6	Water	8260B	5030B	0.04	0.210	1.00	µg/L	74	130	20
		Trichloroethene	79-01-6	Water	8260B	5030B	0.5	0.190	0.500	µg/L	75	120	20
		Trichlorofluoromethane	75-69-4	Water	8260B	5030B	698	0.190	1.00	µg/L	71	130	20
		Vinyl chloride	75-01-4	Water	8260B	5030B	0.02	0.100	0.500	µg/L	72	123	20
		Xylenes, Total	1330-20-7	Water	8260B	5030B	NE	0.0680	1.00	µg/L	75	120	20
TestAmerica Chicago	SVOCs	1,2,4-Trichlorobenzene	120-82-1	Water	8270D	3510C_LVI	14	0.189	1.60	µg/L	36	98	20
		1,2-Dichlorobenzene	95-50-1	Water	8270D	3510C_LVI	60	0.197	1.60	µg/L	36	96	20
		1,3-Dichlorobenzene	541-73-1	Water	8270D	3510C_LVI	120	0.167	1.60	µg/L	31	95	20
		1,4-Dichlorobenzene	106-46-7	Water	8270D	3510C_LVI	15	0.167	1.60	µg/L	35	95	20
		1-Methylnaphthalene	90-12-0	Water	8270D	3510C_LVI	NE	0.241	0.800	µg/L	35	111	20
		2,2'-oxybis[1-chloropropane]	108-60-1	Water	8270D	3510C_LVI	NE	0.304	1.60	µg/L	24	115	20
		2,4,5-Trichlorophenol	95-95-4	Water	8270D	3510C_LVI	NE	2.05	8.00	µg/L	59	132	20
		2,4,6-Tribromophenol (Surr)	118-79-6	Water	8270D	3510C_LVI	NA			µg/L			
		2,4,6-Trichlorophenol	88-06-2	Water	8270D	3510C_LVI	NE	0.573	4.00	µg/L	61	125	20
		2,4-Dichlorophenol	120-83-2	Water	8270D	3510C_LVI	NE	2.08	8.00	µg/L	61	122	20
		2,4-Dimethylphenol	105-67-9	Water	8270D	3510C_LVI	NE	1.44	8.00	µg/L	49	117	20
		2,4-Dinitrophenol	51-28-5	Water	8270D	3510C_LVI	NE	6.87	16.0	µg/L	47	161	20
		2,4-Dinitrotoluene	121-14-2	Water	8270D	3510C_LVI	0.005	0.196	0.800	µg/L	71	127	20
		2,6-Dinitrotoluene	606-20-2	Water	8270D	3510C_LVI	0.005	0.0590	0.400	µg/L	67	124	20

Laboratory	Analyte Group	Analyte	CAS #	Matrix	Analytical Method	Prep Method	WI Groundwater Preventive Action Limits	MDL	LOQ/RL	Units	LCL % Recovery	UCL % Recovery	RPD
TestAmerica Chicago	SVOCs (cont'd)	2-Chloronaphthalene	91-58-7	Water	8270D	3510C_LVI	NE	0.188	1.60	µg/L	40	114	20
		2-Chlorophenol	95-57-8	Water	8270D	3510C_LVI	NE	0.447	4.00	µg/L	57	108	20
		2-Fluorobiphenyl	321-60-8	Water	8270D	3510C_LVI	NE			µg/L			
		2-Fluorophenol (Surr)	367-12-4	Water	8270D	3510C_LVI	NA			µg/L			
		2-Methylnaphthalene	91-57-6	Water	8270D	3510C_LVI	NE	0.0521	0.400	µg/L	35	113	20
		2-Methylphenol	95-48-7	Water	8270D	3510C_LVI	NE	0.244	1.60	µg/L	54	109	20
		2-Nitroaniline	88-74-4	Water	8270D	3510C_LVI	NE	1.03	4.00	µg/L	59	129	20
		2-Nitrophenol	88-75-5	Water	8270D	3510C_LVI	NE	2.00	8.00	µg/L	62	117	20
		3 & 4 Methylphenol	15831-10-4	Water	8270D	3510C_LVI	NE	0.359	1.60	µg/L	54	107	20
		3,3'-Dichlorobenzidine	91-94-1	Water	8270D	3510C_LVI	NE	1.37	4.00	µg/L	49	127	20
		3-Nitroaniline	99-09-2	Water	8270D	3510C_LVI	NE	1.43	8.00	µg/L	53	126	20
		4,6-Dinitro-2-methylphenol	534-52-1	Water	8270D	3510C_LVI	NE	4.72	16.0	µg/L	66	143	20
		4-Bromophenyl phenyl ether	101-55-3	Water	8270D	3510C_LVI	NE	0.432	4.00	µg/L	61	123	20
		4-Chloro-3-methylphenol	59-50-7	Water	8270D	3510C_LVI	NE	1.84	8.00	µg/L	64	129	20
		4-Chloroaniline	106-47-8	Water	8270D	3510C_LVI	NE	1.61	8.00	µg/L	15	141	20
		4-Chlorophenyl phenyl ether	7005-72-3	Water	8270D	3510C_LVI	NE	0.508	4.00	µg/L	58	120	20
		4-Nitroaniline	100-01-6	Water	8270D	3510C_LVI	NE	1.33	8.00	µg/L	60	148	20
		4-Nitrophenol	100-02-7	Water	8270D	3510C_LVI	NE	5.94	16.0	µg/L	35	112	20
		Acenaphthene	83-32-9	Water	8270D	3510C_LVI	NE	0.247	0.800	µg/L	41	120	20
		Acenaphthylene	208-96-8	Water	8270D	3510C_LVI	NE	0.214	0.800	µg/L	47	112	20
		Anthracene	120-12-7	Water	8270D	3510C_LVI	600	0.267	0.800	µg/L	56	124	20
		Benzo[a]anthracene	56-55-3	Water	8270D	3510C_LVI	NE	0.0453	0.160	µg/L	60	122	20
		Benzo[a]pyrene	50-32-8	Water	8270D	3510C_LVI	0.02	0.0791	0.160	µg/L	66	116	20
		Benzo[b]fluoranthene	205-99-2	Water	8270D	3510C_LVI	0.02	0.0645	0.160	µg/L	66	120	20
		Benzo[g,h,i]perylene	191-24-2	Water	8270D	3510C_LVI	NE	0.300	0.800	µg/L	42	164	20
		Benzo[k]fluoranthene	207-08-9	Water	8270D	3510C_LVI	NE	0.0512	0.160	µg/L	52	123	20
		Benzoic acid	65-85-0	Water	8270D	3510C_LVI	NE	4.61	16.0	µg/L	18	91	20
		Benzyl alcohol	100-51-6	Water	8270D	3510C_LVI	NE	4.83	16.0	µg/L	52	119	20
		Bis(2-chloroethoxy)methane	111-91-1	Water	8270D	3510C_LVI	NE	0.227	1.60	µg/L	57	115	20
		Bis(2-chloroethyl)ether	111-44-4	Water	8270D	3510C_LVI	NE	0.234	1.60	µg/L	50	105	20
		Bis(2-ethylhexyl) phthalate	117-81-7	Water	8270D	3510C_LVI	0.6	1.37	8.00	µg/L	69	123	20
		Butyl benzyl phthalate	85-68-7	Water	8270D	3510C_LVI	NE	0.384	1.60	µg/L	69	123	20
		Carbazole	86-74-8	Water	8270D	3510C_LVI	NE	0.283	4.00	µg/L	63	135	20
		Chrysene	218-01-9	Water	8270D	3510C_LVI	0.02	0.0545	0.400	µg/L	59	126	20
		Dibenz(a,h)anthracene	53-70-3	Water	8270D	3510C_LVI	NE	0.0406	0.240	µg/L	53	149	20
		Dibenzofuran	132-64-9	Water	8270D	3510C_LVI	NE	0.210	1.60	µg/L	54	120	20
		Diethyl phthalate	84-66-2	Water	8270D	3510C_LVI	NE	0.289	1.60	µg/L	54	140	20
		Dimethyl phthalate	131-11-3	Water	8270D	3510C_LVI	NE	0.251	1.60	µg/L	60	130	20
		Di-n-butyl phthalate	84-74-2	Water	8270D	3510C_LVI	100	0.584	4.00	µg/L	64	125	20
		Di-n-octyl phthalate	117-84-0	Water	8270D	3510C_LVI	NE	0.840	8.00	µg/L	62	132	20

Laboratory	Analyte Group	Analyte	CAS #	Matrix	Analytical Method	Prep Method	WI Groundwater Preventive Action Limits	MDL	LOQ/RL	Units	LCL % Recovery	UCL % Recovery	RPD
TestAmerica Chicago	SVOCs (cont'd)	Fluoranthene	206-44-0	Water	8270D	3510C_LVI	80	0.363	0.800	µg/L	68	114	20
		Fluorene	86-73-7	Water	8270D	3510C_LVI	80	0.195	0.800	µg/L	50	125	20
		Hexachlorobenzene	118-74-1	Water	8270D	3510C_LVI	0.1	0.0635	0.400	µg/L	59	122	20
		Hexachlorobutadiene	87-68-3	Water	8270D	3510C_LVI	NE	0.412	4.00	µg/L	25	104	20
		Hexachlorocyclopentadiene	77-47-4	Water	8270D	3510C_LVI	NE	5.10	16.0	µg/L	14	106	20
		Hexachloroethane	67-72-1	Water	8270D	3510C_LVI	NE	0.479	4.00	µg/L	25	96	20
		Indeno[1,2,3-cd]pyrene	193-39-5	Water	8270D	3510C_LVI	NE	0.0598	0.160	µg/L	53	151	20
		Isophorone	78-59-1	Water	8270D	3510C_LVI	NE	0.300	1.60	µg/L	61	112	20
		Naphthalene	91-20-3	Water	8270D	3510C_LVI	10	0.247	0.800	µg/L	41	106	20
		Nitrobenzene	98-95-3	Water	8270D	3510C_LVI	NE	0.359	0.800	µg/L	52	112	20
		Nitrobenzene-d5 (Surr)	4165-60-0	Water	8270D	3510C_LVI	NA			µg/L			
		N-Nitrosodi-n-propylamine	621-64-7	Water	8270D	3510C_LVI	NE	0.123	0.400	µg/L	47	113	20
		N-Nitrosodiphenylamine	86-30-6	Water	8270D	3510C_LVI	0.7	0.296	0.800	µg/L	50	117	20
		Pentachlorophenol	87-86-5	Water	8270D	3510C_LVI	1	3.15	16.0	µg/L	55	129	20
		Phenanthrene	85-01-8	Water	8270D	3510C_LVI	NE	0.241	0.800	µg/L	55	126	20
		Phenol	108-95-2	Water	8270D	3510C_LVI	400	0.537	4.00	µg/L	34	89	20
		Phenol-d5 (Surr)	4165-62-2	Water	8270D	3510C_LVI	NA			µg/L			
		Pyrene	129-00-0	Water	8270D	3510C_LVI	50	0.341	0.800	µg/L	62	118	20
		Terphenyl-d14 (Surr)	1718-51-0	Water	8270D	3510C_LVI	NA			µg/L			
TestAmerica Nashville	PAH SIM	1-Methylnaphthalene	90-12-0	Water	8270SIM	3510C	NE	0.02	0.1	µg/L	35	111	20
		2-Fluorobiphenyl	321-60-8	Water	8270SIM	3510C	NE			µg/L			
		2-Methylnaphthalene	91-57-6	Water	8270SIM	3510C	NE	0.03	0.1	µg/L	35	113	20
		Acenaphthene	83-32-9	Water	8270SIM	3510C	NE	0.02	0.1	µg/L	41	120	20
		Acenaphthylene	208-96-8	Water	8270SIM	3510C	NE	0.03	0.1	µg/L	47	112	20
		Anthracene	120-12-7	Water	8270SIM	3510C	600	0.03	0.1	µg/L	56	124	20
		Benzo[a]anthracene	56-55-3	Water	8270SIM	3510C	NE	0.02	0.1	µg/L	60	122	20
		Benzo[a]pyrene	50-32-8	Water	8270SIM	3510C	0.02	0.02	0.1	µg/L	66	116	20
		Benzo[b]fluoranthene	205-99-2	Water	8270SIM	3510C	NE	0.02	0.1	µg/L	66	120	20
		Benzo[g,h,i]perylene	191-24-2	Water	8270SIM	3510C	NE	0.02	0.1	µg/L	42	164	20
		Benzo[k]fluoranthene	207-08-9	Water	8270SIM	3510C	80	0.02	0.1	µg/L	52	123	20
		Chrysene	218-01-9	Water	8270SIM	3510C	0.02	0.02	0.1	µg/L	59	126	20
		Dibenz(a,h)anthracene	53-70-3	Water	8270SIM	3510C	NE	0.02	0.1	µg/L	53	149	20
		Fluoranthene	206-44-0	Water	8270SIM	3510C	0.02	0.03	0.1	µg/L	68	114	20
		Fluorene	86-73-7	Water	8270SIM	3510C	80	0.02	0.1	µg/L	50	125	20
		Indeno[1,2,3-cd]pyrene	193-39-5	Water	8270SIM	3510C	NE	0.02	0.1	µg/L	53	151	20
		Naphthalene	91-20-3	Water	8270SIM	3510C	10	0.02	0.1	µg/L	41	106	20
		Nitrobenzene-d5 (Surr)	4165-60-0	Water	8270SIM	3510C	NA			µg/L			
		Phenanthrene	85-01-8	Water	8270SIM	3510C	NE	0.03	0.1	µg/L	55	126	20
		Pyrene	129-00-0	Water	8270SIM	3510C	50	0.02	0.1	µg/L	62	118	20
		Terphenyl-d14 (Surr)	1718-51-0	Water	8270SIM	3510C	NA			µg/L			

Laboratory	Analyte Group	Analyte	CAS #	Matrix	Analytical Method	Prep Method	WI Groundwater Preventive Action Limits	MDL	LOQ/RL	Units	LCL % Recovery	UCL % Recovery	RPD
TestAmerica Chicago	Pesticides	4,4'-DDD	72-54-8	Water	8081B	3510C_LVI	NE	0.0133	0.0400	µg/L	78	129	20
		4,4'-DDE	72-55-9	Water	8081B	3510C_LVI	NE	0.00380	0.0400	µg/L	74	120	20
		4,4'-DDT	50-29-3	Water	8081B	3510C_LVI	NE	0.00320	0.0400	µg/L	61	122	20
		Aldrin	309-00-2	Water	8081B	3510C_LVI	NE	0.00530	0.0400	µg/L	58	110	20
		alpha-BHC	319-84-6	Water	8081B	3510C_LVI	NE	0.00260	0.0400	µg/L	72	113	20
		alpha-Chlordane	5103-71-9	Water	8081B	3510C_LVI	NE	0.00440	0.0400	µg/L	75	114	20
		beta-BHC	319-85-7	Water	8081B	3510C_LVI	NE	0.0102	0.0400	µg/L	77	115	20
		DCB Decachlorobiphenyl	2051-24-3	Water	8081B	3510C_LVI	NE			µg/L			
		delta-BHC	319-86-8	Water	8081B	3510C_LVI	NE	0.0103	0.0400	µg/L	77	122	20
		Dieldrin	60-57-1	Water	8081B	3510C_LVI	NE	0.0129	0.0400	µg/L	75	119	20
		Endosulfan I	959-98-8	Water	8081B	3510C_LVI	NE	0.00410	0.0400	µg/L	59	113	20
		Endosulfan II	33213-65-9	Water	8081B	3510C_LVI	NE	0.00280	0.0400	µg/L	68	120	20
		Endosulfan sulfate	1031-07-8	Water	8081B	3510C_LVI	NE	0.0117	0.0400	µg/L	75	136	20
		Endrin	72-20-8	Water	8081B	3510C_LVI	0.4	0.0142	0.0400	µg/L	73	121	20
		Endrin aldehyde	7421-93-4	Water	8081B	3510C_LVI	NE	0.00820	0.0400	µg/L	76	129	20
		Endrin ketone	53494-70-5	Water	8081B	3510C_LVI	NE	0.0170	0.0400	µg/L	75	135	20
		gamma-BHC (Lindane)	58-89-9	Water	8081B	3510C_LVI	0.02	0.00560	0.0400	µg/L	72	118	20
		gamma-Chlordane	5103-74-2	Water	8081B	3510C_LVI	NE	0.00720	0.0400	µg/L	74	116	20
		Heptachlor	76-44-8	Water	8081B	3510C_LVI	0.04	0.0135	0.0400	µg/L	60	110	20
		Heptachlor epoxide	1024-57-3	Water	8081B	3510C_LVI	0.02	0.0138	0.0400	µg/L	80	119	20
		Methoxychlor	72-43-5	Water	8081B	3510C_LVI	4	0.0230	0.0800	µg/L	64	126	20
		Tetrachloro-m-xylene	877-09-8	Water	8081B	3510C_LVI	NA			µg/L			
		Toxaphene	8001-35-2	Water	8081B	3510C_LVI	0.3	0.200	0.400	µg/L			
TestAmerica Chicago	PCBs	PCB-1016	12674-11-2	Water	8082A	3510C_LVI	0.003	0.0670	0.400	µg/L	70	130	20
		PCB-1221	11104-28-2	Water	8082A	3510C_LVI	0.003	0.200	0.400	µg/L			
		PCB-1232	11141-16-5	Water	8082A	3510C_LVI	0.003	0.200	0.400	µg/L			
		PCB-1242	53469-21-9	Water	8082A	3510C_LVI	0.003	0.200	0.400	µg/L	70	130	20
		PCB-1248	12672-29-6	Water	8082A	3510C_LVI	0.003	0.200	0.400	µg/L	70	130	20
		PCB-1254	11097-69-1	Water	8082A	3510C_LVI	0.003	0.200	0.400	µg/L	70	130	20
		PCB-1260	11096-82-5	Water	8082A	3510C_LVI	0.003	0.0700	0.400	µg/L	70	130	20
		Tetrachloro-m-xylene	877-09-8	Water	8082A	3510C_LVI	NA			µg/L			
		DCB Decachlorobiphenyl	2051-24-3	Water	8082A	3510C_LVI	NA			µg/L			
TestAmerica Chicago	DRO & GRO	WI Gasoline Range Organics (C5-C10)	STL00215	Water	WI GRO	5030B	NE	10.0	30.0	µg/L	80	120	20
		WI Diesel Range Organics (C10-C28)	STL00143	Water	WI DRO	3510C_LVI	NE	0.0325	0.0800	mg/L	75	125	20
		n-Nonane	111-84-2	Water	WI DRO	3510C_LVI	NA			mg/L			
TestAmerica Chicago	Metals	Aluminum	7429-90-5	Water	6020A	3005A	40	53.9	100	µg/L	80	120	20
		Antimony	7440-36-0	Water	6020A	3005A	1.2	1.01	3.00	µg/L	80	120	20
		Arsenic	7440-38-2	Water	6020A	3005A	1	0.439	1.00	µg/L	80	120	20
		Barium	7440-39-3	Water	6020A	3005A	400	0.841	2.50	µg/L	80	120	20
		Beryllium	7440-41-7	Water	6020A	3005A	0.4	0.237	1.00	µg/L	80	120	20

Laboratory	Analyte Group	Analyte	CAS #	Matrix	Analytical Method	Prep Method	WI Groundwater Preventive Action Limits	MDL	LOQ/RL	Units	LCL % Recovery	UCL % Recovery	RPD
TestAmerica Chicago	Metals (cont'd)	Cadmium	7440-43-9	Water	6020A	3005A	0.5	0.19	0.500	µg/L	80	120	20
		Calcium	7440-70-2	Water	6020A	3005A	NE	106	200	µg/L	80	120	20
		Chromium	7440-47-3	Water	6020A	3005A	10	0.608	5.00	µg/L	80	120	20
		Cobalt	7440-48-4	Water	6020A	3005A	8	0.189	1.00	µg/L	80	120	20
		Copper	7440-50-8	Water	6020A	3005A	130	0.962	2.00	µg/L	80	120	20
		Iron	7439-89-6	Water	6020A	3005A	150	26.2	100	µg/L	80	120	20
		Lead	7439-92-1	Water	6020A	3005A	1.5	0.141	0.500	µg/L	80	120	20
		Magnesium	7439-95-4	Water	6020A	3005A	NE	83.3	200	µg/L	80	120	20
		Manganese	7439-96-5	Water	6020A	3005A	60	0.99	2.50	µg/L	80	120	20
		Nickel	7440-02-0	Water	6020A	3005A	20	0.528	2.00	µg/L	80	120	20
		Potassium	9/7/7440	Water	6020A	3005A	25	189	500	µg/L	80	120	20
		Selenium	7782-49-2	Water	6020A	3005A	10	0.834	2.50	µg/L	80	120	20
		Silver	7440-22-4	Water	6020A	3005A	10	0.0803	0.500	µg/L	80	120	20
		Sodium	7440-23-5	Water	6020A	3005A	NE	88.4	200	µg/L	80	120	20
		Thallium	7440-28-0	Water	6020A	3005A	0.4	0.591	2.00	µg/L	80	120	20
		Vanadium	7440-62-2	Water	6020A	3005A	6	2.16	5.00	µg/L	80	120	20
		Zinc	7440-66-6	Water	6020A	3005A	2500	4.59	20	µg/L	80	120	20
		Chromium, hexavalent	18540-29-9	Water	3500CRB	NA	10	0.0038	0.01	mg/L	85	115	20
		Mercury	7439-97-6	Water	7470A	7470A_Prep	0.02	0.0611	0.2	µg/L	80	120	20
TestAmerica Chicago	Misc	Alkalinity	STL00171	Water	2320B	NA	NE	3.85	5	mg/L	80	120	20
		Nitrate as N	14797-55-8	Water	300	NA	2	0.046	0.2	mg/L	90	110	20
		Sulfate	14808-79-8	Water	300	NA	125	0.127	0.2	mg/L	90	110	20
		Cyanide, Total	57-12-5	Water	4500CNE	Distill_CN	0.04	0.0012	0.01	mg/L	80	120	20
		pH	STL00204	Water	4500H+	NA	NE	0.2	0.2	SU			
		Phosphorus as P	7723-14-0	Water	4500PE	4500P_B	NE	0.0251	0.05	mg/L	80	120	20

Note:
Indicates MDL exceeds the WI Groundwater PAL

CAS = Chemical Abstracts Service
CN = cyanide
DRO = diesel range organic
GRO = gasoline range organic
Hex Chrome = hexavalent chromium
LCL = lower control limit
LOQ = limit of quantification
MDL = method detection limit
mg/L = milligrams per liter
N = nitrogen
NA = not applicable
NE = not established
P = phosphorus
PAH = polynuclear aromatic hydrocarbon
PAL = preventive action limit
PCB = polychlorinated biphenyl
RL = reporting limit
RPD = Relative Percent Difference
SIM = selected ion monitoring
SU = standard units
Surr = surrogate
SVOC = semi-volatile organic compound
U.S. EPA = United States Environmental Protection Agency
UCL = upper control limit
µg/L = micrograms per liter
VOC = Volatile Organic Compound
WI = Wisconsin

Table 2C
Analytical Parameters, Reporting Limits, Precision and Accuracy
TestAmerica Laboratories - Air Samples

Laboratory	Analyte	CAS #	DL/MDL (See Note 1)	LOQ/PQL (See Note 1)	MW	LOQ/PQL	LCL % Recovery	UCL % Recovery	RPDL (%)	EPA Indoor Air RSL (Residential)	EPA Indoor Air RSL (Industrial)	Comments
	VOCs (TO-15)		ppb (v/v)	ppb (v/v)	g/mol	ug/m3				ug/m3	ug/m3	
TestAmerica Knoxville	1,1,1-Trichloroethane	71-55-6	0.03	0.2	133.4	1.09	70	130	25	5,200	22,000	
	1,1,2,2-Tetrachloroethane	79-34-5	0.061	0.2	167.9	1.37	70	130	25	0.48	2.1	
	1,1,2-Trichloro-1,2,2-trifluoroethane	76-13-1	0.031	0.2	187.4	1.53	70	130	25	31,000	130,000	
	1,1,2-Trichloroethane	79-00-5	0.054	0.2	133.4	1.09	70	130	25	0.21	0.88	
	1,1-Dichloroethane	75-34-3	0.026	0.2	99.0	0.81	70	130	25	18	77	
	1,1-Dichloroethene	75-35-4	0.034	0.2	96.9	0.79	70	130	25	210	880	
	1,2,4-Trichlorobenzene	120-82-1	0.098	1	181.4	7.42	60	140	25	2.1	8.8	
	1,2,4-Trimethylbenzene	95-63-6	0.063	0.2	120.2	0.98	70	130	25	7.3	31	
	1,2-Dibromoethane (EDB)	106-93-4	0.044	0.2	187.9	1.54	70	130	25	0.047	0.2	
	1,2-Dichloro-1,1,2,2-tetrafluoroethane	76-14-2	0.032	0.2	170.9	1.4	60	140	25	NS	NS	
	1,2-Dichlorobenzene	95-50-1	0.07	0.2	147.0	1.2	70	130	25	210	880	
	1,2-Dichloroethane	107-06-2	0.047	0.2	99.0	0.81	70	130	25	1.1	4.7	
	1,2-Dichloropropane	78-87-5	0.052	0.2	113.0	0.92	70	130	25	2.8	12	
	1,3,5-Trimethylbenzene	108-67-8	0.065	0.2	120.2	0.98	70	130	25	NS	NS	
	1,3-Dichlorobenzene	541-73-1	0.065	0.2	147.0	1.2	70	130	25	NS	NS	
	1,4-Dichlorobenzene	106-46-7	0.064	0.2	147.0	1.2	70	130	25	2.6	11	
	Benzene	71-43-2	0.056	0.2	78.1	0.64	70	130	25	3.6	16	
	Benzyl chloride	100-44-7	0.078	0.4	126.6	2.07	70	130	25	0.57	2.5	
	Bromomethane	74-83-9	0.032	0.2	95.0	0.78	70	130	25	5.2	22	
	Carbon tetrachloride	56-23-5	0.038	0.2	153.8	1.26	70	130	25	4.7	20	
	Chlorobenzene	108-90-7	0.049	0.2	112.6	0.92	70	130	25	52	220	
	Chloroethane	75-00-3	0.035	0.2	64.5	0.53	70	130	25	10,000	44,000	
	Chloroform	67-66-3	0.038	0.2	119.4	0.98	70	130	25	1.2	5.3	
	Chloromethane	74-87-3	0.16	0.5	50.5	1.03	60	140	25	94	390	
	cis-1,2-Dichloroethene	156-59-2	0.06	0.2	96.9	0.79	70	130	25	NS	NS	
	cis-1,3-Dichloropropene	10061-01-5	0.074	0.2	111.0	0.91	70	130	25	7	31	
	Dichlorodifluoromethane	75-71-8	0.068	0.2	120.9	0.99	60	140	25	100	440	
	Ethylbenzene	100-41-4	0.068	0.2	106.2	0.87	70	130	25	11	49	
	Hexachlorobutadiene	87-68-3	0.078	1	260.7	10.66	60	140	25	1.3	5.6	
	Methylene chloride	75-09-2	0.13	0.5	84.9	1.74	70	130	25	630	2,600	
	m-Xylene & p-Xylene	179601-23-1	0.12	0.2	106.2	0.87	70	130	25	100	440	
	o-Xylene	95-47-6	0.061	0.2	106.2	0.87	70	130	25	100	440	
	Styrene	100-42-5	0.058	0.2	104.2	0.85	70	130	25	1,000	4,400	

Table 2C
Analytical Parameters, Reporting Limits, Precision and Accuracy
TestAmerica Laboratories - Air Samples

Laboratory	Analyte	CAS #	DL/MDL (See Note 1)	LOQ/PQL (See Note 1)	MW	LOQ/PQL	LCL % Recovery	UCL % Recovery	RPDL (%)	EPA Indoor Air RSL (Residential)	EPA Indoor Air RSL (Industrial)	Comments
	VOCs (TO-15)		ppb (v/v)	ppb (v/v)	g/mol	ug/m3				ug/m3	ug/m3	
TestAmerica Knoxville	Tetrachloroethene	127-18-4	0.04	0.2	165.8	1.36	70	130	25	42	180	
	Toluene	108-88-3	0.12	0.2	92.1	0.75	70	130	25	5,200	22,000	
	trans-1,3-Dichloropropene	10061-02-6	0.048	0.2	111.0	0.91	70	130	25	7.0	31	
	Trichloroethene	79-01-6	0.036	0.2	131.4	1.1	70	130	25	2.1	8.8	
	Trichlorofluoromethane	75-69-4	0.024	0.2	137.4	1.12	60	140	25	730	3,100	
	Vinyl chloride	75-01-4	0.071	0.2	62.5	0.51	70	130	25	1.7	28	
	Surr: 4-Bromofluorobenzene	460-00-4	--	--	--	--	60	140	--	--	--	Surrogate

Notes:

CAS = Chemical Abstracts Service
DL =detection limit
EPA = Environmental Protection Agency
g/mol = grams per mole
LCL = lower control limit
LOQ = limit of quantification
MDL = method detection limit
MW = molecular weight
ppb = parts per billion
PQL = practical quantitation limit
RPDL = relative percent difference limit
RSL =regional screening level
Surr = surrogate
TO = toxic organics
UCL = upper control limit
ug/m3 = micrograms per cubic meter
v/v = unit volume per unit volume
VOC = Volatile Organic Compound

Labor-atory	Analyte Group	Analyte	CAS #	Matrix	Analytical Method	WI Soil Standard	Soil Standard References (see note 1)	WI Sediment TEC (see note 2)	DL/MDL	LOQ/PQL	Units	LCL % Recovery	UCL % Recovery	RPDL	Comments
		1,1,1,2-Tetrachloroethane	630-20-6	Soil	SW846 8260C	0.053	GW	NE	0.013	0.044	mg/kg	74	112	13	
		1,1,1-Trichloroethane (TCA)	71-55-6	Soil	SW846 8260C	0.140	GW	NE	0.011	0.038	mg/kg	76	118	13	
		1,1,2,2-Tetrachloroethane	79-34-5	Soil	SW846 8260C	0.00016	GW	NE	0.017	0.058	mg/kg	67	120	18	
		1,1,2-Trichloroethane	79-00-5	Soil	SW846 8260C	0.0032	GW	NE	0.014	0.048	mg/kg	72	124	20	
		1,1-Dichloroethane	75-34-3	Soil	SW846 8260C	0.48	GW	NE	0.016	0.054	mg/kg	75	122	21	
		1,1-Dichloroethene	75-35-4	Soil	SW846 8260C	0.005	GW	NE	0.014	0.048	mg/kg	66	135	19	
		1,1-Dichloropropene	563-58-6	Soil	SW846 8260C	NE	---	NE	0.015	0.049	mg/kg	78	116	16	
		1,2,3-Trichlorobenzene	87-61-6	Soil	SW846 8260C	48.9	NIDC	NE	0.016	0.052	mg/kg	63	136	47	
		1,2,3-Trichloropropane	96-18-4	Soil	SW846 8260C	0.005	NIDC	NE	0.015	0.049	mg/kg	66	130	20	
		1,2,4-Trichlorobenzene	120-82-1	Soil	SW846 8260C	0.410	GW	0.008	0.013	0.044	mg/kg	68	127	35	
		1,2,4-Trimethylbenzene	95-63-6	Soil	SW846 8260C	1.40	GW	NE	0.017	0.055	mg/kg	69	133	13	
		1,2-Dibromo-3-chloropropane (DBCP)	96-12-8	Soil	SW846 8260C	0.00017	GW	NE	0.016	0.052	mg/kg	57	120	29	
		1,2-Dibromoethane (EDB)	106-93-4	Soil	SW846 8260C	0.000028	GW	NE	0.017	0.055	mg/kg	81	110	14	
		1,2-Dichlorobenzene	95-50-1	Soil	SW846 8260C	1.2	GW	0.023	0.014	0.046	mg/kg	81	114	11	
		1,2-Dichloroethane (EDC)	107-06-2	Soil	SW846 8260C	0.0028	GW	NE	0.014	0.048	mg/kg	73	121	16	
		1,2-Dichloroethene (cis)	156-59-2	Soil	SW846 8260C	NE	---	NE	0.014	0.046	mg/kg	79	116	13	
		1,2-Dichloroethene (trans)	156-60-5	Soil	SW846 8260C	NE	---	NE	0.014	0.046	mg/kg	64	131	22	
		1,2-Dichloropropane	78-87-5	Soil	SW846 8260C	0.0033	GW	NE	0.017	0.058	mg/kg	77	118	15	
		1,3,5-Trimethylbenzene	108-67-8	Soil	SW846 8260C	182	NIDC	NE	0.017	0.055	mg/kg	76	120	13	
		1,3-Dichlorobenzene	541-73-1	Soil	SW846 8260C	1.2	GW	NE	0.011	0.038	mg/kg	83	111	13	
		1,3-Dichloropropane	142-28-9	Soil	SW846 8260C	1490	NIDC	NE	0.016	0.052	mg/kg	81	115	15	
		1,3-Dichloropropene (cis)	10061-01-5	Soil	SW846 8260C	0.00029	GW	NE	0.012	0.04	mg/kg	76	114	15	
CT Labs	VOCs	1,3-Dichloropropene (trans)	10061-02-6	Soil	SW846 8260C	0.00029	GW	NE	0.017	0.057	mg/kg	68	109	16	
		1,4-Dichlorobenzene	106-46-7	Soil	SW846 8260C	0.140	GW	0.031	0.014	0.047	mg/kg	82	110	12	
		2,2-Dichloropropane	594-20-7	Soil	SW846 8260C	527	NIDC	NE	0.014	0.045	mg/kg	63	117	17	
		2-Chlorotoluene	95-49-8	Soil	SW846 8260C	907	NIDC	NE	0.014	0.046	mg/kg	74	119	15	
		2-Hexanone	591-78-6	Soil	SW846 8260C	244	NIDC	NE	0.16	0.53	mg/kg	64	136	25	
		4-Chlorotoluene	106-43-4	Soil	SW846 8260C	253	NIDC	NE	0.016	0.054	mg/kg	72	124	14	
		Acetone	67-64-1	Soil	SW846 8260C	3.68	GW	NE	0.14	0.46	mg/kg	54	143	28	
		Benzene	71-43-2	Soil	SW846 8260C	0.0051	GW	0.057	0.008	0.028	mg/kg	80	124	24	
		Bromobenzene	108-86-1	Soil	SW846 8260C	354	NIDC	NE	0.014	0.047	mg/kg	81	112	14	
		Bromochloromethane	74-97-5	Soil	SW846 8260C	232	NIDC	NE	0.020	0.065	mg/kg	78	117	15	
		Bromodichloromethane	75-27-4	Soil	SW846 8260C	0.00033	GW	NE	0.015	0.050	mg/kg	77	114	15	
		Bromoform	75-25-2	Soil	SW846 8260C	0.0023	GW	NE	0.014	0.045	mg/kg	56	117	19	
		Bromomethane	74-83-9	Soil	SW846 8260C	0.0051	GW	NE	0.05	0.17	mg/kg	52	151	30	
		Carbon disulfide	75-15-0	Soil	SW846 8260C	0.59	GW	NE	0.030	0.099	mg/kg	58	137	22	
		Carbon tetrachloride	56-23-5	Soil	SW846 8260C	0.0039	GW	NE	0.014	0.046	mg/kg	72	117	13	
		Chlorobenzene	108-90-7	Soil	SW846 8260C	392	NIDC	NE	0.018	0.06	mg/kg	81	112	11	
		Chloroethane	75-00-3	Soil	SW846 8260C	0.230	GW	NE	0.05	0.15	mg/kg	48	156	34	
		Chloroform	67-66-3	Soil	SW846 8260C	0.0033	GW	NE	0.015	0.049	mg/kg	77	117	13	
		Chloromethane	74-87-3	Soil	SW846 8260C	0.016	GW	NE	0.014	0.048	mg/kg	61	137	19	
		Dibromochloromethane	124-48-1	Soil	SW846 8260C	0.032	GW	NE	0.013	0.044	mg/kg	69	109	14	
		Dibromomethane	74-95-3	Soil	SW846 8260C	35	NIDC	NE	0.012	0.039	mg/kg	80	112	16	
		Dichlorodifluoromethane	75-71-8	Soil	SW846 8260C	3.1	GW	NE	0.012	0.040	mg/kg	55	145	16	
		Diisopropyl ether	108-20-3	Soil	SW846 8260C	2260	---	NE	0.016	0.054	mg/kg	73	124	16	

Labor-atory	Analyte Group	Analyte	CAS #	Matrix	Analytical Method	WI Soil Standard	Soil Standard References (see note 1)	WI Sediment TEC (see note 2)	DL/MDL	LOQ/PQL	Units	LCL % Recovery	UCL % Recovery	RPDL	Comments
CT Labs	VOCs	Ethylbenzene	100-41-4	Soil	SW846 8260C	1.6	GW	NE	0.007	0.022	mg/kg	79	124	24	
		Hexachloro-1,3-butadiene	87-68-3	Soil	SW846 8260C	6.22	NIDC	NE	0.015	0.05	mg/kg	60	136	23	
		Isopropylbenzene (Cumene)	98-82-8	Soil	SW846 8260C	268	NIDC	NE	0.018	0.061	mg/kg	67	119	12	
		m&p-Xylene	1330-20-7	Soil	SW846 8260C	3.9*	GW	0.025*	0.03	0.10	mg/kg	79	126	24	
		Methyl ethyl ketone (2-Butanone)	78-93-3	Soil	SW846 8260C	1.7	GW	NE	0.14	0.46	mg/kg	70	126	24	
		Methyl isobutyl ketone (MIBK)	108-10-1	Soil	SW846 8260C	0.23	GW	NE	0.15	0.51	mg/kg	67	135	21	
		Methyl tert-butyl ether (MTBE)	1634-04-4	Soil	SW846 8260C	0.027	GW	NE	0.017	0.056	mg/kg	68	125	26	
		Methylene Chloride	75-09-2	Soil	SW846 8260C	0.0026	GW	NE	0.022	0.074	mg/kg	35	146	24	
		Naphthalene	91-20-3	Soil	SW846 8260C	0.66	GW	0.176	0.014	0.046	mg/kg	57	142	44	
		n-Butylbenzene	104-51-8	Soil	SW846 8260C	108	NIDC	NE	0.017	0.056	mg/kg	73	127	14	
		n-Propylbenzene	103-65-1	Soil	SW846 8260C	264	NIDC	NE	0.015	0.049	mg/kg	73	122	14	
		o-Xylene	95-47-6	Soil	SW846 8260C	3.9*	GW	0.025*	0.008	0.027	mg/kg	79	125	24	
		p-Isopropyltoluene	99-87-6	Soil	SW846 8260C	162	NIDC	NE	0.016	0.053	mg/kg	75	121	14	
		sec-Butylbenzene	135-98-8	Soil	SW846 8260C	145	NIDC	NE	0.017	0.056	mg/kg	76	122	15	
		Styrene	100-42-5	Soil	SW846 8260C	0.22	GW	NE	0.019	0.063	mg/kg	80	118	14	
		tert-Butylbenzene	98-06-6	Soil	SW846 8260C	183	NIDC	NE	0.017	0.056	mg/kg	77	118	14	
		Tetrachloroethene (PCE)	127-18-4	Soil	SW846 8260C	0.0045	GW	NE	0.011	0.036	mg/kg	71	122	13	
		Tetrahydrofuran	109-99-9	Soil	SW846 8260C	0.022	GW	NE	0.11	0.37	mg/kg	69	127	24	
		Toluene	108-88-3	Soil	SW846 8260C	1.1	GW	0.89	0.011	0.037	mg/kg	79	124	24	
		Trichloroethene (TCE)	79-01-6	Soil	SW846 8260C	0.0036	GW	NE	0.011	0.037	mg/kg	67	130	14	
		Trichlorofluoromethane (CFC-11)	75-69-4	Soil	SW846 8260C	4.5	GW	NE	0.014	0.047	mg/kg	54	145	24	
		Vinyl chloride	75-01-4	Soil	SW846 8260C	0.00014	GW	NE	0.012	0.041	mg/kg	68	136	17	
		Surr: 1,2 Dichloroethane-d4	17060-07-0	Soil	SW846 8260C	NA	---	NA	80	117	% Recovery	80	117		Surrogate
		Surr: 4-Bromofluorobenzene	460-00-4	Soil	SW846 8260C	NA	---	NA	77	136	% Recovery	77	136		Surrogate
		Surr: Toluene-d8	2037-26-5	Soil	SW846 8260C	NA	---	NA	85	122	% Recovery	85	122		Surrogate
		Surr: Dibromofluoromethane	1868-53-7	Soil	SW846 8260C	NA	---	NA	82	118	% Recovery	82	118		Surrogate
CT Labs	PVOC LUST	Benzene	71-43-2	Soil	SW846 EPA 8021B	0.0051	GW	0.057	0.010	0.035	mg/kg	80	120	20	
		Ethylbenzene	100-41-4	Soil	SW846 EPA 8021B	1.6	GW	NE	0.015	0.051	mg/kg	80	120	20	
		Methyl tert-butyl ether (MTBE)	1634-04-4	Soil	SW846 EPA 8021B	0.027	GW	NE	0.017	0.058	mg/kg	80	120	20	
		Toluene	108-88-3	Soil	SW846 EPA 8021B	1.1	GW	0.89	0.016	0.054	mg/kg	80	120	20	
		1,2,4-Trimethylbenzene	95-63-6	Soil	SW846 EPA 8021B	1.40	GW	NE	0.016	0.055	mg/kg	80	120	20	
		1,3,5-Trimethylbenzene	108-67-8	Soil	SW846 EPA 8021B	1.40	GW	NE	0.016	0.053	mg/kg	80	120	20	
		m & p-Xylene	1330-20-7	Soil	SW846 EPA 8021B	3.9*	GW	0.025*	0.021	0.069	mg/kg	80	120	20	
		o-Xylene	95-47-6	Soil	SW846 EPA 8021B	3.9*	GW	0.025*	0.016	0.053	mg/kg	80	120	20	
		Surr: a,a,a-Trifluorotolu	98-08-8	Soil	SW846 EPA 8021B	NA		NA	80	120	% Recovery	80	120		
CT Labs	SVOCs	Acenaphthene	83-32-9	Soil	SW846 8270D	3440	NIDC	0.0067	0.023	0.074	mg/kg	12	112	20	
		Acenaphthylene	208-96-8	Soil	SW846 8270D	NE	---	0.0059	0.024	0.077	mg/kg	22	106	20	
		Acetophenone	98-86-2	Soil	SW846 8270D	2,520	NIDC	NE	0.026	0.082	mg/kg	25	96	20	
		Aniline	62-53-3	Soil	SW846 8270D	85.2	NIDC	NE	0.011	0.034	mg/kg	12	63	20	
		Anthracene	120-12-7	Soil	SW846 8270D	198	GW	0.0572	0.021	0.068	mg/kg	30	112	20	
		Azobenzene	103-33-3	Soil	SW846 8270D	5.32	NIDC	NE	0.05	0.17	mg/kg	9	131	20	
		Benzidine	92-87-5	Soil	SW846 8270D	0.00050	NIDC	NE	0.4	1.2	mg/kg	1	138	20	
		Benzo(a)anthracene	56-55-3	Soil	SW846 8270D	0.148	NIDC	0.108	0.022	0.070	mg/kg	35	134	20	
		Benzo(b)fluoranthene	205-99-2	Soil	SW846 8270D	0.148	NIDC	0.24	0.014	0.045	mg/kg	19	141	20	
		Benzo(k)fluoranthene	207-08-9	Soil	SW846 8270D	1.48	NIDC	0.24	0.017	0.053	mg/kg	41	134	20	

Labor-atory	Analyte Group	Analyte	CAS #	Matrix	Analytical Method	WI Soil Standard	Soil Standard References (see note 1)	WI Sediment TEC (see note 2)	DL/MDL	LOQ/PQL	Units	LCL % Recovery	UCL % Recovery	RPDL	Comments
		Benzo(g,h,i)perylene	191-24-2	Soil	SW846 8270D	NE	---	0.17	0.029	0.092	mg/kg	26	153	20	
		Benzo(a)pyrene	50-32-8	Soil	SW846 8270D	0.0148	NIDC	0.15	0.020	0.064	mg/kg	46	128	20	
		4-Bromophenylphenyl ether	101-55-3	Soil	SW846 8270D	NE	---	NE	0.015	0.057	mg/kg	14	122	20	
		Butylbenzylphthalate	85-68-7	Soil	SW846 8270D	256	NIDC	NE	0.017	0.054	mg/kg	48	135	20	
		Carbazole	86-74-8	Soil	SW846 8270D	NE	---	NE	0.027	0.085	mg/kg	40	126	20	
		4-Chloroaniline	106-47-8	Soil	SW846 8270D	2.43	NIDC	NE	0.010	0.032	mg/kg	1	100	20	
		bis(2-Chloroethoxy)methane	111-91-1	Soil	SW846 8270D	183	NIDC	NE	0.021	0.067	mg/kg	22	92	20	
		bis(2-Chloroethyl) ether	111-44-4	Soil	SW846 8270D	0.265	NIDC	NE	0.016	0.050	mg/kg	26	100	20	
		2,2'-Oxybis(1-chloropropane)	108-60-1	Soil	SW846 8270D	5.4	NIDC	NE	0.025	0.078	mg/kg	16	117	20	
		4-Chloro-3-methylphenol	59-50-7	Soil	SW846 8270D	6,110	NIDC	NE	0.027	0.087	mg/kg	9	100	20	
		2-Chloronaphthalene	91-58-7	Soil	SW846 8270D	6,290	NIDC	NE	0.016	0.051	mg/kg	7	113	20	
		2-Chlorophenol	95-57-8	Soil	SW846 8270D	391	NIDC	NE	0.027	0.085	mg/kg	24	92	20	
		4-Chlorophenylphenyl ether	7005-72-3	Soil	SW846 8270D	NE	---	NE	0.023	0.074	mg/kg	12	115	20	
		Chrysene	218-01-9	Soil	SW846 8270D	0.145	GW	0.166	0.024	0.077	mg/kg	30	139	20	
		Dibenz(a,h)anthracene	53-70-3	Soil	SW846 8270D	0.0148	NIDC	0.033	0.022	0.070	mg/kg	28	146	20	
		Dibenzofuran	132-64-9	Soil	SW846 8270D	72.2	NIDC	0.15	0.020	0.063	mg/kg	8	108	20	
		Di-n-butylphthalate	84-74-2	Soil	SW846 8270D	5.04	GW	2.2	0.021	0.066	mg/kg	47	126	20	
		1,2-Dichlorobenzene	95-50-1	Soil	SW846 8270D	1.168	GW	0.023	0.025	0.079	mg/kg	25	91	20	
		1,3-Dichlorobenzene	541-73-1	Soil	SW846 8270D	1.153	GW	NE	0.020	0.065	mg/kg	22	91	20	
		1,4-Dichlorobenzene	106-46-7	Soil	SW846 8270D	0.144	GW	0.031	0.020	0.064	mg/kg	25	85	20	
		3,3'-Dichlorobenzidine	91-94-1	Soil	SW846 8270D	1.08	NIDC	NE	0.030	0.096	mg/kg	30	95	20	
		2,4-Dichlorophenol	120-83-2	Soil	SW846 8270D	183	NIDC	NE	0.027	0.086	mg/kg	23	92	20	
CT Labs	SVOCs	2,6-Dichlorophenol	87-65-0	Soil	SW846 8270D	NE	---	NE	0.023	0.073	mg/kg	5	94	20	
		Diethylphthalate	84-66-2	Soil	SW846 8270D	48,900	NIDC	0.61	0.020	0.063	mg/kg	22	125	20	
		2,4-Dimethylphenol	105-67-9	Soil	SW846 8270D	1,220	NIDC	0.29	0.024	0.076	mg/kg	1	108	20	
		Dimethylphthalate	131-11-3	Soil	SW846 8270D	NE	---	0.53	0.023	0.074	mg/kg	16	117	20	
		Di-n-octylphthalate	117-84-0	Soil	SW846 8270D	611	NIDC	0.58	0.019	0.061	mg/kg	51	131	20	
		4,6-Dinitro-2-methylphenol	534-52-1	Soil	SW846 8270D	4.89	NIDC	NE	0.015	0.049	mg/kg	1	136	20	
		2,4-Dinitrophenol	51-28-5	Soil	SW846 8270D	122	NIDC	NE	0.10	0.33	mg/kg	1	123	20	
		2,4-Dinitrotoluene	121-14-2	Soil	SW846 8270D	0.00013	GW	NE	0.022	0.072	mg/kg	7	128	20	
		2,6-Dinitrotoluene	606-20-2	Soil	SW846 8270D	0.00014	GW	NE	0.031	0.098	mg/kg	1	126	20	
		bis(2-Ethylhexyl)phthalate	117-81-7	Soil	SW846 8270D	2.88	GW	NE	0.019	0.062	mg/kg	46	138	20	
		Fluoranthene	206-44-0	Soil	SW846 8270D	88.9	GW	0.423	0.021	0.066	mg/kg	37	141	20	
		Fluorene	86-73-7	Soil	SW846 8270D	14.8	GW	0.0774	0.022	0.071	mg/kg	8	117	20	
		Hexachlorobenzene	118-74-1	Soil	SW846 8270D	0.0252	GW	NE	0.030	0.094	mg/kg	30	114	20	
		Hexachlorobutadiene	87-68-3	Soil	SW846 8270D	6.22	NIDC	NE	0.028	0.089	mg/kg	27	90	20	
		Hexachlorocyclopentadiene	77-47-4	Soil	SW846 8270D	366	NIDC	NE	0.015	0.046	mg/kg	8	103	20	
		Hexachloroethane	67-72-1	Soil	SW846 8270D	12.1	NIDC	NE	0.025	0.079	mg/kg	25	82	20	
		Hexachloropropene	1888-71-7	Soil	SW846 8270D	NE	---	NE	0.024	0.077	mg/kg	20	89	20	
		Indeno(1,2,3-cd)pyrene	193-39-5	Soil	SW846 8270D	0.148	NIDC	0.2	0.024	0.075	mg/kg	40	143	20	
		Isophorone	78-59-1	Soil	SW846 8270D	511	NIDC	NE	0.026	0.083	mg/kg	18	103	20	
		2-Methylnaphthalene	91-57-6	Soil	SW846 8270D	229	NIDC	0.0202	0.04	0.13	mg/kg	15	116	20	
		2-Methylphenol (o-Cresol)	95-48-7	Soil	SW846 8270D	3.060	NIDC	6.7	0.030	0.094	mg/kg	24	86	20	
		3&4-Methylphenol (m&p Cresol)	1319-77-3	Soil	SW846 8270D	NE		NE	0.030	0.095	mg/kg	20	90	20	
		Naphthalene	91-20-3	Soil	SW846 8270D	0.658	GW	0.176	0.018	0.056	mg/kg	31	89	20	

Labor-atory	Analyte Group	Analyte	CAS #	Matrix	Analytical Method	WI Soil Standard	Soil Standard References (see note 1)	WI Sediment TEC (see note 2)	DL/MDL	LOQ/PQL	Units	LCL % Recovery	UCL % Recovery	RPDL	Comments
CT Labs	SVOCs	2-Nitroaniline	88-74-4	Soil	SW846 8270D	606	NIDC	NE	0.020	0.062	mg/kg	6	122	20	
		3-Nitroaniline	99-09-2	Soil	SW846 8270D	NE	---	NE	0.015	0.049	mg/kg	10	113	20	
		4-Nitroaniline	100-01-6	Soil	SW846 8270D	24.3	NIDC	NE	0.03	0.11	mg/kg	1	140	20	
		Nitrobenzene	98-95-3	Soil	SW846 8270D	6.92	NIDC	NE	0.04	0.11	mg/kg	21	106	20	
		2-Nitrophenol	88-75-5	Soil	SW846 8270D	NE	---	NE	0.023	0.073	mg/kg	27	92	20	
		4-Nitrophenol	100-02-7	Soil	SW846 8270D	NE	---	NE	0.10	0.32	mg/kg	1	138	20	
		N-Nitrosodimethylamine	62-75-9	Soil	SW846 8270D	0.0026	NIDC	NE	0.027	0.087	mg/kg	24	86	20	
		N-Nitroso-di-n-propylamine	621-64-7	Soil	SW846 8270D	0.0694	NIDC	NE	0.026	0.084	mg/kg	24	97	20	
		N-Nitrosodiphenylamine	86-30-6	Soil	SW846 8270D	0.0764	GW	NE	0.03	0.10	mg/kg	19	133	20	
		N-Nitrosopyrrolidine	930-55-2	Soil	SW846 8270D	0.231	NIDC	NE	0.031	0.099	mg/kg	24	97	20	
		Pentachlorophenol (PCP)	87-86-5	Soil	SW846 8270D	0.0202	GW	0.15	0.021	0.066	mg/kg	13	127	20	
		Phenanthrene	85-01-8	Soil	SW846 8270D	NE	---	0.204	0.016	0.049	mg/kg	25	129	20	
		Phenol	108-95-2	Soil	SW846 8270D	2.295	GW	4.2	0.031	0.098	mg/kg	13	100	20	
		Pyrene	129-00-0	Soil	SW846 8270D	54.1	GW	0.195	0.018	0.058	mg/kg	42	130	20	
		Pyridine	110-86-1	Soil	SW846 8270D	0.0069	GW	NE	0.017	0.053	mg/kg	1	63	20	
		1,2,4,5-Tetrachlorobenzene	95-94-3	Soil	SW846 8270D	NE	---	NE	0.025	0.080	mg/kg	24	99	20	
		1,2,4-Trichlorobenzene	120-82-1	Soil	SW846 8270D	0.408	GW	0.008	0.023	0.073	mg/kg	1	107	20	
		2,4,5-Trichlorophenol	95-95-4	Soil	SW846 8270D	6,110	NIDC	NE	0.028	0.089	mg/kg	7	126	20	
		2,4,6-Trichlorophenol	88-06-2	Soil	SW846 8270D	NE	---	NE	0.026	0.082	mg/kg	4	104	20	
		Surr: Nitrobenzene-d5	4165-60-0	Soil	SW846 8270D	NA	---	NA	31	102	% Recovery	31	102		Surrogate
		Surr: 2-Fluorobiphenyl	321-60-8	Soil	SW846 8270D	NA	---	NA	37	99	% Recovery	37	99		Surrogate
		Surr: Phenol-d5	4165-62-2	Soil	SW846 8270D	NA	---	NA	29	120	% Recovery	29	120		Surrogate
		Surr: 2-Fluorophenol	367-12-4	Soil	SW846 8270D	NA	---	NA	29	108	% Recovery	29	108		Surrogate
		Surr: 2,4,6-Tribromophenol	118-79-8	Soil	SW846 8270D	NA	---	NA	50	109	% Recovery	50	109		Surrogate
		Surr: Terphenyl-d14	1718-51-0	Soil	SW846 8270D	NA	---	NA	48	106	% Recovery	48	106		Surrogate
CT Labs	PAHs	Anthracene	120-12-7	Soil	SW846 8310	198	GW	0.0572	0.009	0.050	mg/kg	42	119	47	
		Pyrene	129-00-0	Soil	SW846 8310	54	GW	0.195	0.006	0.050	mg/kg	31	127	52	
		Benzo(g,h,i)perylene	191-24-2	Soil	SW846 8310	NE	---	0.17	0.005	0.025	mg/kg	16	139	46	
		Indeno(1,2,3-cd)pyrene	193-39-5	Soil	SW846 8310	0.148	NIDC	0.2	0.004	0.025	mg/kg	29	125	49	
		Benzo(b)fluoranthene	205-99-2	Soil	SW846 8310	0.148	NIDC	0.24	0.0015	0.0100	mg/kg	20	138	49	
		Fluoranthene	206-44-0	Soil	SW846 8310	89	GW	0.423	0.0019	0.0100	mg/kg	26	133	51	
		Benzo(k)fluoranthene	207-08-9	Soil	SW846 8310	1.48	NIDC	0.24	0.003	0.011	mg/kg	25	129	50	
		Acenaphthylene	208-96-8	Soil	SW846 8310	NE	---	0.0059	0.04	0.30	mg/kg	37	127	43	
		Chrysene	218-01-9	Soil	SW846 8310	0.14	GW	0.166	0.007	0.025	mg/kg	38	130	51	
		Surr: Decafluorobiphenyl	434-90-2	Soil	SW846 8310	NA	---	NA	31	118	% Recovery	31	118		Surrogate
		Benzo(a)pyrene	50-32-8	Soil	SW846 8310	0.015	NIDC	0.15	0.003	0.013	mg/kg	28	132	50	
		Dibenz(a,h)anthracene	53-70-3	Soil	SW846 8310	0.015	NIDC	0.033	0.010	0.050	mg/kg	40	119	43	
		Benzo(a)anthracene	56-55-3	Soil	SW846 8310	0.148	NIDC	0.108	0.0023	0.0077	mg/kg	29	134	54	
		Acenaphthene	83-32-9	Soil	SW846 8310	3440	NIDC	0.0067	0.05	0.30	mg/kg	24	136	51	
		Phenanthrene	85-01-8	Soil	SW846 8310	NE	---	0.204	0.013	0.050	mg/kg	37	132	49	
		Fluorene	86-73-7	Soil	SW846 8310	15	GW	0.0774	0.020	0.150	mg/kg	45	114	47	
		1-Methylnaphthalene	90-12-0	Soil	SW846 8310	15.6	NIDC	NE	0.03	0.30	mg/kg	35	124	47	
		Naphthalene	91-20-3	Soil	SW846 8310	0.66	GW	0.176	0.04	0.30	mg/kg	44	132	45	
		2-Methylnaphthalene	91-57-6	Soil	SW846 8310	229	NIDC	0.0202	0.04	0.30	mg/kg	36	127	48	

Labor-atory	Analyte Group	Analyte	CAS #	Matrix	Analytical Method	WI Soil Standard	Soil Standard References (see note 1)	WI Sediment TEC (see note 2)	DL/MDL	LOQ/PQL	Units	LCL % Recovery	UCL % Recovery	RPDL	Comments
CT Labs	Pesticides	4,4-DDD	72-54-8	Soil	SW846 8081B	2.02	NIDC	NE	0.0011	0.0038	mg/kg	41	139	21	
		4,4-DDE	72-55-9	Soil	SW846 8081B	1.43	NIDC	NE	0.0011	0.0036	mg/kg	35	141	29	
		4,4-DDT	50-29-3	Soil	SW846 8081B	1.72	NIDC	NE	0.0010	0.0033	mg/kg	40	153	39	
		Aldrin	309-00-2	Soil	SW846 8081B	0.029	NIDC	0.002	0.0008	0.0026	mg/kg	39	132	31	
		alpha-BHC	319-84-6	Soil	SW846 8081B	0.077	NIDC	0.006	0.0004	0.0015	mg/kg	34	140	31	
		alpha-Chlordane	5103-71-9	Soil	SW846 8081B	NE	---	NE	0.0005	0.0018	mg/kg	41	131	37	
		beta-BHC	319-85-7	Soil	SW846 8081B	0.27	NIDC	0.005	0.0008	0.0026	mg/kg	35	143	40	
		delta-BHC	319-89-9	Soil	SW846 8081B	NE	---	NE	0.0007	0.0023	mg/kg	28	129	32	
		Chlordane (Technical)	57-74-9	Soil	SW846 8081B	NE	---	0.0032	0.0050	0.0180	mg/kg	45	128	20	
		Dieldrin	60-57-1	Soil	SW846 8081B	0.030	NIDC	0.0019	0.0006	0.0021	mg/kg	40	135	33	
		Endosulfan I	959-98-8	Soil	SW846 8081B	NE	---	NE	0.0006	0.0021	mg/kg	42	130	39	
		Endosulfan II	33213-65-9	Soil	SW846 8081B	NE	---	NE	0.0006	0.0019	mg/kg	45	135	32	
		Endosulfan sulfate	1031-07-8	Soil	SW846 8081B	NE	---	NE	0.0013	0.0044	mg/kg	32	142	36	
		Endrin	72-20-8	Soil	SW846 8081B	0.16	GW	0.0022	0.0006	0.0021	mg/kg	40	155	43	
		Endrin aldehyde	7421-93-4	Soil	SW846 8081B	NE	---	NE	0.0011	0.0035	mg/kg	26	132	35	
		Endrin ketone	53494-70-5	Soil	SW846 8081B	NE	---	NE	0.0015	0.0049	mg/kg	37	150	30	
		gamma-BHC (Lindane)	58-89-9	Soil	SW846 8081B	0.0023	GW	0.003	0.0005	0.0016	mg/kg	39	136	39	
		gamma-Chlordane	5103-74-2	Soil	SW846 8081B	NE	---	NE	0.0005	0.0015	mg/kg	40	135	38	
		Heptachlor	76-44-8	Soil	SW846 8081B	0.108	NIDC	NE	0.0019	0.0063	mg/kg	38	151	28	
		Heptachlor epoxide	1024-57-3	Soil	SW846 8081B	0.0082	GW	0.0025	0.0008	0.0027	mg/kg	45	128	36	
		Methoxychlor	72-43-5	Soil	SW846 8081B	4.3	GW	NE	0.0010	0.0034	mg/kg	38	159	42	
		Toxaphene	8001-35-2	Soil	SW846 8081B	0.441	NIDC	0.001	0.0090	0.0310	mg/kg	42	134	20	
		Surr: 2,4,5,6-CL4-m-xylene	877-09-8	Soil	SW846 8081B	NA	---		39	131	% Recovery	39	131		Surrogate
		Surr: Decachlorobiphenyl	2051-24-3	Soil	SW846 8081B	NA	---		40	138	% Recovery	40	138	38	Surrogate
CT Labs	PCBs	Aroclor® 1016	12674-11-2	Soil	SW846 8082A	3.93	NIDC	NE	0.010	0.034	mg/kg	48	151	40	
		Aroclor® 1221	11104-28-2	Soil	SW846 8082A	0.159	NIDC	NE	0.011	0.035	mg/kg				
		Aroclor® 1232	11141-16-5	Soil	SW846 8082A	0.159	NIDC	NE	0.008	0.027	mg/kg				
		Aroclor® 1242	53469-21-9	Soil	SW846 8082A	0.221	NIDC	NE	0.004	0.014	mg/kg				
		Aroclor® 1248	12672-29-6	Soil	SW846 8082A	0.221	NIDC	NE	0.003	0.009	mg/kg				
		Aroclor® 1254	11097-69-1	Soil	SW846 8082A	0.221	NIDC	NE	0.005	0.017	mg/kg				
		Aroclor® 1260	11096-82-5	Soil	SW846 8082A	0.221	NIDC	NE	0.011	0.035	mg/kg	51	143	38	
		Surr: 2,4,5,6-tetrachloro-m-xylene	877-09-8	Soil	SW846 8082A	NE	---	NE	54	135	% Recovery	54	135	20	Surrogate
		Surr: Decachlorobiphenyl (DCBP)	2051-24-3	Soil	SW846 8082A	NE	---	NE	54	141	% Recovery	54	141	20	Surrogate
CT Labs	Other	Gasoline Range Organics	8006-61-9	Soil	WI Mod GRO	NE	---	NE	1.4	4.6	mg/kg	73	128	20	
		Diesel Range Organics	68334-30-5	Soil	WI Mod DRO	NE	---	NE	2.4	8.0	mg/kg	70	124	20	
CT Labs	ICP Metals	Aluminum	7429-90-5	Soil	SW846 6010C	600	GW	NE	0.4	1.2	mg/kg	75	125	20	
		Antimony	7440-36-0	Soil	SW846 6010C	0.54	GW	2	0.4	1.4	mg/kg	75	125	20	
		Arsenic	7440-38-2	Soil	SW846 6010C	0.58	GW	9.8	0.3	1.1	mg/kg	54	131	29	
		Barium	7440-39-3	Soil	SW846 6010C	164.8	GW	NE	0.04	0.14	mg/kg	59	131	20	
		Beryllium	7440-41-7	Soil	SW846 6010C	6.3	GW	NE	0.014	0.046	mg/kg	75	125	20	
		Boron	7440-42-8	Soil	SW846 6010C	6.4	GW	NE	0.3	1.1	mg/kg	75	125	20	
		Cadmium	7440-43-9	Soil	SW846 6010C	0.75	GW	0.99	0.019	0.064	mg/kg	52	133	29	
		Calcium	7440-70-2	Soil	SW846 6010C	NE	---	NE	1.1	3.7	mg/kg	75	125	20	

Table 2D
Analytical Parameters, Reporting Limits, Precision and Accuracy
CT Laboratories - Soil Samples

Labor-atory	Analyte Group	Analyte	CAS #	Matrix	Analytical Method	WI Soil Standard	Soil Standard References (see note 1)	WI Sediment TEC (see note 2)	DL/MDL	LOQ/PQL	Units	LCL % Recovery	UCL % Recovery	RPDL	Comments
CT Labs	ICP Metals	Chromium	7440-47-3	Soil	SW846 6010C	360,000 if no Cr-V	GW	43	0.07	0.22	mg/kg	65	121	27	
		Cobalt	7440-48-4	Soil	SW846 6010C	3.6	GW	NE	0.04	0.15	mg/kg	75	125	20	
		Copper	7440-50-8	Soil	SW846 6010C	91.6	GW	32	0.12	0.38	mg/kg	75	125	20	
		Iron	7439-89-6	Soil	SW846 6010C	54800	NIDC	20,000	0.9	2.9	mg/kg	75	125	20	
		Lead	7439-92-1	Soil	SW846 6010C	27	GW	36	0.26	0.87	mg/kg	59	126	35	
		Magnesium	7439-95-4	Soil	SW846 6010C	NE	---	NE	0.3	1.0	mg/kg	75	125	20	
		Manganese	7439-96-5	Soil	SW846 6010C	39	GW	460	0.20	0.65	mg/kg	75	125	20	
		Molybdenum	7439-98-7	Soil	SW846 6010C	1.6	GW	NE	0.17	0.55	mg/kg	75	125	20	
		Nickel	7440-02-0	Soil	SW846 6010C	13	GW	23	0.14	0.48	mg/kg	75	125	20	
		Potassium	7440-09-7	Soil	SW846 6010C	NE	---	NE	17	57	mg/kg	49	133	21	
		Selenium	7782-49-2	Soil	SW846 6010C	0.52	GW	NE	0.5	1.6	mg/kg	75	125	28	
		Silver	7440-22-4	Soil	SW846 6010C	0.85	GW	1.6	0.13	0.39	mg/kg	56	125	27	
		Sodium	7440-23-5	Soil	SW846 6010C	NE	---	NE	10	32	mg/kg	75	125	20	
		Thallium	7440-28-0	Soil	SW846 6010C	0.28	GW	NE	0.28	0.94	mg/kg	75	125	20	
		Tin	7440-31-5	Soil	SW846 6010C	46900	NIDC	NE	0.22	0.74	mg/kg	75	125	20	
		Titanium	7440-32-6	Soil	SW846 6010C	NE	---	NE	0.17	0.57	mg/kg	75	125	20	
		Vanadium	7440-62-2	Soil	SW846 6010C	60	GW	NE	0.17	0.55	mg/kg	75	125	20	
		Zinc	7440-66-6	Soil	SW846 6010C	23500	NIDC	120	0.10	0.33	mg/kg	75	125	20	
CT Labs	GFA Metals	Antimony	7440-36-0	Soil	SW846 7010	0.54	GW	2	0.07	0.22	mg/kg	80	120	20	
		Arsenic	7440-38-2	Soil	SW846 7010	0.58	GW	9.8	0.12	0.41	mg/kg	80	120	20	
		Lead	7439-92-1	Soil	SW846 7010	27	GW	36	0.023	0.077	mg/kg	80	120	20	
		Selenium	7782-49-2	Soil	SW846 7010	0.52	GW	NE	0.08	0.27	mg/kg	80	120	20	
		Silver	7440-22-4	Soil	SW846 7010	0.85	GW	1.6	0.0026	0.0086	mg/kg	80	120	20	
		Thallium	7440-28-0	Soil	SW846 7010	0.28	GW	NE	0.0008	0.0027	mg/kg	80	120	20	
CT Labs	Other Metals	Hexavalent Chromium	18540-29-9	Soil	EPA 7196A	0.293	NIDC	NE	0.9	2.9	mg/kg	82	115	20	
		Mercury	7439-97-6	Soil	SW846 7471B	0.21	GW	0.18	0.004	0.013	mg/kg	78	112	20	
CT Labs	Misc	Cyanide	57-12-5	Soil	SW846 9012	26.4	NIDC	NE	0.11	0.36	mg/kg	69	131	20	
		Flashpoint	NA	Soil	EPA 1010A	NE	---	NE	NA	NA	degrees F	90	110	5	
		Total Organic Carbon (TOC)	14808-79-8	Soil	Lloyd Kahn/9060A	NE	---	NE	256	853	mg/kg	84	113	30	
		Phosphorous (total)	18540-29-9	Soil	EPA 365.4	1.56	NIDC	NE	15	49	mg/kg	85	120	20	
		Reactive cyanide	57-12-5	Soil	ASTM D5049	NE	---	NE	10	N/A	mg/kg	70	130	20	
		Reactive sulfide	18496-25-8	Soil	ASTM D4978	NE	---	NE	2	N/A	mg/kg	70	130	20	

Notes: Yellow shading designates DLs or MDLs that exceed the WI soil reference standards and/or sediment TECs.
1) Soil References:
A) WDNR residual contaminant levels for protection of groundwater (non-idustrial settings).
B) WDNR residual contaminant levels for protection of human health from direct contact (non-industrial settings)
2) All WI Sediment TECs shown are from "Consensus-Based Sediment Quality Guidelines, Recommendations for Use & Application, Interim Guidance, WDNR Publication WT-732 2003 (December 2003)
3) The RCL shown for xylenes is for total xylenes
4) The RCL shown for GRO and DRO is for sites having relatively high permeability soil (as defined in Chapter NR720, Wisc. Adm. Code).

CAS = Chemical Abstracts Service
DL = detection limit
DRO = diesel range organic
EPA = Environmental Protection Agency
F = Fahrenheit
GFA = graphite furnace atomic absorption spectrometry
GRO = gasoline range organic
ICP = inductively coupled plasma
LCL = lower control limit
LOQ = limit of quantification
LUST = leaking underground storage tank
MDL = method detection limit
mg/L = milligrams per liter
misc = miscellaneous
mod = modified
NA = not applicable or not available
NE = not established
PAH = polynuclear aromatic hydrocarbon
PCB = polychlorinated biphenyl
PQL = practical quantitation limit
PVOC = petroleum VOC
RL = reporting limit
RPD = Relative Percent Difference
RPDL = relative percent difference limit
SIM = selected ion monitoring
SU = standard units
Surr = surrogate
SVOC = semi-volatile organic compound
TCLP = toxicity characteristic leaching procedure
TEC = threshold effect concentration
UCL = upper control limit
µg/kg = micrograms per kilogram
VOC = volatile organic compound
WI = Wisconsin
WDNR = Wisconsin Department of Natural Resources

Table 2E
Analytical Parameters, Reporting Limits, Precision and Accuracy
CT Laboratories - Water Samples

Laboratory	Analyte Group	Analyte	CAS #	Matrix	Analytical Method	WI Groundwater Preventive Action Limits	DL/MDL	LOQ/PQL	Units	LCL % Recovery	UCL % Recovery	RPDL (%)	Comments
CT Labs	VOCs	1,1,1,2-Tetrachloroethane	630-20-6	Water	SW846 8260C	7	0.6	2.0	ug/L	80	118	20	
		1,1,1-Trichloroethane (TCA)	71-55-6	Water	SW846 8260C	40	0.25	0.84	ug/L	83	120	20	
		1,1,2,2-Tetrachloroethane	79-34-5	Water	SW846 8260C	0.02	0.5	1.8	ug/L	75	126	20	
		1,1,2-Trichloroethane	79-00-5	Water	SW846 8260C	0.5	0.21	0.70	ug/L	82	120	20	
		1,1-Dichloroethane	75-34-3	Water	SW846 8260C	85	0.5	1.8	ug/L	85	118	20	
		1,1-Dichloroethene	75-35-4	Water	SW846 8260C	0.7	0.23	0.78	ug/L	83	120	20	
		1,1-Dichloropropene	563-58-6	Water	SW846 8260C	NE	0.4	1.3	ug/L	82	120	20	
		1,2,3-Trichlorobenzene	87-61-6	Water	SW846 8260C	NE	0.4	1.2	ug/L	59	137	20	
		1,2,3-Trichloropropane	96-18-4	Water	SW846 8260C	12	0.7	2.3	ug/L	76	122	20	
		1,2,4-Trichlorobenzene	120-82-1	Water	SW846 8260C	14	0.5	1.8	ug/L	68	127	20	
		1,2,4-Trimethylbenzene	95-63-6	Water	SW846 8260C	96	0.6	1.9	ug/L	80	121	20	See note 2
		1,2-Dibromo-3-chloropropane (DBCP)	96-12-8	Water	SW846 8260C	0.02	0.7	2.4	ug/L	57	134	20	
		1,2-Dibromoethane (EDB)	106-93-4	Water	SW846 8260C	0.005	0.4	1.4	ug/L	82	116	20	
		1,2-Dichlorobenzene	95-50-1	Water	SW846 8260C	60	0.6	1.8	ug/L	83	118	20	
		1,2-Dichloroethane (EDC)	107-06-2	Water	SW846 8260C	0.5	0.20	0.65	ug/L	82	121	20	
		1,2-Dichloropropane	78-87-5	Water	SW846 8260C	0.5	0.5	1.7	ug/L	82	119	20	
		1,3,5-Trimethylbenzene	108-67-8	Water	SW846 8260C	96	0.5	1.6	ug/L	82	121	20	See note 2
		1,3-Dichlorobenzene	541-73-1	Water	SW846 8260C	120	0.5	1.6	ug/L	82	117	20	
		1,3-Dichloropropane	142-28-9	Water	SW846 8260C	NE	0.4	1.2	ug/L	83	119	20	
		1,4-Dichlorobenzene	106-46-7	Water	SW846 8260C	15	0.5	1.8	ug/L	83	116	20	
		2,2-Dichloropropane	594-20-7	Water	SW846 8260C	NE	0.6	1.9	ug/L	63	140	20	
		Methyl ethyl ketone (2-Butanone)	78-93-3	Water	SW846 8260C	800	5	18	ug/L	69	137	20	
		2-Hexanone	591-78-6	Water	SW846 8260C	NE	6	20	ug/L	68	140	20	
		2-Chlorotoluene	95-49-8	Water	SW846 8260C	NE	0.6	1.8	ug/L	80	120	20	
		4-Chlorotoluene	106-43-4	Water	SW846 8260C	NE	0.6	1.9	ug/L	80	119	20	
		Methyl isobutyl ketone (MIBK)	108-10-1	Water	SW846 8260C	50	5	17	ug/L	73	138	20	
		Acetone	67-64-1	Water	SW846 8260C	1800	7	23	ug/L	68	138	20	
		Benzene	71-43-2	Water	SW846 8260C	0.5	0.25	0.84	ug/L	84	121	20	
		Bromobenzene	108-86-1	Water	SW846 8260C	NE	0.5	1.7	ug/L	81	117	20	
		Bromochloromethane	74-97-5	Water	SW846 8260C	NE	0.4	1.5	ug/L	83	118	20	
		Bromodichloromethane	75-27-4	Water	SW846 8260C	0.06	0.5	1.6	ug/L	81	121	20	
		Bromoform	75-25-2	Water	SW846 8260C	0.44	0.5	1.6	ug/L	58	128	20	
		Bromomethane	74-83-9	Water	SW846 8260C	1	1.0	3.4	ug/L	54	143	20	
		Carbon disulfide	75-15-0	Water	SW846 8260C	200	0.4	1.4	ug/L	64	140	20	
		Carbon tetrachloride	56-23-5	Water	SW846 8260C	0.5	0.4	1.4	ug/L	76	127	20	
		Chlorobenzene	108-90-7	Water	SW846 8260C	20	0.5	1.6	ug/L	84	118	20	
		Chloroethane	75-00-3	Water	SW846 8260C	80	0.8	2.7	ug/L	67	137	20	
		Chloroform	67-66-3	Water	SW846 8260C	0.6	0.27	0.91	ug/L	82	120	20	
		Chloromethane	74-87-3	Water	SW846 8260C	3	0.6	2.1	ug/L	66	132	20	
		1,2-Dichloroethene (cis)	156-59-2	Water	SW846 8260C	7	0.21	0.70	ug/L	84	117	20	

Table 2E
Analytical Parameters, Reporting Limits, Precision and Accuracy
CT Laboratories - Water Samples

Laboratory	Analyte Group	Analyte	CAS #	Matrix	Analytical Method	WI Groundwater Preventive Action Limits	DL/MDL	LOQ/PQL	Units	LCL % Recovery	UCL % Recovery	RPDL (%)	Comments
CT Labs	VOCs (cont'd)	1,3-Dichloropropene (cis)	10061-01-5	Water	SW846 8260C	0.04	0.4	1.4	ug/L	78	122	20	See note 1
		Dibromochloromethane	124-48-1	Water	SW846 8260C	6	0.4	1.5	ug/L	72	122	20	
		Dibromomethane	74-95-3	Water	SW846 8260C	NE	0.6	2.0	ug/L	85	116	20	
		Dichlorodifluoromethane	75-71-8	Water	SW846 8260C	200	0.6	2.0	ug/L	62	141	20	
		Diisopropyl ether	108-20-3	Water	SW846 8260C	NE	0.6	2.0	ug/L	79	128	20	
		Ethylbenzene	100-41-4	Water	SW846 8260C	140	0.5	1.6	ug/L	84	120	20	
		Hexachloro-1,3-butadiene	87-68-3	Water	SW846 8260C	NE	0.8	2.8	ug/L	64	138	20	
		Isopropylbenzene (Cumene)	98-82-8	Water	SW846 8260C	NE	0.4	1.5	ug/L	76	126	20	
		m&p-Xylene	179601-23-1	Water	SW846 8260C	400	1.0	3.3	ug/L	84	120	20	See note 3
		Methylene Chloride	75-09-2	Water	SW846 8260C	0.5	0.5	1.8	ug/L	76	129	20	
		Methyl tert-butyl ether (MTBE)	1634-04-4	Water	SW846 8260C	12	0.20	0.67	ug/L	80	123	20	
		Naphthalene	91-20-3	Water	SW846 8260C	10	0.5	1.5	ug/L	51	142	20	
		n-Butylbenzene	104-51-8	Water	SW846 8260C	NE	0.4	1.4	ug/L	74	128	20	
		n-Propylbenzene	103-65-1	Water	SW846 8260C	NE	0.4	1.5	ug/L	81	122	20	
		o-Xylene	95-47-6	Water	SW846 8260C	400	0.5	1.8	ug/L	83	118	20	See note 3
		p-Isopropyltoluene	99-87-6	Water	SW846 8260C	NE	0.5	1.6	ug/L	79	123	20	
		sec-Butylbenzene	135-98-8	Water	SW846 8260C	NE	0.5	1.7	ug/L	80	122	20	
		Styrene	100-42-5	Water	SW846 8260C	10	0.4	1.2	ug/L	83	119	20	
		tert-Butylbenzene	98-06-6	Water	SW846 8260C	NE	0.5	1.6	ug/L	80	122	20	
		Tetrachloroethene (PCE)	127-18-4	Water	SW846 8260C	0.5	0.24	0.81	ug/L	80	125	20	
		Tetrahydrofuran	109-99-9	Water	SW846 8260C	10	4	12	ug/L	73	134	20	
		Toluene	108-88-3	Water	SW846 8260C	160	0.5	1.6	ug/L	85	120	20	
		1,2-Dichloroethene (trans)	156-60-5	Water	SW846 8260C	20	0.20	0.68	ug/L	83	119	20	
		1,3-Dichloropropene (trans)	10061-02-6	Water	SW846 8260C	0.04	0.4	1.5	ug/L	70	125	20	See note 1
		Trichloroethene (TCE)	79-01-6	Water	SW846 8260C	0.5	0.24	0.79	ug/L	82	119	20	
		Trichlorofluoromethane (CFC 11)	75-69-4	Water	SW846 8260C	698	0.3	1.0	ug/L	80	128	20	
		Vinyl chloride	75-01-4	Water	SW846 8260C	0.02	0.18	0.60	ug/L	76	127	20	
		Surr: 1,2 Dichloroethane-d4	17060-07-0	Water	SW846 8260C	NA	89	112	% Recovery	83	116		Surrogate
		Surr: 4-Bromofluorobenzene	460-00-4	Water	SW846 8260C	NA	80	125	% Recovery	80	129		Surrogate
		Surr: Dibromofluoromethane	1868-53-7	Water	SW846 8260C	NA	88	115	% Recovery	85	115		Surrogate
		Surr: Toluene-d8	2037-26-5	Water	SW846 8260C	NA	88	115	% Recovery	85	117		Surrogate
CT Labs	PVOC LUST	1,2,4-Trimethylbenzene	95-63-6	Water	SW846 8021B	96	0.6	2.1	ug/L	80	120	20	See note 2
		1,3,5-Trimethylbenzene	108-67-8	Water	SW846 8021B	96	0.5	1.5	ug/L	80	120	20	See note 2
		Benzene	71-43-2	Water	SW846 8021B	0.5	0.5	1.5	ug/L	80	120	20	
		Ethylbenzene	100-41-4	Water	SW846 8021B	140	0.5	1.8	ug/L	80	120	20	
		Methyl tert-butyl ether (MTBE)	1634-04-4	Water	SW846 8021B	12	0.5	1.7	ug/L	80	120	20	
		Toluene	108-88-3	Water	SW846 8021B	160	0.4	1.5	ug/L	80	120	20	
		m & p-Xylene	1330-20-7	Water	SW846 8021B	400	1.0	3.3	ug/L	80	120	20	See note 3
		o-Xylene	95-47-6	Water	SW846 8021B	400	0.5	1.6	ug/L	80	120	20	See note 3
		Surr: a,a,a-Trifluorotolu	98-08-8	Water	SW846 8021B	NA	80	120	% Recovery	80	120	20	Surrogate

Laboratory	Analyte Group	Analyte	CAS #	Matrix	Analytical Method	WI Groundwater Preventive Action Limits	DL/MDL	LOQ/PQL	Units	LCL % Recovery	UCL % Recovery	RPDL (%)	Comments
CT Labs	SVOCs	1,2,4,5-Tetrachlorobenzene	95-94-3	Water	SW846 8270D	NE	0.24	0.79	ug/L	40	110	25	
		1,2,4-Trichlorobenzene	120-82-1	Water	SW846 8270D	14	0.22	0.73	ug/L	33	109	27	
		1,2-Dichlorobenzene	95-50-1	Water	SW846 8270D	60	0.17	0.54	ug/L	34	105	27	
		1,3-Dichlorobenzene	541-73-1	Water	SW846 8270D	120	0.14	0.43	ug/L	33	102	28	
		1,4-Dichlorobenzene	106-46-7	Water	SW846 8270D	15	0.17	0.53	ug/L	31	104	26	
		2,4,5-Trichlorophenol	95-95-4	Water	SW846 8270D	NE	0.5	1.6	ug/L	45	116	25	
		2,4,6-Trichlorophenol	88-06-2	Water	SW846 8270D	NE	0.12	0.40	ug/L	41	118	35	
		2,4-Dichlorophenol	120-83-2	Water	SW846 8270D	NE	0.5	1.5	ug/L	44	114	33	
		2,4-Dimethylphenol	105-67-9	Water	SW846 8270D	NE	0.18	0.56	ug/L	40	117	43	
		2,4-Dinitrophenol	51-28-5	Water	SW846 8270D	NE	1.5	4.9	ug/L	21	125	49	
		2,4-Dinitrotoluene	121-14-2	Water	SW846 8270D	0.005	0.20	0.66	ug/L	63	114	10	
		2,6-Dichlorophenol	87-65-0	Water	SW846 8270D	NE	0.4	1.1	ug/L	25	124	40	
		2,6-Dinitrotoluene	606-20-2	Water	SW846 8270D	0.005	0.19	0.61	ug/L	61	112	16	
		2-Chloronaphthalene	91-58-7	Water	SW846 8270D	NE	0.19	0.58	ug/L	48	106	23	
		2-Chlorophenol	95-57-8	Water	SW846 8270D	NE	0.12	0.38	ug/L	43	103	28	
		2-Methylnaphthalene	91-57-6	Water	SW846 8270D	NE	0.4	1.1	ug/L	43	110	25	
		2-Methylphenol (o-Cresol)	95-48-7	Water	SW846 8270D	NE	0.4	1.4	ug/L	42	103	24	
		2-Nitroaniline	88-74-4	Water	SW846 8270D	NE	0.29	0.95	ug/L	58	113	14	
		2-Nitrophenol	88-75-5	Water	SW846 8270D	NE	0.28	0.89	ug/L	38	115	33	
		3&4-Methylphenol (m&p Cresol)	1319-77-3	Water	SW846 8270D	NE	0.4	1.3	ug/L	33	105	26	
		3,3'-Dichlorobenzidine	91-94-1	Water	SW846 8270D	NE	0.26	0.88	ug/L	34	161	19	
		3-Nitroaniline	99-09-2	Water	SW846 8270D	NE	0.4	1.4	ug/L	39	126	13	
		4,6-Dinitro-2-methylphenol	534-52-1	Water	SW846 8270D	NE	0.6	1.8	ug/L	35	124	39	
		4-Bromophenylphenyl ether	101-55-3	Water	SW846 8270D	NE	0.22	0.73	ug/L	58	109	15	
		4-Chloro-3-methylphenol	59-50-7	Water	SW846 8270D	NE	0.27	0.88	ug/L	52	112	21	
		4-Chloroaniline	106-47-8	Water	SW846 8270D	NE	0.15	0.48	ug/L	28	108	25	
		4-Chlorophenylphenyl ether	7005-72-3	Water	SW846 8270D	NE	0.19	0.62	ug/L	56	108	15	
		4-Nitroaniline	100-01-6	Water	SW846 8270D	NE	0.6	1.8	ug/L	51	130	20	
		4-Nitrophenol	100-02-7	Water	SW846 8270D	NE	0.6	1.9	ug/L	0	113	45	
		Acenaphthene	83-32-9	Water	SW846 8270D	NE	0.20	0.66	ug/L	52	107	20	
		Acenaphthylene	208-96-8	Water	SW846 8270D	NE	0.21	0.67	ug/L	53	107	20	
		Acetophenone	98-86-2	Water	SW846 8270D	NE	0.22	0.68	ug/L	40	124	25	
		Aniline	62-53-3	Water	SW846 8270D	NE	0.17	0.52	ug/L	18	101	56	
		Anthracene	120-12-7	Water	SW846 8270D	600	0.25	0.83	ug/L	61	111	12	
		Azobenzene	103-33-3	Water	SW846 8270D	NE	0.5	1.6	ug/L	56	112	13	
		Benzidine	92-87-5	Water	SW846 8270D	NE	2.5	7.8	ug/L	0	165	72	
		Benzo(a)anthracene	56-55-3	Water	SW846 8270D	NE	0.24	0.79	ug/L	61	113	13	
		Benzo(a)pyrene	50-32-8	Water	SW846 8270D	0.02	0.5	1.5	ug/L	61	111	18	
		Benzo(b)fluoranthene	205-99-2	Water	SW846 8270D	0.02	0.4	1.4	ug/L	59	114	21	
		Benzo(g,h,i)perylene	191-24-2	Water	SW846 8270D	NE	0.5	1.6	ug/L	52	117	27	

Table 2E
Analytical Parameters, Reporting Limits, Precision and Accuracy
CT Laboratories - Water Samples

Laboratory	Analyte Group	Analyte	CAS #	Matrix	Analytical Method	WI Groundwater Preventive Action Limits	DL/MDL	LOQ/PQL	Units	LCL % Recovery	UCL % Recovery	RPDL (%)	Comments
CT Labs	SVOCs (cont'd)	Benzo(k)fluoranthene	207-08-9	Water	SW846 8270D	NE	0.6	1.9	ug/L	61	116	25	
		Benzyl alcohol	100-51-6	Water	SW846 8270D	NE	0.28	0.91	ug/L	33	109	30	
		bis(2-Chloroethoxy)methane	111-91-1	Water	SW846 8270D	NE	0.18	0.60	ug/L	51	111	25	
		bis(2-Chloroethyl) ether	111-44-4	Water	SW846 8270D	NE	0.21	0.70	ug/L	48	105	26	
		Bis(2-Chloroisopropyl)ether	108-60-1	Water	SW846 8270D	NE	0.19	0.62	ug/L	47	109	26	
		bis(2-Ethylhexyl)phthalate	117-81-7	Water	SW846 8270D	0.6	0.27	0.89	ug/L	54	133	19	
		Butylbenzylphthalate	85-68-7	Water	SW846 8270D	NE	0.25	0.81	ug/L	53	125	10	
		Carbazole	86-74-8	Water	SW846 8270D	NE	0.27	0.88	ug/L	58	130	12	
		2-Chloro-5-methylphenol	615-74-7	Water	SW846 8270D	NE	0.76	2.5	ug/L	62	108	20	
		3 & 4-Chlorophenol	108-43-0	Water	SW846 8270D	NE	1.4	4.5	ug/L	58	83	20	
		Chrysene	218-01-9	Water	SW846 8270D	0.02	0.27	0.90	ug/L	61	114	13	
		Dibenz(a,h)anthracene	53-70-3	Water	SW846 8270D	NE	0.6	1.8	ug/L	57	114	15	
		Dibenzofuran	132-64-9	Water	SW846 8270D	NE	0.15	0.49	ug/L	56	107	17	
		2,3-Dichlorophenol	576-24-9	Water	SW846 8270D	NE	0.69	2.3	ug/L	59	123	20	
		2,5-Dichlorophenol	583-78-8	Water	SW846 8270D	NE	0.72	2.4	ug/L	61	119	20	
		3,4-Dichlorophenol	95-77-2	Water	SW846 8270D	NE	0.64	2.1	ug/L	65	127	20	
		Diethylphthalate	84-66-2	Water	SW846 8270D	NE	0.28	0.91	ug/L	49	124	10	
		Dimethylphthalate	131-11-3	Water	SW846 8270D	NE	0.22	0.72	ug/L	56	113	17	
		2,5-Dinitrophenol	329-71-5	Water	SW846 8270D	NE	0.45	1.5	ug/L	43	177	20	
		Di-n-butylphthalate	84-74-2	Water	SW846 8270D	100	0.25	0.82	ug/L	57	126	13	
		Di-n-octylphthalate	117-84-0	Water	SW846 8270D	NE	0.25	0.83	ug/L	57	122	18	
		Fluoranthene	206-44-0	Water	SW846 8270D	80	0.25	0.83	ug/L	61	113	12	
		Fluorene	86-73-7	Water	SW846 8270D	80	0.20	0.67	ug/L	58	108	14	
		Hexachlorobutadiene	87-68-3	Water	SW846 8270D	NE	0.22	0.71	ug/L	24	110	0.31	
		Hexachlorobenzene	118-74-1	Water	SW846 8270D	0.1	0.26	0.85	ug/L	50	109	11	
		Hexachlorocyclopentadiene	77-47-4	Water	SW846 8270D	NE	0.13	0.40	ug/L	45	113	32	
		Hexachloroethane	67-72-1	Water	SW846 8270D	NE	0.20	0.64	ug/L	26	105	29	
		Hexachloropropene	1888-71-7	Water	SW846 8270D	NE	0.4	1.2	ug/L	50	150	29	
		Indeno(1,2,3-cd)pyrene	193-39-5	Water	SW846 8270D	NE	0.5	1.6	ug/L	56	114	27	
		Isophorone	78-59-1	Water	SW846 8270D	NE	0.21	0.69	ug/L	50	111	25	
		2-Methyl-4-chlorophenol	1570-64-5	Water	SW846 8270D	NE	0.87	2.9	ug/L	55	121	20	
		1-Methylnaphthalene	90-12-0	Water	SW846 8270D	NE	0.20	0.64	ug/L	45	104	20	
		Naphthalene	91-20-3	Water	SW846 8270D	10	0.21	0.70	ug/L	43	106	24	
		2-Naphthylamine	91-59-8	Water	SW846 8270D	NE	1.6	5.3	ug/L	14	179	45	
		Nitrobenzene	98-95-3	Water	SW846 8270D	NE	0.22	0.70	ug/L	46	111	22	
		N-Nitrosodi-n-butylamine	924-16-3	Water	SW846 8270D	NE	0.65	2.2	ug/L	64	124	20	
		N-Nitrosodimethylamine	62-75-9	Water	SW846 8270D	NE	0.4	1.2	ug/L	9	104	25	
		N-Nitrosodi-n-propylamine	621-64-7	Water	SW846 8270D	NE	0.24	0.80	ug/L	51	111	25	
		N-Nitrosopyrrolidine	930-55-2	Water	SW846 8270D	NE	0.20	0.61	ug/L	45	113	25	
		N-Nitrosodiethylamine	55-18-5	Water	SW846 8270D	NE	0.71	2.4	ug/L	47	140	20	

Table 2E
Analytical Parameters, Reporting Limits, Precision and Accuracy
CT Laboratories - Water Samples

Laboratory	Analyte Group	Analyte	CAS #	Matrix	Analytical Method	WI Groundwater Preventive Action Limits	DL/MDL	LOQ/PQL	Units	LCL % Recovery	UCL % Recovery	RPDL (%)	Comments
CT Labs	SVOCs (cont'd)	N-Nitrosodiphenylamine	86-30-6	Water	SW846 8270D	0.7	0.5	1.5	ug/L	56	113	12	
		Pentachlorobenzene	608-93-5	Water	SW846 8270D	NE	0.65	2.2	ug/L	35	141	20	
		Pentachlorophenol (PCP)	87-86-5	Water	SW846 8270D	1.0	0.6	1.8	ug/L	36	123	41	
		Phenanthrene	85-01-8	Water	SW846 8270D	NE	0.25	0.82	ug/L	61	110	12	
		Phenol	108-95-2	Water	SW846 8270D	400	0.13	0.42	ug/L	0	108	35	
		Pyrene	129-00-0	Water	SW846 8270D	50	0.26	0.84	ug/L	60	117	19	
		Pyridine	110-86-1	Water	SW846 8270D	2.0	0.11	0.33	ug/L	0	106	66	
		2,3,4,6-Tetrachlorophenol	58-90-2	Water	SW846 8270D	NE	1.0	3.3	ug/L	50	150	20	
		Surr: Nitrobenzene-d5	4165-60-0	Water	SW846 8270D	NA	54	104	% Recovery	51	109		Surrogate
		Surr: 2-Fluorobiphenyl	321-60-8	Water	SW846 8270D	NA	45	109	% Recovery	51	106		Surrogate
		Surr: Phenol-d5	4165-62-2	Water	SW846 8270D	NA	1	114	% Recovery	1	120		Surrogate
		Surr: 2-Fluorophenol	367-12-4	Water	SW846 8270D	NA	30	96	% Recovery	21	88		Surrogate
		Surr: 2,4,6-Tribromophenol	118-79-8	Water	SW846 8270D	NA	25	144	% Recovery	48	126		Surrogate
		Surr: Terphenyl-d14	1718-51-0	Water	SW846 8270D	NA	44	130	% Recovery	58	122		Surrogate
CT Labs	PAHs	1-Methylnaphthalene	90-12-0	Water	SW846 8310	NE	0.28	3.0	ug/L	50	109	21	
		2-Methylnaphthalene	91-57-6	Water	SW846 8310	NE	0.4	3.0	ug/L	48	111	20	
		Acenaphthene	83-32-9	Water	SW846 8310	NE	0.5	3.0	ug/L	49	114	18	
		Acenaphthylene	208-96-8	Water	SW846 8310	NE	0.4	3.0	ug/L	51	111	19	
		Anthracene	120-12-7	Water	SW846 8310	600	0.12	0.50	ug/L	52	112	16	
		Benzo(a)anthracene	56-55-3	Water	SW846 8310	NE	0.018	0.062	ug/L	47	112	22	
		Benzo(a)pyrene	50-32-8	Water	SW846 8310	0.02	0.024	0.125	ug/L	37	117	56	
		Benzo(b)fluoranthene	205-99-2	Water	SW846 8310	0.02	0.027	0.100	ug/L	47	112	13	
		Benzo(g,h,i)perylene	191-24-2	Water	SW846 8310	NE	0.04	0.25	ug/L	33	109	24	
		Benzo(k)fluoranthene	207-08-9	Water	SW846 8310	NE	0.03	0.11	ug/L	43	111	16	
		Chrysene	218-01-9	Water	SW846 8310	0.02	0.05	0.50	ug/L	52	112	11	
		Dibenz(a,h)anthracene	53-70-3	Water	SW846 8310	NE	0.07	0.50	ug/L	34	109	43	
		Fluoranthene	206-44-0	Water	SW846 8310	80	0.04	0.14	ug/L	49	110	18	
		Fluorene	86-73-7	Water	SW846 8310	80	0.13	1.50	ug/L	53	111	17	
		Indeno(1,2,3-cd)pyrene	193-39-5	Water	SW846 8310	NE	0.04	0.25	ug/L	29	109	24	
		Naphthalene	91-20-3	Water	SW846 8310	10	0.4	3.0	ug/L	49	110	21	
		Phenanthrene	85-01-8	Water	SW846 8310	NE	0.08	0.50	ug/L	53	115	15	
		Pyrene	129-00-0	Water	SW846 8310	50	0.08	0.50	ug/L	56	110	13	
		Surr: Decafluorobiphenyl	434-90-2	Water	SW846 8310	NA	29	106	% Recovery	36	111		Surrogate
CT Labs	Pesticides	4,4-DDD	72-54-8	Water	SW846 8081B	NE	0.007	0.025	ug/L	65	137	20	
		4,4-DDE	72-55-9	Water	SW846 8081B	NE	0.011	0.035	ug/L	66	134	20	
		4,4-DDT	50-29-3	Water	SW846 8081B	NE	0.007	0.025	ug/L	59	145	20	
		Aldrin	309-00-2	Water	SW846 8081B	NE	0.009	0.029	ug/L	56	131	20	
		alpha-BHC	319-84-6	Water	SW846 8081B	NE	0.006	0.020	ug/L	57	137	20	
		alpha-Chlordane	5103-71-9	Water	SW846 8081B	NE	0.010	0.034	ug/L	67	132	20	
		beta-BHC	319-85-7	Water	SW846 8081B	NE	0.015	0.051	ug/L	64	134	20	

Table 2E
Analytical Parameters, Reporting Limits, Precision and Accuracy
CT Laboratories - Water Samples

Laboratory	Analyte Group	Analyte	CAS #	Matrix	Analytical Method	WI Groundwater Preventive Action Limits	DL/MDL	LOQ/PQL	Units	LCL % Recovery	UCL % Recovery	RPDL (%)	Comments
CT Labs	Pesticides (cont'd)	delta-BHC	319-89-9	Water	SW846 8081B	NE	0.008	0.025	ug/L	28	141	20	
		Dieldrin	60-57-1	Water	SW846 8081B	NE	0.009	0.031	ug/L	68	134	20	
		Endosulfan I	959-98-8	Water	SW846 8081B	NE	0.011	0.035	ug/L	66	135	20	
		Endosulfan II	33213-65-9	Water	SW846 8081B	NE	0.007	0.022	ug/L	65	138	20	
		Endosulfan sulfate	1031-07-8	Water	SW846 8081B	NE	0.010	0.033	ug/L	56	136	20	
		Endrin	72-20-8	Water	SW846 8081B	0.4	0.009	0.029	ug/L	60	149	20	
		Endrin aldehyde	7421-93-4	Water	SW846 8081B	NE	0.007	0.022	ug/L	60	131	20	
		Endrin ketone	53494-70-5	Water	SW846 8081B	NE	0.008	0.028	ug/L	63	141	20	
		Chlordane (Technical)	57-74-9	Water	SW846 8081B	0.2	0.102	0.325	ug/L	72	122	20	
		gamma-Chlordane	5103-74-2	Water	SW846 8081B	NE	0.011	0.037	ug/L	66	134	20	
		Heptachlor	76-44-8	Water	SW846 8081B	0.04	0.007	0.022	ug/L	56	137	20	
		Heptachlor epoxide	1024-57-3	Water	SW846 8081B	0.02	0.009	0.031	ug/L	69	132	20	
		Lindane (gamma-BHC)	58-89-9	Water	SW846 8081B	0.02	0.008	0.028	ug/L	64	131	20	
		Methoxychlor	72-43-5	Water	SW846 8081B	4	0.008	0.027	ug/L	59	151	20	
		Mirex	2385-85-5	Water	SW846 8081B	NE	0.010	0.020	ug/L	70	130	20	
		Toxaphene	8001-35-2	Water	SW846 8081B	0.3	0.176	0.562	ug/L	73	129	20	
		Surr: 2,4,5,6-CL4-m-xylene	877-09-8	Water	SW846 8081B	NA	59	120	% Recovery	38	132		Surrogate
		Surr: Decachlorobiphenyl	2051-24-3	Water	SW846 8081B	NA	39	146	% Recovery	52	143		Surrogate
CT Labs	PCBs	Aroclor® 1016	12674-11-2	Water	SW846 8082A	0.003	0.18	0.59	ug/L	60	136	9	See note 4
		Aroclor® 1221	11104-28-2	Water	SW846 8082A	0.003	0.23	0.77	ug/L				See note 4
		Aroclor® 1232	11141-16-5	Water	SW846 8082A	0.003	0.22	0.73	ug/L				See note 4
		Aroclor® 1242	53469-21-9	Water	SW846 8082A	0.003	0.13	0.44	ug/L				See note 4
		Aroclor® 1248	12672-29-6	Water	SW846 8082A	0.003	0.14	0.45	ug/L				See note 4
		Aroclor® 1254	11097-69-1	Water	SW846 8082A	0.003	0.13	0.44	ug/L				See note 4
		Aroclor® 1260	11096-82-5	Water	SW846 8082A	0.003	0.18	0.62	ug/L	59	137	11	See note 4
		Surr: 2,4,5,6-tetrachloro-m-xylene	877-09-8	Water	SW846 8082A	NA	45	125	% Recovery	36	146		Surrogate
		Surr: Decachlorobiphenyl (DCBP)	2051-24-3	Water	SW846 8082A	NA	34	154	% Recovery	62	145		Surrogate
CT Labs	Other	Gasoline Range Organics	8006-61-9	Water	WI Mod GRO	NE	29	98.0	ug/L	80	120	20	
		Diesel Range Organics	68334-30-5	Water	WI Mod DRO	NE	41	136.0	ug/L	75	115	20	
CT Labs	ICP Metals	Total Aluminum	7429-90-5	Water	SW846 6010C	40	6	21	ug/L	80	120	20	
		Total Antimony	7440-36-0	Water	SW846 6010C	1.2	4	13	ug/L	80	120	20	
		Total Arsenic	7440-38-2	Water	SW846 6010C	1	4	14	ug/L	80	120	20	
		Total Barium	7440-39-3	Water	SW846 6010C	400	0.4	1.2	ug/L	80	120	20	
		Total Beryllium	7440-41-7	Water	SW846 6010C	0.4	0.23	0.75	ug/L	80	120	20	
		Total Boron	7440-42-8	Water	SW846 6010C	200	2.9	9.8	ug/L	75	125	20	
		Total Cadmium	7440-43-9	Water	SW846 6010C	0.5	0.23	0.76	ug/L	80	120	20	
		Total Calcium	7440-70-2	Water	SW846 6010C	NE	10	34	ug/L	80	120	20	
		Total Chromium	7440-47-3	Water	SW846 6010C	10	1.9	6.4	ug/L	80	120	20	
		Total Cobalt	7440-48-4	Water	SW846 6010C	8	1	3.4	ug/L	80	120	20	
		Total Copper	7440-50-8	Water	SW846 6010C	130	4	13	ug/L	80	120	20	

Table 2E
Analytical Parameters, Reporting Limits, Precision and Accuracy
CT Laboratories - Water Samples

Laboratory	Analyte Group	Analyte	CAS #	Matrix	Analytical Method	WI Groundwater Preventive Action Limits	DL/MDL	LOQ/PQL	Units	LCL % Recovery	UCL % Recovery	RPDL (%)	Comments
CT Labs	ICP Metals (cont'd)	Total Iron	7439-89-6	Water	SW846 6010C	150	20	65	ug/L	80	120	20	
		Total Lead	7439-92-1	Water	SW846 6010C	1.5	1.3	4.1	ug/L	80	120	20	
		Total Magnesium	7439-95-4	Water	SW846 6010C	NE	6	20	ug/L	80	120	20	
		Total Manganese	7439-96-5	Water	SW846 6010C	60	1.4	4.7	ug/L	80	120	20	
		Total Molybdenum	7439-98-7	Water	SW846 6010C	8	0.8	2.6	ug/L	80	120	20	
		Total Nickel	7440-02-0	Water	SW846 6010C	20	2.3	7.5	ug/L	80	120	20	
		Total Potassium	7440-09-7	Water	SW846 6010C	25	170	560	ug/L	75	130	20	
		Total Selenium	7782-49-2	Water	SW846 6010C	10	5	17	ug/L	80	120	20	
		Total Silver	7440-22-4	Water	SW846 6010C	10	1.3	4.4	ug/L	80	120	20	
		Total Sodium	7440-23-5	Water	SW846 6010C	NE	140	450	ug/L	87	116	20	
		Total Thallium	7440-28-0	Water	SW846 6010C	0.4	4	14	ug/L	80	120	20	
		Total Tin	7440-31-5	Water	SW846 6010C	NE	2.4	8	ug/L	75	125	20	
		Total Titanium	7440-32-6	Water	SW846 6010C	NE	1.2	4.1	ug/L	75	125	20	
		Total Vanadium	7440-62-2	Water	SW846 6010C	6	1.7	5.7	ug/L	80	120	20	
		Total Zinc	7440-66-6	Water	SW846 6010C	2500	2.4	8.1	ug/L	80	120	20	
CT Labs	GFA Metals	Total Antimony	7440-36-0	Water	SW846 7010	1.2	0.8	2.6	ug/L	87	111	20	
		Total Arsenic	7440-38-2	Water	SW846 7010	1	1	3.3	ug/L	72	124	20	
		Total Lead	7439-92-1	Water	SW846 7010	1.5	0.3	1.1	ug/L	78	127	20	
		Total Selenium	7782-49-2	Water	SW846 7010	10	1.7	5.5	ug/L	72	124	20	
		Total Silver	7440-22-4	Water	SW846 7010	10	0.05	0.16	ug/L	80	120	20	
		Total Thallium	7440-28-0	Water	SW846 7010	0.4	0.8	2.7	ug/L	84	116	20	
CT Labs	Other Metals	Hexavalent Chromium	18540-29-9	Water	EPA 7196A	10	6.2	20.7	ug/L	87	115	20	See note 5
		Mercury	7439-97-6	Water	SW846 7470A	0.02	0.05	0.18	ug/L	81	112	20	

Table 2E
Analytical Parameters, Reporting Limits, Precision and Accuracy
CT Laboratories - Water Samples

Laboratory	Analyte Group	Analyte	CAS #	Matrix	Analytical Method	WI Groundwater Preventive Action Limits	DL/MDL	LOQ/PQL	Units	LCL % Recovery	UCL % Recovery	RPDL (%)	Comments
CT Labs	Misc	Alkalinity		Water	EPA 310.2	NE	7	23	mg/L	90	110	20	
		Cyanide	57-12-5	Water	SW846 9012	0.04	5	17	mg/L	69	135	20	See note 6
		Flashpoint	NA	Water	EPA 1010A	NE	NA	NA	degrees F	90	110	5	
		Nitrate		Water	EPA 300	2	0.04	0.13	mg/L	80	120	20	See note 7
		Oil & Grease		Water	EPA 1664	NE	1.4	2.8	mg/L	NA	NA	NA	
		Total Organic Carbon (TOC)	14808-79-8	Water	Lloyd Kahn/9060A	NE	0.4	1.4	mg/L	84	113	30	
		Phosphorous (total)	18540-29-9	Water	EPA 365.4	NE	0.25	0.82	mg/L	81	122	20	
		Reactive cyanide	57-12-5	Water	ASTM D5049	NE	10	N/A	mg/L	70	130	20	
		Reactive sulfide	18496-25-8	Water	ASTM D4978	NE	2	N/A	mg/L	70	130	20	
		Sulfate		Water	EPA 300	125	1.0	3.4	mg/L	80	120	20	
		Methane	74-82-8	Water	MOD RSK 175		0.3	1.0	ug/L	70	130	20	
		Ethane	74-84-0	Water	MOD RSK 175		0.6	2.0	ug/L	70	130	20	
		Ethene	74-85-1	Water	MOD RSK 175		0.9	2.9	ug/L	41	138	20	
		Carbon Dioxide	124-39-9	Water	MOD RSK 175		168	559	ug/L	30	154	20	

Notes:
1) The PAL shown is for cis-1,3-dichloropropene and trans-1,3-dichloropropene combined
2) The PAL shown is for 1,2,4-TMB and 1,3,5-TMB combined
3) The PAL shown is for total xylenes
4) The PAL shown is for total PCBs
5) The PAL shown is for total chromium
6) The PAL shown is for "free" cyanide
7) The PAL shown is for Nitrate as N
Yellow shading designates DLs or MDLs that exceed the WI groundwater PALs

ASTM = American Society for Testing and Materials
CAS = Chemical Abstracts Service
DL = detection limit
DRO = diesel range organics
EPA = Environmental Protection Agency
F = Fahrenheit
GFA = graphite filter atomizer
GRO = gasoline range organics
ICP = inductively coupled plasma
LCL = lower control limit
LOQ = limit of quantitation
LUST = leaking underground storage tank
MDL = method detection limit
mg/L = milligrams per liter
mod = modified
NA = not applicable or not available
NE = not established
PAH = polynuclear aromatic hydrocarbon
PAL = preventive action limit (as established under Ch. NR141, Wisc. Adm. Code)
PCB = polychlorinated biphenyl
PQL = practical quantitation limit
PVOC = petroleum VOCs
RPDL = relative percent difference limit
SVOC = semi-volatile organic compound
TMB = trimethylbenzene
TOC = total organic carbon
UCL = upper control limit
ug/L = micrograms per liter
VOC = volatile organic compound
WI = Wisconsin

Lab	Analyte Group	Analyte	CAS Number	Matrix	Analytical Method	Prep Method	WI Soil Standard	Soil Standard References	MDL	MRL	Units	LCL	UCL	RPD	Comments
EMT	Herbicides	2,4,5-T	93-76-5	Solid	8321A	3510	611,000	NIDC	17.3	100	ug/kg	45	135	20	
		2,4,5-TP (Silvex)	93-72-1	Solid	8321A	3510	55	GW	15.5	100	ug/kg	45	125	20	
		2,4-D	94-75-7	Solid	8321A	3510	36	GW	32.8	100	ug/kg	35	145	20	
		2,4-DB	94-82-6	Solid	8321A	3510	489,000	NIDC	11.0	100	ug/kg	50	155	20	
		Dalapon	75-99-0	Solid	8321A	3510	1,830,000	NIDC	706	2000	ug/kg	50	150	20	
		Dicamba	1918-00-9	Solid	8321A	3510	160	GW	23.7	100	ug/kg	55	110	20	
		Dichlorprop	120-36-5	Solid	8321A	3510	NE	---	17.9	100	ug/kg	75	140	20	
		Dinoseb	88-85-7	Solid	8321A	3510	120	GW	12.1	100	ug/kg	50	150	20	
		MCPA	94-74-6	Solid	8321A	3510	30,600	NIDC	14.7	100	ug/kg	50	150	20	
		MCPP	7085-19-0	Solid	8321A	3510	61,100	NIDC	31.6	100	ug/kg	50	150	20	
		Pentachlorophenol	87-86-5	Solid	8321A	3510	892	NIDC	12.9	100	ug/kg	50	150	20	
		Picloram	1918-02-1	Solid	8321A	3510	280	GW	25.0	100	ug/kg	50	150	20	
		3,5-Dichlorobenzoic Acid	51-36-5	Solid	8321A	3510	NE	---			ug/kg				Surrogate
EMT	Metals	Aluminum	7429-90-5	Solid	6010B	3050	600	GW	1.60	12.5	mg/kg	74	119	20	
		Antimony	7440-36-0	Solid	6010B	3050	0.54	GW	1.04	2.50	mg/kg	79	114	20	
		Arsenic	7440-38-2	Solid	6010B	3050	0.58	GW	0.600	2.50	mg/kg	82	111	20	
		Barium	7440-39-3	Solid	6010B	3050	164.8	GW	0.100	2.50	mg/kg	83	113	20	
		Beryllium	7440-41-7	Solid	6010B	3050	6.3	GW	0.120	0.250	mg/kg	83	113	20	
		Boron	7440-42-8	Solid	6010B	3050	6.4	GW	0.850	1.25	mg/kg	72	114	20	
		Cadmium	7440-43-9	Solid	6010B	3050	0.75	GW	0.120	0.250	mg/kg	82	113	20	
		Calcium	7440-70-2	Solid	6010B	3050	NE	---	8.06	12.5	mg/kg	81	116	20	
		Chromium	7440-47-3	Solid	6010B	3050	360,000 if no Cr-VI	GW	0.630	2.50	mg/kg	85	113	20	
		Cobalt	7440-48-4	Solid	6010B	3050	3.6	GW	0.150	2.50	mg/kg	85	112	20	
		Copper	7440-50-8	Solid	6010B	3050	91.6	GW	0.295	2.50	mg/kg	81	117	20	
		Iron	7439-89-6	Solid	6010B	3050	54,800	NIDC	1.14	2.50	mg/kg	81	118	20	
		Lead	7439-92-1	Solid	6010B	3050	27	GW	0.800	2.50	mg/kg	81	112	20	
		Magnesium	7439-95-4	Solid	6010B	3050	NE	---	0.585	12.5	mg/kg	78	115	20	
		Manganese	7439-96-5	Solid	6010B	3050	39	GW	0.120	2.50	mg/kg	84	114	20	
		Molybdenum	7439-98-7	Solid	6010B	3050	1.6	GW	0.450	2.50	mg/kg	82	116	20	
		Nickel	7440-02-0	Solid	6010B	3050	13	GW	0.300	2.50	mg/kg	83	113	20	
		Phosphorus	7723-14-0	Solid	6010B	3050	1.56	NIDC	0.350	12.5	mg/kg	92	114	20	
		Potassium	7440-09-7	Solid	6010B	3050	NE	---	0.735	12.5	mg/kg	81	116	20	
		Selenium	7782-49-2	Solid	6010B	3050	0.52	GW	0.785	2.50	mg/kg	78	111	20	
		Silver	7440-22-4	Solid	6010B	3050	0.85	GW	0.100	0.250	mg/kg	82	112	20	
		Sodium	7440-23-5	Solid	6010B	3050	NE	---	4.45	12.5	mg/kg	83	118	20	
		Strontium	7440-24-6	Solid	6010B	3050	46,900	NIDC	10.4	50.0	mg/kg	83	114	20	
		Tantalum	7440-25-7	Solid	6010B	3050	NE	---	1.55	2.50	mg/kg	80	120	20	
		Thallium	7440-28-0	Solid	6010B	3050	0.28	GW	0.995	2.50	mg/kg	83	111	20	
		Tin	7440-31-5	Solid	6010B	3050	46,900	NIDC	0.865	2.50	mg/kg	80	120	20	
		Titanium	7440-32-6	Solid	6010B	3050	NE	---	0.520	2.50	mg/kg	83	114	20	
		Vanadium	7440-62-2	Solid	6010B	3050	60	GW	0.260	2.50	mg/kg	82	114	20	
		Zinc	7440-66-6	Solid	6010B	3050	23,500	NIDC	0.600	2.50	mg/kg	82	113	20	

Lab	Analyte Group	Analyte	CAS Number	Matrix	Analytical Method	Prep Method	WI Soil Standard	Soil Standard References	MDL	MRL	Units	LCL	UCL	RPD	Comments
EMT	Metals	Aluminum	7429-90-5	Solid	6020A	3015A	600	GW	0.0980	12.5	mg/kg	78	124	20	
		Antimony	7440-36-0	Solid	6020A	3015A	0.54	GW	0.0130	2.50	mg/kg	72	124	20	
		Arsenic	7440-38-2	Solid	6020A	3015A	0.58	GW	0.00550	2.50	mg/kg	82	118	20	
		Barium	7440-39-3	Solid	6020A	3015A	164.8	GW	0.0470	2.50	mg/kg	86	116	20	
		Beryllium	7440-41-7	Solid	6020A	3015A	6.3	GW	0.0230	0.250	mg/kg	80	120	20	
		Boron	7440-42-8	Solid	6020A	3015A	6.4	GW	0.0260	1.25	mg/kg	74	128	20	
		Cadmium	7440-43-9	Solid	6020A	3015A	0.75	GW	0.00160	0.250	mg/kg	84	116	20	
		Calcium	7440-70-2	Solid	6020A	3015A	NE	---	1.80	12.5	mg/kg	86	118	20	
		Chromium	7440-47-3	Solid	6020A	3015A	360,000 if no Cr-VI	GW	0.0340	2.50	mg/kg	83	119	20	
		Cobalt	7440-48-4	Solid	6020A	3015A	3.6	GW	0.0200	1.25	mg/kg	84	115	20	
		Copper	7440-50-8	Solid	6020A	3015A	91.6	GW	0.0320	2.50	mg/kg	84	119	20	
		Iron	7439-89-6	Solid	6020A	3015A	54,800	NIDC	0.660	5.00	mg/kg	81	124	20	
		Lead	7439-92-1	Solid	6020A	3015A	27	GW	0.0400	2.50	mg/kg	84	118	20	
		Magnesium	7439-95-4	Solid	6020A	3015A	NE	---	1.20	12.5	mg/kg	80	123	20	
		Manganese	7439-96-5	Solid	6020A	3015A	39	GW	0.0950	2.50	mg/kg	85	116	20	
		Molybdenum	7439-98-7	Solid	6020A	3015A	1.6	GW	0.0940	2.50	mg/kg	83	114	20	
		Nickel	7440-02-0	Solid	6020A	3015A	13	GW	0.0370	2.50	mg/kg	84	119	20	
		Phosphorus	7723-14-0	Solid	6020A	3015A	1.56	NIDC	0.790	12.5	mg/kg	80	120	20	
		Potassium	7440-09-7	Solid	6020A	3015A	NE	---	1.20	12.5	mg/kg	85	119	20	
		Selenium	7782-49-2	Solid	6020A	3015A	0.52	GW	0.00480	2.50	mg/kg	80	119	20	
		Silver	7440-22-4	Solid	6020A	3015A	0.85	GW	0.0280	0.250	mg/kg	83	118	20	
		Sodium	7440-23-5	Solid	6020A	3015A	NE	---	1.70	12.5	mg/kg	79	125	20	
		Thallium	7440-28-0	Solid	6020A	3015A	0.28	GW	0.00120	2.50	mg/kg	83	118	20	
		Tin	7440-31-5	Solid	6020A	3015A	46,900	NIDC	0.110	2.50	mg/kg	82	121	20	
		Titanium	7440-32-6	Solid	6020A	3015A	NE	---	0.0590	2.50	mg/kg	83	117	20	
		Vanadium	7440-62-2	Solid	6020A	3015A	60	GW	0.0160	2.50	mg/kg	82	116	20	
		Zinc	7440-66-6	Solid	6020A	3015A	23500	NIDC	0.0500	2.50	mg/kg	82	119	20	
		Chromium, Hexavalent	18540-29-9	Solid	7196	3060	0.293	NIDC	0.500	5.00	mg/kg	84	110	10	
		Mercury	7439-97-6	Solid	7471B	7471B_prep	0.21	GW	0.0148	0.0600	mg/kg	80	124	20	

Lab	Analyte Group	Analyte	CAS Number	Matrix	Analytical Method	Prep Method	WI Soil Standard	Soil Standard References	MDL	MRL	Units	LCL	UCL	RPD	Comments
EMT	PAHs	1-Methylnaphthalene	90-12-0	Solid	8310	3540	15,600	NIDC	11.5	25.0	ug/kg	40	137	20	
		2-Methylnaphthalene	91-57-6	Solid	8310	3540	229,000	NIDC	10.5	25.0	ug/kg	40	135	20	
		Acenaphthene	83-32-9	Solid	8310	3540	3,440,000	NIDC	9.74	25.0	ug/kg	47	127	20	
		Acenaphthylene	208-96-8	Solid	8310	3540	NE	---	8.30	25.0	ug/kg	56	117	20	
		Anthracene	120-12-7	Solid	8310	3540	198,000	GW	5.46	25.0	ug/kg	65	113	20	
		Benzo(a)anthracene	56-55-3	Solid	8310	3540	148	NIDC	6.08	25.0	ug/kg	69	126	20	
		Benzo(a)pyrene	50-32-8	Solid	8310	3540	15	NIDC	6.07	25.0	ug/kg	63	120	20	
		Benzo(b)fluoranthene	205-99-2	Solid	8310	3540	148	NIDC	5.87	25.0	ug/kg	71	120	20	
		Benzo(g,h,i)perylene	191-24-2	Solid	8310	3540	NE	---	6.99	25.0	ug/kg	69	129	20	
		Benzo(k)fluoranthene	207-08-9	Solid	8310	3540	1,480	NIDC	5.69	25.0	ug/kg	70	120	20	
		Chrysene	218-01-9	Solid	8310	3540	140	GW	5.75	25.0	ug/kg	76	115	20	
		Dibenzo(a,h)anthracene	53-70-3	Solid	8310	3540	15	NIDC	5.32	25.0	ug/kg	70	118	20	
		Fluoranthene	206-44-0	Solid	8310	3540	89,000	GW	7.67	25.0	ug/kg	70	119	20	
		Fluorene	86-73-7	Solid	8310	3540	15,000	GW	8.40	25.0	ug/kg	61	119	20	
		Indeno(1,2,3-cd)pyrene	193-39-5	Solid	8310	3540	148	NIDC	7.66	25.0	ug/kg	64	134	20	
		Naphthalene	91-20-3	Solid	8310	3540	NE	---	10.4	25.0	ug/kg	36	135	20	
		Phenanthrene	85-01-8	Solid	8310	3540	NE	---	6.48	25.0	ug/kg	65	118	20	
		Pyrene	129-00-0	Solid	8310	3540	54,000	GW	7.70	25.0	ug/kg	69	119	20	
		4-Terphenyl-d14	1718-51-0	Solid	8310	3540	NA	---			ug/kg				Surrogate
EMT	PCBs	Aroclor 1016	12674-11-2	Solid	8082A	3540	3,930	NIDC	53.0	200	ug/kg	47	134	20	GW RCL = 9.4 µg/kg
		Aroclor 1221	11104-28-2	Solid	8082A	3540	159	NIDC	86.3	250	ug/kg	40	140	20	GW RCL = 9.4 µg/kg
		Aroclor 1232	11141-16-5	Solid	8082A	3540	159	NIDC	15.3	100	ug/kg	40	140	20	GW RCL = 9.4 µg/kg
		Aroclor 1242	53469-21-9	Solid	8082A	3540	221	NIDC	25.5	150	ug/kg	40	140	20	GW RCL = 9.4 µg/kg
		Aroclor 1248	12672-29-6	Solid	8082A	3540	221	NIDC	10.7	50.0	ug/kg	40	140	20	GW RCL = 9.4 µg/kg
		Aroclor 1254	11097-69-1	Solid	8082A	3540	221	NIDC	18.9	100	ug/kg	67	135	20	GW RCL = 9.4 µg/kg
		Aroclor 1260	11096-82-5	Solid	8082A	3540	221	NIDC	46.0	200	ug/kg	53	140	20	GW RCL = 9.4 µg/kg
		Aroclor 1262	37324-23-5	Solid	8082A	3540	NE	---	18.0	100	ug/kg	40	140	20	GW RCL = 9.4 µg/kg
		Aroclor 1268	11100-14-4	Solid	8082A	3540	NE	---	34.4	150	ug/kg	40	140	20	GW RCL = 9.4 µg/kg
		Total PCB	1336-36-3	Solid	8082A	3540	221	NIDC	86.3	250	ug/kg				GW RCL = 9.4 µg/kg
		2,4,5,6-Tetrachloro-m-xylene	877-09-8	Solid	8082A	3540	NA	---			ug/kg				Surrogate
		Decachlorobiphenyl	2051-24-3	Solid	8082A	3540	NA	---			ug/kg				Surrogate
EMT	Pesticides	2,4'-DDD	53-19-0	Solid	8081B	3540	NE	---	2.40	50.0	ug/kg				
		2,4'-DDE	3424-82-6	Solid	8081B	3540	NE	---	4.50	50.0	ug/kg				
		2,4'-DDT	789-02-6	Solid	8081B	3540	NE	---	1.70	10.0	ug/kg				
		4,4'-DDD	72-54-8	Solid	8081B	3540	2,020	NIDC	0.480	10.0	ug/kg	56	139	20	
		4,4'-DDE	72-55-9	Solid	8081B	3540	1,430	NIDC	0.400	10.0	ug/kg	56	134	20	
		4,4'-DDT	50-29-3	Solid	8081B	3540	1,720	NIDC	1.25	10.0	ug/kg	50	141	20	
		Alachlor	15972-60-8	Solid	8081B	3540	3.3	GW	15.1	100	ug/kg	50	141	20	
		Aldrin	309-00-2	Solid	8081B	3540	29	NIDC	0.671	10.0	ug/kg	45	136	20	
		alpha-BHC	319-84-6	Solid	8081B	3540	77	NIDC	0.664	10.0	ug/kg	45	137	20	
		alpha-Chlordane	5103-71-9	Solid	8081B	3540	NE	---	3.82	50.0	ug/kg				
		Atrazine	1912-24-9	Solid	8081B	3540	3.9	GW	12.9	100	ug/kg	50	150	20	
		beta-BHC	319-85-7	Solid	8081B	3540	270	NIDC	0.867	10.0	ug/kg	50	136	20	

Lab	Analyte Group	Analyte	CAS Number	Matrix	Analytical Method	Prep Method	WI Soil Standard	Soil Standard References	MDL	MRL	Units	LCL	UCL	RPD	Comments
EMT	Pesticides (cont'd)	Chlordane	57-74-9	Solid	8081B	3540	NE	---	23.5	200	ug/kg				
		delta-BHC	319-86-8	Solid	8081B	3540	NE	---	0.620	10.0	ug/kg	47	139	20	
		Dieldrin	60-57-1	Solid	8081B	3540	30	NIDC	0.237	10.0	ug/kg	56	136	20	
		Endosulfan I	959-98-8	Solid	8081B	3540	NA	---	0.363	10.0	ug/kg	53	132	20	
		Endosulfan II	33213-65-9	Solid	8081B	3540	NE	---	0.405	10.0	ug/kg	53	134	20	
		Endosulfan sulfate	1031-07-8	Solid	8081B	3540	NE	---	1.10	10.0	ug/kg	55	136	20	
		Endrin	72-20-8	Solid	8081B	3540	160	GW	2.40	10.0	ug/kg	57	140	20	
		Endrin aldehyde	7421-93-4	Solid	8081B	3540	NE	---	1.23	10.0	ug/kg	35	137	20	
		Endrin ketone	53494-70-5	Solid	8081B	3540	NE	---	0.937	10.0	ug/kg	55	136	20	
		gamma-BHC	58-89-9	Solid	8081B	3540	2.3	GW	0.722	10.0	ug/kg	49	135	20	
		gamma-Chlordane	5566-34-7	Solid	8081B	3540	NE	---	5.08	50.0	ug/kg				
		Heptachlor	76-44-8	Solid	8081B	3540	108	NIDC	1.39	10.0	ug/kg	47	136	20	
		Heptachlor epoxide	1024-57-3	Solid	8081B	3540	8.2	GW	0.646	10.0	ug/kg	52	136	20	
		Methoxychlor	72-43-5	Solid	8081B	3540	4,300	GW	2.19	10.0	ug/kg	52	143	20	
		Simazine	122-34-9	Solid	8081B	3540	3.9	GW	14.7	100	ug/kg	50	150	20	
		Toxaphene	8001-35-2	Solid	8081B	3540	441	NIDC	42.8	300	ug/kg				
		2,4,5,6-Tetrachloro-m-xylene	877-09-8	Solid	8081B	3540	NA	---			ug/kg				Surrogate
		Decachlorobiphenyl	2051-24-3	Solid	8081B	3540	NE	---			ug/kg				Surrogate
EMT	SVOCs	1,2,4,5-Tetrachlorobenzene	95-94-3	Solid	8270D	3550	NE	---	5.00	45.0	ug/kg	37	119	20	
		1,2,4-Trichlorobenzene	120-82-1	Solid	8270D	3550	408	GW	1.75	8.00	ug/kg	34	118	20	
		1,2-Dichlorobenzene	95-50-1	Solid	8270D	3550	1,168	GW	1.37	8.00	ug/kg	33	117	20	
		1,2-Dinitrobenzene	528-29-0	Solid	8270D	3550	6,110	NIDC		60.0	ug/kg	44	115	20	
		1,3,5-Trinitrobenzene	99-35-4	Solid	8270D	3550	2,230,000	NIDC		60.0	ug/kg	57	121	20	
		1,3-Dichlorobenzene	541-73-1	Solid	8270D	3550	1,153	GW	1.99	8.00	ug/kg	30	115	20	
		1,3-Dinitrobenzene	99-65-0	Solid	8270D	3550	6,110	NIDC		60.0	ug/kg	43	127	20	
		1,4-Dichlorobenzene	106-46-7	Solid	8270D	3550	144	GW	1.83	8.00	ug/kg	31	115	20	
		1,4-Dichlorobenzene-d4	3855-82-1	Solid	8270D	3550	NE	---			ug/kg				
		1,4-Dinitrobenzene	100-25-4	Solid	8270D	3550	6,110	NIDC		60.0	ug/kg	37	132	20	
		1,4-Naphthoquinone	130-15-4	Solid	8270D	3550	NE	---		60.0	ug/kg	55	108	20	
		1-Methylnaphthalene	90-12-0	Solid	8270D	3550	15,600	NIDC	0.876	8.00	ug/kg	40	119	20	
		2,3,4,6-Tetrachlorophenol	58-90-2	Solid	8270D	3550	1,830,000	NIDC	20.0	60.0	ug/kg	44	125	20	
		2,3-Dichloroaniline	608-27-5	Solid	8270D	3550	NE	---		60.0	ug/kg	44	121	20	
		2,4,5-Trichlorophenol	95-95-4	Solid	8270D	3550	6,110,000	NIDC	11.1	100	ug/kg	41	124	20	
		2,4,6-Trichlorophenol	88-06-2	Solid	8270D	3550	NE	---	13.1	100	ug/kg	39	132	20	
		2,4-Dichlorophenol	120-83-2	Solid	8270D	3550	183,000	NIDC	13.9	100	ug/kg	40	122	20	
		2,4-Dimethylphenol	105-67-9	Solid	8270D	3550	1,220,000	NIDC	16.4	100	ug/kg	30	127	20	
		2,4-Dinitrophenol	51-28-5	Solid	8270D	3550	122,000	NIDC	14.0	100	ug/kg	36	116	20	
		2,4-Dinitrotoluene	121-14-2	Solid	8270D	3550	0.13	GW	200	700	ug/kg	48	126	20	
		2,6-Dichlorophenol	87-65-0	Solid	8270D	3550	NE	---	1.87	8.00	ug/kg	41	117	20	
		2,6-Dinitrotoluene	606-20-2	Solid	8270D	3550	0.14	GW	208	800	ug/kg	46	124	20	
		2-Acetylaminofluorene	53-96-3	Solid	8270D	3550	128	NIDC		60.0	ug/kg	54	134	20	
		2-Chloronaphthalene	91-58-7	Solid	8270D	3550	6,260,000	NIDC	1.16	8.00	ug/kg	41	114	20	
		2-Chlorophenol	95-57-8	Solid	8270D	3550	391,000	NIDC	13.3	100	ug/kg	34	121	20	

Lab	Analyte Group	Analyte	CAS Number	Matrix	Analytical Method	Prep Method	WI Soil Standard	Soil Standard References	MDL	MRL	Units	LCL	UCL	RPD	Comments
EMT	SVOCs (cont'd)	2-Methylnaphthalene	91-57-6	Solid	8270D	3550	229,000	NIDC	1.60	8.00	ug/kg	38	122	20	
		2-Methylphenol	95-48-7	Solid	8270D	3550	3,060,000	NIDC	14.1	100	ug/kg	32	122	20	
		2-Nitroaniline	88-74-4	Solid	8270D	3550	606,000	NIDC	16.0	100	ug/kg	44	127	20	
		2-Nitrophenol	88-75-5	Solid	8270D	3550	NE	---	14.0	100	ug/kg	36	123	20	
		2-Picoline	109-06-8	Solid	8270D	3550	NE	---		60.0	ug/kg	27	103	20	
		3 & 4-Methylphenol	84989-04-8	Solid	8270D	3550	NE	---	10.8	100	ug/kg	34	119	20	
		3,3´-Dichlorobenzidine	91-94-1	Solid	8270D	3550	1,080	NIDC	185	700	ug/kg	22	121	20	
		3-Methylcholanthrene	56-49-5	Solid	8270D	3550	5.23	NIDC		45.0	ug/kg	56	134	20	
		3-Nitroaniline	99-09-2	Solid	8270D	3550	NE	---	14.1	100	ug/kg	29	108	20	
		4,6-Dinitro-2-methylphenol	534-52-1	Solid	8270D	3550	4,890	NIDC	202	800	ug/kg	29	132	20	
		4-Bromophenyl-phenylether	101-55-3	Solid	8270D	3550	NE	---	16.6	100	ug/kg	46	124	20	
		4-Chloro-3-methylphenol	59-50-7	Solid	8270D	3550	6,110,000	NIDC	15.0	100	ug/kg	45	122	20	
		4-Chloroaniline	106-47-8	Solid	8270D	3550	2430	NIDC	28.5	400	ug/kg	17	106	20	
		4-Chlorophenyl-phenylether	7005-72-3	Solid	8270D	3550	NE	---	13.7	100	ug/kg	45	121	20	
		4-Nitroaniline	100-01-6	Solid	8270D	3550	24,300	NIDC	13.9	100	ug/kg	20	123	20	
		4-Nitrophenol	100-02-7	Solid	8270D	3550	NE	---	254	800	ug/kg	30	132	20	
		5-Nitro-o-toluidine	99-55-8	Solid	8270D	3550	53,900	NIDC		60.0	ug/kg	23	117	20	
		7,12-Dimethylbenz(a)anthracene	57-97-6	Solid	8270D	3550	0.431	NIDC		45.0	ug/kg	50	142	20	
		Acenaphthene	83-32-9	Solid	8270D	3550	3,440,000	NIDC	0.944	8.00	ug/kg	40	123	20	
		Acenaphthene-d10	15067-26-2	Solid	8270D	3550	NE	---			ug/kg				
		Acenaphthylene	208-96-8	Solid	8270D	3550	NE	---	13.6	100	ug/kg	32	132	20	
		Acetophenone	98-86-2	Solid	8270D	3550	2,520,000	NIDC	5.00	15.0	ug/kg	33	115	20	
		Aniline	62-53-3	Solid	8270D	3550	85,200	NIDC	189	700	ug/kg	40	60	20	
		Anthracene	120-12-7	Solid	8270D	3550	198,000	GW	1.26	20.0	ug/kg	47	123	20	
		Azobenzene as 1,2-Diphenylhydrazine	103-33-3	Solid	8270D	3550	5,320	NIDC	16.7	100	ug/kg	39	125	20	
		Benzaldehyde	100-52-7	Solid	8270D	3550	1,160,000	NIDC			ug/kg				
		Benzidine	92-87-5	Solid	8270D	3550	0.50	NIDC	122	700	ug/kg	11	110	20	
		Benzo(a)anthracene	56-55-3	Solid	8270D	3550	148	NIDC	0.952	8.00	ug/kg	49	126	20	
		Benzo(a)pyrene	50-32-8	Solid	8270D	3550	14.8	NIDC	15.2	100	ug/kg	45	129	20	
		Benzo(b)fluoranthene	205-99-2	Solid	8270D	3550	148	NIDC	1.95	8.00	ug/kg	45	132	20	
		Benzo(g,h,i)perylene	191-24-2	Solid	8270D	3550	NE	---	1.99	8.00	ug/kg	43	134	20	
		Benzo(k)fluoranthene	207-08-9	Solid	8270D	3550	1,480	NIDC	1.90	8.00	ug/kg	47	132	20	
		Benzoic acid	65-85-0	Solid	8270D	3550	100,000,000	NIDC	215	800	ug/kg	19	68	20	
		Benzyl alcohol	100-51-6	Solid	8270D	3550	6,110,000	NIDC	12.4	100	ug/kg	29	122	20	
		Biphenyl	92-52-4	Solid	8270D	3550	73,700	NIDC			ug/kg				
		Bis(2-chloroethoxy)methane	111-91-1	Solid	8270D	3550	183,000	NIDC	1.30	8.00	ug/kg	36	121	20	
		Bis(2-chloroethyl)ether	111-44-4	Solid	8270D	3550	265	NIDC	1.78	8.00	ug/kg	31	120	20	
		Bis(2-chloroisopropyl)ether	108-60-1	Solid	8270D	3550	5,400	NIDC	1.93	8.00	ug/kg	33	131	20	
		Bis(2-ethylhexyl)phthalate	117-81-7	Solid	8270D	3550	2,880	GW	14.7	100	ug/kg	51	133	20	
		Butyl benzyl phthalate	85-68-7	Solid	8270D	3550	256,000	NIDC	1.39	40.0	ug/kg	48	132	20	
		Carbazole	86-74-8	Solid	8270D	3550	NE	---	14.9	100	ug/kg	50	123	20	
		Chlorobenzilate	510-15-6	Solid	8270D	3550	4,410	NIDC		60.0	ug/kg	49	150	20	

Lab	Analyte Group	Analyte	CAS Number	Matrix	Analytical Method	Prep Method	WI Soil Standard	Soil Standard References	MDL	MRL	Units	LCL	UCL	RPD	Comments
EMT	SVOCs (cont'd)	Chrysene	218-01-9	Solid	8270D	3550	145	GW	14.0	100	ug/kg	50	124	20	
		Chrysene-d12	1719-03-5	Solid	8270D	3550	NE	---			ug/kg				
		Diallate	2303-16-4	Solid	8270D	3550	7,960	NIDC		60.0	ug/kg	56	132	20	
		Dibenzo(a,h)anthracene	53-70-3	Solid	8270D	3550	14.8	NIDC	25.9	400	ug/kg	45	134	20	
		Dibenzofuran	132-64-9	Solid	8270D	3550	72,200	NIDC	13.0	100	ug/kg	44	120	20	
		Diethyl phthalate	84-66-2	Solid	8270D	3550	48,900,000	NIDC	13.5	100	ug/kg	50	124	20	
		Dimethoate	60-51-5	Solid	8270D	3550	0.90	GW		60.0	ug/kg	28	108	20	
		Dimethyl phthalate	131-11-3	Solid	8270D	3550	NE	---	12.7	100	ug/kg	48	124	20	
		Di-n-butyl phthalate	84-74-2	Solid	8270D	3550	5,040	GW	16.4	100	ug/kg	51	128	20	
		Di-n-octyl phthalate	117-84-0	Solid	8270D	3550	611,000	NIDC	10.7	100	ug/kg	45	150	20	
		Dinoseb	88-85-7	Solid	8270D	3550	123	GW		60.0	ug/kg	16	119	20	
		Diphenylamine	122-39-4	Solid	8270D	3550	1,530,000	NIDC		3000	ug/kg	48	111	20	
		Ethyl methanesulfonate	62-50-0	Solid	8270D	3550	NE	---		60.0	ug/kg	34	136	20	
		Fluoranthene	206-44-0	Solid	8270D	3550	88,900	GW	17.6	100	ug/kg	50	127	20	
		Fluorene	86-73-7	Solid	8270D	3550	14,800	GW	12.9	100	ug/kg	43	125	20	
		Hexachlorobenzene	118-74-1	Solid	8270D	3550	25.2	GW	16.7	100	ug/kg	45	122	20	
		Hexachlorobutadiene	87-68-3	Solid	8270D	3550	6,220	NIDC	14.9	100	ug/kg	32	123	20	
		Hexachlorocyclopentadiene	77-47-4	Solid	8270D	3550	366,000	NIDC	10.4	100	ug/kg	23	94	20	
		Hexachloroethane	67-72-1	Solid	8270D	3550	12,100	NIDC	13.3	100	ug/kg	28	117	20	
		Hexachloropropene	1888-71-7	Solid	8270D	3550	NE	---		60.0	ug/kg	32	132	20	
		Indeno(1,2,3-cd)pyrene	193-39-5	Solid	8270D	3550	148	NIDC	20.5	100	ug/kg	46	133	20	
		Isodrin	465-73-6	Solid	8270D	3550	NE	---		44.0	ug/kg	56	132	20	
		Isophorone	78-59-1	Solid	8270D	3550	511,000	NIDC	16.0	100	ug/kg	30	122	20	
		Methyl methanesulfonate	66-27-3	Solid	8270D	3550	4,900	NIDC		60.0	ug/kg	38	117	20	
		Metolachlor	51218-45-2	Solid	8270D	3550	236	GW	14.3	45.0	ug/kg				
		Naphthalene	91-20-3	Solid	8270D	3550	658	GW	12.5	100	ug/kg	35	123	20	
		Naphthalene-d8	1146-65-2	Solid	8270D	3550	NE	---			ug/kg				
		Nitrobenzene	98-95-3	Solid	8270D	3550	6,920	NIDC	17.8	100	ug/kg	34	122	20	
		N-Nitrosodiethylamine	55-18-5	Solid	8270D	3550	0.768	NIDC		100	ug/kg	41	124	20	
		N-Nitrosodimethylamine	62-75-9	Solid	8270D	3550	2.26	NIDC	9.46	40.0	ug/kg	23	120	20	
		N-Nitroso-di-n-butylamine	924-16-3	Solid	8270D	3550	94.3	NIDC		60.0	ug/kg	59	124	20	
		N-Nitrosodi-n-propylamine	621-64-7	Solid	8270D	3550	69.4	NIDC	1.32	8.00	ug/kg	36	120	20	
		N-Nitrosodiphenylamine	86-30-6	Solid	8270D	3550	76.4	GW	21.8	100	ug/kg	38	127	20	
		N-Nitrosomorpholine	59-89-2	Solid	8270D	3550	NE	---		60.0	ug/kg	50	133	20	
		N-Nitrosopiperidine	100-75-4	Solid	8270D	3550	51.6	NIDC		60.0	ug/kg	60	119	20	
		N-Nitrosopyrrolidine	930-55-2	Solid	8270D	3550	231	NIDC	1.64	8.00	ug/kg	45	126	20	
		O,O,O-Triethylphosphorothioate	126-68-1	Solid	8270D	3550	468,000	NIDC		60.0	ug/kg	59	124	20	
		Octadecane	593-45-3	Solid	8270D	3550	NE	---		45.0	ug/kg	44	131	20	
		Pentachlorobenzene	608-93-5	Solid	8270D	3550	48,900	NIDC		60.0	ug/kg	54	125	20	
		Pentachloroethane	76-01-7	Solid	8270D	3550	NE	---		60.0	ug/kg	39	102	20	
		Pentachloronitrobenzene	82-68-8	Solid	8270D	3550	1,870	NIDC		60.0	ug/kg	38	134	20	
		Pentachlorophenol	87-86-5	Solid	8270D	3550	20.2	GW	8.47	40.0	ug/kg	25	133	20	
		Perylene-d12	1520-96-3	Solid	8270D	3550	NE	---			ug/kg				

Lab	Analyte Group	Analyte	CAS Number	Matrix	Analytical Method	Prep Method	WI Soil Standard	Soil Standard References	MDL	MRL	Units	LCL	UCL	RPD	Comments
EMT	SVOCs (cont'd)	Phenacetin	62-44-2	Solid	8270D	3550	221,000	NIDC		60.0	ug/kg	57	133	20	
		Phenanthrene	85-01-8	Solid	8270D	3550	NE	---	15.3	100	ug/kg	20	121	20	
		Phenanthrene-d10	1517-22-2	Solid	8270D	3550	NE	---			ug/kg				
		Phenol	108-95-2	Solid	8270D	3550	2,295	GW	14.8	100	ug/kg	34	121	20	
		Pronamide	23950-58-5	Solid	8270D	3550	NE	---		60.0	ug/kg	56	130	20	
		Pyrene	129-00-0	Solid	8270D	3550	54,100	GW	15.9	40.0	ug/kg	47	127	20	
		Pyridine	110-86-1	Solid	8270D	3550	6.9	GW	143	700	ug/kg	29	60	20	
		Safrole	94-59-7	Solid	8270D	3550	523	NIDC		60.0	ug/kg	47	129	20	
		Thionazin	297-97-2	Solid	8270D	3550	NE	---		6020	ug/kg	62	127	20	
		2,4,6-Tribromophenol	118-79-6	Solid	8270D	3550	NE	---			ug/kg				Surrogate
		2-Fluorobiphenyl	321-60-8	Solid	8270D	3550	NE	---			ug/kg				Surrogate
		2-Fluorophenol	367-12-4	Solid	8270D	3550	NE	---			ug/kg				Surrogate
		4-Terphenyl-d14	1718-51-0	Solid	8270D	3550	NE	---			ug/kg				Surrogate
		Nitrobenzene-d5	4165-60-0	Solid	8270D	3550	NE	---			ug/kg				Surrogate
		Phenol-d5	4165-62-2	Solid	8270D	3550	NE	---			ug/kg				Surrogate
EMT	TCLP Herbicides	2,4,5-T	93-76-5	Solid	8321A	1311/3510	NE	Haz Waste	0.000398	0.00150	mg/L	35	110	20	
		2,4,5-TP (Silvex)	93-72-1	Solid	8321A	1311/3510	1	Haz Waste	0.000254	0.00150	mg/L	50	115	20	
		2,4-D	94-75-7	Solid	8321A	1311/3510	10	Haz Waste	0.000261	0.00150	mg/L	35	115	20	
		3,5-Dichlorobenzoic Acid	51-36-5	Solid	8321A	1311/3510	NA	Haz Waste			mg/L				Surrogate
EMT	TCLP Metals	Arsenic	7440-38-2	Solid	6010C	1311/3015	5	Haz Waste	0.0127	0.0500	mg/L	82	111	20	
		Barium	7440-39-3	Solid	6010C	1311/3015	100	Haz Waste	0.00200	0.0500	mg/L	83	113	20	
		Cadmium	7440-43-9	Solid	6010C	1311/3015	1	Haz Waste	0.00200	0.00500	mg/L	82	113	20	
		Chromium	7440-47-3	Solid	6010C	1311/3015	5	Haz Waste	0.00410	0.0500	mg/L	85	113	20	
		Lead	7439-92-1	Solid	6010C	1311/3015	5	Haz Waste	0.0160	0.0500	mg/L	81	112	20	
		Selenium	7782-49-2	Solid	6010C	1311/3015	1	Haz Waste	0.0180	0.0500	mg/L	78	111	20	
		Silver	7440-22-4	Solid	6010C	1311/3015	5	Haz Waste	0.00300	0.0500	mg/L	82	112	20	
		Arsenic	7440-38-2	Solid	6020A	1311/3015	5	Haz Waste	0.0000540	0.00500	mg/L	82	118	20	
		Barium	7440-39-3	Solid	6020A	1311/3015	100	Haz Waste	0.000110	0.00500	mg/L	86	116	20	
		Cadmium	7440-43-9	Solid	6020A	1311/3015	1	Haz Waste	0.0000600	0.000500	mg/L	84	116	20	
		Chromium	7440-47-3	Solid	6020A	1311/3015	5	Haz Waste	0.0000680	0.00500	mg/L	83	119	20	
		Lead	7439-92-1	Solid	6020A	1311/3015	5	Haz Waste	0.0000600	0.00500	mg/L	84	118	20	
		Selenium	7782-49-2	Solid	6020A	1311/3015	1	Haz Waste	0.000100	0.00500	mg/L	80	119	20	
		Silver	7440-22-4	Solid	6020A	1311/3015	5	Haz Waste	0.000110	0.000500	mg/L	83	118	20	
		Mercury	7439-97-6	Solid	7470A	1311/245-7470	0.2	Haz Waste	0.000100	0.00100	mg/L	80	124	20	

Lab	Analyte Group	Analyte	CAS Number	Matrix	Analytical Method	Prep Method	WI Soil Standard	Soil Standard References	MDL	MRL	Units	LCL	UCL	RPD	Comments
EMT	TCLP Pesticides	Chlordane	57-74-9	Solid	8081B	1311/3510	0.03	Haz Waste	0.0000490	0.000500	mg/L				
		Endrin	72-20-8	Solid	8081B	1311/3510	0.02	Haz Waste	0.00000200	0.000300	mg/L	55	135	20	
		gamma-BHC	58-89-9	Solid	8081B	1311/3510	0.4	Haz Waste	0.00000300	0.000300	mg/L	25	135	20	
		Heptachlor	76-44-8	Solid	8081B	1311/3510	0.008	Haz Waste	0.00000500	0.000300	mg/L	40	130	20	
		Heptachlor epoxide	1024-57-3	Solid	8081B	1311/3510	0.008	Haz Waste	0.00000200	0.000300	mg/L	60	130	20	
		Methoxychlor	72-43-5	Solid	8081B	1311/3510	10	Haz Waste	0.00000200	0.000300	mg/L	55	150	20	
		Toxaphene	8001-35-2	Solid	8081B	1311/3510	0.5	Haz Waste	0.000316	0.00150	mg/L				
		2,4,5,6-Tetrachloro-m-xylene	877-09-8	Solid	8081B	1311/3510	NA	Haz Waste			mg/L				Surrogate
		Decachlorobiphenyl	2051-24-3	Solid	8081B	1311/3510	NA	Haz Waste			mg/L				Surrogate
EMT	TCLP SVOCs	1,4-Dichlorobenzene	106-46-7	Solid	8270D	1311/3510	7.5	Haz Waste	0.000600	0.00500	mg/L	31	115	20	
		1,4-Dichlorobenzene-d4	3855-82-1	Solid	8270D	1311/3510	NA	Haz Waste			mg/L				
		2,4,5-Trichlorophenol	95-95-4	Solid	8270D	1311/3510	400	Haz Waste	0.000700	0.0100	mg/L	41	124	20	
		2,4,6-Trichlorophenol	88-06-2	Solid	8270D	1311/3510	2	Haz Waste	0.00100	0.0100	mg/L	39	126	20	
		2,4-Dinitrotoluene	121-14-2	Solid	8270D	1311/3510	0.13	Haz Waste	0.00140	0.0250	mg/L	48	126	20	
		2-Methylphenol	95-48-7	Solid	8270D	1311/3510	NE	Haz Waste	0.00510	0.0200	mg/L	32	122	20	
		3 & 4-Methylphenol	84989-04-8	Solid	8270D	1311/3510	NE	Haz Waste	0.00260	0.0200	mg/L	34	119	20	
		Acenaphthene-d10	15067-26-2	Solid	8270D	1311/3510	NA	Haz Waste			mg/L				
		Chrysene-d12	1719-03-5	Solid	8270D	1311/3510	NA	Haz Waste			mg/L				
		Cresols, Total	1319-77-3	Solid	8270D	1311/3510	200	Haz Waste	0.00770	0.0400	mg/L	40	105	20	
		Hexachlorobenzene	118-74-1	Solid	8270D	1311/3510	0.13	Haz Waste	0.000200	0.00500	mg/L	45	122	20	
		Hexachlorobutadiene	87-68-3	Solid	8270D	1311/3510	0.5	Haz Waste	0.00260	0.0200	mg/L	32	123	20	
		Hexachloroethane	67-72-1	Solid	8270D	1311/3510	3	Haz Waste	0.00280	0.0200	mg/L	28	117	20	
		Naphthalene-d8	1146-65-2	Solid	8270D	1311/3510	NA	Haz Waste			mg/L				
		Nitrobenzene	98-95-3	Solid	8270D	1311/3510	2	Haz Waste	0.000800	0.00500	mg/L	34	122	20	
		Pentachlorophenol	87-86-5	Solid	8270D	1311/3510	100	Haz Waste	0.0190	0.100	mg/L	25	133	20	
		Perylene-d12	1520-96-3	Solid	8270D	1311/3510	NA	Haz Waste			mg/L				
		Phenanthrene-d10	1517-22-2	Solid	8270D	1311/3510	NA	Haz Waste			mg/L				
		Pyridine	110-86-1	Solid	8270D	1311/3510	5	Haz Waste	0.00240	0.0200	mg/L	50	150	20	
		2,4,6-Tribromophenol	118-79-6	Solid	8270D	1311/3510	NA	Haz Waste			mg/L				Surrogate
		2-Fluorobiphenyl	321-60-8	Solid	8270D	1311/3510	NA	Haz Waste			mg/L				Surrogate
		2-Fluorophenol	367-12-4	Solid	8270D	1311/3510	NA	Haz Waste			mg/L				Surrogate
		4-Terphenyl-d14	1718-51-0	Solid	8270D	1311/3510	NA	Haz Waste			mg/L				Surrogate
		Nitrobenzene-d5	4165-60-0	Solid	8270D	1311/3510	NA	Haz Waste			mg/L				Surrogate
		Phenol-d5	4165-62-2	Solid	8270D	1311/3510	NA	Haz Waste			mg/L				Surrogate
EMT	TCLP VOCs	1,1-Dichloroethene	75-35-4	Solid	8260B	1311/5030	NE	Haz Waste	0.000500	0.00200	mg/L	70	131	20	
		1,2-Dichloroethane	107-06-2	Solid	8260B	1311/5030	0.5	Haz Waste	0.000300	0.00200	mg/L	78	122	20	
		1,4-Dichlorobenzene	106-46-7	Solid	8260B	1311/5030	7.5	Haz Waste	0.000500	0.00400	mg/L	75	120	20	
		1,4-Dichlorobenzene-d4	3855-82-1	Solid	8260B	1311/5030	NA	Haz Waste			mg/L				
		1,4-Difluorobenzene	540-36-3	Solid	8260B	1311/5030	NA	Haz Waste			mg/L				
		2-Butanone	78-93-3	Solid	8260B	1311/5030	200	Haz Waste	0.00130	0.00700	mg/L	51	148	20	
		Benzene	71-43-2	Solid	8260B	1311/5030	0.5	Haz Waste	0.000400	0.00200	mg/L	77	121	20	
		Carbon tetrachloride	56-23-5	Solid	8260B	1311/5030	0.5	Haz Waste	0.000500	0.00400	mg/L	70	135	20	
		Chlorobenzene	108-90-7	Solid	8260B	1311/5030	100	Haz Waste	0.000500	0.00400	mg/L	79	120	20	

Lab	Analyte Group	Analyte	CAS Number	Matrix	Analytical Method	Prep Method	WI Soil Standard	Soil Standard References	MDL	MRL	Units	LCL	UCL	RPD	Comments
EMT	TCLP VOCs (cont'd)	Chlorobenzene-d5	3114-55-4	Solid	8260B	1311/5030	NA	Haz Waste			mg/L				
		Chloroform	67-66-3	Solid	8260B	1311/5030	6	Haz Waste	0.000400	0.00200	mg/L	78	123	20	
		Ethylbenzene	100-41-4	Solid	8260B	1311/5030	NE	Haz Waste	0.000500	0.00200	mg/L	76	122	20	
		m,p-Xylene	179601-23-1	Solid	8260B	1311/5030	NE	Haz Waste	0.000900	0.00400	mg/L	77	124	20	
		o-Xylene	95-47-6	Solid	8260B	1311/5030	NE	Haz Waste	0.000400	0.00400	mg/L	77	123	20	
		Pentafluorobenzene	363-72-4	Solid	8260B	1311/5030	NA	Haz Waste			mg/L				
		Tetrachloroethene	127-18-4	Solid	8260B	1311/5030	0.7	Haz Waste	0.000600	0.00400	mg/L	73	128	20	
		Toluene	108-88-3	Solid	8260B	1311/5030	NE	Haz Waste	0.000400	0.00200	mg/L	77	121	20	
		Trichloroethene	79-01-6	Solid	8260B	1311/5030	0.5	Haz Waste	0.000500	0.00200	mg/L	77	123	20	
		Vinyl chloride	75-01-4	Solid	8260B	1311/5030	0.2	Haz Waste	0.000400	0.00200	mg/L	56	135	20	
		Xylenes, Total	1330-20-7	Solid	8260B	1311/5030	NE	Haz Waste	0.00130	0.00800	mg/L				
		1,2-Dichlorobenzene-d4	2199-69-1	Solid	8260B	1311/5030	NA	Haz Waste	0.00120	0.0200	mg/L				Surrogate
		1,2-Dichloroethane-d4	17060-07-0	Solid	8260B	1311/5030	NA	Haz Waste	0.00150	0.0200	mg/L				Surrogate
		4-Bromofluorobenzene	460-00-4	Solid	8260B	1311/5030	NA	Haz Waste	0.000800	0.0100	mg/L				Surrogate
		Dibromofluoromethane	1868-53-7	Solid	8260B	1311/5030	NA	Haz Waste	0.00110	0.0200	mg/L				Surrogate
		Fluorobenzene	462-06-6	Solid	8260B	1311/5030	NA	Haz Waste	0.000700	0.0200	mg/L				Surrogate
		Toluene-d8	2037-26-5	Solid	8260B	1311/5030	NA	Haz Waste	0.00110	0.0200	mg/L				Surrogate
EMT	DRO & GRO	Diesel Range Organics	68334-30-5	Solid	WDNR_DRO	3550/WDNR_DRO_prep	100,000	GW	1.56	20.0	ug/kg	70	120	20	
		Gasoline Range Organics	8006-61-9	Solid	WDNR_GRO	WDNR_GRO_prep	100,000	GW	3.12	20.0	ug/kg	80	120	20	
		1,4-Dichlorobenzene-d4	3855-82-1	Solid	WDNR_GRO	WDNR_GRO_prep	NE	---			ug/kg				
EMT	WDNR PVOC	1,2,4-Trimethylbenzene	95-63-6	Solid	WDNR_PVOC	WDNR_PVOC_prep	1,400	GW	0.570	25.0	ug/kg	80	120	20	
		1,3,5-Trimethylbenzene	108-67-8	Solid	WDNR_PVOC	WDNR_PVOC_prep	182,000	NIDC	0.549	25.0	ug/kg	80	120	20	
		Benzene	71-43-2	Solid	WDNR_PVOC	WDNR_PVOC_prep	5.1	GW	0.469	25.0	ug/kg	80	120	20	
		Ethylbenzene	100-41-4	Solid	WDNR_PVOC	WDNR_PVOC_prep	1,600	GW	0.254	25.0	ug/kg	80	120	20	
		m,p-Xylene	179601-23-1	Solid	WDNR_PVOC	WDNR_PVOC_prep	3,900	GW	0.614	25.0	ug/kg	80	120	20	
		Methyl tert-butyl ether	1634-04-4	Solid	WDNR_PVOC	WDNR_PVOC_prep	27	GW	0.380	25.0	ug/kg	80	120	20	
		Naphthalene	91-20-3	Solid	WDNR_PVOC	WDNR_PVOC_prep	2.6	GW	0.218	25.0	ug/kg	80	120	20	
		o-Xylene	95-47-6	Solid	WDNR_PVOC	WDNR_PVOC_prep	434,000	NIDC	0.301	25.0	ug/kg	80	120	20	
		Toluene	108-88-3	Solid	WDNR_PVOC	WDNR_PVOC_prep	1,100	GW	0.417	25.0	ug/kg	80	120	20	
		Xylenes, Total	1330-20-7	Solid	WDNR_PVOC	WDNR_PVOC_prep	3,900	GW	0.915	25.0	ug/kg	80	120	20	
		1,4-Dichlorobenzene-d4	3855-82-1	Solid	WDNR_PVOC	WDNR_PVOC_prep	NE	---			ug/kg				Surrogate
EMT	WDNR VOC	1,1,1,2-Tetrachloroethane	630-20-6	Solid	WDNR_VOC	WDNR_VOC_prep	53	GW	9.44	25.0	ug/kg	65	135	20	
		1,1,1-Trichloroethane	71-55-6	Solid	WDNR_VOC	WDNR_VOC_prep	140	GW	8.96	25.0	ug/kg	55	145	20	
		1,1,2,2-Tetrachloroethane	79-34-5	Solid	WDNR_VOC	WDNR_VOC_prep	0.16	GW	17.4	25.0	ug/kg	40	145	20	
		1,1,2-Trichloro-1,2,2-Trifluoroethane	76-13-1	Solid	WDNR_VOC	WDNR_VOC_prep	910,000	NIDC	20.8	25.0	ug/kg	70	130	20	
		1,1,2-Trichloroethane	79-00-5	Solid	WDNR_VOC	WDNR_VOC_prep	3.2	GW	11.3	25.0	ug/kg	50	140	20	
		1,1-Dichloroethane	75-34-3	Solid	WDNR_VOC	WDNR_VOC_prep	480	GW	9.24	25.0	ug/kg	65	135	20	
		1,1-Dichloroethene	75-35-4	Solid	WDNR_VOC	WDNR_VOC_prep	5	GW	22.3	25.0	ug/kg	55	150	20	
		1,1-Dichloropropanone	513-88-2	Solid	WDNR_VOC	WDNR_VOC_prep	NE	---		25.0	ug/kg				

Lab	Analyte Group	Analyte	CAS Number	Matrix	Analytical Method	Prep Method	WI Soil Standard	Soil Standard References	MDL	MRL	Units	LCL	UCL	RPD	Comments
EMT	WDNR VOC (cont'd)	1,1-Dichloropropene	563-58-6	Solid	WDNR_VOC	WDNR_VOC_prep	NE	---	11.4	25.0	ug/kg	60	145	20	
		1,2,3-Trichlorobenzene	87-61-6	Solid	WDNR_VOC	WDNR_VOC_prep	48,900	NIDC	25.9	25.0	ug/kg	50	145	20	
		1,2,3-Trichloropropane	96-18-4	Solid	WDNR_VOC	WDNR_VOC_prep	5	NIDC	19.2	25.0	ug/kg	50	140	20	
		1,2,4-Trichlorobenzene	120-82-1	Solid	WDNR_VOC	WDNR_VOC_prep	410	GW	24.5	25.0	ug/kg	55	140	20	
		1,2,4-Trimethylbenzene	95-63-6	Solid	WDNR_VOC	WDNR_VOC_prep	1400	GW	10.2	25.0	ug/kg	55	145	20	
		1,2-Dibromo-3-chloropropane	96-12-8	Solid	WDNR_VOC	WDNR_VOC_prep	0.17	GW	30.4	25.0	ug/kg	25	150	20	
		1,2-Dibromoethane	106-93-4	Solid	WDNR_VOC	WDNR_VOC_prep	0.028	GW	12.5	25.0	ug/kg	60	135	20	
		1,2-Dichlorobenzene	95-50-1	Solid	WDNR_VOC	WDNR_VOC_prep	1200	GW	13.1	25.0	ug/kg	65	125	20	
		1,2-Dichloroethane	107-06-2	Solid	WDNR_VOC	WDNR_VOC_prep	2.8	GW	8.26	25.0	ug/kg	60	145	20	
		1,2-Dichloroethene, Total	540-59-0	Solid	WDNR_VOC	WDNR_VOC_prep	NE	---	16.1	25.0	ug/kg	55	135	20	
		1,2-Dichloropropane	78-87-5	Solid	WDNR_VOC	WDNR_VOC_prep	3.3	GW	25.2	25.0	ug/kg	65	125	20	
		1,3,5-Trimethylbenzene	108-67-8	Solid	WDNR_VOC	WDNR_VOC_prep	182,000	NIDC	9.62	25.0	ug/kg	55	145	20	
		1,3-Dichlorobenzene	541-73-1	Solid	WDNR_VOC	WDNR_VOC_prep	1200	GW	10.4	25.0	ug/kg	65	135	20	
		1,3-Dichloropropane	142-28-9	Solid	WDNR_VOC	WDNR_VOC_prep	1,490,000	NIDC	20.6	25.0	ug/kg	70	130	20	
		1,3-Dichloropropene, Total	542-75-6	Solid	WDNR_VOC	WDNR_VOC_prep	0.29	GW	18.2	25.0	ug/kg	55	135	20	
		1,4-Dichlorobenzene	106-46-7	Solid	WDNR_VOC	WDNR_VOC_prep	140	GW	9.68	25.0	ug/kg	65	135	20	
		1,4-Dichlorobenzene-d4	3855-82-1	Solid	WDNR_VOC	WDNR_VOC_prep	NE	---		25.0	ug/kg				
		1,4-Difluorobenzene	540-36-3	Solid	WDNR_VOC	WDNR_VOC_prep	NE	---		25.0	ug/kg				
		1,4-Dioxane	123-91-1	Solid	WDNR_VOC	WDNR_VOC_prep	1.2	GW	253	25.0	ug/kg	70	130	20	
		1-Bromopropane	106-94-5	Solid	WDNR_VOC	WDNR_VOC_prep	NE	---	12.2	25.0	ug/kg	70	130	20	
		1-Butanol	71-36-3	Solid	WDNR_VOC	WDNR_VOC_prep	6,110,000	NIDC	572	25.0	ug/kg	70	130	20	
		1-Propanol	71-23-8	Solid	WDNR_VOC	WDNR_VOC_prep	NE	---	1040	25.0	ug/kg	70	130	20	
		2,2-Dichloropropane	594-20-7	Solid	WDNR_VOC	WDNR_VOC_prep	527,000	NIDC	9.37	25.0	ug/kg	55	145	20	
		2-Butanone	78-93-3	Solid	WDNR_VOC	WDNR_VOC_prep	1700	GW	85.9	25.0	ug/kg	10	180	20	
		2-Chloro-1,3-butadiene	126-99-8	Solid	WDNR_VOC	WDNR_VOC_prep	14	NIDC	11.2	25.0	ug/kg	70	130	20	
		2-Chloroethyl vinyl ether	110-75-8	Solid	WDNR_VOC	WDNR_VOC_prep	1,640,000	NIDC	15.5	25.0	ug/kg	70	130	20	
		2-Chlorotoluene	95-49-8	Solid	WDNR_VOC	WDNR_VOC_prep	907,000	NIDC	10.4	25.0	ug/kg	60	140	20	
		2-Hexanone	591-78-6	Solid	WDNR_VOC	WDNR_VOC_prep	244,000	NIDC	60.7	25.0	ug/kg	30	160	20	
		4-Chlorotoluene	106-43-4	Solid	WDNR_VOC	WDNR_VOC_prep	253,000	NIDC	6.36	25.0	ug/kg	65	135	20	
		4-Isopropyltoluene	99-87-6	Solid	WDNR_VOC	WDNR_VOC_prep	162,000	NIDC	13.9	25.0	ug/kg	65	140	20	
		4-Methyl-2-pentanone	108-10-1	Solid	WDNR_VOC	WDNR_VOC_prep	230	GW	69.3	25.0	ug/kg	30	165	20	
		Acetone	67-64-1	Solid	WDNR_VOC	WDNR_VOC_prep	3680	GW	135	25.0	ug/kg	10	180	20	
		Acetonitrile	75-05-8	Solid	WDNR_VOC	WDNR_VOC_prep	1,260,000	NIDC	787	25.0	ug/kg	70	130	20	
		Acrolein	107-02-8	Solid	WDNR_VOC	WDNR_VOC_prep	223	NIDC	345	25.0	ug/kg	70	130	20	
		Acrylonitrile	107-13-1	Solid	WDNR_VOC	WDNR_VOC_prep	314	NIDC	56.6	25.0	ug/kg	70	130	20	
		Benzene	71-43-2	Solid	WDNR_VOC	WDNR_VOC_prep	5.1	GW	6.46	25.0	ug/kg	65	135	20	
		Bromobenzene	108-86-1	Solid	WDNR_VOC	WDNR_VOC_prep	354,000	NIDC	9.94	25.0	ug/kg	55	130	20	
		Bromochloromethane	74-97-5	Solid	WDNR_VOC	WDNR_VOC_prep	232,000	NIDC	9.60	25.0	ug/kg	60	135	20	
		Bromodichloromethane	75-27-4	Solid	WDNR_VOC	WDNR_VOC_prep	0.33	GW	15.9	25.0	ug/kg	60	135	20	
		Bromoform	75-25-2	Solid	WDNR_VOC	WDNR_VOC_prep	2.3	GW	11.8	25.0	ug/kg	45	150	20	
		Bromomethane	74-83-9	Solid	WDNR_VOC	WDNR_VOC_prep	5.1	GW	39.6	25.0	ug/kg	10	180	20	
		Carbon disulfide	75-15-0	Solid	WDNR_VOC	WDNR_VOC_prep	590	GW	5.54	25.0	ug/kg	30	180	20	
		Carbon tetrachloride	56-23-5	Solid	WDNR_VOC	WDNR_VOC_prep	3.9	GW	5.30	25.0	ug/kg	55	145	20	

Lab	Analyte Group	Analyte	CAS Number	Matrix	Analytical Method	Prep Method	WI Soil Standard	Soil Standard References	MDL	MRL	Units	LCL	UCL	RPD	Comments
EMT	WDNR VOC (cont'd)	Chlorobenzene	108-90-7	Solid	WDNR_VOC	WDNR_VOC_prep	392,000	NIDC	4.30	25.0	ug/kg	65	130	20	
		Chlorobenzene-d5	3114-55-4	Solid	WDNR_VOC	WDNR_VOC_prep	NE	---		25.0	ug/kg				
		Chloroethane	75-00-3	Solid	WDNR_VOC	WDNR_VOC_prep	230	GW	42.4	25.0	ug/kg	20	175	20	
		Chloroform	67-66-3	Solid	WDNR_VOC	WDNR_VOC_prep	3.3	GW	7.34	25.0	ug/kg	65	135	20	
		Chloromethane	74-87-3	Solid	WDNR_VOC	WDNR_VOC_prep	16	GW	14.2	25.0	ug/kg	40	140	20	
		cis-1,2-Dichloroethene	156-59-2	Solid	WDNR_VOC	WDNR_VOC_prep	41	GW	8.12	25.0	ug/kg	55	135	20	
		cis-1,3-Dichloropropene	10061-01-5	Solid	WDNR_VOC	WDNR_VOC_prep	1,220,000	NIDC	11.4	25.0	ug/kg	65	135	20	
		Cyclohexane	110-82-7	Solid	WDNR_VOC	WDNR_VOC_prep	117,000	NIDC	34.4	25.0	ug/kg	70	130	20	
		Dibromochloromethane	124-48-1	Solid	WDNR_VOC	WDNR_VOC_prep	32	GW	16.5	25.0	ug/kg	55	140	20	
		Dibromomethane	74-95-3	Solid	WDNR_VOC	WDNR_VOC_prep	35,000	NIDC	16.8	25.0	ug/kg	65	135	20	
		Dichlorodifluoromethane	75-71-8	Solid	WDNR_VOC	WDNR_VOC_prep	3100	GW	9.62	25.0	ug/kg	15	155	20	
		Ethyl acetate	84508-45-2	Solid	WDNR_VOC	WDNR_VOC_prep	NE	---	60.2	25.0	ug/kg	70	130	20	
		Ethyl ether	60-29-7	Solid	WDNR_VOC	WDNR_VOC_prep	10,100,000	NIDC	33.3	25.0	ug/kg	70	130	20	
		Ethyl methacrylate	97-63-2	Solid	WDNR_VOC	WDNR_VOC_prep	1,100,000	NIDC	11.4	25.0	ug/kg	70	130	20	
		Ethylbenzene	100-41-4	Solid	WDNR_VOC	WDNR_VOC_prep	1600	GW	5.18	25.0	ug/kg	65	135	20	
		Hexachlorobutadiene	87-68-3	Solid	WDNR_VOC	WDNR_VOC_prep	6,220	NIDC	11.2	25.0	ug/kg	40	155	20	
		Hexachloroethane	67-72-1	Solid	WDNR_VOC	WDNR_VOC_prep	12,100	NIDC		25.0	ug/kg	70	130	20	
		Hexane	110-54-3	Solid	WDNR_VOC	WDNR_VOC_prep	8440	GW	8.01	25.0	ug/kg	70	130	20	
		Iodomethane	74-88-4	Solid	WDNR_VOC	WDNR_VOC_prep	3,040,000	NIDC	12.0	25.0	ug/kg	70	130	20	
		Isobutanol	78-83-1	Solid	WDNR_VOC	WDNR_VOC_prep	18,300,000	NIDC	488	25.0	ug/kg	70	130	20	
		Isopropanol	67-63-0	Solid	WDNR_VOC	WDNR_VOC_prep	100,000,000	NIDC	264	25.0	ug/kg	70	130	20	
		Isopropylbenzene	98-82-8	Solid	WDNR_VOC	WDNR_VOC_prep	268,000	NIDC	11.1	25.0	ug/kg	70	140	20	
		m,p-Xylene	179601-23-1	Solid	WDNR_VOC	WDNR_VOC_prep	3,900	GW	12.2	25.0	ug/kg	70	135	20	
		Methacrylonitrile	126-98-7	Solid	WDNR_VOC	WDNR_VOC_prep	7,640	NIDC	29.4	25.0	ug/kg	70	130	20	
		Methyl methacrylate	80-62-6	Solid	WDNR_VOC	WDNR_VOC_prep	2,360,000	NIDC	19.5	25.0	ug/kg	70	130	20	
		Methyl tert-butyl ether	1634-04-4	Solid	WDNR_VOC	WDNR_VOC_prep	27	GW	6.82	25.0	ug/kg	70	130	20	
		Methylene chloride	75-09-2	Solid	WDNR_VOC	WDNR_VOC_prep	2.6	GW	13.3	25.0	ug/kg	40	155	20	
		Naphthalene	91-20-3	Solid	WDNR_VOC	WDNR_VOC_prep	660	GW	18.0	25.0	ug/kg	25	140	20	
		n-Butylbenzene	104-51-8	Solid	WDNR_VOC	WDNR_VOC_prep	108,000	NIDC	11.3	25.0	ug/kg	70	130	20	
		n-Propylbenzene	103-65-1	Solid	WDNR_VOC	WDNR_VOC_prep	264,000	NIDC	6.78	25.0	ug/kg	50	145	20	
		o-Xylene	95-47-6	Solid	WDNR_VOC	WDNR_VOC_prep	434,000	NIDC	9.31	25.0	ug/kg	70	135	20	
		Pentachloroethane	76-01-7	Solid	WDNR_VOC	WDNR_VOC_prep	5,390	NIDC		25.0	ug/kg	70	130	20	
		Pentafluorobenzene	363-72-4	Solid	WDNR_VOC	WDNR_VOC_prep	NE	---		25.0	ug/kg				
		Propionitrile	107-12-0	Solid	WDNR_VOC	WDNR_VOC_prep	15,600,000	NIDC	4310	25.0	ug/kg	70	130	20	
		sec-Butylbenzene	135-98-8	Solid	WDNR_VOC	WDNR_VOC_prep	145,000	NIDC	6.94	25.0	ug/kg	50	145	20	
		Styrene	100-42-5	Solid	WDNR_VOC	WDNR_VOC_prep	220	GW	9.06	25.0	ug/kg	65	135	20	
		tert-Butylbenzene	98-06-6	Solid	WDNR_VOC	WDNR_VOC_prep	183,000	NIDC	8.98	25.0	ug/kg	55	145	20	
		Tetrachloroethene	127-18-4	Solid	WDNR_VOC	WDNR_VOC_prep	4.5	GW	11.6	25.0	ug/kg	55	150	20	
		Tetrahydrofuran	109-99-9	Solid	WDNR_VOC	WDNR_VOC_prep	22	GW	37.9	25.0	ug/kg	70	130	20	
		Toluene	108-88-3	Solid	WDNR_VOC	WDNR_VOC_prep	1100	GW	8.86	25.0	ug/kg	60	135	20	
		trans-1,2-Dichloroethene	156-60-5	Solid	WDNR_VOC	WDNR_VOC_prep	59	GW	8.01	25.0	ug/kg	55	145	20	
		trans-1,3-Dichloropropene	10061-02-6	Solid	WDNR_VOC	WDNR_VOC_prep	1,570,000	NIDC	6.78	25.0	ug/kg	55	140	20	

Table 2F
Analytical Parameters, Reporting Limits, Precision and Accuracy
Environmental Monitoring Technologies, Inc. Laboratory - Soil and Bulk Samples

Lab	Analyte Group	Analyte	CAS Number	Matrix	Analytical Method	Prep Method	WI Soil Standard	Soil Standard References	MDL	MRL	Units	LCL	UCL	RPD	Comments
EMT	WDNR VOC (cont'd)	trans-1,4-Dichloro-2-butene	110-57-6	Solid	WDNR_VOC	WDNR_VOC_prep	10	NIDC	28.6	25.0	ug/kg	70	130	20	
		Trichloroethene	79-01-6	Solid	WDNR_VOC	WDNR_VOC_prep	3.6	GW	10.1	25.0	ug/kg	70	130	20	
		Trichlorofluoromethane	75-69-4	Solid	WDNR_VOC	WDNR_VOC_prep	4500	GW	11.5	25.0	ug/kg	10	215	20	
		Vinyl acetate	108-05-4	Solid	WDNR_VOC	WDNR_VOC_prep	1,400,000	NIDC	16.0	25.0	ug/kg	50	150	20	
		Vinyl chloride	75-01-4	Solid	WDNR_VOC	WDNR_VOC_prep	0.14	GW	6.14	25.0	ug/kg	45	140	20	
		Xylenes, Total	1330-20-7	Solid	WDNR_VOC	WDNR_VOC_prep	3900	GW	21.5	25.0	ug/kg	70	135	20	
		4-Bromofluorobenzene	460-00-4	Solid	WDNR_VOC	WDNR_VOC_prep	1,060,000	NIDC		25.0	ug/kg				Surrogate
		Dibromofluoromethane	1868-53-7	Solid	WDNR_VOC	WDNR_VOC_prep	NE	---		25.0	ug/kg				Surrogate
		Fluorobenzene	462-06-6	Solid	WDNR_VOC	WDNR_VOC_prep	2,390,000	NIDC		25.0	ug/kg				Surrogate
		Toluene-d8	2037-26-5	Solid	WDNR_VOC	WDNR_VOC_prep	NE	---		25.0	ug/kg				Surrogate
		1,2-Dichlorobenzene-d4	2199-69-1	Solid	WDNR_VOC	WDNR_VOC_prep	NE	---		25.0	ug/kg				Surrogate
		1,2-Dichloroethane-d4	17060-07-0	Solid	WDNR_VOC	WDNR_VOC_prep	NE	---		25.0	ug/kg				Surrogate
EMT	Misc	Cyanide	57-12-5	Solid	9014	9010	26.4	NIDC	0.100	0.500	mg/kg	76	120	10	
		Ignitability (open cup)		Solid	D92-90	None	NA	---		35.0	°F				
		Free Liquid		Solid	9095	None	NA	---	1	1	Pass/ Fail				
		Total Solids	Moist	Solid	2540G	None	NA	---	0.0170	0.100	%	93	115	10	
		pH		Solid	9045	None	NA	---			SU	90	110		
		Phosphorus, Total (As P)	7723-14-0	Solid	4500	4500_PHOS_prep	1.56	NIDC	0.00600	0.0500	mg/kg	80	120	10	
		Sulfide	18496-25-8	Solid	9030	None	NA	---	4.6	10	mg/kg	80	120	14.1	

Notes:
Yellow shading designates MDLs that exceed their respective WI soil standards.
1) GW and NIDC RCLs are from the January 2015 update to the WDNR's RCL spreadsheet (available for download at http://dnr.wi.gov/topic/brownfields/professionals.html)
2) The hazardous waste TCLP limits are from 40 CFR 261.24.
3) The RCL shown for xylenes is for total xylenes
4) The RCL shown for GRO and DRO is for sites having relatively high permeability soil (as defined in Chapter NR720, Wisc. Adm. Code).

CAS = Chemical Abstracts Service
DRO = diesel range organic
µg/kg = micrograms per kilogram
CFR = Code of Federal Regulations
cont'd = continued
Cr-VI = hexavalent chromium
EMT = Environmental Monitoring Technologies, Inc.
F = Fahrenheit
GRO = gasoline range organic
GW = groundwater
haz = hazardous
LCL = lower control limit
MDL = method detection limit
mg/kg = milligrams per kilogram
mg/L = milligrams per liter
misc = miscellaneous
mod = modified
MRL = method reporting limit
NA = not applicable or not available
NE = not established
NIDC = non-industrial direct contact
P = phosphorus
PAH = polynuclear aromatic hydrocarbon
PCB = polychlorinated biphenyl
prep = preparation
PVOC = petroleum VOC
RCL = residual contaminant level
RPD = Relative Percent Difference
SU = standard units
Surr = surrogate
SVOC = semi-volatile organic compound
TCLP = toxicity characteristic leaching procedure
U.S. EPA = United States Environmental Protection Agency
UCL = upper control limit
VOC = volatile organic compound
WDNR = Wisconsin Department of Natural Resources
WI = Wisconsin

Lab	Analyte Group	Analyte	CAS Number	Matrix	Analytical Method	Prep Method	WI NR140 PAL	TCLP Haz Waste Limit	MDL	MRL	Units	LCL	UCL	RPD	Comments
EMT	Herbicides	3,5-Dichlorobenzoic Acid	51-36-5	Water	8321A	3510	NE	---			ug/L				Surrogate
		2,4,5-T	93-76-5	Water	8321A	3510	NE	---	0.398	1.50	ug/L	35	110	20	
		2,4,5-TP (Silvex)	93-72-1	Water	8321A	3510	5	---	0.254	1.50	ug/L	50	115	20	
		2,4-D	94-75-7	Water	8321A	3510	7	---	0.261	1.50	ug/L	35	115	20	
		2,4-DB	94-82-6	Water	8321A	3510	NE	---	0.311	1.50	ug/L	45	130	20	
		Dicamba	1918-00-9	Water	8321A	3510	60	---	0.513	1.50	ug/L	60	110	20	
		Dichlorprop	120-36-5	Water	8321A	3510	NE	---	0.264	1.50	ug/L	70	120	20	
		Dinoseb	88-85-7	Water	8321A	3510	1.4	---	0.554	1.50	ug/L	20	100	20	
		MCPA	94-74-6	Water	8321A	3510	NE	---	0.333	1.50	ug/L	60	145	20	
		MCPP	7085-19-0	Water	8321A	3510	NE	---	0.524	1.50	ug/L	50	150	20	
		Pentachlorophenol	87-86-5	Water	8321A	3510	0.1	---	0.536	1.50	ug/L	50	150	20	
		Picloram	1918-02-1	Water	8321A	3510	100	---	0.264	1.50	ug/L	50	150	20	
EMT	Metals	Aluminum	7429-90-5	Water	6010C	3015	0.04	---	0.0203	0.250	mg/L	86	115	20	
		Antimony	7440-36-0	Water	6010C	3015	0.0012	---	0.0206	0.0500	mg/L	88	113	20	
		Arsenic	7440-38-2	Water	6010C	3015	0.001	---	0.0127	0.0500	mg/L	87	113	20	
		Barium	7440-39-3	Water	6010C	3015	0.4	---	0.00200	0.0500	mg/L	88	113	20	
		Beryllium	7440-41-7	Water	6010C	3015	0.0004	---	0.00290	0.00500	mg/L	89	112	20	
		Boron	7440-42-8	Water	6010C	3015	0.2	---	0.0170	0.0500	mg/L	85	113	20	
		Cadmium	7440-43-9	Water	6010C	3015	0.0005	---	0.00200	0.00500	mg/L	88	113	20	
		Calcium	7440-70-2	Water	6010C	3015	NE	---	0.0671	0.250	mg/L	87	113	20	
		Chromium	7440-47-3	Water	6010C	3015	0.01	---	0.00410	0.0500	mg/L	90	113	20	
		Cobalt	7440-48-4	Water	6010C	3015	0.008	---	0.00300	0.0500	mg/L	89	114	20	
		Copper	7440-50-8	Water	6010C	3015	0.13	---	0.0148	0.0500	mg/L	86	114	20	
		Iron	7439-89-6	Water	6010C	3015	0.15	---	0.0522	0.100	mg/L	87	115	20	
		Lead	7439-92-1	Water	6010C	3015	0.0015	---	0.0160	0.0500	mg/L	86	113	20	
		Magnesium	7439-95-4	Water	6010C	3015	NE	---	0.0189	0.250	mg/L	85	113	20	
		Manganese	7439-96-5	Water	6010C	3015	0.025	---	0.00230	0.0500	mg/L	90	114	20	
		Molybdenum	7439-98-7	Water	6010C	3015	0.008	---	0.00900	0.0500	mg/L	89	113	20	
		Nickel	7440-02-0	Water	6010C	3015	0.02	---	0.00600	0.0500	mg/L	88	113	20	
		Phosphorus	7723-14-0	Water	6010C	3015	NE	---	0.0109	0.250	mg/L	88	113	20	
		Potassium	7440-09-7	Water	6010C	3015	NE	---	0.158	0.250	mg/L	86	114	20	
		Selenium	7782-49-2	Water	6010C	3015	0.01	---	0.0180	0.0500	mg/L	83	114	20	
		Silver	7440-22-4	Water	6010C	3015	0.01	---	0.00300	0.0500	mg/L	84	115	20	
		Sodium	7440-23-5	Water	6010C	3015	NE	---	0.0890	0.250	mg/L	87	115	20	
		Strontium	7440-24-6	Water	6010C	3015	NE	---	0.0500	0.0625	mg/L	90	113	20	
		Tantalum	7440-25-7	Water	6010C	3015	NE	---	0.0534	0.0600	mg/L	80	120	20	
		Thallium	7440-28-0	Water	6010C	3015	0.0004	---	0.0163	0.0500	mg/L	85	114	20	
		Tin	7440-31-5	Water	6010C	3015	NE	---	0.00720	0.0500	mg/L	88	115	20	
		Titanium	7440-32-6	Water	6010C	3015	NE	---	0.00510	0.125	mg/L	91	111	20	
		Vanadium	7440-62-2	Water	6010C	3015	0.006	---	0.00500	0.0500	mg/L	90	111	20	
		Zinc	7440-66-6	Water	6010C	3015	0.0025	---	0.0120	0.0500	mg/L	87	115	20	

Lab	Analyte Group	Analyte	CAS Number	Matrix	Analytical Method	Prep Method	WI NR140 PAL	TCLP Haz Waste Limit	MDL	MRL	Units	LCL	UCL	RPD	Comments
EMT	Metals	Aluminum	7429-90-5	Water	6020A	3015	0.04	---	0.00530	0.0250	mg/L	84	117	20	
		Antimony	7440-36-0	Water	6020A	3015	0.0012	---	0.000120	0.00500	mg/L	85	117	20	
		Arsenic	7440-38-2	Water	6020A	3015	0.001	---	0.0000540	0.00500	mg/L	84	116	20	
		Barium	7440-39-3	Water	6020A	3015	0.4	---	0.000110	0.00500	mg/L	86	114	20	
		Beryllium	7440-41-7	Water	6020A	3015	0.0004	---	0.0000580	0.000500	mg/L	83	121	20	
		Boron	7440-42-8	Water	6020A	3015	0.2	---	0.000260	0.00500	mg/L	73	130	20	
		Cadmium	7440-43-9	Water	6020A	3015	0.0005	---	0.0000600	0.000500	mg/L	87	115	20	
		Calcium	7440-70-2	Water	6020A	3015	NE	---	0.0130	0.0250	mg/L	87	118	20	
		Chromium	7440-47-3	Water	6020A	3015	0.01	---	0.0000680	0.00500	mg/L	85	116	20	
		Cobalt	7440-48-4	Water	6020A	3015	0.008	---	0.0000590	0.00500	mg/L	86	115	20	
		Copper	7440-50-8	Water	6020A	3015	0.13	---	0.000640	0.00500	mg/L	85	118	20	
		Iron	7439-89-6	Water	6020A	3015	0.15	---	0.00612	0.0250	mg/L	87	118	20	
		Lead	7439-92-1	Water	6020A	3015	0.0015	---	0.0000600	0.00500	mg/L	88	115	20	
		Magnesium	7439-95-4	Water	6020A	3015	NE	---	0.00670	0.0250	mg/L	83	118	20	
		Manganese	7439-96-5	Water	6020A	3015	0.025	---	0.000150	0.00500	mg/L	87	115	20	
		Molybdenum	7439-98-7	Water	6020A	3015	0.008	---	0.000150	0.00500	mg/L	83	115	20	
		Nickel	7440-02-0	Water	6020A	3015	0.02	---	0.0000820	0.00500	mg/L	85	117	20	
		Phosphorus	7723-14-0	Water	6020A	3015	NE	---	0.0100	0.0250	mg/L	80	120	20	
		Potassium	7440-09-7	Water	6020A	3015	NE	---	0.00580	0.0250	mg/L	87	115	20	
		Selenium	7782-49-2	Water	6020A	3015	0.01	---	0.000100	0.00500	mg/L	80	120	20	
		Silver	7440-22-4	Water	6020A	3015	0.01	---	0.000110	0.000500	mg/L	85	116	20	
		Sodium	7440-23-5	Water	6020A	3015	NE	---	0.00850	0.0250	mg/L	85	117	20	
		Thallium	7440-28-0	Water	6020A	3015	0.0004	---	0.0000600	0.00500	mg/L	82	116	20	
		Tin	7440-31-5	Water	6020A	3015	NE	---	0.000250	0.00500	mg/L	86	115	20	
		Titanium	7440-32-6	Water	6020A	3015	NE	---	0.000580	0.00500	mg/L	83	115	20	
		Vanadium	7440-62-2	Water	6020A	3015	0.006	---	0.0000280	0.00500	mg/L	86	115	20	
		Zinc	7440-66-6	Water	6020A	3015	0.0025	---	0.000610	0.00500	mg/L	83	119	20	
EMT	Metals	Chromium, Hexavalent	18540-29-9	Water	3500	None	NE	---	0.00100	0.0100	mg/L	90	110	10	
		Mercury	7439-97-6	Water	7470A	7470A_prep	0.0002	---	0.000100	0.000250	mg/L	82	119	20	
		Mercury	7439-97-6	Water	7471B	7471B_prep	0.0002	---	0.000100	0.000250	mg/L	82	119	20	
EMT	PAHs	1-Methylnaphthalene	90-12-0	Water	8310	3510	NE	---	0.0379	0.100	ug/L	40	106	20	
		2-Methylnaphthalene	91-57-6	Water	8310	3510	NE	---	0.0288	0.100	ug/L	41	106	20	
		Acenaphthene	83-32-9	Water	8310	3510	NE	---	0.0254	0.100	ug/L	45	112	20	
		Acenaphthylene	208-96-8	Water	8310	3510	NE	---	0.0306	5.00	ug/L	53	108	20	
		Anthracene	120-12-7	Water	8310	3510	600	---	0.0367	0.100	ug/L	58	113	20	
		Benzo(a)anthracene	56-55-3	Water	8310	3510	NE	---	0.0264	0.100	ug/L	54	124	20	
		Benzo(a)pyrene	50-32-8	Water	8310	3510	0.02	---	0.0586	0.100	ug/L	58	120	20	
		Benzo(b)fluoranthene	205-99-2	Water	8310	3510	0.02	---	0.0264	0.100	ug/L	54	124	20	
		Benzo(g,h,i)perylene	191-24-2	Water	8310	3510	NE	---	0.0269	0.100	ug/L	55	122	20	
		Benzo(k)fluoranthene	207-08-9	Water	8310	3510	NE	---	0.0325	0.100	ug/L	53	124	20	
		Chrysene	218-01-9	Water	8310	3510	0.02	---	0.0375	0.100	ug/L	61	119	20	
		Dibenzo(a,h)anthracene	53-70-3	Water	8310	3510	NE	---	0.0365	0.100	ug/L	56	119	20	
		Fluoranthene	206-44-0	Water	8310	3510	80	---	0.0380	0.100	ug/L	55	119	20	

Lab	Analyte Group	Analyte	CAS Number	Matrix	Analytical Method	Prep Method	WI NR140 PAL	TCLP Haz Waste Limit	MDL	MRL	Units	LCL	UCL	RPD	Comments
EMT	PAHs (cont'd)	Fluorene	86-73-7	Water	8310	3510	80	---	0.0477	0.100	ug/L	53	111	20	
		Indeno(1,2,3-cd)pyrene	193-39-5	Water	8310	3510	NE	---	0.0316	0.100	ug/L	53	126	20	
		Naphthalene	91-20-3	Water	8310	3510	10	---	0.0211	0.100	ug/L	42	105	20	
		Phenanthrene	85-01-8	Water	8310	3510	NE	---	0.0483	0.100	ug/L	57	114	20	
		Pyrene	129-00-0	Water	8310	3510	50	---	0.0371	0.100	ug/L	58	114	20	
		4-Terphenyl-d14	1718-51-0	Water	8310	3510	NA	---			ug/L				Surrogate
EMT	PCBs	Aroclor 1221	11104-28-2	Water	8082A	3510	0.003	---	0.123	0.800	ug/L	40	130	20	
		Aroclor 1232	11141-16-5	Water	8082A	3510	0.003	---	0.161	1.00	ug/L	40	130	20	
		Aroclor 1242	53469-21-9	Water	8082A	3510	0.003	---	0.146	1.00	ug/L	40	130	20	
		Aroclor 1248	12672-29-6	Water	8082A	3510	0.003	---	0.148	1.00	ug/L	62	104	20	
		Aroclor 1254	11097-69-1	Water	8082A	3510	0.003	---	0.116	0.800	ug/L	34	127	20	
		Aroclor 1260	11096-82-5	Water	8082A	3510	0.003	---	0.0992	0.500	ug/L	45	134	20	
		Aroclor 1262	37324-23-5	Water	8082A	3510	0.003	---	0.154	1.00	ug/L	50	150	30	
		Aroclor 1268	11100-14-4	Water	8082A	3510	0.003	---	0.0805	0.500	ug/L	50	150	30	
		Total PCB	1336-36-3	Water	8082A	3510	0.003	---	0.161	1.00	ug/L				
		2,4,5,6-Tetrachloro-m-xylene	877-09-8	Water	8082A	3510	NA	---			ug/L				Surrogate
		Decachlorobiphenyl	2051-24-3	Water	8082A	3510	NA	---			ug/L				Surrogate
EMT	Pesticides	2,4'-DDD	53-19-0	Water	8081B	3510C	NE	---	0.00400	0.300	ug/L				
		2,4'-DDE	3424-82-6	Water	8081B	3510C	NE	---	0.00200	0.300	ug/L				
		2,4'-DDT	789-02-6	Water	8081B	3510C	NE	---	0.00300	0.300	ug/L				
		4,4'-DDD	72-54-8	Water	8081B	3510C	NE	---	0.00230	0.300	ug/L	56	143	20	
		4,4'-DDE	72-55-9	Water	8081B	3510C	NE	---	0.00270	0.300	ug/L	57	135	20	
		4,4'-DDT	50-29-3	Water	8081B	3510C	NE	---	0.00300	0.300	ug/L	51	143	20	
		Alachlor	15972-60-8	Water	8081B	3510C	0.2	---	0.0865	0.500	ug/L	19	132	20	
		Aldrin	309-00-2	Water	8081B	3510C	NE	---	0.00190	0.300	ug/L	45	134	20	
		alpha-BHC	319-84-6	Water	8081B	3510C	NE	---	0.00170	0.300	ug/L	54	138	20	
		alpha-Chlordane	5103-71-9	Water	8081B	3510C	NE	---	0.0134	0.500	ug/L	60	129	20	
		Atrazine	1912-24-9	Water	8081B	3510C	0.3	---	0.120	0.500	ug/L	57	119	20	
		beta-BHC	319-85-7	Water	8081B	3510C	NE	---	0.00260	0.300	ug/L	56	136	20	
		Chlordane	57-74-9	Water	8081B	3510C	0.2	---	0.0495	0.500	ug/L				
		delta-BHC	319-86-8	Water	8081B	3510C	NE	---	0.00220	0.300	ug/L	52	142	20	
		Dieldrin	60-57-1	Water	8081B	3510C	NE	---	0.00220	0.300	ug/L	60	136	20	
		Endosulfan I	959-98-8	Water	8081B	3510C	NE	---	0.00240	0.300	ug/L	62	126	20	
		Endosulfan II	33213-65-9	Water	8081B	3510C	NE	---	0.00260	0.300	ug/L	52	135	20	
		Endosulfan sulfate	1031-07-8	Water	8081B	3510C	NE	---	0.00320	0.300	ug/L	62	133	20	
		Endrin	72-20-8	Water	8081B	3510C	0.4	---	0.00150	0.300	ug/L	60	138	20	
		Endrin aldehyde	7421-93-4	Water	8081B	3510C	NE	---	0.00280	0.300	ug/L	51	132	20	
		Endrin ketone	53494-70-5	Water	8081B	3510C	NE	---	0.00170	0.300	ug/L	58	134	20	
		gamma-BHC	58-89-9	Water	8081B	3510C	NE	---	0.00280	0.300	ug/L	59	134	20	
		gamma-Chlordane	5566-34-7	Water	8081B	3510C	NE	---	0.0126	0.500	ug/L	56	136	20	
		Heptachlor	76-44-8	Water	8081B	3510C	0.04	---	0.00470	0.300	ug/L	54	130	20	
		Heptachlor epoxide	1024-57-3	Water	8081B	3510C	0.02	---	0.00200	0.300	ug/L	61	133	20	
		Methoxychlor	72-43-5	Water	8081B	3510C	4	---	0.00250	0.300	ug/L	54	145	20	

Lab	Analyte Group	Analyte	CAS Number	Matrix	Analytical Method	Prep Method	WI NR140 PAL	TCLP Haz Waste Limit	MDL	MRL	Units	LCL	UCL	RPD	Comments
EMT	Pesticides (cont'd)	Simazine	122-34-9	Water	8081B	3510C	0.4	---	0.144	0.500	ug/L	35	124	20	
		Toxaphene	8001-35-2	Water	8081B	3510C	0.3	---	0.316	1.50	ug/L	50	150	20	
		2,4,5,6-Tetrachloro-m-xylene	877-09-8	Water	8081B	3510C	NE	---			ug/L				Surrogate
		Decachlorobiphenyl	2051-24-3	Water	8081B	3510C	NE	---			ug/L				Surrogate
EMT	SVOCs	1,2,4,5-Tetrachlorobenzene	95-94-3	Water	8270D	3510C	NE	---	1.39	5.00	ug/L	50	121	20	
		1,2,4-Trichlorobenzene	120-82-1	Water	8270D	3510C	14	---	0.637	5.00	ug/L	29	116	20	
		1,2-Dichlorobenzene	95-50-1	Water	8270D	3510C	60	---	0.662	5.00	ug/L	32	111	20	
		1,2-Dinitrobenzene	528-29-0	Water	8270D	3510C	NE	---	2.28	10.0	ug/L	59	109	20	
		1,3,5-Trinitrobenzene	99-35-4	Water	8270D	3510C	NE	---	2.00	10.0	ug/L	41	137	20	
		1,3-Dichlorobenzene	541-73-1	Water	8270D	3510C	120	---	0.709	5.00	ug/L	28	110	20	
		1,3-Dinitrobenzene	99-65-0	Water	8270D	3510C	NE	---	2.00	10.0	ug/L	49	128	20	
		1,4-Dichlorobenzene	106-46-7	Water	8270D	3510C	15	---	0.617	5.00	ug/L	28	110	20	
		1,4-Dichlorobenzene-d4	3855-82-1	Water	8270D	3510C	NE	---			ug/L				
		1,4-Dinitrobenzene	100-25-4	Water	8270D	3510C	NE	---	2.09	10.0	ug/L	50	150	20	
		1,4-Naphthoquinone	130-15-4	Water	8270D	3510C	NE	---	2.00	10.0	ug/L	50	150	20	
		1-Methylnaphthalene	90-12-0	Water	8270D	3510C	NE	---	0.259	5.00	ug/L	41	119	20	
		1-Naphthylamine	134-32-7	Water	8270D	3510C	NE	---	2.25	10.0	ug/L	24	124	20	
		2,3,4,6-Tetrachlorophenol	58-90-2	Water	8270D	3510C	NE	---	2.00	10.0	ug/L	50	128	20	
		2,3-Dichloroaniline	608-27-5	Water	8270D	3510C	NE	---	10.0	10.0	ug/L	70	129	20	
		2,4,5-Trichlorophenol	95-95-4	Water	8270D	3510C	NE	---	0.742	10.0	ug/L	53	123	20	
		2,4,6-Trichlorophenol	88-06-2	Water	8270D	3510C	NE	---	0.992	10.0	ug/L	50	125	20	
		2,4-Dichlorophenol	120-83-2	Water	8270D	3510C	NE	---	1.18	10.0	ug/L	47	121	20	
		2,4-Dimethylphenol	105-67-9	Water	8270D	3510C	NE	---	1.05	10.0	ug/L	31	124	20	
		2,4-Dinitrophenol	51-28-5	Water	8270D	3510C	NE	---	7.37	50.0	ug/L	23	143	20	
		2,4-Dinitrotoluene	121-14-2	Water	8270D	3510C	NE	---	1.36	25.0	ug/L	57	128	20	
		2,6-Dichlorophenol	87-65-0	Water	8270D	3510C	NE	---	1.74	10.0	ug/L	50	118	20	
		2,6-Dinitrotoluene	606-20-2	Water	8270D	3510C	NE	---	0.371	5.00	ug/L	57	124	20	
		2-Acetylaminofluorene	53-96-3	Water	8270D	3510C	NE	---	2.00	10.0	ug/L	60	138	20	
		2-Chloronaphthalene	91-58-7	Water	8270D	3510C	NE	---	0.608	5.00	ug/L	40	116	20	
		2-Chlorophenol	95-57-8	Water	8270D	3510C	NE	---	1.14	5.00	ug/L	38	117	20	
		2-Methylnaphthalene	91-57-6	Water	8270D	3510C	NE	---	0.218	5.00	ug/L	40	121	20	
		2-Methylphenol	95-48-7	Water	8270D	3510C	NE	---	5.05	20.0	ug/L	30	117	20	
		2-Nitroaniline	88-74-4	Water	8270D	3510C	NE	---	1.80	25.0	ug/L	55	127	20	
		2-Nitrophenol	88-75-5	Water	8270D	3510C	NE	---	1.50	25.0	ug/L	47	123	20	
		2-Picoline	109-06-8	Water	8270D	3510C	NE	---	2.08	10.0	ug/L	34	109	20	
		3 & 4-Methylphenol	84989-04-8	Water	8270D	3510C	NE	---	2.64	20.0	ug/L	29	110	20	
		3,3´-Dichlorobenzidine	91-94-1	Water	8270D	3510C	NE	---	10.2	50.0	ug/L	27	129	20	
		3,3'-Dimethylbenzidine	119-93-7	Water	8270D	3510C	NE	---	2.10	10.0	ug/L	50	150	20	
		3-Methylcholanthrene	56-49-5	Water	8270D	3510C	NE	---	2.32	10.0	ug/L	56	133	20	
		3-Nitroaniline	99-09-2	Water	8270D	3510C	NE	---	2.80	10.0	ug/L	41	128	20	
		4,4'-Methylenebis(2-chloroaniline)	101-14-4	Water	8270D	3510C	NE	---	3.60	20.0	ug/L	52	200	20	
		4,6-Dinitro-2-methylphenol	534-52-1	Water	8270D	3510C	NE	---	13.7	100	ug/L	44	137	20	

Lab	Analyte Group	Analyte	CAS Number	Matrix	Analytical Method	Prep Method	WI NR140 PAL	TCLP Haz Waste Limit	MDL	MRL	Units	LCL	UCL	RPD	Comments
EMT	SVOCs (cont'd)	4-Aminobiphenyl	92-67-1	Water	8270D	3510C	NE	---	8.69	30.0	ug/L	50	150	20	
		4-Bromophenyl-phenylether	101-55-3	Water	8270D	3510C	NE	---	0.379	5.00	ug/L	55	124	20	
		4-Chloro-3-methylphenol	59-50-7	Water	8270D	3510C	NE	---	2.92	20.0	ug/L	52	119	20	
		4-Chloroaniline	106-47-8	Water	8270D	3510C	NE	---	0.524	5.00	ug/L	33	117	20	
		4-Chlorophenyl-phenylether	7005-72-3	Water	8270D	3510C	NE	---	0.561	5.00	ug/L	53	121	20	
		4-Nitroaniline	100-01-6	Water	8270D	3510C	NE	---	1.71	10.0	ug/L	31	130	20	
		4-Nitrophenol	100-02-7	Water	8270D	3510C	NE	---	4.35	25.0	ug/L	8	97	20	
		4-Nitroquinoline,1-oxide	56-57-5	Water	8270D	3510C	NE	---	2.04	10.0	ug/L				
		5-Nitro-o-toluidine	99-55-8	Water	8270D	3510C	NE	---	1.80	10.0	ug/L	38	126	20	
		7,12-Dimethylbenz(a)anthracene	57-97-6	Water	8270D	3510C	NE	---	1.50	5.00	ug/L	61	133	20	
		Acenaphthene	83-32-9	Water	8270D	3510C	NE	---	0.214	5.00	ug/L	47	122	20	
		Acenaphthene-d10	15067-26-2	Water	8270D	3510C	NE	---			ug/L				
		Acenaphthylene	208-96-8	Water	8270D	3510C	NE	---	2.19	10.0	ug/L	41	130	20	
		Acetochlor	34256-82-1	Water	8270D	3510C	0.7	---	18.1	55.0	ug/L				
		Acetophenone	98-86-2	Water	8270D	3510C	NE	---	1.65	5.00	ug/L	46	118	20	
		Aniline	62-53-3	Water	8270D	3510C	NE	---	0.760	5.00	ug/L	27	94	20	
		Anthracene	120-12-7	Water	8270D	3510C	600	---	1.27	10.0	ug/L	57	123	20	
		Aramite	140-57-8	Water	8270D	3510C	NE	---	1.80	10.0	ug/L	34	132	20	
		Atrazine	1912-24-9	Water	8270D	3510C	0.3	---			ug/L				
		Azobenzene as 1,2-Diphenylhydrazine	103-33-3	Water	8270D	3510C	NE	---	1.72	10.0	ug/L	61	116	20	
		Benzaldehyde	100-52-7	Water	8270D	3510C	NE	---			ug/L				
		Benzidine	92-87-5	Water	8270D	3510C	NE	---	16.4	100	ug/L	17	134	20	
		Benzo(a)anthracene	56-55-3	Water	8270D	3510C	NE	---	0.592	10.0	ug/L	58	125	20	
		Benzo(a)pyrene	50-32-8	Water	8270D	3510C	0.02	---	0.754	10.0	ug/L	54	128	20	
		Benzo(b)fluoranthene	205-99-2	Water	8270D	3510C	0.02	---	0.554	25.0	ug/L	53	131	20	
		Benzo(g,h,i)perylene	191-24-2	Water	8270D	3510C	NE	---	0.630	10.0	ug/L	50	134	20	
		Benzo(k)fluoranthene	207-08-9	Water	8270D	3510C	NE	---	0.552	5.00	ug/L	57	129	20	
		Benzoic acid	65-85-0	Water	8270D	3510C	NE	---	18.2	100	ug/L	7	52	20	
		Benzyl alcohol	100-51-6	Water	8270D	3510C	NE	---	1.91	10.0	ug/L	31	112	20	
		Biphenyl	92-52-4	Water	8270D	3510C	NE	---			ug/L				
		Bis(2-chloroethoxy)methane	111-91-1	Water	8270D	3510C	NE	---	0.475	5.00	ug/L	48	120	20	
		Bis(2-chloroethyl)ether	111-44-4	Water	8270D	3510C	NE	---	0.630	5.00	ug/L	43	118	20	
		Bis(2-chloroisopropyl)ether	108-60-1	Water	8270D	3510C	NE	---	0.753	5.00	ug/L	37	130	20	
		Bis(2-ethylhexyl)phthalate	117-81-7	Water	8270D	3510C	NE	---	2.81	10.0	ug/L	55	135	20	
		Bis(chloromethyl)ether	542-88-1	Water	8270D	3510C	NE	---	35.0	105	ug/L	50	150	20	
		Butyl benzyl phthalate	85-68-7	Water	8270D	3510C	NE	---	5.05	20.0	ug/L	53	134	20	
		Carbazole	86-74-8	Water	8270D	3510C	NE	---	0.202	5.00	ug/L	60	122	20	
		Chlorobenzilate	510-15-6	Water	8270D	3510C	NE	---	0.770	5.00	ug/L	58	150	20	
		Chloropyrifos	2921-88-2	Water	8270D	3510C	0.4	---	2.59	10.0	ug/L				
		Chrysene	218-01-9	Water	8270D	3510C	0.02	---	0.468	5.00	ug/L	59	123	20	
		Chrysene-d12	1719-03-5	Water	8270D	3510C	NE	---			ug/L				
		cis, trans-Isosafrole	17627-76-8	Water	8270D	3510C	NE	---	2.41	10.0	ug/L	50	150	20	

Lab	Analyte Group	Analyte	CAS Number	Matrix	Analytical Method	Prep Method	WI NR140 PAL	TCLP Haz Waste Limit	MDL	MRL	Units	LCL	UCL	RPD	Comments
EMT	SVOCs (cont'd)	Decane	124-18-5	Water	8270D	3510C	NE	---	10.0	30.0	ug/L	29	105	20	
		Diallate	2303-16-4	Water	8270D	3510C	NE	---	2.14	10.0	ug/L	50	150	20	
		Dibenzo(a,h)anthracene	53-70-3	Water	8270D	3510C	NE	---	0.656	25.0	ug/L	51	134	20	
		Dibenzofuran	132-64-9	Water	8270D	3510C	NE	---	1.72	10.0	ug/L	53	118	20	
		Diethyl phthalate	84-66-2	Water	8270D	3510C	NE	---	1.19	10.0	ug/L	56	125	20	
		Dimethoate	60-51-5	Water	8270D	3510C	0.4	---	0.500	10.0	ug/L	50	150	20	
		Dimethyl phthalate	131-11-3	Water	8270D	3510C	NE	---	1.75	10.0	ug/L	45	127	20	
		Di-n-butyl phthalate	84-74-2	Water	8270D	3510C	100	---	0.825	10.0	ug/L	59	127	20	
		Di-n-octyl phthalate	117-84-0	Water	8270D	3510C	NE	---	0.489	10.0	ug/L	51	140	20	
		Dinoseb	88-85-7	Water	8270D	3510C	1.4	---	2.00	10.0	ug/L	61	126	20	
		Diphenylamine	122-39-4	Water	8270D	3510C	NE	---	1.76	10.0	ug/L	55	111	20	
		Disulfoton	298-04-4	Water	8270D	3510C	NE	---	1.08	5.00	ug/L	55	130	20	
		Ethyl methanesulfonate	62-50-0	Water	8270D	3510C	NE	---	1.23	5.00	ug/L	62	118	20	
		Famphur	52-85-7	Water	8270D	3510C	NE	---	2.19	10.0	ug/L	30	130	20	
		Fluoranthene	206-44-0	Water	8270D	3510C	80	---	0.523	10.0	ug/L	57	128	20	
		Fluorene	86-73-7	Water	8270D	3510C	80	---	0.314	5.00	ug/L	52	124	20	
		Hexachlorobenzene	118-74-1	Water	8270D	3510C	0.1	---	0.212	5.00	ug/L	53	125	20	
		Hexachlorobutadiene	87-68-3	Water	8270D	3510C	NE	---	2.61	20.0	ug/L	22	124	20	
		Hexachlorocyclopentadiene	77-47-4	Water	8270D	3510C	NE	---	2.24	25.0	ug/L	19	112	20	
		Hexachloroethane	67-72-1	Water	8270D	3510C	NE	---	2.83	20.0	ug/L	21	115	20	
		Hexachloropropene	1888-71-7	Water	8270D	3510C	NE	---	2.87	10.0	ug/L	40	140	20	
		Indeno(1,2,3-cd)pyrene	193-39-5	Water	8270D	3510C	NE	---	0.336	10.0	ug/L	52	134	20	
		Isodrin	465-73-6	Water	8270D	3510C	NE	---	1.92	10.0	ug/L	68	128	20	
		Isophorone	78-59-1	Water	8270D	3510C	NE	---	0.533	10.0	ug/L	42	124	20	
		Kepone	143-50-0	Water	8270D	3510C	NE	---	6.29	20.0	ug/L	30	130	20	
		Malathion	121-75-5	Water	8270D	3510C	NE	---	1.76	10.0	ug/L				
		Methapyrilene	91-80-5	Water	8270D	3510C	NE	---	2.75	10.0	ug/L	40	140	20	
		Methyl methanesulfonate	66-27-3	Water	8270D	3510C	NE	---	1.56	5.00	ug/L	33	107	20	
		Methyl parathion	298-00-0	Water	8270D	3510C	NE	---	1.47	25.0	ug/L	45	159	20	
		Naphthalene	91-20-3	Water	8270D	3510C	10	---	0.201	5.00	ug/L	40	121	20	
		Naphthalene-d8	1146-65-2	Water	8270D	3510C	NE	---			ug/L				
		Nitrobenzene	98-95-3	Water	8270D	3510C	NE	---	0.837	5.00	ug/L	45	121	20	
		N-Nitrosodiethylamine	55-18-5	Water	8270D	3510C	NE	---	1.20	5.00	ug/L	43	121	20	
		N-Nitrosodimethylamine	62-75-9	Water	8270D	3510C	NE	---	3.33	20.0	ug/L	16	89	20	
		N-Nitroso-di-n-butylamine	924-16-3	Water	8270D	3510C	NE	---	1.36	5.00	ug/L	60	121	20	
		N-Nitrosodi-n-propylamine	621-64-7	Water	8270D	3510C	NE	---	0.698	10.0	ug/L	49	119	20	
		N-Nitrosodiphenylamine	86-30-6	Water	8270D	3510C	0.7	---	2.80	20.0	ug/L	51	123	20	
		N-Nitrosomorpholine	59-89-2	Water	8270D	3510C	NE	---	1.64	5.00	ug/L	55	117	20	
		N-Nitroso-n-methylethylamine	10595-95-6	Water	8270D	3510C	NE	---	0.800	5.00	ug/L	41	117	20	
		N-Nitrosopiperidine	100-75-4	Water	8270D	3510C	NE	---	1.35	5.00	ug/L	56	121	20	
		N-Nitrosopyrrolidine	930-55-2	Water	8270D	3510C	NE	---	1.61	10.0	ug/L	48	113	20	
		O,O,O-Triethylphosphorothioate	126-68-1	Water	8270D	3510C	NE	---	1.34	5.00	ug/L	66	119	20	
		o-Anisidine	90-04-0	Water	8270D	3510C	NE	---	100	300	ug/L				

Lab	Analyte Group	Analyte	CAS Number	Matrix	Analytical Method	Prep Method	WI NR140 PAL	TCLP Haz Waste Limit	MDL	MRL	Units	LCL	UCL	RPD	Comments
EMT	SVOCs (cont'd)	Octadecane	593-45-3	Water	8270D	3510C	NE	---	25.0	75.0	ug/L	50	128	20	
		o-Toluidine	95-53-4	Water	8270D	3510C	NE	---	2.00	10.0	ug/L	30	110	20	
		p-Aminoazobenzene	60-09-3	Water	8270D	3510C	NE	---	100	300	ug/L				
		Parathion	56-38-2	Water	8270D	3510C	NE	---	1.96	25.0	ug/L	66	140	20	
		p-Dimethylaminoazobenzene	60-11-7	Water	8270D	3510C	NE	---	2.22	10.0	ug/L	50	150	20	
		Pentachlorobenzene	608-93-5	Water	8270D	3510C	NE	---	1.58	5.00	ug/L	59	123	20	
		Pentachloroethane	76-01-7	Water	8270D	3510C	NE	---	2.00	10.0	ug/L	30	92	20	
		Pentachloronitrobenzene	82-68-8	Water	8270D	3510C	NE	---	2.58	10.0	ug/L	54	139	20	
		Pentachlorophenol	87-86-5	Water	8270D	3510C	0.1	---	19.0	100	ug/L	35	138	20	
		Perylene-d12	1520-96-3	Water	8270D	3510C	NE	---			ug/L				
		Phenacetin	62-44-2	Water	8270D	3510C	NE	---	2.00	10.0	ug/L	71	124	20	
		Phenanthrene	85-01-8	Water	8270D	3510C	NE	---	0.222	5.00	ug/L	59	120	20	
		Phenanthrene-d10	1517-22-2	Water	8270D	3510C	NE	---			ug/L				
		Phenol	108-95-2	Water	8270D	3510C	400	---	1.04	5.00	ug/L	6	94	20	
		Phorate	298-02-2	Water	8270D	3510C	NE	---	0.830	5.00	ug/L	38	139	20	
		Phosmet	732-11-6	Water	8270D	3510C	NE	---	1.92	10.0	ug/L				
		Pronamide	23950-58-5	Water	8270D	3510C	NE	---	0.580	10.0	ug/L	65	129	20	
		Pyrene	129-00-0	Water	8270D	3510C	50	---	0.141	5.00	ug/L	57	126	20	
		Pyridine	110-86-1	Water	8270D	3510C	2	---	2.44	20.0	ug/L	21	84	20	
		Safrole	94-59-7	Water	8270D	3510C	NE	---	0.830	10.0	ug/L	61	119	20	
		Thionazin	297-97-2	Water	8270D	3510C	NE	---	1.32	5.00	ug/L	72	132	20	
		Trifluralin	1582-09-8	Water	8270D	3510C	0.75	---	1.37	10.0	ug/L				
		2,4,6-Tribromophenol	118-79-6	Water	8270D	3510C	NE	---			ug/L				Surrogate
		2-Fluorobiphenyl	321-60-8	Water	8270D	3510C	NE	---			ug/L				Surrogate
		2-Fluorophenol	367-12-4	Water	8270D	3510C	NE	---			ug/L				Surrogate
		4-Terphenyl-d14	1718-51-0	Water	8270D	3510C	NE	---			ug/L				Surrogate
		Nitrobenzene-d5	4165-60-0	Water	8270D	3510C	NE	---			ug/L				Surrogate
		Phenol-d5	4165-62-2	Water	8270D	3510C	NE	---			ug/L				Surrogate
EMT	TCLP Herbicides	2,4,5-T	93-76-5	Water	8321A	1311/3510	---	NE	0.000398	0.00150	mg/L	35	110	20	
		2,4,5-TP (Silvex)	93-72-1	Water	8321A	1311/3510	---	1	0.000254	0.00150	mg/L	50	115	20	
		2,4-D	94-75-7	Water	8321A	1311/3510	---	10	0.000261	0.00150	mg/L	35	115	20	
		3,5-Dichlorobenzoic Acid	51-36-5	Water	8321A	1311/3510	---	NA			mg/L				Surrogate

Lab	Analyte Group	Analyte	CAS Number	Matrix	Analytical Method	Prep Method	WI NR140 PAL	TCLP Haz Waste Limit	MDL	MRL	Units	LCL	UCL	RPD	Comments
EMT	TCLP Metals	Mercury	7439-97-6	Water	7470	1311/245-7470	---	0.2	0.000100	0.00100	mg/L	82	119	20	
		Arsenic	7440-38-2	Water	6010C	1311/3015	---	5.0	0.0127	0.0500	mg/L	87	113	20	
		Barium	7440-39-3	Water	6010C	1311/3015	---	100	0.00200	0.0500	mg/L	88	113	20	
		Cadmium	7440-43-9	Water	6010C	1311/3015	---	1.0	0.00200	0.00500	mg/L	88	113	20	
		Chromium	7440-47-3	Water	6010C	1311/3015	---	5.0	0.00410	0.0500	mg/L	90	113	20	
		Lead	7439-92-1	Water	6010C	1311/3015	---	5.0	0.0160	0.0500	mg/L	86	113	20	
		Selenium	7782-49-2	Water	6010C	1311/3015	---	1.0	0.0180	0.0500	mg/L	83	114	20	
		Silver	7440-22-4	Water	6010C	1311/3015	---	5.0	0.00300	0.0500	mg/L	84	115	20	
		Arsenic	7440-38-2	Water	6020A	1311/3015	---	5.0	0.0000540	0.00500	mg/L	84	116	20	
		Barium	7440-39-3	Water	6020A	1311/3015	---	100	0.000110	0.00500	mg/L	86	114	20	
		Cadmium	7440-43-9	Water	6020A	1311/3015	---	1.0	0.0000600	0.000500	mg/L	87	115	20	
		Chromium	7440-47-3	Water	6020A	1311/3015	---	5.0	0.0000680	0.00500	mg/L	85	116	20	
		Lead	7439-92-1	Water	6020A	1311/3015	---	5.0	0.0000600	0.00500	mg/L	88	115	20	
		Selenium	7782-49-2	Water	6020A	1311/3015	---	1.0	0.000100	0.00500	mg/L	80	120	20	
		Silver	7440-22-4	Water	6020A	1311/3015	---	5.0	0.000110	0.000500	mg/L	85	116	20	
EMT	TCLP Pesticides	2,4,5,6-Tetrachloro-m-xylene	877-09-8	Water	8081B	1311/3510	---	NA			mg/L				Surrogate
		Decachlorobiphenyl	2051-24-3	Water	8081B	1311/3510	---	NA			mg/L				Surrogate
		Chlordane	57-74-9	Water	8081B	1311/3510	---	0.03	0.0000490	0.000500	mg/L				
		Endrin	72-20-8	Water	8081B	1311/3510	---	0.02	0.00000200	0.000300	mg/L	55	135	20	
		gamma-BHC (Lindane)	58-89-9	Water	8081B	1311/3510	---	0.4	0.00000300	0.000300	mg/L	25	135	20	
		Heptachlor	76-44-8	Water	8081B	1311/3510	---	0.008	0.00000500	0.000300	mg/L	40	130	20	
		Heptachlor epoxide	1024-57-3	Water	8081B	1311/3510	---	0.008	0.00000200	0.000300	mg/L	60	130	20	
		Methoxychlor	72-43-5	Water	8081B	1311/3510	---	10	0.00000200	0.000300	mg/L	55	150	20	
		Toxaphene	8001-35-2	Water	8081B	1311/3510	---	0.5	0.000316	0.00150	mg/L				
EMT	TCLP SVOCs	2,4,6-Tribromophenol	118-79-6	Water	8270D	1311/3510	---	NA			mg/L				Surrogate
		2-Fluorobiphenyl	321-60-8	Water	8270D	1311/3510	---	NA			mg/L				Surrogate
		2-Fluorophenol	367-12-4	Water	8270D	1311/3510	---	NA			mg/L				Surrogate
		4-Terphenyl-d14	1718-51-0	Water	8270D	1311/3510	---	NA			mg/L				Surrogate
		Nitrobenzene-d5	4165-60-0	Water	8270D	1311/3510	---	NA			mg/L				Surrogate
		Phenol-d5	4165-62-2	Water	8270D	1311/3510	---	NA			mg/L				Surrogate
		1,4-Dichlorobenzene	106-46-7	Water	8270D	1311/3510	---	7.5	0.000600	0.00500	mg/L	23	100	20	
		1,4-Dichlorobenzene-d4	3855-82-1	Water	8270D	1311/3510	---	NA			mg/L				
		2,4,5-Trichlorophenol	95-95-4	Water	8270D	1311/3510	---	400	0.000700	0.0100	mg/L	45	109	20	
		2,4,6-Trichlorophenol	88-06-2	Water	8270D	1311/3510	---	2	0.00100	0.0100	mg/L	43	109	20	
		2,4-Dinitrotoluene	121-14-2	Water	8270D	1311/3510	---	0.13	0.00140	0.0250	mg/L	49	105	20	
		2-Methylphenol	95-48-7	Water	8270D	1311/3510	---	NE	0.00510	0.0200	mg/L	21	110	20	
		3 & 4-Methylphenol	84989-04-8	Water	8270D	1311/3510	---	NE	0.00260	0.0200	mg/L	21	106	20	
		Acenaphthene-d10	15067-26-2	Water	8270D	1311/3510	---	NA			mg/L				
		Chrysene-d12	1719-03-5	Water	8270D	1311/3510	---	NA			mg/L				
		Cresols, Total	1319-77-3	Water	8270D	1311/3510	---	200	0.00770	0.0400	mg/L	8	74	20	
		Hexachlorobenzene	118-74-1	Water	8270D	1311/3510	---	0.13	0.000200	0.00500	mg/L	53	108	20	
		Hexachlorobutadiene	87-68-3	Water	8270D	1311/3510	---	0.5	0.00260	0.0200	mg/L	33	94	20	
		Hexachloroethane	67-72-1	Water	8270D	1311/3510	---	3	0.00280	0.0200	mg/L	18	97	20	

Lab	Analyte Group	Analyte	CAS Number	Matrix	Analytical Method	Prep Method	WI NR140 PAL	TCLP Haz Waste Limit	MDL	MRL	Units	LCL	UCL	RPD	Comments
EMT	TCLP SVOCs (cont'd)	Naphthalene-d8	1146-65-2	Water	8270D	1311/3510	---	NA			mg/L				
		Nitrobenzene	98-95-3	Water	8270D	1311/3510	---	2	0.000800	0.00500	mg/L	16	111	20	
		Pentachlorophenol	87-86-5	Water	8270D	1311/3510	---	100	0.0190	0.100	mg/L	43	117	20	
		Perylene-d12	1520-96-3	Water	8270D	1311/3510	---	NA			mg/L				
		Phenanthrene-d10	1517-22-2	Water	8270D	1311/3510	---	NA			mg/L				
		Pyridine	110-86-1	Water	8270D	1311/3510	---	5	0.00240	0.0200	mg/L	15	82	20	
EMT	TCLP VOCs	1,2-Dichlorobenzene-d4	2199-69-1	Water	8260B	1311/5030	---	NA	0.00120	0.0200	mg/L				Surrogate
		1,2-Dichloroethane-d4	17060-07-0	Water	8260B	1311/5030	---	NA	0.00150	0.0200	mg/L				Surrogate
		4-Bromofluorobenzene	460-00-4	Water	8260B	1311/5030	---	NA	0.000800	0.0100	mg/L				Surrogate
		Dibromofluoromethane	1868-53-7	Water	8260B	1311/5030	---	NA	0.00110	0.0200	mg/L				Surrogate
		Fluorobenzene	462-06-6	Water	8260B	1311/5030	---	NA	0.000700	0.0200	mg/L				Surrogate
		Toluene-d8	2037-26-5	Water	8260B	1311/5030	---	NA	0.00110	0.0200	mg/L				Surrogate
		1,1-Dichloroethene	75-35-4	Water	8260B	1311/5030	---	NE	0.000500	0.00200	mg/L	70	131	20	
		1,2-Dichloroethane	107-06-2	Water	8260B	1311/5030	---	0.5	0.000300	0.00200	mg/L	78	122	20	
		1,4-Dichlorobenzene	106-46-7	Water	8260B	1311/5030	---	7.5	0.000500	0.00400	mg/L	75	120	20	
		1,4-Dichlorobenzene-d4	3855-82-1	Water	8260B	1311/5030	---	NA			mg/L				
		1,4-Difluorobenzene	540-36-3	Water	8260B	1311/5030	---	NA			mg/L				
		2-Butanone	78-93-3	Water	8260B	1311/5030	---	200	0.00130	0.00700	mg/L	51	148	20	
		Benzene	71-43-2	Water	8260B	1311/5030	---	0.5	0.000400	0.00200	mg/L	77	121	20	
		Carbon tetrachloride	56-23-5	Water	8260B	1311/5030	---	0.5	0.000500	0.00400	mg/L	70	135	20	
		Chlorobenzene	108-90-7	Water	8260B	1311/5030	---	100	0.000500	0.00400	mg/L	79	120	20	
		Chlorobenzene-d5	3114-55-4	Water	8260B	1311/5030	---	NA			mg/L				
		Chloroform	67-66-3	Water	8260B	1311/5030	---	6	0.000400	0.00200	mg/L	78	123	20	
		Ethylbenzene	100-41-4	Water	8260B	1311/5030	---	NE	0.000500	0.00200	mg/L	76	122	20	
		m,p-Xylene	179601-23-1	Water	8260B	1311/5030	---	NE	0.000900	0.00400	mg/L	77	124	20	
		o-Xylene	95-47-6	Water	8260B	1311/5030	---	NE	0.000400	0.00400	mg/L	77	123	20	
		Pentafluorobenzene	363-72-4	Water	8260B	1311/5030	---	NA			mg/L				
		Tetrachloroethene	127-18-4	Water	8260B	1311/5030	---	0.7	0.000600	0.00400	mg/L	73	128	20	
		Toluene	108-88-3	Water	8260B	1311/5030	---	NE	0.000400	0.00200	mg/L	77	121	20	
		Trichloroethene	79-01-6	Water	8260B	1311/5030	---	0.5	0.000500	0.00200	mg/L	77	123	20	
		Vinyl chloride	75-01-4	Water	8260B	1311/5030	---	0.2	0.000400	0.00200	mg/L	56	135	20	
		Xylenes, Total	1330-20-7	Water	8260B	1311/5030	---	NE	0.00130	0.00800	mg/L				
EMT	VOCs	1,1,1,2-Tetrachloroethane	630-20-6	Water	8260B	5030	7	---	0.432	2.00	ug/L	78	124	20	
		1,1,1-Trichloroethane	71-55-6	Water	8260B	5030	40	---	0.375	2.00	ug/L	74	131	20	
		1,1,2,2-Tetrachloroethane	79-34-5	Water	8260B	5030	0.02	---	0.462	2.00	ug/L	71	121	20	
		1,1,2-Trichloro-1,2,2-Trifluoroethane	76-13-1	Water	8260B	5030	NE	---	0.500	4.00	ug/L	70	136	20	
		1,1,2-Trichloroethane	79-00-5	Water	8260B	5030	0.5	---	0.390	2.00	ug/L	80	119	20	
		1,1-Dichloroethane	75-34-3	Water	8260B	5030	85	---	0.472	2.00	ug/L	77	125	20	
		1,1-Dichloroethene	75-35-4	Water	8260B	5030	0.7	---	0.479	2.00	ug/L	71	131	20	
		1,1-Dichloropropanone	513-88-2	Water	8260B	5030	0.5	---	0.297	6.00	ug/L				
		1,1-Dichloropropene	563-58-6	Water	8260B	5030	NE	---	0.453	2.00	ug/L	79	125	20	

Lab	Analyte Group	Analyte	CAS Number	Matrix	Analytical Method	Prep Method	WI NR140 PAL	TCLP Haz Waste Limit	MDL	MRL	Units	LCL	UCL	RPD	Comments
		1,2,3-Trichlorobenzene	87-61-6	Water	8260B	5030	NE	---	0.452	2.00	ug/L	69	129	20	
		1,2,3-Trichloropropane	96-18-4	Water	8260B	5030	12	---	0.508	2.00	ug/L	73	122	20	
		1,2,4-Trichlorobenzene	120-82-1	Water	8260B	5030	40	---	0.407	2.00	ug/L	69	130	20	
		1,2,4-Trimethylbenzene	95-63-6	Water	8260B	5030	96	---	0.786	4.00	ug/L	76	124	20	
		1,2-Dibromo-3-chloropropane	96-12-8	Water	8260B	5030	0.02	---	0.970	8.00	ug/L	62	128	20	
		1,2-Dibromoethane	106-93-4	Water	8260B	5030	0.005	---	0.463	2.00	ug/L	77	121	20	
		1,2-Dichlorobenzene	95-50-1	Water	8260B	5030	60	---	0.553	4.00	ug/L	80	119	20	
		1,2-Dichloroethane	107-06-2	Water	8260B	5030	0.5	---	0.326	2.00	ug/L	73	128	20	
		1,2-Dichloroethene, Total	540-59-0	Water	8260B	5030	7	---	4.59	20.0	ug/L	79	121	20	
		1,2-Dichloropropane	78-87-5	Water	8260B	5030	0.5	---	0.310	2.00	ug/L	78	122	20	
		1,3,5-Trimethylbenzene	108-67-8	Water	8260B	5030	96	---	0.479	4.00	ug/L	75	124	20	
		1,3-Dichlorobenzene	541-73-1	Water	8260B	5030	120	---	0.445	2.00	ug/L	80	119	20	
		1,3-Dichloropropane	142-28-9	Water	8260B	5030	NE	---	0.438	2.00	ug/L	80	119	20	
		1,3-Dichloropropene, Total	542-75-6	Water	8260B	5030	0.04	---	0.477	2.00	ug/L	77	123	20	
		1,4-Dichlorobenzene	106-46-7	Water	8260B	5030	15	---	0.527	4.00	ug/L	79	118	20	
		1,4-Dichlorobenzene-d4	3855-82-1	Water	8260B	5030	NE	---			ug/L				
		1,4-Difluorobenzene	540-36-3	Water	8260B	5030	NE	---			ug/L				
		1,4-Dioxane	123-91-1	Water	8260B	5030	0.3	---	12.5	80.0	ug/L	59	139	20	
		1-Bromopropane	106-94-5	Water	8260B	5030	NE	---	0.451	2.00	ug/L	70	130	20	
		1-Butanol	71-36-3	Water	8260B	5030	NE	---	22.3	90.0	ug/L	70	130	20	
		1-Chlorobutane	109-69-3	Water	8260B	5030	NE	---	0.358	2.00	ug/L	70	130	20	
EMT	VOCs (cont'd)	1-Propanol	71-23-8	Water	8260B	5030	NE	---	57.4	360	ug/L	70	130	20	
		2,2-Dichloropropane	594-20-7	Water	8260B	5030	NE	---	0.424	2.00	ug/L	60	139	20	
		2-Butanone	78-93-3	Water	8260B	5030	800	---	1.30	7.00	ug/L	56	143	20	
		2-Chloro-1,3-butadiene	126-99-8	Water	8260B	5030	NE	---	0.359	2.00	ug/L	65	135	20	
		2-Chloroethyl vinyl ether	110-75-8	Water	8260B	5030	NE	---	2.52	10.0	ug/L	51	139	20	
		2-Chlorotoluene	95-49-8	Water	8260B	5030	NE	---	0.450	2.00	ug/L	79	122	20	
		2-Hexanone	591-78-6	Water	8260B	5030	NE	---	1.10	7.00	ug/L	57	139	20	
		2-Nitropropane	79-46-9	Water	8260B	5030	NE	---	2.41	16.0	ug/L	49	136	20	
		3-Chloro-1-propene	107-05-1	Water	8260B	5030	NE	---	0.318	2.00	ug/L	70	130	20	
		4-Chlorotoluene	106-43-4	Water	8260B	5030	NE	---	0.456	2.00	ug/L	78	122	20	
		4-Isopropyltoluene	99-87-6	Water	8260B	5030	NE	---	0.537	4.00	ug/L	77	127	20	
		4-Methyl-2-pentanone	108-10-1	Water	8260B	5030	50	---	1.14	7.00	ug/L	67	130	20	
		Acetaldehyde	75-07-0	Water	8260B	5030	NE	---	500	1500	ug/L				
		Acetone	67-64-1	Water	8260B	5030	1800	---	9.69	70.0	ug/L	39	160	20	
		Acetonitrile	75-05-8	Water	8260B	5030	NE	---	14.4	100	ug/L	50	142	20	
		Acrolein	107-02-8	Water	8260B	5030	NE	---	3.74	24.0	ug/L	39	155	20	
		Acrylonitrile	107-13-1	Water	8260B	5030	NE	---	0.650	4.00	ug/L	63	135	20	
		Benzene	71-43-2	Water	8260B	5030	0.5	---	0.423	2.00	ug/L	79	120	20	
		Bromobenzene	108-86-1	Water	8260B	5030	NE	---	0.619	4.00	ug/L	80	120	20	
		Bromochloromethane	74-97-5	Water	8260B	5030	NE	---	0.364	2.00	ug/L	78	123	20	
		Bromodichloromethane	75-27-4	Water	8260B	5030	0.06	---	0.424	2.00	ug/L	79	125	20	
		Bromoform	75-25-2	Water	8260B	5030	0.44	---	0.493	2.00	ug/L	66	130	20	

Lab	Analyte Group	Analyte	CAS Number	Matrix	Analytical Method	Prep Method	WI NR140 PAL	TCLP Haz Waste Limit	MDL	MRL	Units	LCL	UCL	RPD	Comments
EMT	VOCs (cont'd)	Bromomethane	74-83-9	Water	8260B	5030	1	---	0.688	4.00	ug/L	53	141	20	
		Carbon disulfide	75-15-0	Water	8260B	5030	200	---	0.482	2.00	ug/L	64	133	20	
		Carbon tetrachloride	56-23-5	Water	8260B	5030	0.5	---	0.545	4.00	ug/L	72	136	20	
		Chlorobenzene	108-90-7	Water	8260B	5030	NE	---	0.474	2.00	ug/L	82	118	20	
		Chlorobenzene-d5	3114-55-4	Water	8260B	5030	NE	---			ug/L				
		Chlorodifluoromethane	75-45-6	Water	8260B	5030	0.7	---	1.00	2.00	ug/L				
		Chloroethane	75-00-3	Water	8260B	5030	80	---	1.09	8.00	ug/L	60	138	20	
		Chloroform	67-66-3	Water	8260B	5030	0.6	---	0.355	2.00	ug/L	79	124	20	
		Chloromethane	74-87-3	Water	8260B	5030	3	---	0.669	4.00	ug/L	50	139	20	
		cis-1,2-Dichloroethene	156-59-2	Water	8260B	5030	7	---	2.25	10.0	ug/L	78	123	20	
		cis-1,3-Dichloropropene	10061-01-5	Water	8260B	5030	0.04	---	0.227	1.00	ug/L	75	124	20	
		Cyclohexane	110-82-7	Water	8260B	5030	NE	---	0.248	4.00	ug/L	71	130	20	
		Cyclohexanone	108-94-1	Water	8260B	5030	NE	---	10.0	30.0	ug/L				
		Dibromochloromethane	124-48-1	Water	8260B	5030	6	---	0.416	2.00	ug/L	74	126	20	
		Dibromomethane	74-95-3	Water	8260B	5030	NE	---	0.420	2.00	ug/L	79	123	20	
		Dichlorodifluoromethane	75-71-8	Water	8260B	5030	200	---	0.466	2.00	ug/L	32	152	20	
		Dichlorofluoromethane	75-43-4	Water	8260B	5030	NE	---	0.420	2.00	ug/L				
		Ethyl acetate	84508-45-2	Water	8260B	5030	NE	---	2.13	4.00	ug/L	55	138	20	
		Ethyl ether	60-29-7	Water	8260B	5030	100	---	0.432	2.00	ug/L	70	130	20	
		Ethyl methacrylate	97-63-2	Water	8260B	5030	NE	---	0.212	4.00	ug/L	72	126	20	
		Ethylbenzene	100-41-4	Water	8260B	5030	140	---	0.457	2.00	ug/L	79	121	20	
		Ethylene oxide	75-21-8	Water	8260B	5030	NE	---	100	100	ug/L				
		Heptane	142-82-5	Water	8260B	5030	NE	---	2.00	2.00	ug/L				
		Hexachlorobutadiene	87-68-3	Water	8260B	5030	NE	---	0.563	4.00	ug/L	66	134	20	
		Hexachloroethane	67-72-1	Water	8260B	5030	NE	---	0.290	2.00	ug/L	72	134	20	
		Hexane	110-54-3	Water	8260B	5030	NE	---	0.437	2.00	ug/L	48	143	20	
		Iodomethane	74-88-4	Water	8260B	5030	NE	---	1.34	3.00	ug/L	69	131	20	
		Isobutanol	78-83-1	Water	8260B	5030	NE	---	64.0	360	ug/L	63	133	20	
		Isopropanol	67-63-0	Water	8260B	5030	NE	---	73.4	360	ug/L	56	142	20	
		Isopropyl acetate	108-21-4	Water	8260B	5030	NE	---	10.0	100	ug/L				
		Isopropyl ether	108-20-3	Water	8260B	5030	NE	---	10.0	30.0	ug/L				
		Isopropylbenzene	98-82-8	Water	8260B	5030	NE	---	0.540	4.00	ug/L	72	131	20	
		m,p-Xylene	179601-23-1	Water	8260B	5030	400	---	0.900	4.00	ug/L	80	121	20	
		Methacrylonitrile	126-98-7	Water	8260B	5030	NE	---	1.04	4.00	ug/L	63	133	20	
		Methyl acetate	79-20-9	Water	8260B	5030	NE	---	0.663	4.00	ug/L	56	136	20	
		Methyl acrylate	96-33-3	Water	8260B	5030	NE	---	2.00	2.00	ug/L	70	130	20	
		Methyl formate	107-31-3	Water	8260B	5030	NE	---	31.6	200	ug/L				
		Methyl methacrylate	80-62-6	Water	8260B	5030	NE	---	0.455	2.00	ug/L	67	128	20	
		Methyl tert-butyl ether	1634-04-4	Water	8260B	5030	12	---	0.250	2.00	ug/L	71	124	20	
		Methylcyclohexane	108-87-2	Water	8260B	5030	NE	---	0.250	2.00	ug/L	72	132	20	
		Methylene chloride	75-09-2	Water	8260B	5030	0.5	---	0.384	2.00	ug/L	74	124	20	
		Naphthalene	91-20-3	Water	8260B	5030	10	---	0.392	2.00	ug/L	61	128	20	

Lab	Analyte Group	Analyte	CAS Number	Matrix	Analytical Method	Prep Method	WI NR140 PAL	TCLP Haz Waste Limit	MDL	MRL	Units	LCL	UCL	RPD	Comments
EMT	VOCs (cont'd)	n-Butylbenzene	104-51-8	Water	8260B	5030	NE	---	0.465	2.00	ug/L	75	128	20	
		Nitrobenzene	98-95-3	Water	8260B	5030	NE	---	0.500	2.00	ug/L	70	130	20	
		n-Propylbenzene	103-65-1	Water	8260B	5030	NE	---	0.481	2.00	ug/L	76	126	20	
		o-Xylene	95-47-6	Water	8260B	5030	400	---	0.449	4.00	ug/L	78	122	20	
		Pentachloroethane	76-01-7	Water	8260B	5030	NE	---	0.470	2.00	ug/L	69	133	20	
		Pentafluorobenzene	363-72-4	Water	8260B	5030	NE	---			ug/L				
		Propionitrile	107-12-0	Water	8260B	5030	NE	---	1.75	8.00	ug/L	64	136	20	
		Propyl acetate	109-60-4	Water	8260B	5030	NE	---	50.0	50.0	ug/L	76	126	20	
		Propylene oxide	75-56-9	Water	8260B	5030	NE	---	10.0	100	ug/L				
		sec-Butylbenzene	135-98-8	Water	8260B	5030	NE	---	0.568	4.00	ug/L	77	126	20	
		Styrene	100-42-5	Water	8260B	5030	10	---	0.310	2.00	ug/L	78	123	20	
		tert-Butylbenzene	98-06-6	Water	8260B	5030	NE	---	0.476	2.00	ug/L	78	124	20	
		Tetrachloroethene	127-18-4	Water	8260B	5030	0.5	---	0.612	4.00	ug/L	74	129	20	
		Tetrahydrofuran	109-99-9	Water	8260B	5030	10	---	1.62	4.00	ug/L	57	133	20	
		Toluene	108-88-3	Water	8260B	5030	160	---	0.394	2.00	ug/L	80	121	20	
		trans-1,2-Dichloroethene	156-60-5	Water	8260B	5030	20	---	2.34	10.0	ug/L	75	124	20	
		trans-1,3-Dichloropropene	10061-02-6	Water	8260B	5030	0.04	---	0.250	1.00	ug/L	73	127	20	
		trans-1,4-Dichloro-2-butene	110-57-6	Water	8260B	5030	NE	---	0.600	8.00	ug/L	43	140	20	
		Trichloroethene	79-01-6	Water	8260B	5030	0.5	---	0.479	2.00	ug/L	79	123	20	
		Trichlorofluoromethane	75-69-4	Water	8260B	5030	NE	---	1.24	8.00	ug/L	65	141	20	
		Vinyl acetate	108-05-4	Water	8260B	5030	NE	---	0.555	4.00	ug/L	54	146	20	
		Vinyl chloride	75-01-4	Water	8260B	5030	0.02	---	0.426	2.00	ug/L	58	137	20	
		Xylenes, Total	1330-20-7	Water	8260B	5030	400	---	1.35	8.00	ug/L	79	121	20	
		1,2-Dichlorobenzene-d4	2199-69-1	Water	8260B	5030	NA	---	1.18	20.0	ug/L				Surrogate
		1,2-Dichloroethane-d4	17060-07-0	Water	8260B	5030	NA	---	1.51	20.0	ug/L				Surrogate
		4-Bromofluorobenzene	460-00-4	Water	8260B	5030	NA	---	0.809	10.0	ug/L				Surrogate
		Dibromofluoromethane	1868-53-7	Water	8260B	5030	NA	---			ug/L				Surrogate
		Fluorobenzene	462-06-6	Water	8260B	5030	NA	---	0.680	20.0	ug/L				Surrogate
		Toluene-d8	2037-26-5	Water	8260B	5030	NA	---	1.10	20.0	ug/L				Surrogate
EMT	DRO & GRO	Diesel Range Organics	68334-30-5	Water	WDNR_DRO	3510	NE	---	0.0217	0.200	ug/L	75	115	20	
		Gasoline Range Organics	8006-61-9	Water	WDNR_GRO	5030	NE	---	0.0672	0.200	ug/L	80	120	20	
		1,4-Dichlorobenzene-d4	3855-82-1	Water	WDNR_GRO	5030	NA	---			ug/L				
EMT	WDNR PVOC	1,2,4-Trimethylbenzene	95-63-6	Water	WDNR_PVOC	5030	96	---	0.0255	2.00	ug/L	80	120	20	
		1,3,5-Trimethylbenzene	108-67-8	Water	WDNR_PVOC	5030	96	---	0.0414	2.00	ug/L	80	120	20	
		Benzene	71-43-2	Water	WDNR_PVOC	5030	0.5	---	0.0242	2.00	ug/L	80	120	20	
		Ethylbenzene	100-41-4	Water	WDNR_PVOC	5030	140	---	0.0244	2.00	ug/L	80	120	20	
		m,p-Xylene	179601-23-1	Water	WDNR_PVOC	5030	400	---	0.0955	2.00	ug/L	80	120	20	
		Methyl tert-butyl ether	1634-04-4	Water	WDNR_PVOC	5030	12	---	0.0966	2.00	ug/L	80	120	20	
		Naphthalene	91-20-3	Water	WDNR_PVOC	5030	10	---	0.0761	2.00	ug/L	80	120	20	
		o-Xylene	95-47-6	Water	WDNR_PVOC	5030	400	---	0.0513	2.00	ug/L	80	120	20	
		Toluene	108-88-3	Water	WDNR_PVOC	5030	160	---	0.0434	2.00	ug/L	80	120	20	
		Xylenes, Total	1330-20-7	Water	WDNR_PVOC	5030	400	---	0.147	4.00	ug/L	80	120	20	
		1,4-Dichlorobenzene-d4	3855-82-1	Water	WDNR_PVOC	5030	NA	---	0.583		ug/L				Surrogate

Lab	Analyte Group	Analyte	CAS Number	Matrix	Analytical Method	Prep Method	WI NR140 PAL	TCLP Haz Waste Limit	MDL	MRL	Units	LCL	UCL	RPD	Comments
		1,2-Dichlorobenzene-d4	2199-69-1	Water	WDNR_VOC	5030	NA	---	1.18	20.0	ug/L				Surrogate
		1,2-Dichloroethane-d4	17060-07-0	Water	WDNR_VOC	5030	NA	---	1.51	20.0	ug/L				Surrogate
		4-Bromofluorobenzene	460-00-4	Water	WDNR_VOC	5030	NA	---	0.809	10.0	ug/L				Surrogate
		Dibromofluoromethane	1868-53-7	Water	WDNR_VOC	5030	NA	---			ug/L				Surrogate
		Fluorobenzene	462-06-6	Water	WDNR_VOC	5030	NA	---	0.680	20.0	ug/L				Surrogate
		Toluene-d8	2037-26-5	Water	WDNR_VOC	5030	NA	---	1.10	20.0	ug/L				Surrogate
		1,1,1,2-Tetrachloroethane	630-20-6	Water	WDNR_VOC	5030	7	---	0.370	2.00	ug/L	78	124	20	
		1,1,1-Trichloroethane	71-55-6	Water	WDNR_VOC	5030	40	---	0.349	2.00	ug/L	74	131	20	
		1,1,2,2-Tetrachloroethane	79-34-5	Water	WDNR_VOC	5030	0.02	---	0.291	2.00	ug/L	71	121	20	
		1,1,2-Trichloro-1,2,2-Trifluoroethane	76-13-1	Water	WDNR_VOC	5030	NE	---	0.805	4.00	ug/L	70	136	20	
		1,1,2-Trichloroethane	79-00-5	Water	WDNR_VOC	5030	0.5	---	0.264	2.00	ug/L	80	119	20	
		1,1-Dichloroethane	75-34-3	Water	WDNR_VOC	5030	85	---	1.94	8.00	ug/L	77	125	20	
		1,1-Dichloroethene	75-35-4	Water	WDNR_VOC	5030	0.7	---	1.02	4.00	ug/L	71	131	20	
		1,1-Dichloropropanone	513-88-2	Water	WDNR_VOC	5030	NE	---	0.297	6.00	ug/L				
		1,1-Dichloropropene	563-58-6	Water	WDNR_VOC	5030	NE	---	0.501	2.00	ug/L	79	125	20	
		1,2,3-Trichlorobenzene	87-61-6	Water	WDNR_VOC	5030	NE	---	0.314	2.00	ug/L	69	129	20	
		1,2,3-Trichloropropane	96-18-4	Water	WDNR_VOC	5030	12	---	0.275	2.00	ug/L	73	122	20	
		1,2,4-Trichlorobenzene	120-82-1	Water	WDNR_VOC	5030	14	---	0.280	2.00	ug/L	69	130	20	
		1,2,4-Trimethylbenzene	95-63-6	Water	WDNR_VOC	5030	96	---	0.338	2.00	ug/L	76	124	20	
		1,2-Dibromo-3-chloropropane	96-12-8	Water	WDNR_VOC	5030	0.02	---	0.488	2.00	ug/L	62	128	20	
EMT	WDNR VOC	1,2-Dibromoethane	106-93-4	Water	WDNR_VOC	5030	0.005	---	0.320	2.00	ug/L	77	121	20	
		1,2-Dichlorobenzene	95-50-1	Water	WDNR_VOC	5030	60	---	0.278	2.00	ug/L	80	119	20	
		1,2-Dichloroethane	107-06-2	Water	WDNR_VOC	5030	0.5	---	0.274	2.00	ug/L	73	128	20	
		1,2-Dichloroethene, Total	540-59-0	Water	WDNR_VOC	5030	7	---	0.854	4.00	ug/L	79	121	20	
		1,2-Dichloropropane	78-87-5	Water	WDNR_VOC	5030	0.5	---	1.11	4.00	ug/L	78	122	20	
		1,3,5-Trimethylbenzene	108-67-8	Water	WDNR_VOC	5030	96	---	0.310	2.00	ug/L	75	124	20	
		1,3-Dichlorobenzene	541-73-1	Water	WDNR_VOC	5030	120	---	0.250	2.00	ug/L	80	119	20	
		1,3-Dichloropropane	142-28-9	Water	WDNR_VOC	5030	NE	---	0.278	2.00	ug/L	80	119	20	
		1,3-Dichloropropene, Total	542-75-6	Water	WDNR_VOC	5030	0.04	---	0.592	4.00	ug/L	77	123	20	
		1,4-Dichlorobenzene	106-46-7	Water	WDNR_VOC	5030	15	---	0.250	2.00	ug/L	79	118	20	
		1,4-Dichlorobenzene-d4	3855-82-1	Water	WDNR_VOC	5030	NE	---			ug/L				
		1,4-Difluorobenzene	540-36-3	Water	WDNR_VOC	5030	NE	---			ug/L				
		1,4-Dioxane	123-91-1	Water	WDNR_VOC	5030	0.3	---	10.1	80.0	ug/L	59	139	20	
		1-Bromopropane	106-94-5	Water	WDNR_VOC	5030	NE	---	0.451	2.00	ug/L	70	130	20	
		1-Butanol	71-36-3	Water	WDNR_VOC	5030	NE	---	6.69	90.0	ug/L	70	130	20	
		1-Chlorobutane	109-69-3	Water	WDNR_VOC	5030	NE	---	0.358	2.00	ug/L	70	130	20	
		1-Propanol	71-23-8	Water	WDNR_VOC	5030	NE	---	46.5	360	ug/L	70	130	20	
		2,2-Dichloropropane	594-20-7	Water	WDNR_VOC	5030	NE	---	0.373	2.00	ug/L	60	139	20	
		2-Butanone	78-93-3	Water	WDNR_VOC	5030	800	---	1.38	8.00	ug/L	56	143	20	
		2-Chloro-1,3-butadiene	126-99-8	Water	WDNR_VOC	5030	NE	---	0.359	2.00	ug/L	65	135	20	
		2-Chloroethyl vinyl ether	110-75-8	Water	WDNR_VOC	5030	NE	---	0.999	4.00	ug/L	51	139	20	
		2-Chlorotoluene	95-49-8	Water	WDNR_VOC	5030	NE	---	0.424	2.00	ug/L	79	122	20	

Lab	Analyte Group	Analyte	CAS Number	Matrix	Analytical Method	Prep Method	WI NR140 PAL	TCLP Haz Waste Limit	MDL	MRL	Units	LCL	UCL	RPD	Comments
EMT	WDNR VOC (cont'd)	2-Hexanone	591-78-6	Water	WDNR_VOC	5030	NE	---	1.04	8.00	ug/L	57	139	20	
		2-Nitropropane	79-46-9	Water	WDNR_VOC	5030	NE	---	2.41	16.0	ug/L	49	136	20	
		3-Chloro-1-propene	107-05-1	Water	WDNR_VOC	5030	NE	---	0.318	2.00	ug/L	70	130	20	
		4-Chlorotoluene	106-43-4	Water	WDNR_VOC	5030	NE	---	0.392	2.00	ug/L	78	122	20	
		4-Isopropyltoluene	99-87-6	Water	WDNR_VOC	5030	NE	---	0.318	2.00	ug/L	77	127	20	
		4-Methyl-2-pentanone	108-10-1	Water	WDNR_VOC	5030	50	---	0.660	28.0	ug/L	67	130	20	
EMT	WDNR VOC (cont'd)	Acetaldehyde	75-07-0	Water	WDNR_VOC	5030	NE	---	500	1500	ug/L				
		Acetone	67-64-1	Water	WDNR_VOC	5030	1800	---	3.75	28.0	ug/L	39	160	20	
		Acetonitrile	75-05-8	Water	WDNR_VOC	5030	NE	---	3.47	20.0	ug/L	50	142	20	
		Acrolein	107-02-8	Water	WDNR_VOC	5030	NE	---	6.63	20.0	ug/L	39	155	20	
		Acrylonitrile	107-13-1	Water	WDNR_VOC	5030	NE	---	0.742	4.00	ug/L	63	135	20	
		Benzene	71-43-2	Water	WDNR_VOC	5030	0.5	---	0.370	2.00	ug/L	79	120	20	
		Bromobenzene	108-86-1	Water	WDNR_VOC	5030	NE	---	0.406	2.00	ug/L	80	120	20	
		Bromochloromethane	74-97-5	Water	WDNR_VOC	5030	NE	---	0.277	2.00	ug/L	78	123	20	
		Bromodichloromethane	75-27-4	Water	WDNR_VOC	5030	0.06	---	0.310	2.00	ug/L	79	125	20	
		Bromoform	75-25-2	Water	WDNR_VOC	5030	0.44	---	0.254	2.00	ug/L	66	130	20	
		Bromomethane	74-83-9	Water	WDNR_VOC	5030	1	---	3.30	20.0	ug/L	53	141	20	
		Carbon disulfide	75-15-0	Water	WDNR_VOC	5030	200	---	0.259	2.00	ug/L	64	133	20	
		Carbon tetrachloride	56-23-5	Water	WDNR_VOC	5030	0.5	---	0.390	2.00	ug/L	72	136	20	
		Chlorobenzene	108-90-7	Water	WDNR_VOC	5030	NE	---	0.358	2.00	ug/L	82	118	20	
		Chlorobenzene-d5	3114-55-4	Water	WDNR_VOC	5030	NE	---			ug/L				
		Chlorodifluoromethane	75-45-6	Water	WDNR_VOC	5030	700	---	1.00	2.00	ug/L				
		Chloroethane	75-00-3	Water	WDNR_VOC	5030	80	---	0.906	4.00	ug/L	60	138	20	
		Chloroform	67-66-3	Water	WDNR_VOC	5030	0.6	---	0.397	2.00	ug/L	79	124	20	
		Chloromethane	74-87-3	Water	WDNR_VOC	5030	3	---	2.23	8.00	ug/L	50	139	20	
		cis-1,2-Dichloroethene	156-59-2	Water	WDNR_VOC	5030	7	---	0.421	2.00	ug/L	78	123	20	
		cis-1,3-Dichloropropene	10061-01-5	Water	WDNR_VOC	5030	0.04	---	0.278	2.00	ug/L	75	124	20	
		Cyclohexane	110-82-7	Water	WDNR_VOC	5030	NE	---	0.248	4.00	ug/L	71	130	20	
		Cyclohexanone	108-94-1	Water	WDNR_VOC	5030	NE	---	10.0	30.0	ug/L				
		Dibromochloromethane	124-48-1	Water	WDNR_VOC	5030	6	---	0.492	2.00	ug/L	74	126	20	
		Dibromomethane	74-95-3	Water	WDNR_VOC	5030	NE	---	0.449	2.00	ug/L	79	123	20	
		Dichlorodifluoromethane	75-71-8	Water	WDNR_VOC	5030	200	---	0.321	2.00	ug/L	32	152	20	
		Dichlorofluoromethane	75-43-4	Water	WDNR_VOC	5030	NE	---	0.420	2.00	ug/L				
		Ethyl acetate	84508-45-2	Water	WDNR_VOC	5030	NE	---	1.39	4.00	ug/L	55	138	20	
		Ethyl ether	60-29-7	Water	WDNR_VOC	5030	100	---	0.316	2.00	ug/L	70	130	20	
		Ethyl methacrylate	97-63-2	Water	WDNR_VOC	5030	NE	---	0.212	4.00	ug/L	72	126	20	
		Ethylbenzene	100-41-4	Water	WDNR_VOC	5030	140	---	0.431	2.00	ug/L	79	121	20	
		Ethylene oxide	75-21-8	Water	WDNR_VOC	5030	NE	---	20.0	100	ug/L				
		Heptane	142-82-5	Water	WDNR_VOC	5030	NE	---	2.00	2.00	ug/L				
		Hexachlorobutadiene	87-68-3	Water	WDNR_VOC	5030	NE	---	0.358	2.00	ug/L	66	134	20	
		Hexachloroethane	67-72-1	Water	WDNR_VOC	5030	NE	---	0.290	2.00	ug/L	72	134	20	
		Hexane	110-54-3	Water	WDNR_VOC	5030	120	---	0.470	2.00	ug/L	48	143	20	
		Iodomethane	74-88-4	Water	WDNR_VOC	5030	NE	---	1.01	3.04	ug/L	69	131	20	

Lab	Analyte Group	Analyte	CAS Number	Matrix	Analytical Method	Prep Method	WI NR140 PAL	TCLP Haz Waste Limit	MDL	MRL	Units	LCL	UCL	RPD	Comments
EMT	WDNR VOC (cont'd)	Isobutanol	78-83-1	Water	WDNR_VOC	5030	NE	---	21.8	72.0	ug/L	63	133	20	
		Isopropanol	67-63-0	Water	WDNR_VOC	5030	NE	---	9.31	72.0	ug/L	56	142	20	
		Isopropyl acetate	108-21-4	Water	WDNR_VOC	5030	NE	---	10.0	100	ug/L				
		Isopropyl ether	108-20-3	Water	WDNR_VOC	5030	NE	---	10.0	30.0	ug/L				
		Isopropylbenzene	98-82-8	Water	WDNR_VOC	5030	NE	---	0.256	2.00	ug/L	72	131	20	
		m,p-Xylene	179601-23-1	Water	WDNR_VOC	5030	400	---	0.310	4.00	ug/L	80	121	20	
		Methacrylonitrile	126-98-7	Water	WDNR_VOC	5030	NE	---	1.04	4.00	ug/L	63	133	20	
		Methyl acetate	79-20-9	Water	WDNR_VOC	5030	NE	---	20.0	100	ug/L				
		Methyl acrylate	96-33-3	Water	WDNR_VOC	5030	NE	---	2.00	2.00	ug/L	70	130	20	
		Methyl formate	107-31-3	Water	WDNR_VOC	5030	NE	---	31.6	200	ug/L				
		Methyl methacrylate	80-62-6	Water	WDNR_VOC	5030	NE	---	0.310	2.00	ug/L	67	128	20	
		Methyl tert-butyl ether	1634-04-4	Water	WDNR_VOC	5030	12	---	0.322	2.00	ug/L	71	124	20	
		Methylene chloride	75-09-2	Water	WDNR_VOC	5030	0.5	---	0.358	2.00	ug/L	74	124	20	
		Naphthalene	91-20-3	Water	WDNR_VOC	5030	10	---	0.377	2.00	ug/L	61	128	20	
		n-Butylbenzene	104-51-8	Water	WDNR_VOC	5030	NE	---	0.292	2.00	ug/L	75	128	20	
		Nitrobenzene	98-95-3	Water	WDNR_VOC	5030	NE	---	0.500	2.00	ug/L	70	130	20	
		n-Propylbenzene	103-65-1	Water	WDNR_VOC	5030	NE	---	0.239	4.00	ug/L	76	126	20	
		o-Xylene	95-47-6	Water	WDNR_VOC	5030	400	---	0.349	2.00	ug/L	78	122	20	
		Pentachloroethane	76-01-7	Water	WDNR_VOC	5030	NE	---	0.470	2.00	ug/L	69	133	20	
		Pentafluorobenzene	363-72-4	Water	WDNR_VOC	5030	NE	---			ug/L				
		Propionitrile	107-12-0	Water	WDNR_VOC	5030	NE	---	1.75	8.00	ug/L	64	136	20	
		Propyl acetate	109-60-4	Water	WDNR_VOC	5030	NE	---	50.0	50.0	ug/L	76	126	20	
		Propylene oxide	75-56-9	Water	WDNR_VOC	5030	NE	---	10.0	100	ug/L				
		sec-Butylbenzene	135-98-8	Water	WDNR_VOC	5030	NE	---	0.318	2.00	ug/L	77	126	20	
		Styrene	100-42-5	Water	WDNR_VOC	5030	10	---	0.534	4.00	ug/L	78	123	20	
		tert-Butylbenzene	98-06-6	Water	WDNR_VOC	5030	NE	---	0.356	2.00	ug/L	78	124	20	
		Tetrachloroethene	127-18-4	Water	WDNR_VOC	5030	0.5	---	0.400	2.00	ug/L	74	129	20	
		Tetrahydrofuran	109-99-9	Water	WDNR_VOC	5030	10	---	0.675	4.00	ug/L	57	133	20	
		Toluene	108-88-3	Water	WDNR_VOC	5030	160	---	0.299	2.00	ug/L	80	121	20	
		trans-1,2-Dichloroethene	156-60-5	Water	WDNR_VOC	5030	20	---	0.433	2.00	ug/L	75	124	20	
		trans-1,3-Dichloropropene	10061-02-6	Water	WDNR_VOC	5030	0.04	---	0.314	2.00	ug/L	73	127	20	
		trans-1,4-Dichloro-2-butene	110-57-6	Water	WDNR_VOC	5030	NE	---	2.95	8.00	ug/L	43	140	20	
		Trichloroethene	79-01-6	Water	WDNR_VOC	5030	0.5	---	0.439	2.00	ug/L	79	123	20	
		Trichlorofluoromethane	75-69-4	Water	WDNR_VOC	5030	NE	---	0.259	2.00	ug/L	65	141	20	
		Vinyl acetate	108-05-4	Water	WDNR_VOC	5030	NE	---	1.01	8.00	ug/L	54	146	20	
		Vinyl chloride	75-01-4	Water	WDNR_VOC	5030	0.02	---	0.316	2.00	ug/L	58	137	20	
		Xylenes, Total	1330-20-7	Water	WDNR_VOC	5030	400	---	0.660	6.00	ug/L	79	121	20	

Lab	Analyte Group	Analyte	CAS Number	Matrix	Analytical Method	Prep Method	WI NR140 PAL	TCLP Haz Waste Limit	MDL	MRL	Units	LCL	UCL	RPD	Comments
EMT	Misc	Alkalinity, Bicarbonate (as CaCO3)	71-52-3	Water	2320	None	NE	---	1.50	10.0	mg/L	95	105	10	
		Alkalinity, Carbonate (as $CaCO_3$)	3812-32-6	Water	2320	None	NE	---	1.50	10.0	mg/L	95	105	10	
		Alkalinity, Total (as $CaCO_3$)	10001	Water	2320	None	NE	---	1.50	10.0	mg/L	95	105	10	
		Nitrogen, Nitrate	14797-55-8	Water	300	None	NE	---	0.00500	0.0500	mg/L	90	110		
		Sulfate	14808-79-8	Water	300	None	NE	---	0.0700	0.500	mg/L	90	110		
		Nitrogen, Nitrate	14797-55-8	Water	9056	None	NE	---	0.00500	0.0500	mg/L	88	111	20	
		Sulfate	14808-79-8	Water	9056	None	125	---	0.0700	0.500	mg/L	87	112	20	
		Oil and Grease (HEM)		Water	1664	None	NE	---	0.930	4.00	mg/L	78	114	18	
		Phosphorus, Total (as P)	7723-14-0	Water	4500	4500_PHOS_prep	NE	---	0.00600	0.0500	mg/L	80	120	10	
		Nitrogen, Nitrate/Nitrite (as N)		Water	4500_NO3_HACH	None	2	---	0.0270	0.100	mg/L	90	110		
		Biochemical Oxygen Demand		Water	5210	None	NE	---	2.00	15.0	mg/L	84.6	115	9.46	
		Chemical Oxygen Demand (COD)		Water	8000	None	NE	---	2.60	10.0	mg/L	85	115	10	
		Cyanide	57-12-5	Water	4500	4500_CN_prep	0.04	---	0.00200	0.0100	mg/L	80	120	20	
		Cyanide	57-12-5	Water	9014	9010	0.04	---	0.00200	0.0100	mg/L	83	116	10	
		Ignitability (closed cup)		Water	1010	None	NE	---	0.00	0.00	°F	90	110	20	

Notes:

Yellow shading designates MDLs that exceed the WI NR140 PALs or TCLP hazardous waste limits.
1) NR140 PALs used on this table were obtained from http://docs.legis.wisconsin.gov/code/admin_code/nr/100/140.pdf
2) The hazardous waste TCLP limits are from 40 CFR 261.24.

$CaCO_3$ = calcium carbonate
CAS = Chemical Abstracts Service
CFR = Code of Federal Regulations
cont'd = continued
Cr-VI = hexavalent chromium
DRO = diesel range organic
EMT = Environmental Monitoring Technologies, Inc.
F = Fahrenheit
GRO = gasoline range organic
haz = hazardous
LCL = lower control limit
MDL = method detection limit
mg/L = milligrams per liter
misc = miscellaneous
mod = modified
MRL = method reporting limit
NA = not applicable or not available
NE = not established
NR140 = Chapter NR140 Wis. Adm. Code
P = phosphorus
PAH = polynuclear aromatic hydrocarbon
PAL = preventive action limit
PCB = polychlorinated biphenyl
prep = preparation
PVOC = petroleum VOC
RPD = Relative Percent Difference
SU = standard units
Surr = surrogate
SVOC = semi-volatile organic compound
TCLP = toxicity characteristic leaching procedure
U.S. EPA = United States Environmental Protection Agency
UCL = upper control limit
µg/L = micrograms per liter
VOC = volatile organic compound
WDNR = Wisconsin Department of Natural Resources
WI = Wisconsin

Table 2H
Analytical Parameters, Reporting Limits, Precision and Accuracy
Legend - Asbestos and Paint Chip Samples

Laboratory	Analyte	CAS #	Matrix	Analytical Method	Standards	MDL	RL	Units	LCL % Recovery	UCL % Recovery	RPDL
Legend	Asbestos - Bulk	1332-21-4	Solid	EPA 600/R-93/11	>1%	1	1	%	NA	NA	NA
Legend	Lead - Paint Chips	7439-92-1	Solid	EPA 6010C	5,000	0.70	25	mg/kg	80	120	20

Table 3
Field and Laboratory
QA/QC Sample
Requirements

QC Sample Type		Frequency of Sample/Analysis	Details
Field Samples	Duplicate Samples	1 duplicate per 20 samples per matrix, or 1 duplicate per sample matrix if fewer than 20 samples	Duplicate sample to be collected by the same methods at the same time as the original sample. Used to verify sample and analytical reproducibility.
	Equipment/Field Blanks*	1 equipment blank per 20 samples, minimum 1 equipment blank per day per sample matrix or 1 field blank per bottle lot used, or one per site, whichever is more frequent	Distilled water placed into contact with sampling equipment. Used to assess quality of data from field sampling and decontamination procedures. ***** If all disposable equipment/single use sampling equipment is being used, then field blanks may be collected at a rate of 1 per bottle lot or per site, whichever is more frequent.
	Trip Blanks	1 trip blank per cooler containing samples for VOC analysis for water samples	Laboratory prepared organic-free blank to assess potential contamination during sample container shipment and storage, for VOCs in water only.
		1 trip blank per field sampling event, or per lot of bottles for soils, whichever is more frequent	For soil VOC samples preserved with methanol, one set of preserved vials will be included to assess potential contamination during sample container shipment and storage.
		1 trip blank per lot of bottles for wipes	If wipes are used for lead dust sampling, one sample jar containing an unused wipe will be supplied by the lab and will accompany the samples to assess potential contamination during sample container shipment and storage.
Lab Samples	Matrix Spike/ Matrix Spike Duplicate	1 MS/MSD per 20 or fewer samples per matrix in accordance with laboratory SOP	Laboratory spiked sample to evaluate matrix and measurement methodology.
	Method Blanks	1 method blank per daily run of samples prepared, or per laboratory SOP	Laboratory blank sample to assess potential for contamination from laboratory instruments or procedures.
	Laboratory Control Samples and Duplicates	Analyzed as per method requirements and laboratory SOPs	Evaluates laboratory reproducibility.

Note: MS/MSD = matrix spike/matrix spike duplicate
QA = quality assurance
QA/QC = quality assurance/quality control
SOP(s) = standard operating procedure(s)
VOC = volatile organic compound

Table 4
Sample Container, Preservation and Holding Time Requirements

Matrix	Analysis	Container	Preservation	Holding Time
SOIL	Metals	4 oz glass/plastic jar	Cool to </= 6° C	6 months; Mercury 28 days; Chromium VI 30 days
	VOCs/PVOCs	40 ml tared glass VOA vial with 10 grams of soil (TA & CT Labs; 5 grams for EMT)	CH_3OH, Cool to </= 6° MeOH	14 days
	SVOCs/PAHs	4 oz glass jar	Cool to </= 6° C	14 days for extraction; 40 days for analysis
	DRO	60 ml tared glass jar w/ 25 grams of soil (TA & CT Labs; 4 oz tared glass jar w/ 25 grams of soil for EMT)	Cool to </= 6° C	Add solvent within 10 days; analyze within 47 days
	GRO	40 ml tared glass VOA vial with 10 grams of soil (TA & CT Labs; 5 grams for EMT)	CH_3OH, Cool to </= 6° MeOH	14 days
	Pesticides, Herbicides and PCBs	4 oz glass	Cool to </= 6° C	14 days for extraction; 40 days for analysis
	Reactive Cyanide / Cyanide Total/ TOC	4 oz glass/plastic jar	Cool to </= 6° C	14 days CN; 28 days TOC
	TCLP VOCs	4 oz glass	Sample Cool to </= 6° C, minimum headpsace; TCLP extract: Cool to </= 6° C, HCl to pH<2, No Headspace	14 days until extraction; 14 days after extraction
	TCLP SVOCs	4 oz glass	Sample Cool to </= 6° C, Store in Dark; TCLP extract: Cool to </= 6° C, Store in Dark	14 days to prepare leachate; 7 days to extract; 40 days after extraction to analyze
	TCLP Metals (except Mercury)	4 oz glass/plastic jar	Sample Cool to </= 6° C; TCLP extract: HNO_3 to pH<2	180 days until extraction; 180 days after extraction
	TCLP Mercury	4 oz glass/plastic jar	Sample Cool to </= 6° C; TCLP extract: HNO_3 to pH<2	28 days until extraction; 28 days after extraction
	TCLP PCBs	4 oz glass/plastic jar	Sample Cool to </= 6° C; TCLP extract: Cool to </= 6° C	14 days until extraction; 40 days after extraction
	TCLP Pesticides	4 oz glass	Sample Cool to </= 6° C; TCLP extract: Cool to </= 6° C	14 days until extraction; 40 days after extraction to analyze
	Reactive Sulfide	4 oz glass/plastic jar	Cool to </= 6° C	None
	Total Sulfide	4 oz glass/plastic jar	Cool to </= 6° C	7 days
	% Moisture	4 oz glass/plastic jar	Cool to </= 6° C	7 days
	pH	4 oz glass/plastic jar	Cool to </= 6° C	Measure as soon as possible
	Flash Point	4 oz glass/plastic jar	Cool to </= 6° C	28 days
	Free Liquids - Paint Filter	4 oz glass/plastic jar	Cool to </= 6° C	180 days
WATER	Metals	250 ml plastic bottle (TA & CT Labs; 500 ml for EMT)	HNO_3 to pH<2,	6 months; Mercury 28 days
	Cr^{+6}	125 ml plastic bottle	Cool to </= 6° C	24 hours
	VOCs/PVOCs/GRO	3 – 40 ml glass VOC vials, per analysis	HCl to pH <2, Cool to </= 6° C	14 days
	Dissolved Gases (methane, ethane, ethene)	3 - 40 ml glass VOC vials, per analysis	HCl to pH <2, Cool to </= 6° C	14 days

Table 4
Sample Container, Preservation and Holding Time Requirements

Matrix	Analysis	Container	Preservation	Holding Time
WATER (CONT'D)	PAH/SVOCs/PCBs/ Pesticides	(2) 125 mL amber glass bottles PCB/Pesticides (TA & CT Labs); (2) 250 mL amber glass bottles PAH/SVOC (TA & CT Labs); (2) 1 L amber glass bottles (EMT)	Cool to </= 6° C	7 days for extraction; 40 days for analysis
	PAH SIM	(2) 1L amber glass bottles	Cool to </= 6° C	7 days for extraction; 40 days for analysis
	DRO	(2) 250 mL amber glass bottles (TA & CT Labs); (2) 1 L amber glass bottles (EMT)	HCl to pH <2, Cool to </= 6° C	7 days for extraction; 40 days for analysis
	Cyanide	500 ml plastic bottle	NaOH to pH>12 Cool to </= 6° C	14 days
	Alkalinity	125 ml plastic bottle	Cool to </= 6° C	14 days
	Nitrate	125 ml plastic bottle	Cool to </= 6° C	48 hours
	Phosphorus	125 ml plastic bottle (TA & CT Labs; 500 ml for EMT)	H_2SO_4 to pH<2, Cool to </= 6° C	28 days
	Sulfate	125 ml plastic bottle	Cool to </= 6° C	28 days
	Oil and Grease	(2) 1 L amber glass bottle	Cool to </= 6° C H_2SO_4 to pH <2 (TA & CT Labs); HCl to pH < 2 (EMT)	28 days
	BOD	500 ml plastic bottle	Cool to </= 6° C	2 days
	COD	500 ml plastic bottle	Cool to </= 6° C H_2SO_4 to pH<2,	28 days
	TOC	500 ml plastic bottle	Cool to </= 6° C H_2SO_4 to pH<2,	28 days
Bulk	Asbestos	Resealable plastic bag or glass/plastic jar	None	None
Paint Chips	Lead	Resealable plastic bag or glass/plastic jar	None	None
Air	TO-15 VOCs	Summa Canister/Tedlar bag	None	30 days summa, 72 hrs Tedlar

Notes: BOD = biochemical oxygen demand; C = centigrade; CN = cyanide; COD = chemical oxygen demand; Cr = chromium; DRO = diesel range organic; EMT = Environmental Monitoring Technologies, Inc.; GRO = gasoline range organic; H_2SO_4 = sulfuric acid; HCl = hydrochloric acid; HNO_3 = nitric acid; L = liter; MeOH = methanol; Ml = milliliter; NaOH = sodium hydroxide; Oz = ounce; PAH = polynuclear aromatic hydrocarbon; PCB = polychlorinated biphenyl; SIM = selected ion monitoring; SVOC = semi-volatile organic compound; TA = TestAmerica; TCLP = toxicity characteristic leaching procedure; TO = toxic organics; TOC = total organic carbon; VOA = volatile organic analyte; VOC = volatile organic compound.

Table 5 – QA Objectives for Field Measurements

Matrix	Parameter	Method Reference	Precision(1)	Accuracy(2)	Completeness
Groundwater or Surface Water	Water levels	ASTM D5413 - 93(2007)	+/- 0.01 ft	0.005 ft	95%
	Temperature	EPA 170.1, Mercury thermometer or electronic temperature probe	±0.5° C	1.0° C	95%
	Conductivity	EPA 120.1, Electrometric	±25 µmho/cm^2	10 µmho/cm^2	95%
	pH	EPA 150.1, Electrometric	±0.1 pH units	0.05 pH units	95%
	Turbidity	EPA 180.1, Electrometric	10 NTU(4)	0.5 NTU(3)	95%
	Redox Potential	ASTM D1498-08	±10 mV	10 mV	95%
	Dissolved Oxygen	SM-A4500	±0.05 mg/L	±0.1 mg/L	95%
Solid Material	Lead Paint	RMD XRF LPA-1	±0.1 mg/cm2 on wood/drywall; +0.15 mg/cm2 on metal/concrete	1.0 mg/cm^2	95%

Notes:

1. Expressed as the acceptable deviation from the scale.
2. Expected based on equipment manufacturer specifications.
3. Acceptable accuracy and precision based on the range of measurements.

ASTM = American Society for Testing and Materials (*Annual Book of ASTM Standards* , American Society of Testing and Materials, 2008)
C = centigrade
Cm = centimeter
EPA = Environmental Protection Agency
Ft = feet
mg/L = milligrams per liter
mV = millivolt
NTU = nephelometric turbidity unit.
QA = quality assurance
µmho = micromhos
SM = *Standard Methods for the Examination of Water and Wastewater, 21st ed* . (APHA, 2005).

Table 6
Preventive Maintenance for
Field Measurement Equipment

INSTRUMENTS	MAINTENANCE PROCEDURES/SCHEDULE	SPARE PARTS IN STOCK
ppbRae 3000 Photoionization Detector	1. Calibrate beginning and end of each day and as necessary during use. 2. Check battery, and recharge when low. 3. Clean lamp and sensor when display creeps upward, PID responds to moisture, or when movement of PID results in response on display 4. Replace external dust filter as needed.	1. Battery charger 2. Spare lamps 3. Spare filter cartridges
Thermo Environmental Model 580B Photoionization Detector	1. Calibrate beginning and end of each day, and as necessary during use. 2. Check battery, and recharge when low. 3. Clean lamp and dust filter as needed. 4. Replace water traps if they become wet.	1. Spare lamps 2. Spare dust filters.
Field Gas Chromatograph	1. Change injector septa daily. 2. Repack column when separation and linearity becomes poor. 3. Clean PID lamp before each initial calibration; change when sensitivity lost. 4. Clean injector port/liner weekly.	1. Septa 2. Empty columns and column packing 3. PID lamps 4. Injector lines
pH Meter	1. Calibrate beginning and end of each day, and as necessary during use. 2. Replace electrodes as needed.	1. pH buffers 2. Batteries 3. Spare electrodes
Conductivity Meter	1. Calibrate beginning and end of each day, and as necessary during use. 2. Check redline and replace batteries if does not calibrate.	1. Batteries
YSI 556 Multi-Meter	1. Calibrate beginning and end of each day, and as necessary during use. 2. Replace sensors per manufacturers guidelines.	1. buffer solutions 2. Batteries
RMD XRF	1. Confirm calibration at the beginning and end of each day using the paint film nearest 1.0 mg/cm^2. 2. Check battery and recharge when low. 3. Replace sensor cover as needed.	1. NIST Sandard Reference Material paint film 2. Battery Charger 3. Spare sensor covers

Notes: PID = photoionization detector
UV = ultraviolet

APPENDICES

APPENDIX A – STANTEC RESUMES

David B. Holmes PG

Senior Environmental Scientist/Brownfields Funding Specialist

Mr. Holmes has more than 28 years of professional consulting experience performing and managing environmental assessment, investigation, and cleanup projects and helping public and private sector clients to secure funding to implement these projects. David has worked on hundreds of brownfield sites on behalf of local government and developer clients throughout the US. He has exceptional experience securing state and federal grants to support brownfields redevelopment (more than $20 million in grant to date) as well as water resources and habitat restoration projects (more than $8 million in grants to date).

EDUCATION

Master of Science Geology, University of Wisconsin, Milwaukee, Wisconsin, 1988

Bachelor of Science Geology, University of Wisconsin, Milwaukee, Wisconsin, 1984

Doctoral Program Coursework, University of Wisconsin, School of Freshwater Science, Milwaukee, Wisconsin, 2014

OSHA, Health & Safety for Hazardous Waste Operations, 40-hour, 2011

REGISTRATIONS

Professional Geologist #2301, State of Indiana

Professional Geologist #887-13, State of Wisconsin

PROJECT EXPERIENCE

Brownfields

Redevelopment Projects at the Historic Pabst Brewery Complex, Milwaukee, Wisconsin (Funding Specialist)

David is assisting Blue Ribbon Management LLC in procuring funding and implementing cleanup activities in support of three planned developments at the historic brewery complex (at one time, the world's largest brewery). The developments include a $12 million office building (completed in 2014), a $4 million micro-brewery, and a $44 million residence to house 400 international university student residence in the historic bottling plant. David is assisting with securing local, state, and federal funding for assessment, cleanup, abatement, and infrastructure improvements in association with these projects.

White Stone Village Development, Cobalt Partners LLC, Menomonee Falls, Wisconsin

David is assisting two developer clients (Fiduciary Real Estate Development and Cobalt Partners LLC) with environmental assessment, funding, and cleanup of the former D&L Manufacturing property and adjoining parcels forming a 50-acre development site in suburban Milwaukee Assistance to date has included conducting Phase I and II ESAs, environmental site investigations, remedial planning, and oversight of approximately $2 million in cleanup at the site which includes four former manufacturing facilities, a bulk fuel storage facility, and a former gas station. The site is one of the largest redevelopment sites in suburban Milwaukee, both in terms of its land area and the value of the expected development (>$100 million) which will include a Costco store, 3 mid-box retail stores, a hotel, and approximately 340 market rate apartments. Assistance included securing a $500,000 State of Wisconsin brownfields grant to help off-set environmental cleanup costs.

Site Revitalization Program Development, Washington County, Wisconsin (Grant Writer/Project Manager)

David is assisting Washington County in the development of a County-led Site Revitalization Program - a joint effort between the County Planning and Parks Department and the County's economic development agency. A goal for the program is to integrate the County's revitalization efforts focused on brownfields sites with the County's economic development and business retention /recruitment efforts, with a goal of maximizing the extent to which brownfields revitalization can effectively be linked to private investment and jobs creation. David served initially on an "economic toolbox" advisory committee for the EDWC, one outcome of which was the successful application for a $600,000 USEPA Coalition Brownfields Assessment Grant awarded to the County in 2014, as part of a coalition that included five of the County's incorporated cities and villages. Stantec is implementing the grant which will include completion of a county-wide inventory of brownfield sites, community outreach, and assessment and/or reuse planning for up to 20 priority brownfields sites.

** denotes projects completed with other firms*

David B. Holmes PG

Senior Environmental Scientist/Brownfields Funding Specialist

USEPA Assessment and Cleanup Grant Applications Assistance, Various Clients (Grant Writer)

Since 2005, David has authored or coauthored more than 80 applications to the USEPA for brownfields assessment and cleanup grants. David has worked with local units of government (including cities, counties, and regional agencies) as well as non-profit organizations in 14 states (AK, CA, CO, FL, IL, IN, MN, ND, NY, OR, SC, SD, WA, and WI) in pursuing these grants. David has had significant success in working with first time grant applicants. Within the states of Wisconsin and Minnesota during the past four grant competitions (FY2010 to FY2013), 13 of 22 assessment grants awarded to first-time grantees were the result of applications for which David provided assistance.

PECFA Site Investigations and Cleanup, Milwaukee County, Wisconsin (Project Manager)

David assisted Milwaukee County with assessment, cleanup, and PECFA reimbursement for approximately 30 LUST sites owned or operated by the County, including the Milwaukee County Zoo, bus maintenance facilities, numerous parks and other County-owned properties.

Stock Lumber Property Redevelopment*, Princeton, Wisconsin (Grant Writer/Project Manager)

David assisted the City of Princeton with assessment, cleanup, and redevelopment of a 7-acre former lumber yard property adjacent to the City's downtown with industrial uses dating to the 1870s. David assisted the City in procuring both a $70,000 site assessment grant (SAG) from the Wisconsin DNR as well as a $137,000 Blight Elimination and Brownfields Redevelopment Grant from the WI Dept. of Commerce, and then implementing both grants.

USEPA Brownfield Grant Implementation, Various Locations, Wisconsin, Minnesota, Washington

Dave is assisting with all aspects of grant implementation including preparation of Quality Assurance Project Plans, preparation of eligibility determination requests, preparation of site-specific sampling and analysis plans, Site investigation reports and preparation of quarterly reports for 14 brownfields assessment grants awarded in Fiscal Years 2010-2013.

Brownfields Assessments - Waupun, Wisconsin

David assisted the City with Phase I and II ESAs on 12 parcels. The City wanted to evaluate the parcels for environmental concerns before acquiring the properties for redevelopment and/or entry into a brownfields program.

Various Redevelopment Projects*, Milwaukee, Wisconsin

David facilitated Wisconsin Department of Commerce grants for three properties in the Milwaukee metropolitan area. The grants ranged from $80,000 to $240,000, with each grant being critical to the project proceeding. The grants allowed for development of an apartment complex, a custard stand, and an industrial laundry cleaning facility.

Brownfields Program*, Elkhart County, Indiana (Lead Grant Writer/Project Manager)

David was responsible for implementation of two USEPA brownfields assessment grants awarded to Elkhart County in 2006. David wrote the grant applications as well as applications for two additional assessment grants awarded by USEPA in 2009. As part of the brownfield inventory and prioritization task, a custom web-based geographic information system (GIS) computer application (the "e-Atlas") that uses ESRI ArcGIS Server technology designed specifically for brownfields identification, management, and analysis of environmental information. As part of the inventory, records for 5,600 potential brownfield sites stored in several non-spatial databases were mapped in the County's GIS and aligned with property parcels. In addition, more than 200,000 pages of paper inspection records collected for commercial and industrial properties throughout the County over 20 years as part of Groundwater Protection Program were indexed, scanned and linked into the County's document management system (Laserfiche). The web based GIS interface allows users to interact with the information via the map, and to view, query, buffer, and link to additional content. The e-Atlas subsequently served as the model for a similar system known as "INSIT" or Indianapolis Site Inventory tool, developed by the City of Indianapolis which is also a web based GIS application that utilizes ArcGIS Server technology.

** denotes projects completed with other firms*

David B. Holmes PG

Senior Environmental Scientist/Brownfields Funding Specialist

City of Goshen Brownfields Program*, Goshen, Indiana (Project Manager)

David was responsible for implementation of two U.S. EPA brownfields assessment grants, two U.S. EPA cleanup grants, and five State of Indiana brownfields grants targeting an historic industrial area located adjacent to the Elkhart River. David was the primary author for brownfield grants totaling more than $1.25 million. Work included Phase I and II ESAs, site investigation, and development of remedial action plans. U.S. EPA grant activities performed by David included preparation of initial site eligibility determination forms, a quality assurance project plan, site-specific sampling and analysis plans, and quarterly progress reports. Several firsts in the history of the U.S. EPA brownfield grant program were reportedly achieved on this project related to effective use of the assessment grants for leveraging subsequent cleanup grants.

City of Milwaukee Multi-Year Environmental Assessment Contracts*, Milwaukee, Wisconsin

David was the project manager for three multi-year environmental services contracts with the City of Milwaukee during 1994 through 2005. As part of these contracts, David managed more than 50 environmental assessment or environmental cleanup projects involving more than 500 vacant, abandoned, or underutilized brownfield parcels throughout the City.

The sites assessed ranged from vacant former residential lots to landfills, abandoned historic manufacturing facilities, rail yards, gas stations, to a 5-1/2 block area of the City being targeted for commercial redevelopment. A majority of the projects were performed in conjunction with redevelopment of City-owned parcels by private developers, or sites targeted for acquisition by the City. A significant number of projects were performed in conjunction with USEPA or other state and federal grants. Milwaukee is noteworthy in having received more USEPA brownfields grants than any other local government in the U.S.

Engineering Geology

Ozaukee County NOAA Grant Application Assistance, Wisconsin

David provided grant application assistance as part of a team that wrote the application for Ozaukee County's 2009 grant from the National Oceanic and Atmospheric Administration. Stantec staff worked with the County and dozens of other project partners to coordinate the application, which resulted in the County being awarded a $4.7 million grant from the American Recovery and Reinvestment Act. The grant is one of only three awarded in the Great Lakes Region and is among 50 grants that were awarded from a pool of 841 applications. It is the 10th largest grant of the 50 and the only grant awarded in Wisconsin.

Environmental Site Assessments Phase I, II, III

City of Milwaukee Redevelopment Authority*, Milwaukee, Wisconsin

David managed Phase II environmental assessment activities on behalf of the Redevelopment Authority of the City of Milwaukee throughout an approximate 5-1/2 block area located within an inner city area of Milwaukee. The project site contained more than 300 parcels that were developed for a variety of commercial, industrial, and residential uses in the late 1800's. Most of the project site was cleared in the 1960's and 1970's for a freeway project that was later abandoned. At the time of the assessment, the site consisted of more than 50 parcels with approximately 30 individual owners. Approximately 20 of the parcels contained buildings at the time of the assessment ranging in size from single family residences to four story commercial and multi-family residential buildings. Project activities included performance of a magnetometer survey and search for underground storage tanks (USTs) throughout all open areas of the site, performance of Phase II ESA soil and groundwater sampling on 20 parcels, excavation of test pits at approximately 50 suspected UST locations, performance of asbestos and pre-demolition surveys for seven commercial buildings.

** denotes projects completed with other firms*

David B. Holmes PG

Senior Environmental Scientist/Brownfields Funding Specialist

City of Milwaukee Redevelopment – Environmental Assessment Activities*, Milwaukee, Wisconsin (Project Manager)

David was responsible for environmental assessment activities conducted on behalf of the City of Milwaukee for an approximate 2-1/2 block vacant inner city area. The site historically contained more than 80 commercial, industrial, and residential parcels with development dating to the 1880s. Historic land uses at the property included junk yard, chemical manufacturing, auto repair, paint mixing, car washes, miscellaneous commercial land uses, and residential. The project scope of work included performance of a Phase I ESA for the site as a whole, performance of a magnetometer survey and search for UST's throughout open areas of the property, performance of Phase II soil and groundwater sampling at 10 parcels with historic land uses of environmental concern, performance of additional soil and groundwater testing necessary to fully define the nature and extent of impacts, evaluation of remedial alternatives, and development of a remedial action plan.

Environmental Site Remediation

Industrial Facility Remediation, Illinois (Project Manager)

David was responsible for remediation of lead and petroleum impacts at four separate focus areas at a 106-acre industrial facility located in Illinois. Remedial activities included removal of approximately 5,000 tons of lead-impacted soil. An additional 1200 tons of lead-impacted soil was removed from a drainage swale area located in a separate portion of the property. Petroleum impacted soil was excavated from two additional areas. Worked was performed under the Site Remediation Program (SRP).

** denotes projects completed with other firms*

Richard J. Binder PG, CPG

Associate / Senior Project Manager

Stantec

Mr. Binder is a professional geologist with 25 years' experience involving investigation, remediation and redevelopment of Brownfield, industrial, commercial, telecommunication, public utility, solid waste and aviation sites. Mr. Binder's work experience includes Brownfield redevelopment, remedial investigations/feasibility studies, industrial facility deactivation/deconstruction, environmental due diligence assessments, manufactured gas plant site investigations, petroleum pipeline and aboveground/underground storage tank management, and landfill services. He has also designed and implemented soil, sediment, groundwater and soil vapor remedial actions related to chlorinated solvent, petroleum, cyanide, heavy metal and bio solids contamination utilizing sustainable/green remediation and conventional techniques. State expertise includes Wisconsin, Illinois, Indiana, Michigan, Iowa and Minnesota regulatory, grant and petroleum/drycleaner reimbursement programs. Federal expertise includes CERCLA, RCRA, TSCA and US EPA Brownfield regulatory and grants programs.

EDUCATION

Master of Science, Geological Sciences, University of Wisconsin, Milwaukee, Wisconsin, 1989

Bachelor of Science, Geological Sciences, University of Wisconsin, Milwaukee, Wisconsin, 1985

OSHA, Hazardous Waste Operation and Emergency Response Training, 40-hour + 8-hour Refresher, 2013

CPR and First Aid, Certification, Milwaukee, Wisconsin, 2012

Training, Confined Space Entry, Milwaukee, Wisconsin, 2010

REGISTRATIONS

Professional Geologist #2296, State of Indiana

Professional Geologist #196.001288, State of Illinois

Professional Geologist #734, State of Wisconsin

Certified Professional Geologist #9251, American Institute of Professional Geologists

MEMBERSHIPS

Member, American Institute of Professional Geologists

Member, National Ground Water Association

Member, Geological Society of America

Member, Wisconsin Ground Water Association

AWARDS

1993 Chrysler Quality Excellence Award for Soil and Groundwater Remediation

1992 Chrysler Quality Excellence Award for Soil and Groundwater Remediation

PROJECT EXPERIENCE

Brownfields

Brownfield Grant Funding

Assisted in preparation of 16 successful State and Federal Brownfield grant applications including: Two US EPA Brownfield Cleanup Grants and A US EPA Brownfield Revolving Loan Fund (RLF)/Wisconsin Department of Natural Resources Ready for Reuse subgrant for the City of Wausau, Wisconsin ($550,000; 2012 and 2013); a US EPA Brownfield Area-wide Planning Grant for the City of Wausau, Wisconsin ($200,000; 2013), a Wisconsin Economic Development Corporation Idle Sites Program grant for the City of Wausau, Wisconsin ($1,000,000; 2013), four Wisconsin Department of Commerce Blight Elimination and Brownfield Redevelopment Program grants for private clients located in southern Wisconsin (approximately $475,000; 2004, 2005, 2010 and 2011), a US EPA Brownfield Area-wide Planning Grant for the City of Goshen, Indiana ($175,000; 2010), two US EPA Brownfield Cleanup Grants for the City of Goshen, Indiana ($400,000; 2007), two US EPA Brownfield Assessment grants for Elkhart County, Indiana ($400,000; 2006), and two US EPA Brownfield Assessment grants for the City of Goshen, Indiana ($400,000; 2006).

Richard J. Binder PG, CPG

Associate / Senior Project Manager

US EPA Brownfields Revolving Loan Fund and Cleanup Grant Implementation, Wausau, Wisconsin (Project Manager)

Responsible for implementation of a US EPA Brownfields Revolving Loan Fund (RLF)/Wisconsin Department of Natural Resources Ready for Reuse subgrant, and two US EPA Brownfields Cleanup Grants awarded in 2012 and 2013 to the City of Wausau, Wisconsin related to stream restoration, remediation, infrastructure improvements, and multi-use trail/greenspace design and construction at three contiguous properties totaling 17 acres and located in the Riverfront Redevelopment Area. The Area includes a one-mile section adjacent to the Wisconsin River and downtown undergoing redevelopment and revitalization.

The ongoing project recently won the Brownfield Renewal 2013 National Economic Impact Award. Assisting in all components including development and implementation of the Community Relations Plans (CRP), Analysis of Brownfield Cleanup Alternatives (ABCAs), Quality Assurance Project Plans (QAPPs), Remedial Action Plans (RAPs), Design and Bid Specifications, as well as contractor procurement, construction oversight, and Davis-Bacon and US EPA programmatic reporting.

Also assisting in implementation of a US EPA Area-wide planning grant for the entire East Riverfront District Area.

US EPA Brownfields Assessment, Area-wide Planning and Revolving Load Fund Grant Implementation, 18 Grants, Various Locations, Wisconsin, Minnesota, North Dakota (Project QA/QC Officer)

Responsible for Quality Assurance/Quality Control related to implementation of 18 U.S. EPA Brownfields Assessment (14), Area-wide Planning (3) and Revolving Loan Fund (RLF; 2) Grants for petroleum and hazardous substances awarded in 2010, 2011, 2012 and 2013 to Marinette County Wisconsin, The Cities of Green Bay, Neenah, Racine and Manitowoc, Wisconsin, Dakota County, Minnesota, the Cities of Red Wing and Coon Rapids, Minnesota and the City of Minot, North Dakota. Work is ongoing.

US EPA Brownfields Assessment Grant Implementation, Elkhart County, Indiana (Project Principal and QA/QC Officer)

Provided technical and management oversight for implementation of four US EPA Brownfields assessment grants for petroleum and hazardous substances awarded in 2006 and 2009 to Elkhart County, Indiana.

The focus for the grants was the development of an expandable web-based environmental database ("e-Atlas") that includes records for more than 4,400 facilities and which are integrated with the Counties' GIS as well as assessment of impaired properties.

US EPA Community-wide Brownfields Assessment Grant Implementation, Muncie, Indiana (Project Principal and QA/QC Officer)

Provided technical and management oversight for implementation of a US EPA Community-wide Brownfields Assessment Grant for Hazardous Substances awarded in 2007 to the City of Muncie, Indiana. The grant was utilized to inventory Brownfield properties, perform environmental assessments on select sites, conduct remedial planning and assist with community involvement activities. All data was managed utilizing GIS.

US EPA Brownfields Assessment and Cleanup Grant Implementation, Goshen, Indiana (Project Principal and QA/QC Officer)

Provided technical and management oversight for implementation of two U.S. EPA Brownfields Assessment Grants for petroleum and hazardous substances awarded in 2006 and two U.S. EPA Brownfields Cleanup Grants awarded in 2007 to the City of Goshen, Indiana. Funding was used to assess nine current and/or former industrial properties located along a hydraulic canal located near the historic downtown. Remedial activities were performed at two of the properties in 2009 and consisted of in-situ chemical oxidation and monitoring of a chlorinated solvent plume, demolition and removal of contaminated subsurface structures including hydraulic lifts, underground storage tanks, former waste vaults and excavation and disposal of 8,000 cubic yard of impacted soil.

US EPA Brownfields Assessment Grant Implementation, Wauwatosa, Wisconsin (Principal and QA/QC Officer)

Provided technical and management oversight for implementation of two U.S. EPA Brownfields Assessment Grants for petroleum and hazardous substances awarded in 2009 to the City of Wauwatosa, Wisconsin. The grants are being utilized to inventory Brownfield properties, perform environmental assessments on select sites, conduct remedial planning and assist with community involvement activities as part of a three-year contract. All data is being managed utilizing geographic information system (GIS) and other data management tools.

** denotes projects completed with other firms*

Richard J. Binder PG, CPG

Associate / Senior Project Manager

Multi-Year Brownfield Environmental Assessment and Remediation Contracts, Milwaukee, Wisconsin (QA/QC Officer)

Provided technical and project management assistance for two multi-year brownfield environmental and remediation services contracts with the City of Milwaukee during 2000 through 2005. The sites assessed ranged from vacant former residential lots to landfills, abandoned historic manufacturing facilities, rail yards, gas stations, to a 5-1/2 block area of the City being targeted for commercial redevelopment. A majority of the projects were performed in conjunction with redevelopment of City-owned parcels by private developers, or sites targeted for acquisition by the City. A significant number of projects were performed in conjunction with U.S. EPA or other state and federal grants.

City of West Allis, Wisconsin Decommissioning and Demolition- Former Teledyne Manufacturing Facility, West Allis, Wisconsin (Project Principal)

Provided technical oversight related to demolition/deconstruction and remedial specifications development and implementation related to demolition/deconstruction of a former 330,000 square foot engine manufacturing facility. The project included bid specification preparation, contractor procurement and oversight. Pre-demolition surveys and management of above grade hazardous substances including asbestos, lead-based paint and mercury containing equipment were also performed. The project also included removal of seven underground storage tank systems and management of residual petroleum free product. Deconstruction/demolition materials were tracked utilizing WasteCap Trace software to provide for real time inventory of materials recycled and disposed.

Pioneer Neighborhood Parcel Redevelopment, West Allis, Wisconsin (Project Manager)

Performed Phase I and II Environmental Site Assessments (ESAs), asbestos/pre-demolition survey and developed demolition/deconstruction and remedial specifications related to redevelopment of parcels formerly utilized for bus maintenance, retail and industrial activities in the Pioneer Neighborhood of West Allis, Wisconsin. The approach to facilitate Site development and Site closure included excavation and offsite disposal of soil and use of an engineered barrier/cap to prevent direct contact with residual impacted fill materials. Asbestos abatement/removal was performed in the site structures prior to demolition. The buildings were demolished in the summer of 2007 and the properties redeveloped. A commercial bank was constructed on one portion of the property. A large–scale retirement living center was constructed on the adjoining areas. The project was funded utilizing a State of Wisconsin Site Assessment Grant (SAG) and City funds.

Auto Salvage Yard Redevelopment, Germantown, Wisconsin (Project Manager)

Assisted with redevelopment of a brownfields property consisting of a 25-acre former auto salvage yard property in Germantown, Wisconsin. Funding for investigation, cleanup, and select development activities was provided through Tax Incremental Financing (TIF). Based on the results of initial Phase I and Phase II environmental site assessments, 15 acres of the property were immediately transferred and redeveloped for light industrial use (toy manufacturing). A detailed remedial investigation was conducted on the main auto salvage yard. Remedial activities included disposal of approximately 10,000 cubic yards of soil, car frames, tires, wood, glass, oil, and miscellaneous salvaged materials. A closure plan to address residual arsenic was implemented as part of site preparation work in conjunction with transfer of the property for industrial development. The site was subsequently sold and redeveloped.

** denotes projects completed with other firms*

Richard J. Binder PG, CPG

Associate / Senior Project Manager

Steel Mill Property Redevelopment, Indianapolis, Indiana (Project Manager)

Conducted on-site remedial investigations and remedial actions related to redevelopment of a 9-acre former industrial property located in downtown Indianapolis, Indiana to a new warehousing, vehicle maintenance and office facility. The property previously housed a steel mill including 7-acres of dilapidated buildings. Above ground hazardous materials were appropriately managed and disposed as part of deconstruction of site structures. Soil, soil vapor and groundwater investigations were implemented. An active gas venting system was installed. A two-year monitored natural attenuation program was implemented to address identified volatile organic compounds in groundwater. A soil management plan was also developed to properly address soil excavated during construction activities. The new building and pavement was utilized as a cap to address residual impacted soil. Green building practices included recycling of approximately 75 to 80 percent of the concrete and asphalt for reuse on site; salvaging of all structural members for reuse by a flooring manufacturer and recycling of 95 percent of the steel.

Site Management & Remediation

Automobile Manufacturing Facility, Kenosha, Wisconsin (Project Manager/Project Hydrogeologist)

Responsible for a multi-year, multi-phase investigation and remediation of soil and groundwater related to deactivation and redevelopment/renovation of an automobile manufacturing facility in Kenosha, Wisconsin. Remedial investigations including installation of several hundred boreholes and monitoring wells were conducted to assess subsurface conditions, evaluate remedial alternatives, and design and implement systems for site remediation of petroleum hydrocarbon and chlorinated solvent contamination. Closure was obtained at six support properties. These properties have been transferred and redeveloped. Subsequent work included monitoring the performance of 14 groundwater and product recovery systems, two soil vapor extraction systems, one in situ and one ex situ bioremediation system, monitored natural attenuation and preparation of additional remedial action design work plans related to retained property. Soil and dewatering fluid management was subsequently performed related to two facility renovation and expansion projects. Remedial services totaled over $20,000,000.

Stainless Steel Tube Manufacturing Facility, Wisconsin (Senior Project Manager)

Responsible for RCRA closure investigation and remediation of a former stainless steel tube manufacturing facility located in Wisconsin. Project included work plan development to characterize sediments in two wastewater impoundments and adjacent Creek and wetland areas, characterize overall site hydrogeologic conditions and evaluate the potential for soil, sediment, and groundwater and surface water impact related to site operations. Remedial activities included dredging of contaminated sediments from an adjacent creek and wetland, consolidation onsite, design and installation of a groundwater/free product recovery and treatment system to minimize migration to an adjacent creek, capping of two former impoundment areas and use of phytoremediation to address site soil and groundwater containing volatile organic compounds.

Manufacturing Facility Remediation and Closure, Milwaukee, Wisconsin (Project Manager)

Performed Phase I environmental site assessment, site investigation and remediation in anticipation of closure and sale of a 360,000-square foot manufacturing facility in Milwaukee, Wisconsin. Industrial processes at the facility consisted primarily of machining, degreasing, plating, and assembly. Remedial activities completed included installation and operation and maintenance of two free product recovery systems, demolition and excavation of oil-impacted soil/fill, and hazardous waste closure/cleanup of plating and wastewater treatment areas. Closure of the entire plant site was granted by the WDNR approximately 18 months after the initial site investigation, and a sale of the property has been completed. The property is currently used for warehousing. Closure of the site utilized site-specific soil standards, a deed notice for residual soil impacts, a groundwater use restriction, and demonstration of the effectiveness of natural attenuation to address chlorinated solvents in groundwater.

Office Furniture Manufacturing Facility, Northern Illinois (Project Manager)

Responsible for remedial investigation/feasibility study/remedial design and remedial action of a former 3 million square foot office furniture manufacturing facility in Northern Illinois where soils and groundwater have been impacted by petroleum and chlorinated solvents including LNAPL and DNAPL. Project included remedial investigation, soil vapor extraction/air sparging/groundwater extraction pilot testing, remedial system design, installation and operation.

** denotes projects completed with other firms*

Richard J. Binder PG, CPG

Associate / Senior Project Manager

Printed Circuit Board Manufacturing Facility, North Carolina (Project Hydrogeologist)

Responsible for a hydrogeological characterization and groundwater quality assessment study at an industrial facility in North Carolina to investigate volatile organic compound impacts to shallow and deep aquifers at the site.

Environmental Investigation, Remediation, and Closure, Rubber House Manufacturing Facility, Galesburg, Illinois (Hydrogeologist and Interim Project Manager)

Assisted in completion of site investigations, remedial action plan preparation, and remedial actions for four "focus areas" under the Illinois Site Remediation Program (SRP). Remedial activities at the 106-acre manufacturing facility included removal of more than 6,000 tons of lead-impacted soil, including 1,000 tons that was characteristically hazardous for lead. The cleanup included restoration of two separate drainage swales/wetland areas. In addition, assisted in the clean-up of more than 12 tons of lead-impacted sediment from 2,000 feet of storm sewers, as well as an additional cleanup for a 30,000-gallon fuel storage tank that ruptured in extreme cold. The four focus areas received "no further remediation" letters from the Illinois Environmental Protection Agency (IEPA) in 2011.

Site Investigations for 12 Manufactured Gas Plans, Wisconsin (Project Manager)

Responsible for site investigations of 12 manufactured gas plant (MGP) sites for two electric power utilities in Wisconsin. The initial phase included the review of historical site activities followed by a preliminary site investigation to evaluate the presence or absence of compounds of concern. Phase II investigations were performed to evaluate the extent and magnitude of impacts. Site contaminants included PAH, BETX, phenolic, and cyanide compounds. Light and dense nonaqueous phase liquids (LNAPL and DNAPL) were present at many of the sites.

Drycleaner Facilities (Project Principal)

Responsible for required site assessment and remediation activities for 12 sites administered by the Illinois Drycleaner Environmental Response Trust Fund .The work included preparation of multiple drycleaner specific Phase I ESAs, Phase II ESAs and supplemental site investigations and reports, Remediation Objectives Reports, Remedial Action Plans and remediation. The sites are entered into the Illinois Environmental Protection Agency (IEPA) Site Remediation Program (SRP). Site remedial requirements are determined the Illinois Tiered Approach to Corrective Action (TACO) process. The project sites are located in varied hydrogeologic and hydrologic settings and contaminant complexity. These include assessment and remediation of dry cleaning solvents within fractured bedrock where adjoining water supply wells are contaminated. Another site is located adjacent to a creek and has soil, groundwater, surface water and sediment contamination issues. Site remediation must also take into account the planned construction of a walkway and park areas adjacent to the creek. The projects began in 2005 and are ongoing. The contract amount to date is approximately $500,000.

Aboveground and Underground Storage Tank Investigation

Pipeline Spill Response and Monitoring (Project Manager)

Responsible for coordination of emergency response support activities to address an approximately 55,000-gallon gasoline release to soil and fractured bedrock from a petroleum product pipeline in the Town of Jackson, Wisconsin in 2012. Initial activities included investigation of the extent of release to soil and waste characterization sampling of impacted soils. Additional support included coordination of sampling of 300 private water supply wells and 70 point of entry (POET) groundwater treatment systems. Work included coordination with multiple response teams including the client, local client subsidiary, consultants, and contractors. The site was located in a high-end residential area and required strict health and safety measures including detailed air monitoring and use of flame resistant suits in addition to other standard personal protective equipment. Initial spill response work was complicated by high temperatures in excess of 100 degrees.

** denotes projects completed with other firms*

Richard J. Binder PG, CPG

Associate / Senior Project Manager

Underground Storage Tank Removal (Project Hydrogeologist)

Responsible for removal of eight underground storage tanks (USTs) and related impacted soils, groundwater remediation system installation and operation, and inspection of the installation of new USTs and leak detection systems for a major trucking firm at two-truck maintenance and refueling facilities in California and North Carolina. Also acted as Project Hydrogeologist for the removal of 23 USTs and related site remediation at nine locations in North Carolina for a textile-manufacturing corporation.

Underground Storage Tank Evaluation - Various Locations (Project Manager)

Responsible for remedial investigation, evaluation of remedial alternatives, state agency liaison and remedial action plan preparation and implementation related to numerous underground storage tank (UST) system releases of petroleum and chlorinated solvent compounds in Wisconsin, Illinois, Iowa and Indiana. Many of the projects were completed utilizing State reimbursement programs.

Airports & Aviation

Sioux Gateway Airport, Sioux City, Iowa (Hydrogeologist)

Provided technical support related to a risk based corrective action (RBCA) investigation and remediation of thirteen petroleum product release sites at Sioux Gateway Airport in Sioux City Iowa. The project was performed in conjunction with the City of Sioux City and the Army Corps of Engineers. Free product was present at several of the sites with an estimated 150,000 gallons of jet fuel forming a free product layer up to 4-feet thick covering a 500 foot by 600 foot area. Closure was obtained at 10 of the sites with no further action required. The three remaining sites have been closed with respect to soil and groundwater utilizing institutional controls. Free product recovery will be conducted.

Milwaukee County's General Mitchell International Airport, Milwaukee, Wisconsin (Project Manager)

Provided project management and technical support throughout various phases of remedial system pre-design investigation; remedial system design; construction management; operation, maintenance and monitoring (OM&M); OM&M oversight and soil and groundwater management plan development during site construction activities, related to three release areas at Milwaukee County's General Mitchell International Airport. Project included review of data from 12 previous investigations, additional data acquisition to support selection of a remedy and remedial design, identification of cost-effective remedies for each fueling area, construction oversight and operation support. The intent of the systems is to reduce product levels and concentrations to allow natural attenuation to achieve closure of residual constituents. The systems were deactivated and final closure obtained. A soil and groundwater management plan was also developed for use during construction activities in one area. The project was performed to allow reimbursement through the Petroleum Environmental Cleanup Fund Act (PECFA) program.

Aircraft Refueling Facilities - Various Locations (Project Hydrogeologist)

Responsible for environmental assessment studies at aircraft refueling facilities located in Wisconsin, Massachusetts and Ohio for a fixed based operator. Also provided assistance with soil vapor extraction and groundwater recovery pilot testing.

Milwaukee County's General Mitchell International Airport, Milwaukee, Wisconsin (Project Manager)

Provided project management and technical support for baseline environmental assessment, remediation oversight, underground storage tank/jet fueling system upgrade, infrastructure assessment and spill prevention control and countermeasure plan services at an airport hangar facility located at Milwaukee County's General Mitchell International Airport (Altria/Philip Morris Management Corporation/Former Tenneco, Inc. facility). Services included a multi-phase investigation of soil and groundwater conditions at the facility, evaluation of regulated and unregulated underground storage tank systems and remedial oversight and UST system closure services related to remediation of soil and groundwater impacted by jet fuel and waste oil releases.

** denotes projects completed with other firms*

Richard J. Binder PG, CPG

Associate / Senior Project Manager

Solid Waste

Wisconsin Department of Corrections Landfill Investigation, Waupun, Wisconsin (Project Hydrogeologist)

Designed and implemented supplemental investigations to determine waste characteristics and location as well as soil and groundwater quality in the area of a former licensed landfill operated by the Waupun Correctional Institution. The investigation was complicated by the presence of shallow dolomitic bedrock. The area is also currently farmed, complicating both the investigation and potential for exposure due plant uptake of contaminants and contact with soils. Based on the results of investigation to date, the extent of fill/refuse related to the former landfill as well as related soil and groundwater impacts appears to be defined laterally and vertically.

Groundwater Reovery and Treatment Systems, Waukegan, Illinois (Project Manager)

Provided operation and maintenance oversight for groundwater recovery and treatment systems related to two PCB landfill cells associated with the Waukegan Harbor Superfund site located in Waukegan, Illinois.

Groundwater and Surface Water Monitoring, Keokuk, Iowa (Project Manager)

Responsible for providing semi-annual groundwater and surface water monitoring for an industrial fly ash landfill located in Keokuk, Iowa. Reporting includes statistical analysis of analytical data to evaluate the effects of the landfill on local groundwater and surface water quality.

Groundwater Quality Status Reports, Wisconsin (Project Hydrogeologist)

Responsible for preparation of quarterly groundwater quality status reports for several fly ash and pulp waste landfills in Wisconsin and supervised and prepared monthly leachate management reports.

Groundwater Monitoring Plans (Project Hydrogeologist)

Responsible for the preparation of revised groundwater monitoring plans for two sanitary landfills in northeastern Illinois (Lake Landfill- Lake County and Green Valley Landfill-Naperville)and the installation and abandonment of site monitor wells within underlying dolomitic bedrock.

Monitor Well Integrity Survey, Wisconsin (Project Hydrogeologist)

Performed a monitor well integrity survey at a closed landfill Superfund site located in southeastern Wisconsin. The evaluation consisted of physical inspection, hydraulic testing and review of existing data for each well to assess the integrity of the wells to verify their continued usability for groundwater quality monitoring and identify the potential need, if any, for general maintenance/repairs.

Fort Sheridan Landfill Closures, Illinois

Participated in a 2-day workshop organized on behalf of the Fort Sheridan, Illinois Restoration Advisory Board to review closure plans for two landfills on the Fort Sheridan property. Landfill closure is occurring as part of the military base closure process and is being managed by the U.S. Army Corps of Engineers. The workshops were conducted in the form of a "charrette" used by planners and architects to explore alternate ideas for closure considering future use. Workshop members identified that groundwater movement and communication between the landfill and the surrounding soil should be further defined and leachate collection enhanced to minimize observed groundwater mounding in the landfill and minimize outward migration. Design of the cap from lake level to the top of the bluff (approximately 100 feet) should allow downward migration of leachate for collection while allowing upward migration of gas for collection and address the potential to control any seeps.

Environmental Site Assessments Phase I, II, III

Due Diligence Studies

Performed numerous Phase I and II environmental assessment studies for municipalities, aircraft refueling facilities, trucking firms, real estate developers, chemical manufacturing companies, foundry facilities, manufacturing companies and telecommunications companies. Assessments also included NEPA Impact studies and National Historic Preservation Section 106 reviews for cellular tower sites.

Expert Testimony / Witness

Expert Witness - Former Industrial Property

Provided expert witness testimony regarding site conditions and future remedial costs related to "Quick Take" of a former industrial property utilized for battery manufacture and waste storage for the City of Rock Island, Illinois.
The judge positively ruled that the entire assessed value of the property be placed in escrow pending site remediation

** denotes projects completed with other firms*

and that "Quick Take" criteria were met, allowing the municipality to acquire the property for planned wastewater treatment plant expansion activities. The owner was subsequently relocated and the property remediated and redeveloped as a LEED-certified public works garage.

Expert Witness Technical Support, Ford Motor Company Twin Cities Assembly Plant, St. Paul, Minnesota
Assisted with remedial planning and cost estimating associated with anticipated mixed use property redevelopment scenarios for the Ford Motor Company Twin Cities Assembly Plant (TCAP) located in the City of Saint Paul for Ramsey County. The work was completed to support testimony regarding property value and property tax liability.

Technical Review, Various
Participated in consultant review of attorney files regarding PRP litigation involving volatile organic compound contamination of private water supply wells in a Wisconsin municipality. Also, participated in consultant review of existing subsurface investigation results of a former manufactured gas plant site regarding possible change in property use for an electric power utility in Wisconsin.

Value Engineering, Peer Reviews and Mediation

Fox River Superfund Site
Participated in review of the remedial investigation/feasibility study for the Fox River Superfund site on behalf of a PRP group.

Walnut Creek Study, Warsaw, Indiana
Prepared initial remedial action options analysis/feasibility study to address a release to sediment and surface water in Walnut Creek, downstream of the Warsaw, Indiana wastewater treatment plant no. 1. The project is being performed per CERCLA protocol within the Indiana State Cleanup Program.

Milwaukee Solvay Coke and Gas Superfund Alternative Site, Milwaukee, Wisconsin
Prepared a comprehensive site assessment, summary of previous environmental activities and environmental liability cost estimate for the former Milwaukee Solvay Coke and Gas Superfund Alternative Site on behalf of a local investor group through a local law firm.

Superfund Remedial Investigation/Feasibility Studies - Nationwide
Participated in the peer review of Superfund remedial investigation/feasibility studies at sites nationwide in support of the U.S. EPA Office of Inspector General--Engineering and Science Unit as part of a 3 year contract.

Hydrogeologic Studies

Surface Water-Groundwater Interaction Study, Rock Island, Illinois (Project Hydrogeologist)
Responsible for a surface water- groundwater interaction study related to an infiltration and inflow study for the City of Rock Island, Illinois. Study included hydrogeologic and hydrologic data acquisition and evaluation to assess the cause of increased flow to the city waste water treatment plant during periods of high river stage.

Wisconsin Department of Natural Resources Water Supply Section - Project Research, Wisconsin
Participated in project research to determine the effects of road salt on the glacial and dolomite aquifers in southern Wisconsin for the Wisconsin Department of Natural Resources Water Supply Section.

University of Wisconsin - Lake Michigan Investigation, Milwaukee, Wisconsin
Assisted in U.S. EPA-funded hydrogeologic and geophysical investigation to determine the flux and chemical contribution of groundwater to Lake Michigan at the University of Wisconsin, Milwaukee. Project work included installation and retrieval of seepage meters and seismic reflection and electrical resistivity surveys.

Water Supply Study - Ski Hill, Wisconsin (Project Manager)
Responsible for Initial water supply study to facilitate planned expansion of operations at a ski hill located in southern Wisconsin. The investigation was completed to evaluate the feasibility of using on-site groundwater resources to supplement a planned increase in the amount of water used during snowmaking operations. As part of planned facility expansion and upgrades, peak flow of up to 6,000 gallons per minute (gpm) may be required.

** denotes projects completed with other firms*

Richard J. Binder PG, CPG

Associate / Senior Project Manager

PUBLICATIONS

Binder, R., Byers, H., Powley, E., Till, B., Hawes, R. "Brownfield Redevelopment for LEED Municipal Public Works Facility, City of Rock Island, Illinois". *Presented at U.S. EPA Brownfields Conference, Philadelphia, Pennsylvania*, 2011.

Binder, R., Byers, H., Brinson, M., Hershberger, H. "Historic River Race Brownfield Assessment, Cleanup and Redevelopment Planning, Goshen, Indiana". *Presented at U.S. EPA Brownfields Conference, New Orleans, Louisiana*, 2009.

"Stimulus to Spark Environmental Cleanup". *Interview. Milwaukee Business Journal. Pages A23 and A24*, 2009.

Binder, R., Plevin, R., Dorsey, D. "Inner City Commercial Brownfield Redevelopment Project, Milwaukee, Wisconsin". *Presented at U.S. EPA Brownfields Conference, Detroit, Michigan*, 2008.

Binder, R., Plevin, R., Dorsey, D. "Inner City Catalyst Brownfield Redevelopment Project, Milwaukee, Wisconsin". *Presented at U.S. EPA Brownfields Conference, Boston, Massachusetts*, 2006.

Binder, R. "Historic Steel Mill Redevelopment, Indianapolis, Indiana". *Presented at U.S. EPA Brownfields Conference, Denver, Colorado*, 2005.

Binder, R., "The Contribution of Groundwater to Dry Season Flow From the Stewart Canyon Alpine Watershed, Custer County, Idaho". *Master's Thesis, University of Wisconsin, Milwaukee*, 1989.

Binder, R., "The Contribution of Groundwater to Dry Season Flow From the Stewart Canyon Alpine Watershed, Custer County, Idaho". *Paper Presentation, American Water Resources Association, Wisconsin section, 11th Annual Meeting, Green Bay, Wisconsin*, 1987.

Christopher C. Hatfield PG

Environmental Scientist

Mr. Hatfield is a Professional Geologist with over 17 years of experience in environmental consulting and project management. His project experience includes property assessment, improvement, development and redevelopment of commercial, municipal, and industrial properties. His project management responsibilities include technical direction, data analysis, report writing, budget development and tracking, scheduling, and coordination of fieldwork. Mr. Hatfield has successfully managed and/or personally completed a wide range of projects including: environmental due diligence related to property transactions, Brownfield redevelopment, regulatory permitting and compliance; and investigation and remediation of sites involving soil and groundwater contaminated with petroleum compounds, agricultural chemicals, chlorinated compounds, and metals. His skills in dealing with a wide range of contaminants and site investigations have helped many clients protect and enhance their property values.

EDUCATION

Health & Safety Training for Hazardous Waste Operations, 40-hour, OSHA, 1995

Bachelor of Science, Geology, University of Wisconsin, Madison, Wisconsin, 1995

REGISTRATIONS

Certified Site Assessor, State of Wisconsin

Certified Hydrogeologist, State of Wisconsin

Professional Geologist #1247-13, State of Wisconsin

PROJECT EXPERIENCE

Brownfield Remediation and Redevelopment

Menomonee Indian Tribe of Wisconsin Brownfield Assessment, Keshena, Wisconsin (Senior Geologist)

Chris was the senior geologist when Stantec (then Northern Environmental) assisted the Tribe with its brownfield assessment program. We developed a U.S. EPA-approved QAPP and outlined protocols to maintain consistency during field sampling and lab analysis. This included wild rice sampling, unique to this U.S. EPA project. We wrote 14 SAPs, field standard operating procedures, and health and safety plans. We also provided ESAs on numerous sites to help prioritize them for redevelopment.

US EA Brownfields Assessment Grant Implementation, Dakota County, Minnesota (Senior Geologist)

Chris was a senior geologist responsible for designing and assisting in Phase I and II ESAs for various sites in Dakota County. Chris prepared documents including Quality Assurance Project Plans, Standard Operating Procedure Plans, Sampling and Analysis Plans, Site Specific Workplans and Site Investigation Reports.

Environmental Site Assessments Phase I, II, III

Ladish Malting Company Facility Phase I and II ESAs, Jefferson, Wisconsin (Geologist)

Stantec conducted a Phase I ESA of the 374-acre former Ladish Malting Company Facility. Chris assisted with the Phase I, which identified eight Recognized Environmental Conditions associated with the property. Stantec helped a potential purchaser who was looking to turn the property into an ethanol production facility estimate the level of liability. Stantec completed a Phase II to quickly evaluate the environmental risks associated with the property. With this knowledge, the client was able to successfully manage the environmental risk and eventually purchase the property to construct the largest ethanol production facility in Wisconsin.

Citizens Bank-Phase I and II ESAs, Various locations in Wisconsin, Illinois, and Minnesota (Project Manager)

As Project Manager, Chris has completed ESAs on behalf of Citizens Bank. The client contracted Stantec to perform over 40 Phase I and Phase II ESAs and Transaction Screens at properties in Wisconsin, Michigan, Illinois, and Minnesota. These ESAs were conducted on a variety of commercial properties and foreclosures.

Christopher C. Hatfield PG

Environmental Scientist

Former Nursing Home Site – Phase II ESA, Glendale, Wisconsin

As project manager, Chris directed investigation activities on this property which was the site of a former nursing home. Stantec completed the Phase II Environmental Site Assessment for the property owner, who hoped to sell the property for redevelopment. Historic fill was encountered during the Phase II, but Chris and his project team determined that the fill was regional in extent and demonstrate that it was not a significant threat. In addition, we developed a barrier maintenance program to minimize the potential for direct contact with the contaminated area. This allowed the owner to attain case closure to help facilitate the property sale.

Environmental Site Remediation

Reich Property Chlorinated Solvent Remediation, Ripon, Wisconsin (Project Manager)

Chris directed remedial activities involving a chlorinated solvent release to soil and groundwater at a multi-family residential property. Remediation efforts failed causing the property owner to retain Stantec to design an effective remediation strategy. Chris oversaw the development and implementation of an enhanced bioremediation injection remedial action designed to greatly increase natural attenuation of chlorinated solvents in groundwater at the property. The remedial action successfully reduced chlorinated solvent and daughter product concentrations by over 99.9% and three years after initiation of the remedial action site closure was granted by the WDNR.

GE Medical Systems-RCRA Facility Investigation and Remediation, West Milwaukee, Wisconsin

Chris directed investigation and remedial activities involving a chlorinated solvent release to soil and groundwater at a G.E. Medical Systems industrial facility under the oversight of the U.S. EPA. He oversaw the installation of a vacuum-enhanced groundwater pump and treatment system and provided the technical lead for remediation system operation and groundwater monitoring. Groundwater contaminant treatment was achieved by a combination of air-stripping and carbon filtration. Treated groundwater was permitted for discharge to the local storm sewer system. The remediation system successfully contained the groundwater contaminant plume and reduced contaminant concentrations.

Remedial Investigations & Assessments

Town of Grafton Denow Landfill, Grafton, Wisconsin (Project Manager and Senior Geologist)

As project manager and senior geologist, Chris directed our team as they investigated and monitored groundwater contamination caused by a closed municipal landfill. Portions of the project were completed in cooperation with a second responsible party. The investigation involved installing and sampling more than 20 groundwater monitoring wells into unconsolidated glacial material and bedrock, collecting groundwater samples from over 40 private water supply wells, evaluating contaminant migration and groundwater flow within multiple hydrogeologic units, and development of a remedial action plan using monitored natural attenuation as the long-term remedy for the landfill and coordinating access to adjacent property owners' private water supply wells to collect groundwater samples.

Town of Jackson Garage, Jackson, Wisconsin (Project Manager)

As project manager, Chris directed our team as they investigated and monitored groundwater contamination present at the site due a leaking underground storage tank. The investigation involved installing groundwater monitoring wells into bedrock and coordinating access to adjacent property owners' private water supply wells to collect groundwater samples.

Spill Response Planning

Buckeye Petroleum/West Shore Pipeline-Gasoline Pipeline Spill, Jackson, Wisconsin (Environmental Scientist)

Stantec provided support for the investigation and cleanup of a 50,000-gallon gasoline spill from a buried pipeline. Chris assisted with the evaluation of the extent of gasoline-contaminated soil and collection of groundwater samples from numerous private water supply wells near the spill site and carbon treatment systems installed in homes.

Blanchardville Cooperative Petroleum Spill Response, Blanchardville, Wisconsin (Project Manager and Spill Responder)

Chris coordinated and completed on-site response to an overturned 2000-gallon gasoline tanker truck. Within 24-hours of the spill incident, he guided the removal of approximately 40 tons of gasoline contaminated soil resulting from the spill and

** denotes projects completed with other firms*

Christopher C. Hatfield PG

Environmental Scientist

successfully achieved WDNR site closure. As project manager, Chris directed our team as they investigated and monitored groundwater contamination present at the site due a leaking underground storage tank. The investigation involved installing groundwater monitoring wells into bedrock and coordinating access to adjacent property owners' private water supply wells to collect groundwater samples.

** denotes projects completed with other firms*

Jeffrey R. Brand

Staff Engineer

Mr. Brand schedules and performs environmental monitoring programs, develops, purges, and samples groundwater quality monitoring wells, collects and screens soil samples, maintains and calibrates sampling and analysis equipment, and performs land surveying and computer-aided design. He is also registered to participate in Petroleum Environmental Cleanup Fund Act Program in Wisconsin.

Jeff has more than 10 years of experience and specializes in the investigation and remediation of sites with chlorinated solvent and petroleum hydrocarbon contamination. His work includes soil borings and monitoring well installation, sampling and reporting, and remediation coordination/oversight. His presence on job sites helps ensure that the project work is smooth and well-coordinated with all stakeholders and subcontractors.

Jeff has experience in using many types of sampling equipment, including water level probes, oil/water interface probes, dissolved oxygen meters, pH/Temp/Conductivity meters, Magnetometers, KV portable power augers and samplers, transit levels, GPS units, PIDs, air sampling equipment, YSI 556 data loggers and anemometers.

EDUCATION

Bachelor of Science Environmental Engineering, Michigan Technological University, Houghton, Michigan, 1994

OSHA, Health & Safety Training for Hazardous Waste Operations, 40-hr., 2001

REGISTRATIONS

Certified Site Assessor, State of Wisconsin

PROJECT EXPERIENCE

Brownfields

Glatfelter Mill Redevelopment, Neenah, Wisconsin

Jeff completed the site investigation and oversaw remedial activities on this brownfield redevelopment project. The banner project is transforming a 16-acre site from a closed paper mill to a mixed-use redevelopment that allowed a Fortune 500 company to build offices for up to 500 employees. Stantec has helped the City obtain more than $1.2 million in grants for the project.

Marinette County Brownfields, Marinette, Wisconsin

Jeff is assisting with Phase I and II Environmental Site Assessments on this project, where Stantec is assisting the County in implementing a $200,000 U.S. EPA Petroleum Brownfield Assessment Grant.

Environmental Site Assessments Phase I, II, III

Phase I and II Environmental Site Assessments

Jeff has conducted or participated in hundreds of Phase I and II Environmental Site Assessments throughout his 10 years of employment with Stantec. Typical project tasks include performing historic research on property uses, interviewing current landowners and others with property knowledge, collecting soil and groundwater samples, reviewing lab reports, providing miscellaneous technical assistance, and contributing to final reports.

Environmental Site Remediation

WEL Companies, De Pere, Wisconsin

Jeff assisted with the investigation and remediation at this former industrial/manufactoring site. Jeff provided soil screening, sampling and remediation/oversight during extensive excavation of toluene-contaminated soils. In addition, Jeff provided technical guidance on the construction of an on-site biopile to facilitate remediation of highly contaminated soils.

Graf's Mobile, Algoma, Wisconsin

Jeff assisted with the investigation and remediation at this former gas station. The firm installed a treatment system that included a groundwater pump-and-treat element with an oil/water separator, as well as a groundwater air sparging system an SVE system. The project faced numerous challenges that involved recovering up to two feet of free product identified in monitoring wells that were encroaching onto the beach of Lake Michigan. We worked with approximately five adjacent property owners to install monitoring wells.

** denotes projects completed with other firms*

Andrew J. Swaim

Field Geologist

As a field geologist at Stantec, Mr. Swaim's responsibilities include conducting Environmental Site Assessments, field sampling and monitoring, and post-field analysis and report writing. Andrew also supervises subcontractors and ensures accurate and efficient fieldwork on large-scale remediation projects. He has participated in numerous investigation and remediation projects for properties affected by petroleum and other contaminants. Andrew's diverse skills allow him to assist with a wide range of project types, including environmental site assessments, asbestos investigations, and soil and groundwater monitoring. He also prepares geologic and hydrogeologic maps and cross sections and evaluates distribution data. He is adept at using GFLOW groundwater modeling software.

EDUCATION

Bachelor of Science, Geology and Geophysics, University of Wisconsin, Madison, Wisconsin, 2011

Health & Safety Training for Hazardous Waste Operations, 40-hr., OSHA, 2011

REGISTRATIONS

Asbestos Inspector, State of Wisconsin

Certified Site Assessor, State of Wisconsin

PROJECT EXPERIENCE

Environmental Site Assessments Phase I, II, III

Low Lift Property, Oak Creek, Wisconsin

Andrew was the designated field geologist for this site investigation project on a property where former industrial operations caused potential environmental issues. Stantec completed a groundwater investigation to determine whether remedial action was necessary. Andrew oversaw groundwater monitoring well installation and development activities. The results of Stantec's work confirmed that an adjacent property was the source of contamination.

Confidential Developer, Mequon, Wisconsin

Stantec assisted a developer with soil remediation activities at the site of a proposed residential subdivision. While conducting a Phase I ESA, Stantec discovered a leaking diesel fuel drum on the site. Because the source was known, we were able to bypass the site investigation and begin remediation. Andrew assisted with sampling to delineate the area of contamination, and provided subcontractor oversight during the excavation. We tested the walls of the excavation to determine its effectiveness, and our samples indicated that the remediation was a success.

Watermain Construction, Oak Creek, Wisconsin

The City of Oak Creek was excavating soil for a new watermain when contaminated soil was unexpectedly discovered. Stantec assisted the City with contaminant soil management. Andrew provided soil sampling, screening, characterization, and onsite technical guidance. Initially the contaminated soil was thought to be a hazardous waste. However, using our thorough understanding environmental regulations, we were able to successfully characterize the soil as non-hazardous, thereby significantly reducing soil disposal fees.

Phase II Environmental Site Assessments, Various Locations, Wisconsin

Andrew has conducted Phase II ESAs at numerous drycleaner sites throughout Wisconsin. Project tasks include site characterization and delineating the extent of soil contamination to prepare for remediation.

Phase II Environmental Site Assessment, Glendale, Wisconsin

Andrew assisted with soil sampling at this property, which was the site of a former nursing home. Stantec completed the Phase II ESA for the property owner, who hoped to sell the property for redevelopment. Historic fill was encountered during the Phase II, but the project team was able to document the fill and demonstrate that it was not a significant threat. In addition, we developed a barrier maintenance program to minimize the potential for direct contact with the contaminated area. This allowed the owner to attain case closure to help facilitate the property sale.

Phase I Environmental Site Assessment, Jefferson, Wisconsin

Andrew recently completed a Phase I Environmental Site Assessment at a former restaurant in Jefferson. Stantec was hired by a lender to complete this due diligence project to help facilitate the property transaction.

** denotes projects completed with other firms*

Andrew J. Swaim

Field Geologist

Environmental Site Remediation

Underground Storage Leak Clean Up, Mobile Home Park, Green Lake, Wisconsin

A chlorinated solvent release from a leaking underground storage tank caused significant groundwater contamination at the property. Stantec assisted with cleanup, and Andrew's role was to provide field oversight during the EOS injection. This strategy involved injecting edible oil into the ground to help stimulate bioremediation of chlorinated solvents. Our client enjoyed exceptional success on this project, with contamination levels being reduced from more than 1,000 times above regulatory limits to near no detection. Stantec will be requesting case closure on our client's behalf.

Diesel Spill Response Oversight, Elk Grove Village, Illinois

In response a significant diesel release, Stantec was charged with oversight of soil removal and replacement along a one quarter mile section of creek. Andrew provided soil sampling, screening, characterization, and onsite technical guidance during the significant soil removal and replacement operations.

** denotes projects completed with other firms*

Nicholas J. Heim

Staff Geologist

Mr. Heim is a staff geologist involved with site reconnaissance, historical research and data interpretation in association with writing technical reports. Nick's geological background has allowed him to have experience in a diverse range of projects from geophysical surveys, field mapping projects, soil and groundwater sampling surveys and drilling operations. He is capable of conducting bailer, low flow and system sampling, water, soil and air sampling and well abandonments. He is skilled at coordinating work plans to accomplish scope of work and communicating with clients and colleagues for specific projects and tasks.

EDUCATION

Bachelor of Science, Geology, Winona State University, Winona, Minnesota, 2011

CERTIFICATIONS & TRAINING

AHERA Asbestos Building Inspector, Milwaukee, Wisconsin, 2013

OSHA 40-Hour Hazardous Waste Site Worker Training, Milwaukee, Wisconsin, 2014

MEMBERSHIPS

Member, Geological Society of America

PROJECT EXPERIENCE

Environmental Site Assessments Phase I, II, III

Phase I Environmental Site Assessments*, Various Locations, Wisconsin

Nicholas preformed Phase I Environmental Site Assessments for locations in Wisconsin to identify past or present recognized environmental concerns. Investigated and analyzed data compiled through historical research and site reconnaissance.

NRCS Database Analysis*, Various Locations, Various States

Nick performed site assessments for a variety of locations throughout the United States to identify environmental concerns. He was involved with researching present and historical data using state and federal databases for possible site contamination and environmental hazards for the Wetland Reserve Program and the Grassland Reserve Program.

Geologic Mapping

PreCambrian Research Center Mapping Project*, Lake Vermillion State Park, Minnesota

Nick produced a preliminary bedrock geology map of Lake Vermillion State Park in northern Minnesota. Extensive field mapping identified relationships within a volcanic suite of rocks.

Geologic Studies

Student Research Assistant - Winona State University*, Nemo, South Dakota

Nicholas identified and characterized the shearing and folding of a Proterozoic package of rocks along an unconformity. Project included field mapping, data collection, preparation of samples and thin section analysis. He then presented his findings, " Structural Analysis of Proterozoic Shearing and Folding; Northeast Black Hills, SD" at the Geological Society of America Annual Meeting in October of 2011.

Site Research and Investigation

Site Investigations*, Various Locations, Wisconsin

Nick managed and conducted subsurface/hydrogeologic investigations for developers, municipalities, commercial and industrial property owners across the state of Wisconsin. Delineated the nature and extent of soil and groundwater contamination and developed remedial actions that were consistent with the client's long and short term objectives for the site and maximized the return on dollars invested.

Monitoring and Analysis

Former Chrome Plating Facility*, Kaukauna, Wisconsin

Nicholas operated and maintained a carbon adsorption/ion exchange groundwater treatment system designed to remove solvents and hexavalent chromium. Conducted sampling of the treatment system and on-site groundwater monitoring wells to evaluate the contamination plume. The property is owned by Outagamie County and funded/managed by the Wisconsin Department of Natural Resources.

** denotes projects completed with other firms*

Nicholas J. Heim

Staff Geologist

PUBLICATIONS

"Preliminary Bedrock Geology Map of the Eastern Part of Lake Vermillion State Park, St. Louis County Northeastern Minnesota", 2011.

APPENDIX B – LABORATORY CERTIFICATES

Current Laboratory Certifications and Expiration Dates

LABORATORY	CERTIFICATION	EXPIRATION DATE
Test America - Chicago	WDNR	8-31-15
Test America - North Canton	NELAP	6-30-16
Test America - Canton	WDNR	8-31-15
Test America - Knoxville	WDNR	8-31-15
Test America - Knoxville	Wisconsin does not currently have a TO-15 certification	NA
Legend Technical Services	NVLAP	3-31-16
Legend Technical Services	AIHA-LAP	7-1-16
CT Laboratories	WDNR	8-31-15
Environmental Monitoring Technologies, Inc.	WDNR	8-30-15

Note: AIHA-LAP = American Industrial Hygiene Association Laboratory Accreditation Program; NA = not applicable; NELAP = National Environmental Laboratory Accreditation Program; NVLAP = National Voluntary Laboratory Accreditation Program; TO = toxic organics; WDNR = Wisconsin Department of Natural Resources

State of Wisconsin
Department of Natural Resources

WISCONSIN
DEPT. OF NATURAL RESOURCES

recognizes

Wisconsin Certification under NR 149

of

CT Laboratories

Laboratory Id: **157066030**

as a laboratory licensed to perform environmental sample analysis in support of covered environmental programs (ch. NR149.02 Note) for the parameter(s) specified in the attached Scope of Accreditation.

August 31, 2015

Expiration Date

August 29, 2014

Issued on

Steven Geis, Chief
Environmental Science Services

Cathy Stepp, Secretary
Department of Natural Resources

This certificate does not guarantee validity of data generated, but indicates the methodology, equipment, quality control practices, records, and proficiency of the laboratory have been reviewed and found to satisfy the requirements of ch. NR 149, Wis. Adm. Code.

Scope of Accreditation

CT Laboratories
1230 Lange Ct.
Baraboo, WI 53913

Laboratory Id: **157066030**
Expiration Date: **08/31/15**
Issued Date: **08/29/14**

Wisconsin Certification under NR 149
Matrix: Aqueous (Non-potable Water)

Class: General Chemistry
- Alkalinity *by Colorimetry*
- Alkalinity *by Titration*
- Ammonia as N *by Colorimetry*
- Biochemical Oxygen Demand (BOD) *by 5-d Assay*
- Bromide *by IC*
- Carbonaceous Oxygen Demand (cBOD) *by 5-d Assay*
- Chemical Oxygen Demand (COD) *by Colorimetry*
- Chloride *by IC*
- Chlorophyll *by Colorimetry*
- Cyanide, Available *by Colorimetry*
- Cyanide, Total *by Colorimetry*
- Fluoride *by IC*
- Hardness, Total as CaCO3 *by ICP*
- Kjeldahl Nitrogen, Total *by Colorimetry*
- Nitrate *by IC*
- Nitrite *by IC*
- Oil&Grease, Hexane Ext. Material (HEM) *by Grav-HEM*
- Organic Carbon, Total (TOC) *by Comb-Ox*
- Orthophosphate *by IC*
- Phenolics, Total *by Colorimetry*
- Phosphorus, Total *by Colorimetry*
- Residue, Nonfilterable (TSS) *by Grav*
- Residue, Total *by Grav*
- Residue, Volatile (TVS) *by Grav*
- Residue, Volatile, Nonfilterable (TVSS) *by Grav*
- Silica *by ICP*
- Specific Conductance *by ISE*
- Sulfate *by IC*
- Sulfide *by Titration*
- pH *by ISE*

Class: Metals
- Aluminum *by ICP*
- Antimony *by GFAA*
- Antimony *by ICP*
- Arsenic *by GFAA*
- Arsenic *by ICP*
- Barium *by ICP*
- Beryllium *by ICP*
- Boron *by ICP*
- Cadmium *by ICP*
- Calcium *by ICP*
- Chromium (Hexavalent) *by Colorimetry*
- Chromium (Total) *by ICP*
- Cobalt *by ICP*
- Copper *by ICP*

Class: Metals
- Iron *by ICP*
- Lead *by GFAA*
- Lead *by ICP*
- Lithium *by ICP*
- Magnesium *by ICP*
- Manganese *by ICP*
- Mercury *by Hyd-CVAA*
- Molybdenum *by ICP*
- Nickel *by ICP*
- Potassium *by ICP*
- Selenium *by GFAA*
- Selenium *by ICP*
- Silver *by GFAA*
- Silver *by ICP*
- Sodium *by ICP*
- Strontium *by ICP*
- Thallium *by GFAA*
- Thallium *by ICP*
- Tin *by ICP*
- Titanium *by ICP*
- Vanadium *by ICP*
- Zinc *by ICP*

Class: BNA Semivolatiles
- ## SEMIVOLATILES [BNA] (group) *by GC/MS*

Class: PAH - Polynuclear Aromatic Hydrocarbons (BN)
- ## PAH (group) *by GC/MS*
- ## PAH (group) *by HPLC*

Class: Explosives Residue
- 1,3,5-Trinitrobenzene *by HPLC*
- 1,3-Dinitrobenzene *by HPLC*
- 2,4-Dinitrotoluene *by HPLC*
- 2,6-Dinitrotoluene *by HPLC*
- 2-Amino-4,6-dinitrotoluene *by HPLC*
- 2-Nitrotoluene *by HPLC*
- 3-Nitrotoluene *by HPLC*
- 4-Amino-2,6-dinitrotoluene *by HPLC*
- 4-Nitrotoluene *by HPLC*
- HMX *by HPLC*
- Nitrobenzene *by HPLC*
- Nitroglycerin *by HPLC*
- RDX *by HPLC*

Class: Pesticides, Organochlorine
- ## PESTICIDES, ORGANOCHLORINE (group) *by GC*

The laboratory named above is hereby licensed under ch. NR 149, Wis. Adm. Code for the parameters listed in this attachment.
* Analyte groups are defined and listed at http://dnr.wi.gov by searching keywords "Lab Certification:".

Scope of Accreditation

CT Laboratories
1230 Lange Ct.
Baraboo, WI 53913

Laboratory Id: **157066030**
Expiration Date: **08/31/15**
Issued Date: **08/29/14**

Wisconsin Certification under NR 149
Matrix: Aqueous (Non-potable Water)

Class: Petroleum Hydrocarbons Diesel Range Organics (DRO) *by GC* Gasoline Range Organics (GRO) *by GC* Petroleum VOC (PVOC) *by GC*
Class: PCBs as Aroclors ## PCB as AROCLORS (group) *by GC*
Class: Volatile Organics ## VOLATILE ORGANICS [VOC] (group) *by GC/MS*

The laboratory named above is hereby licensed under ch. NR 149, Wis. Adm. Code for the parameters listed in this attachment.
* Analyte groups are defined and listed at http://dnr.wi.gov by searching keywords "Lab Certification:".

Scope of Accreditation

CT Laboratories
1230 Lange Ct.
Baraboo, WI 53913

Laboratory Id: **157066030**
Expiration Date: **08/31/15**
Issued Date: **08/29/14**

Wisconsin Certification under NR 149
Matrix: Potable Water (Drinking Water)

Class: SDWA - Primary Non-metals
- Cyanide - EPA 335.4
- Fluoride - EPA 300.0
- Nitrate - EPA 300.0
- Nitrite - EPA 300.0

Class: SDWA - Primary Metals
- Antimony - EPA 200.9
- Arsenic - EPA 200.9
- Barium - EPA 200.7
- Beryllium - EPA 200.7
- Cadmium - EPA 200.7
- Chromium - EPA 200.7
- Copper - EPA 200.7
- Lead - EPA 200.9
- Mercury - EPA 245.2
- Nickel - EPA 200.7
- Selenium - EPA 200.9
- Thallium - EPA 200.9

Class: SDWA - Secondary Non-metals
- Sulfate - EPA 300.0

Class: SDWA - Secondary Metals
- Sodium - EPA 200.7

Class: SDWA - Trihalomethanes
- ## THM (group) - EPA 524.2

Class: SDWA - Volatile Organics
- ## VOCS, REGULATED (group) - EPA 524.2

The laboratory named above is hereby licensed under ch. NR 149, Wis. Adm. Code for the parameters listed in this attachment.
* Analyte groups are defined and listed at http://dnr.wi.gov by searching keywords "Lab Certification:".

Scope of Accreditation

CT Laboratories
1230 Lange Ct.
Baraboo, WI 53913

Laboratory Id: **157066030**
Expiration Date: **08/31/15**
Issued Date: **08/29/14**

Wisconsin Certification under NR 149
Matrix: Solid (Waste, Soil & Tissue)

Class: General Chemistry
- Ammonia as N *by Colorimetry*
- Bromide *by IC*
- Chloride *by IC*
- Cyanide, Available *by Colorimetry*
- Cyanide, Total *by Colorimetry*
- Fluoride *by IC*
- Kjeldahl Nitrogen, Total *by Colorimetry*
- Nitrate *by IC*
- Nitrite *by IC*
- Organic Carbon, Total (TOC) *by Comb-Ox*
- Orthophosphate *by IC*
- Phenolics, Total *by Colorimetry*
- Phosphorus, Total *by Colorimetry*
- Residue, Total *by Grav*
- Sulfate *by IC*
- Sulfide *by Titration*

Class: Metals
- Aluminum *by ICP*
- Antimony *by GFAA*
- Antimony *by ICP*
- Arsenic *by GFAA*
- Arsenic *by ICP*
- Barium *by ICP*
- Beryllium *by ICP*
- Boron *by ICP*
- Cadmium *by ICP*
- Calcium *by ICP*
- Chromium (Hexavalent) *by Colorimetry*
- Chromium (Total) *by ICP*
- Cobalt *by ICP*
- Copper *by ICP*
- Iron *by ICP*
- Lead *by GFAA*
- Lead *by ICP*
- Lithium *by ICP*
- Magnesium *by ICP*
- Manganese *by ICP*
- Mercury *by Hyd-CVAA*
- Molybdenum *by ICP*
- Nickel *by ICP*
- Potassium *by ICP*
- Selenium *by GFAA*
- Selenium *by ICP*
- Silver *by GFAA*
- Silver *by ICP*

Class: Metals
- Sodium *by ICP*
- Strontium *by ICP*
- Thallium *by GFAA*
- Thallium *by ICP*
- Tin *by ICP*
- Titanium *by ICP*
- Vanadium *by ICP*
- Zinc *by ICP*

Class: BNA Semivolatiles
- ## SEMIVOLATILES [BNA] (group) *by GC/MS*

Class: PAH - Polynuclear Aromatic Hydrocarbons (BN)
- ## PAH (group) *by HPLC*

Class: Explosives Residue
- 1,3,5-Trinitrobenzene *by HPLC*
- 1,3-Dinitrobenzene *by HPLC*
- 2,4-Dinitrotoluene *by HPLC*
- 2,6-Dinitrotoluene *by HPLC*
- 2-Amino-4,6-dinitrotoluene *by HPLC*
- 2-Nitrotoluene *by HPLC*
- 3-Nitrotoluene *by HPLC*
- 4-Amino-2,6-dinitrotoluene *by HPLC*
- 4-Nitrotoluene *by HPLC*
- HMX *by HPLC*
- Nitrobenzene *by HPLC*
- Nitroglycerin *by HPLC*
- RDX *by HPLC*

Class: Pesticides, Organochlorine
- ## PESTICIDES, ORGANOCHLORINE (group) *by GC*

Class: Petroleum Hydrocarbons
- Diesel Range Organics (DRO) *by GC*
- Gasoline Range Organics (GRO) *by GC*
- Petroleum VOC (PVOC) *by GC*

Class: PCBs as Aroclors
- ## PCB as AROCLORS (group) *by GC*

Class: Volatile Organics
- ## VOLATILE ORGANICS [VOC] (group) *by GC/MS*

Class: Waste Characterization Extractions
- SPLP Extraction *by Waste Extractions*
- TCLP Extraction *by Waste Extractions*

The laboratory named above is hereby licensed under ch. NR 149, Wis. Adm. Code for the parameters listed in this attachment.
* Analyte groups are defined and listed at http://dnr.wi.gov by searching keywords "Lab Certification:".

Scope of Accreditation

CT Laboratories
1230 Lange Ct.
Baraboo, WI 53913

Laboratory Id: **157066030**
Expiration Date: **08/31/15**
Issued Date: **08/29/14**

Wisconsin Certification under NR 149
Matrix: Solid (Waste, Soil & Tissue)

Class: Waste Characterization Assays
Ignitability of Solids *by Waste Assays*
Ignitability, Pensky-Martens Closed Cup *by Waste Assays*

The laboratory named above is hereby licensed under ch. NR 149, Wis. Adm. Code for the parameters listed in this attachment.
* Analyte groups are defined and listed at http://dnr.wi.gov by searching keywords "Lab Certification:".

State of Wisconsin
Department of Natural Resources

recognizes

Wisconsin Certification under NR 149

of

Environmental Monitoring & Technologies(EMT)

Laboratory Id: **999888890**

as a laboratory licensed to perform environmental sample analysis in support of covered environmental programs (ch. NR149.02 Note) for the parameter(s) specified in the attached Scope of Accreditation.

August 31, 2015

Expiration Date

August 5, 2014

Issued on

Steven Geis, Chief
Environmental Science Services

Cathy Stepp, Secretary
Department of Natural Resources

This certificate does not guarantee validity of data generated, but indicates the methodology, equipment, quality control practices, records, and proficiency of the laboratory have been reviewed and found to satisfy the requirements of ch. NR 149, Wis. Adm. Code.

Scope of Accreditation

Environmental Monitoring & Technologies(EMT)
8100 N. Austin Ave.
Morton Grove, IL 60053

Laboratory Id: **999888890**
Expiration Date: **08/31/15**
Issued Date: **08/05/14**

Wisconsin Certification under NR 149
Matrix: Aqueous (Non-potable Water)

Class: General Chemistry

Acidity as CaCO3 *by Titration*
Alkalinity *by Titration*
Ammonia as N *by Titration*
Biochemical Oxygen Demand (BOD) *by 5-d Assay*
Bromide *by IC*
Carbonaceous Oxygen Demand (cBOD) *by 5-d Assay*
Chemical Oxygen Demand (COD) *by Colorimetry*
Chloride *by IC*
Chlorophyll *by Colorimetry*
Cyanide, Available *by Colorimetry*
Cyanide, Available *by Titration*
Cyanide, Total *by Colorimetry*
Fluoride *by IC*
Fluoride *by ISE*
Hardness, Total as CaCO3 *by ICP*
Kjeldahl Nitrogen, Total *by Titration*
Nitrate *by IC*
Nitrate + Nitrite *by Colorimetry*
Nitrite *by Colorimetry*
Nitrite *by IC*
Oil&Grease, Hexane Ext. Material (HEM) *by Grav-HEM*
Organic Carbon, Total (TOC) *by Comb-Ox*
Organic Halides, Extractable (EOX) *by ISE*
Organic Halides, Purgeable (POX) *by ISE*
Orthophosphate *by Colorimetry*
Phenolics, Total *by Colorimetry*
Phosphorus, Total *by Colorimetry*
Residue, Filterable (TDS) *by Grav*
Residue, Nonfilterable (TSS) *by Grav*
Residue, Total *by Grav*
Residue, Volatile (TVS) *by Grav*
Sulfate *by IC*
Sulfide *by Colorimetry*
Sulfide *by ISE*
Sulfide *by Titration*
Sulfides, Acid-Soluble and Acid-Insoluble *by Titration*
Sulfite *by Titration*
Surfactants *by Colorimetry*
pH *by ISE*

Class: Metals

Aluminum *by ICP*
Aluminum *by ICP-MS*
Antimony *by ICP*
Antimony *by ICP-MS*
Arsenic *by ICP*

Class: Metals

Arsenic *by ICP-MS*
Barium *by ICP*
Barium *by ICP-MS*
Beryllium *by ICP*
Beryllium *by ICP-MS*
Boron *by ICP*
Boron *by ICP-MS*
Cadmium *by ICP*
Cadmium *by ICP-MS*
Calcium *by ICP*
Chromium (Hexavalent) *by Colorimetry*
Chromium (Total) *by Colorimetry*
Chromium (Total) *by ICP*
Chromium (Total) *by ICP-MS*
Cobalt *by ICP*
Cobalt *by ICP-MS*
Copper *by ICP*
Copper *by ICP-MS*
Iron *by ICP*
Iron *by ICP-MS*
Lead *by ICP*
Lead *by ICP-MS*
Magnesium *by ICP*
Manganese *by ICP*
Manganese *by ICP-MS*
Mercury *by Hyd-CVAA*
Molybdenum *by ICP*
Molybdenum *by ICP-MS*
Nickel *by ICP*
Nickel *by ICP-MS*
Potassium *by ICP*
Potassium *by ICP-MS*
Selenium *by ICP*
Selenium *by ICP-MS*
Silver *by ICP*
Silver *by ICP-MS*
Sodium *by ICP*
Thallium *by ICP*
Thallium *by ICP-MS*
Tin *by ICP*
Tin *by ICP-MS*
Titanium *by ICP*
Titanium *by ICP-MS*
Vanadium *by ICP*
Vanadium *by ICP-MS*

The laboratory named above is hereby licensed under ch. NR 149, Wis. Adm. Code for the parameters listed in this attachment.
* Analyte groups are defined and listed at http://dnr.wi.gov by searching keywords "Lab Certification:".

Scope of Accreditation

Environmental Monitoring & Technologies(EMT)
8100 N. Austin Ave.
Morton Grove, IL 60053

Laboratory Id: **999888890**
Expiration Date: **08/31/15**
Issued Date: **08/05/14**

Wisconsin Certification under NR 149
Matrix: Aqueous (Non-potable Water)

Class: Metals
Zinc *by ICP*
Zinc *by ICP-MS*

Class: BNA Semivolatiles
SEMIVOLATILES [BNA] (group) *by GC/MS*

Class: PAH - Polynuclear Aromatic Hydrocarbons (BN)
PAH (group) *by GC/MS*
PAH (group) *by HPLC*

Class: Pesticides, Acid (Herbicides)
2,4,5-T *by HPLC*
2,4-D *by HPLC*
2,4-DB *by HPLC*
Dicamba *by HPLC*
Dinoseb (2-sec-butyl-4,6-Dinitrophenol) *by HPLC*
MCPA *by HPLC*
MCPP (Mecoprop) *by HPLC*
Pentachlorophenol *by HPLC*
Silvex (2,4,5-TP) *by HPLC*

Class: Pesticides, Organochlorine
PESTICIDES, ORGANOCHLORINE (group) *by GC*

Class: Petroleum Hydrocarbons
Diesel Range Organics (DRO) *by GC*
Gasoline Range Organics (GRO) *by GC*
Petroleum VOC (PVOC) *by GC*
Petroleum VOC (PVOC) *by GC/MS*

Class: PCBs as Aroclors
PCB as AROCLORS (group) *by GC*

Class: Volatile Organics
VOLATILE ORGANICS [VOC] (group) *by GC/MS*
Ethanol *by GC*
Ethylene Glycol *by GC*
Methanol *by GC*

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* Analyte groups are defined and listed at http://dnr.wi.gov by searching keywords "Lab Certification:".

Scope of Accreditation

Environmental Monitoring & Technologies(EMT)
8100 N. Austin Ave.
Morton Grove, IL 60053

Laboratory Id: **999888890**
Expiration Date: **08/31/15**
Issued Date: **08/05/14**

Wisconsin Certification under NR 149
Matrix: Solid (Waste, Soil & Tissue)

Class: General Chemistry

Ammonia as N *by Titration*
Bromide *by IC*
Chloride *by IC*
Cyanide, Available *by Colorimetry*
Cyanide, Available *by Titration*
Cyanide, Total *by Colorimetry*
Fluoride *by IC*
Fluoride *by ISE*
Kjeldahl Nitrogen, Total *by Titration*
Nitrate *by IC*
Nitrate + Nitrite *by Colorimetry*
Nitrite *by Colorimetry*
Nitrite *by IC*
Organic Carbon, Total (TOC) *by Comb-Ox*
Organic Halides, Extractable (EOX) *by ISE*
Organic Halides, Purgeable (POX) *by ISE*
Orthophosphate *by Colorimetry*
Phenolics, Total *by Colorimetry*
Phosphorus, Total *by Colorimetry*
Residue, Total *by Grav*
Sulfate *by IC*
Sulfide *by Colorimetry*
Sulfide *by ISE*
Sulfide *by Titration*
Sulfides, Acid-Soluble and Acid-Insoluble *by Titration*
pH *by ISE*

Class: Metals

Aluminum *by ICP*
Aluminum *by ICP-MS*
Antimony *by ICP*
Antimony *by ICP-MS*
Arsenic *by ICP*
Arsenic *by ICP-MS*
Barium *by ICP*
Barium *by ICP-MS*
Beryllium *by ICP*
Beryllium *by ICP-MS*
Boron *by ICP*
Boron *by ICP-MS*
Cadmium *by ICP*
Cadmium *by ICP-MS*
Calcium *by ICP*
Chromium (Hexavalent) *by Colorimetry*
Chromium (Total) *by Colorimetry*
Chromium (Total) *by ICP*

Class: Metals

Chromium (Total) *by ICP-MS*
Cobalt *by ICP*
Cobalt *by ICP-MS*
Copper *by ICP*
Copper *by ICP-MS*
Iron *by ICP*
Iron *by ICP-MS*
Lead *by ICP*
Lead *by ICP-MS*
Magnesium *by ICP*
Manganese *by ICP*
Manganese *by ICP-MS*
Mercury *by Hyd-CVAA*
Molybdenum *by ICP*
Molybdenum *by ICP-MS*
Nickel *by ICP*
Nickel *by ICP-MS*
Potassium *by ICP*
Potassium *by ICP-MS*
Selenium *by ICP*
Selenium *by ICP-MS*
Silver *by ICP*
Silver *by ICP-MS*
Sodium *by ICP*
Thallium *by ICP*
Thallium *by ICP-MS*
Tin *by ICP*
Tin *by ICP-MS*
Titanium *by ICP*
Titanium *by ICP-MS*
Vanadium *by ICP*
Vanadium *by ICP-MS*
Zinc *by ICP*
Zinc *by ICP-MS*

Class: BNA Semivolatiles

SEMIVOLATILES [BNA] (group) *by GC/MS*

Class: PAH - Polynuclear Aromatic Hydrocarbons (BN)

PAH (group) *by GC/MS*
PAH (group) *by HPLC*

Class: Pesticides, Organochlorine

PESTICIDES, ORGANOCHLORINE (group) *by GC*

Class: Petroleum Hydrocarbons

Diesel Range Organics (DRO) *by GC*

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* Analyte groups are defined and listed at http://dnr.wi.gov by searching keywords "Lab Certification:".

Scope of Accreditation

Environmental Monitoring & Technologies(EMT)
8100 N. Austin Ave.
Morton Grove, IL 60053

Laboratory Id: **999888890**
Expiration Date: **08/31/15**
Issued Date: **08/05/14**

Wisconsin Certification under NR 149
Matrix: Solid (Waste, Soil & Tissue)

Class: Petroleum Hydrocarbons
- Gasoline Range Organics (GRO) *by GC*
- Petroleum VOC (PVOC) *by GC*
- Petroleum VOC (PVOC) *by GC/MS*

Class: PCBs as Aroclors
- ## PCB as AROCLORS (group) *by GC*

Class: Volatile Organics
- ## VOLATILE ORGANICS [VOC] (group) *by GC/MS*
- Ethanol *by GC*
- Ethylene Glycol *by GC*
- Methanol *by GC*

Class: Waste Characterization Extractions
- TCLP Extraction *by Waste Extractions*

Class: Waste Characterization Assays
- Ignitability of Solids *by Waste Assays*
- Ignitability, Oxidizers *by Waste Assays*
- Ignitability, Pensky-Martens Closed Cup *by Waste Assays*
- Ignitability, Setaflash Closed Cup *by Waste Assays*
- Ignitability, Small Scale Closed Cup *by Waste Assays*
- Waste Analysis, Other *by Waste Assays*

The laboratory named above is hereby licensed under ch. NR 149, Wis. Adm. Code for the parameters listed in this attachment.
* Analyte groups are defined and listed at http://dnr.wi.gov by searching keywords "Lab Certification:".

AIHA Laboratory Accreditation Programs, LLC

acknowledges that

LEGEND Technical Services, Inc.

88 Empire Drive, St. Paul, MN 55103

Laboratory ID: 101095

along with all premises from which key activities are performed, as listed above, has fulfilled the requirements of the AIHA Laboratory Accreditation Programs (AIHA-LAP), LLC accreditation to the ISO/IEC 17025:2005 international standard, *General Requirements for the Competence of Testing and Calibration Laboratories* in the following:

LABORATORY ACCREDITATION PROGRAMS

✓	**INDUSTRIAL HYGIENE**	Accreditation Expires: 07/01/2017
✓	**ENVIRONMENTAL LEAD**	Accreditation Expires: 07/01/2017
☐	**ENVIRONMENTAL MICROBIOLOGY**	Accreditation Expires:
☐	**FOOD**	Accreditation Expires:
☐	**UNIQUE SCOPES**	Accreditation Expires:

Specific Field(s) of Testing (FoT)/Method(s) within each Accreditation Program for which the above named laboratory maintains accreditation is outlined on the attached **Scope of Accreditation**. Continued accreditation is contingent upon successful on-going compliance with ISO/IEC 17025:2005 and AIHA-LAP, LLC requirements. This certificate is not valid without the attached **Scope of Accreditation**. Please review the AIHA-LAP, LLC website (www.aihaaccreditedlabs.org) for the most current Scope.

Gerald Schultz, CIH
Chairperson, Analytical Accreditation Board

Cheryl O. Morton
Managing Director, AIHA Laboratory Accreditation Programs, LLC

Revision 14: 03/26/2014

Date Issued: 06/30/2015

AIHA Laboratory Accreditation Programs, LLC

SCOPE OF ACCREDITATION

LEGEND Technical Services, Inc.
88 Empire Drive, St. Paul, MN 55103

Laboratory ID: **101095**
Issue Date: 06/30/2015

The laboratory is approved for those specific field(s) of testing/methods listed in the table below. Clients are urged to verify the laboratory's current accreditation status for the particular field(s) of testing/Methods, since these can change due to proficiency status, suspension and/or withdrawal of accreditation.

Industrial Hygiene Laboratory Accreditation Program (IHLAP)

Initial Accreditation Date: 03/01/1998

IHLAP Scope Category	**Field of Testing (FoT)** (FoTs cover all relevant IH matrices)	**Technology sub-type/ Detector**	**Published Reference Method/Title of In-house Method**	**Method Description or Analyte** *(for internal methods only)*
Chromatography Core	GC/MS		EPA TO-15	
	Gas Chromatography (Diffusive Samplers)		NIOSH 1614	
Spectrometry Core	Inductively-Coupled Plasma	ICP/AES	EPA SW-846 6010C	
			NIOSH 7303	
Asbestos/Fiber Microscopy Core	Phase Contrast Microscopy (PCM)		NIOSH 7400A	

A complete listing of currently accredited Industrial Hygiene laboratories is available on the AIHA-LAP, LLC website at: http://www.aihaaccreditedlabs.org

AIHA Laboratory Accreditation Programs, LLC

SCOPE OF ACCREDITATION

LEGEND Technical Services, Inc.
88 Empire Drive, St. Paul, MN 55103

Laboratory ID: **101095**
Issue Date: 06/30/2015

The laboratory is approved for those specific field(s) of testing/methods listed in the table below. Clients are urged to verify the laboratory's current accreditation status for the particular field(s) of testing/Methods, since these can change due to proficiency status, suspension and/or withdrawal of accreditation.

The EPA recognizes the AIHA-LAP, LLC ELLAP program as meeting the requirements of the National Lead Laboratory Accreditation Program (NLLAP) established under Title X of the Residential Lead-Based Paint Hazard Reduction Act of 1992 and includes paint, soil and dust wipe analysis. Air analysis is not included as part of the NLLAP.

Environmental Lead Laboratory Accreditation Program (ELLAP)

Initial Accreditation Date: 01/01/2002

Field of Testing (FoT)	Technology sub-type/ Detector	Method	Method Description (*for internal methods only*)
Paint		EPA SW-846 3050B	
		NIOSH 7300	
Soil		EPA SW-846 3050B	
		NIOSH 7300	
Settled Dust by Wipe		EPA SW-846 3050B	
		NIOSH 7300	
Airborne Dust		EPA SW-846 3050B	
		NIOSH 7300	

A complete listing of currently accredited Environmental Lead laboratories is available on the AIHA-LAP, LLC website at: http://www.aihaaccreditedlabs.org

United States Department of Commerce
National Institute of Standards and Technology

Certificate of Accreditation to ISO/IEC 17025:2005

NVLAP LAB CODE: 102081-0

Legend Technical Services, Inc.

St. Paul, MN

is accredited by the National Voluntary Laboratory Accreditation Program for specific services, listed on the Scope of Accreditation, for:

BULK ASBESTOS FIBER ANALYSIS

This laboratory is accredited in accordance with the recognized International Standard ISO/IEC 17025:2005. This accreditation demonstrates technical competence for a defined scope and the operation of a laboratory quality management system (refer to joint ISO-ILAC-IAF Communique dated January 2009).

2015-04-01 through 2016-03-31

Effective dates

For the National Institute of Standards and Technology

National Voluntary Laboratory Accreditation Program

SCOPE OF ACCREDITATION TO ISO/IEC 17025:2005

Legend Technical Services, Inc.
88 Empire Drive
St. Paul, MN 55103
Ms. Cheryl Sykora
Phone: 651-221-4085 Fax: 651-642-1239
E-Mail: CSykora@legend-group.com
URL: http://www.legend-group.com

BULK ASBESTOS FIBER ANALYSIS (PLM) **NVLAP LAB CODE 102081-0**

NVLAP Code	*Designation / Description*
18/A01	EPA 600/M4-82-020: Interim Method for the Determination of Asbestos in Bulk Insulation Samples
18/A03	EPA 600/R-93/116: Method for the Determination of Asbestos in Bulk Building Materials

2015-04-01 through 2016-03-31

Effective dates

For the National Institute of Standards and Technology

NVLAP-01S (REV. 2005-05-19)

State of Wisconsin
Department of Natural Resources

WISCONSIN
DEPT. OF NATURAL RESOURCES

recognizes

Wisconsin Certification under NR 149

of

TestAmerica Canton

Laboratory Id: **999518190**

as a laboratory licensed to perform environmental sample analysis in support of covered environmental programs (ch. NR149.02 Note) for the parameter(s) specified in the attached Scope of Accreditation.

August 31, 2015

Expiration Date

August 26, 2014

Issued on

Steven Geis, Chief
Environmental Science Services

Cathy Stepp, Secretary
Department of Natural Resources

This certificate does not guarantee validity of data generated, but indicates the methodology, equipment, quality control practices, records, and proficiency of the laboratory have been reviewed and found to satisfy the requirements of ch. NR 149, Wis. Adm. Code.

Scope of Accreditation

TestAmerica Canton
4101 Shuffel Drive NW
North Canton, OH 44720

Laboratory Id: **999518190**
Expiration Date: **08/31/15**
Issued Date: **08/26/14**

Wisconsin Certification under NR 149
Matrix: Aqueous (Non-potable Water)

Class: General Chemistry

Alkalinity *by Titration*
Biochemical Oxygen Demand (BOD) *by 5-d Assay*
Carbonaceous Oxygen Demand (cBOD) *by 5-d Assay*
Chemical Oxygen Demand (COD) *by Colorimetry*
Chloride *by Colorimetry*
Chloride *by IC*
Cyanide, Available *by Colorimetry*
Cyanide, Total *by Colorimetry*
Fluoride *by IC*
Hardness, Total as CaCO3 *by Titration*
Nitrate *by IC*
Nitrite *by IC*
Organic Carbon, Total (TOC) *by Comb-Ox*
Orthophosphate *by Colorimetry*
Orthophosphate *by IC*
Phenolics, Total *by Colorimetry*
Phosphorus, Total *by Colorimetry*
Residue, Filterable (TDS) *by Grav*
Residue, Nonfilterable (TSS) *by Grav*
Residue, Total *by Grav*
Sulfate *by IC*
Sulfide *by Titration*
Sulfides, Acid-Soluble and Acid-Insoluble *by Titration*

Class: Metals

Aluminum *by ICP*
Aluminum *by ICP-MS*
Antimony *by ICP*
Antimony *by ICP-MS*
Arsenic *by ICP*
Arsenic *by ICP-MS*
Barium *by ICP*
Barium *by ICP-MS*
Beryllium *by ICP*
Beryllium *by ICP-MS*
Boron *by ICP*
Cadmium *by ICP*
Cadmium *by ICP-MS*
Calcium *by ICP*
Chromium (Total) *by ICP*
Chromium (Total) *by ICP-MS*
Cobalt *by ICP*
Cobalt *by ICP-MS*
Copper *by ICP*
Copper *by ICP-MS*
Iron *by ICP*

Class: Metals

Iron *by ICP-MS*
Lead *by ICP*
Magnesium *by ICP*
Magnesium *by ICP-MS*
Manganese *by ICP*
Manganese *by ICP-MS*
Mercury *by Hyd-CVAA*
Mercury *by UltraLow*
Molybdenum *by ICP*
Molybdenum *by ICP-MS*
Nickel *by ICP*
Nickel *by ICP-MS*
Potassium *by ICP*
Selenium *by ICP*
Selenium *by ICP-MS*
Silver *by ICP*
Silver *by ICP-MS*
Sodium *by ICP*
Thallium *by ICP*
Thallium *by ICP-MS*
Tin *by ICP*
Titanium *by ICP*
Vanadium *by ICP*
Vanadium *by ICP-MS*
Zinc *by ICP*
Zinc *by ICP-MS*

Class: BNA Semivolatiles

SEMIVOLATILES [BNA] (group) *by GC/MS*

Class: PAH - Polynuclear Aromatic Hydrocarbons (BN)

PAH (group) *by GC/MS*

Class: Pesticides, Organochlorine

PESTICIDES, ORGANOCHLORINE (group) *by GC*

Class: Petroleum Hydrocarbons

Diesel Range Organics (DRO) *by GC*
Gasoline Range Organics (GRO) *by GC*

Class: PCBs as Aroclors

PCB as AROCLORS (group) *by GC*

Class: Volatile Organics

VOLATILE ORGANICS [VOC] (group) *by GC/MS*

The laboratory named above is hereby licensed under ch. NR 149, Wis. Adm. Code for the parameters listed in this attachment.
* Analyte groups are defined and listed at http://dnr.wi.gov by searching keywords "Lab Certification:".

Scope of Accreditation

TestAmerica Canton
4101 Shuffel Drive NW
North Canton, OH 44720

Laboratory Id: **999518190**
Expiration Date: **08/31/15**
Issued Date: **08/26/14**

Wisconsin Certification under NR 149
Matrix: Solid (Waste, Soil & Tissue)

Class: General Chemistry
- Chloride *by IC*
- Cyanide, Available *by Colorimetry*
- Cyanide, Total *by Colorimetry*
- Fluoride *by IC*
- Nitrate *by IC*
- Nitrite *by IC*
- Organic Carbon, Total (TOC) *by Comb-Ox*
- Orthophosphate *by Colorimetry*
- Orthophosphate *by IC*
- Phenolics, Total *by Colorimetry*
- Residue, Total *by Grav*
- Sulfate *by IC*
- Sulfide *by Titration*
- Sulfides, Acid-Soluble and Acid-Insoluble *by Titration*

Class: Metals
- Aluminum *by ICP*
- Aluminum *by ICP-MS*
- Antimony *by ICP*
- Antimony *by ICP-MS*
- Arsenic *by ICP*
- Arsenic *by ICP-MS*
- Barium *by ICP*
- Barium *by ICP-MS*
- Beryllium *by ICP*
- Beryllium *by ICP-MS*
- Boron *by ICP*
- Cadmium *by ICP*
- Cadmium *by ICP-MS*
- Calcium *by ICP*
- Chromium (Total) *by ICP*
- Chromium (Total) *by ICP-MS*
- Cobalt *by ICP*
- Cobalt *by ICP-MS*
- Copper *by ICP*
- Copper *by ICP-MS*
- Iron *by ICP*
- Iron *by ICP-MS*
- Lead *by ICP*
- Magnesium *by ICP*
- Magnesium *by ICP-MS*
- Manganese *by ICP*
- Manganese *by ICP-MS*
- Mercury *by Hyd-CVAA*
- Mercury *by UltraLow*
- Molybdenum *by ICP*

Class: Metals
- Molybdenum *by ICP-MS*
- Nickel *by ICP*
- Nickel *by ICP-MS*
- Potassium *by ICP*
- Selenium *by ICP*
- Selenium *by ICP-MS*
- Silver *by ICP*
- Silver *by ICP-MS*
- Sodium *by ICP*
- Thallium *by ICP*
- Thallium *by ICP-MS*
- Tin *by ICP*
- Titanium *by ICP*
- Vanadium *by ICP*
- Vanadium *by ICP-MS*
- Zinc *by ICP*
- Zinc *by ICP-MS*

Class: BNA Semivolatiles
- ## SEMIVOLATILES [BNA] (group) *by GC/MS*

Class: PAH - Polynuclear Aromatic Hydrocarbons (BN)
- ## PAH (group) *by GC/MS*

Class: Pesticides, Organochlorine
- ## PESTICIDES, ORGANOCHLORINE (group) *by GC*

Class: Petroleum Hydrocarbons
- Diesel Range Organics (DRO) *by GC*
- Gasoline Range Organics (GRO) *by GC*

Class: PCBs as Aroclors
- ## PCB as AROCLORS (group) *by GC*

Class: Volatile Organics
- ## VOLATILE ORGANICS [VOC] (group) *by GC/MS*

Class: Waste Characterization Extractions
- TCLP Extraction *by Waste Extractions*

Class: Waste Characterization Assays
- Corrosivity, Liquids *by Waste Assays*
- Ignitability, Pensky-Martens Closed Cup *by Waste Assays*

The laboratory named above is hereby licensed under ch. NR 149, Wis. Adm. Code for the parameters listed in this attachment.
* Analyte groups are defined and listed at http://dnr.wi.gov by searching keywords "Lab Certification:".

OREGON

Environmental Laboratory Accreditation Program

NELAP Recognized

TestAmerica Canton

4062

4101 Shuffel Street NW

North Canton,OH 44720

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

Air	*Drinking Water*	*Non Potable Water*	*Solids and Chem. Waste*	*Tissue*
		Chemistry	Chemistry	

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

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

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

Gary K. Ward

Gary K. Ward, MS

Oregon State Public Health Laboratory

ORELAP Administrator

3150 NW. 229th Ave, Suite 100

Hillsboro, OR 97124

ISSUE DATE: 02/24/2015

EXPIRATION DATE: 02/23/2016

Certificate No: 4062 - 001

Oregon

Environmental Laboratory Accreditation Program

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

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ORELAP Fields of Accreditation

ORELAP ID: 4062
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MATRIX : Non-Potable Water

Reference	Code	Description
ASTM D3987-06	**30030708**	**Shake Extraction of Solid Waste with Water**

Analyte Code	*Analyte*
8031	Extraction/Preparation

Reference	Code	Description
EPA 1010	**10116606**	**Pensky-Martens Closed-Cup Method for Determining Ignitability**

Analyte Code	*Analyte*
1780	Ignitability

Reference	Code	Description
EPA 1010A	**10234807**	**Pensky-Martens Closed-Cup Method for Determining Ignitability**

Analyte Code	*Analyte*
1780	Ignitability

Reference	Code	Description
EPA 120.1	**10006209**	**Conductance - Specific @ 25 C**

Analyte Code	*Analyte*
1610	Conductivity

Reference	Code	Description
EPA 1311	**10118806**	**Toxicity Characteristic Leaching Procedure**

Analyte Code	*Analyte*
8031	Extraction/Preparation

Reference	Code	Description
EPA 1312	**10119003**	**Synthetic Precipitation Leaching Procedure**

Analyte Code	*Analyte*
8031	Extraction/Preparation

Reference	Code	Description
EPA 150.1	**10008205**	**pH - Electrometric Measurement**

Analyte Code	*Analyte*
1900	pH

Reference	Code	Description
EPA 160.1	**10009004**	**Total Dissolved Solids, dried @ 180 C.**

Analyte Code	*Analyte*
1705	Total dissolved solids

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EPA 160.3 **10009800** **Total Solids, dried @ 103-105 C.**

Analyte Code	Analyte
1950	Residue-total

EPA 160.5 **10010603** **Settleable solids**

Analyte Code	Analyte
1965	Residue-settleable

EPA 1630 **10122608** **Methyl Mercury by Purge & Trap Cold Vapor Atomic Fluorescence Spectrometry**

Analyte Code	Analyte
1205	Methyl Mercury

EPA 1631E **10237204** **Mercury in Water by Oxidation, Purge & Trap, and Cold Vapor Atomic Fluorescence**

Analyte Code	Analyte
1095	Mercury

EPA 1664A (HEM) **10127807** **N-Hexane Extractable Material (Oil and Grease) by Extraction and Gravimetry**

Analyte Code	Analyte
1803	n-Hexane Extractable Material (O&G)

EPA 1664A (SGT-HEM) **10261606** **Silica Gen Treated N-Hexane Extractable Material (Oil and Grease)**

Analyte Code	Analyte
2050	Total Petroleum Hydrocarbons (TPH)

EPA 180.1 **10011402** **Turbidity - Nephelometric**

Analyte Code	Analyte
2055	Turbidity

EPA 200.7 4.4 **10013806** **ICP - metals**

Analyte Code	Analyte
1000	Aluminum
1005	Antimony
1010	Arsenic
1015	Barium
1020	Beryllium
1025	Boron
1030	Cadmium
1035	Calcium
1040	Chromium
1050	Cobalt
1055	Copper
1070	Iron
1075	Lead
1080	Lithium
1085	Magnesium
1090	Manganese
1100	Molybdenum
1105	Nickel
1125	Potassium
1140	Selenium
1990	Silica as SiO2
1145	Silicon
1150	Silver

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Analyte Code	Analyte
1155	Sodium
1160	Strontium
1165	Thallium
1175	Tin
1180	Titanium
1185	Vanadium
1190	Zinc

EPA 200.8 **10014401** **ICP/MS - metals**

Analyte Code	Analyte
1000	Aluminum
1005	Antimony
1010	Arsenic
1015	Barium
1020	Beryllium
1025	Boron
1030	Cadmium
1035	Calcium
1040	Chromium
1050	Cobalt
1055	Copper
1070	Iron
1075	Lead
1080	Lithium
1085	Magnesium
1090	Manganese
1100	Molybdenum
1105	Nickel
1125	Potassium
1140	Selenium
1150	Silver
1155	Sodium
1160	Strontium
1165	Thallium
1175	Tin
1180	Titanium
1185	Vanadium
1190	Zinc

EPA 245.1 **10036201** **Mercury by Cold Vapor Atomic Absorption**

Analyte Code	Analyte
1095	Mercury

EPA 300.0 **10053006** **Ion chromatography - anions.**

Analyte Code	Analyte
1540	Bromide
1575	Chloride
1730	Fluoride
1810	Nitrate as N
1840	Nitrite as N
2000	Sulfate

EPA 3005A **10133207** **Acid Digestion of waters for Total Recoverable or Dissolved Metals**

Analyte Code	Analyte
8031	Extraction/Preparation

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EPA 3010A **10133605** **Acid Digestion of Aqueous samples and Extracts for Total Metals**

Analyte Code	Analyte
8031	Extraction/Preparation

EPA 325.2 **10057008** **Chloride - Colorimetric, automated Ferricyanide,II**

Analyte Code	Analyte
1575	Chloride

EPA 330.5 **10059402** **Residual Chlorine - DPD kit or DPD spec.**

Analyte Code	Analyte
1580	Chlorine

EPA 335.1 **10059800** **Cyanides, amenable to chlorination**

Analyte Code	Analyte
1510	Amenable cyanide

EPA 335.2 **10060603** **Cyanide - Titrimetric; Spectrophotometric**

Analyte Code	Analyte
1635	Cyanide

EPA 335.4 **10061208** **Methods for the Determination of Inorganic Substances in Environmental Samples**

Analyte Code	Analyte
1645	Total cyanide

EPA 340.2 **10062007** **Fluoride - Ion selective electrode**

Analyte Code	Analyte
1730	Fluoride

EPA 350.2 **10063806** **Ammonia Nitrogen - Distillation/Titration**

Analyte Code	Analyte
1515	Ammonia as N

EPA 350.3 **10064207** **Ammonia Nitrogen - Ion Selective Electrode**

Analyte Code	Analyte
3751	Ammonia
1515	Ammonia as N

EPA 351.2 **10065006** **Total Kjeldahl Nitrogen - Block Digest, Phenate**

Analyte Code	Analyte
1790	Kjeldahl nitrogen

EPA 351.3 **10065608** **Total Kjeldahl Nitrogen - Titrimetric**

Analyte Code	Analyte
1795	Kjeldahl nitrogen - total

EPA 3510 **10137607** **Separatory Funnel Liquid-liquid extraction**

Analyte Code	Analyte
8031	Extraction/Preparation

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EPA 3510C **10138202** **Separatory Funnel Liquid-liquid extraction**

Analyte Code	Analyte
8031	Extraction/Preparation

EPA 3520 **10138406** **Continuous Liquid-liquid extraction**

Analyte Code	Analyte
8031	Extraction/Preparation

EPA 353.2 **10067206** **Nitrate/Nitrite Nitrogen - Automated, Cadmium**

Analyte Code	Analyte
1820	Nitrate-nitrite

EPA 3620B **10145809** **Florisil Cleanup**

Analyte Code	Analyte
8031	Extraction/Preparation

EPA 3620C **10146006** **Florisil Cleanup**

Analyte Code	Analyte
8031	Extraction/Preparation

EPA 3640A **10147203** **Gel Preparation Cleanup**

Analyte Code	Analyte
8031	Extraction/Preparation

EPA 365.1 **10069600** **Phosphorous - Colorimetric, Automated persulfate**

Analyte Code	Analyte
1870	Orthophosphate as P
1910	Phosphorus, total

EPA 3650B **10147805** **Acid base partition cleanup**

Analyte Code	Analyte
8031	Extraction/Preparation

EPA 3660B **10148400** **Sulfur cleanup**

Analyte Code	Analyte
8031	Extraction/Preparation

EPA 3665A **10148808** **Sulfuric Acid / permanganate Cleanup**

Analyte Code	Analyte
8031	Extraction/Preparation

EPA 405.1 **10075408** **Biochemical Oxygen Demand (5 days @ 20 C).**

Analyte Code	Analyte
1530	Biochemical oxygen demand

EPA 410.4 **10077006** **Chemical Oxygen Demand - Colorimetric, Automated.**

Analyte Code	Analyte
1565	Chemical oxygen demand

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EPA 420.1 **10079206** **Phenolics - Spectrophotometric, manual.**

Analyte Code	Analyte
1905	Total phenolics

EPA 5030B **10153409** **Purge and trap for aqueous samples**

Analyte Code	Analyte
8031	Extraction/Preparation

EPA 5030C **10284603** **Purge-and-Trap for Aqueous Samples**

Analyte Code	Analyte
8031	Extraction/Preparation

EPA 5035 **10154004** **Closed-System Purge-and-Trap and Extraction for Volatile Organics in Soil and Waste Samples**

Analyte Code	Analyte
8031	Extraction/Preparation

EPA 5035A **10284807** **Closed-System Purge-and-Trap and Extraction for Volatile Organics in Soil and Waste Samples**

Analyte Code	Analyte
8031	Extraction/Preparation

EPA 6010B **10155609** **ICP - AES**

Analyte Code	Analyte
1000	Aluminum
1005	Antimony
1010	Arsenic
1015	Barium
1020	Beryllium
1025	Boron
1030	Cadmium
1035	Calcium
1040	Chromium
1050	Cobalt
1055	Copper
1070	Iron
1075	Lead
1080	Lithium
1085	Magnesium
1090	Manganese
1100	Molybdenum
1105	Nickel
1125	Potassium
1140	Selenium
1990	Silica as SiO2
1145	Silicon
1150	Silver
1155	Sodium
1160	Strontium
1165	Thallium
1175	Tin
1180	Titanium
1185	Vanadium
1190	Zinc

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EPA 6010C **10155803** **ICP - AES**

Analyte Code	Analyte
1000	Aluminum
1005	Antimony
1010	Arsenic
1015	Barium
1020	Beryllium
1025	Boron
1030	Cadmium
1035	Calcium
1040	Chromium
1050	Cobalt
1055	Copper
1070	Iron
1075	Lead
1080	Lithium
1085	Magnesium
1090	Manganese
1100	Molybdenum
1105	Nickel
1125	Potassium
1140	Selenium
1990	Silica as SiO2
1145	Silicon
1150	Silver
1155	Sodium
1160	Strontium
1165	Thallium
1175	Tin
1180	Titanium
1185	Vanadium
1190	Zinc

EPA 6020 **10156000** **Inductively Coupled Plasma-Mass Spectrometry**

Analyte Code	Analyte
1000	Aluminum
1005	Antimony
1010	Arsenic
1015	Barium
1020	Beryllium
1025	Boron
1030	Cadmium
1035	Calcium
1040	Chromium
1050	Cobalt
1055	Copper
1070	Iron
1075	Lead
1080	Lithium
1085	Magnesium
1090	Manganese
1100	Molybdenum
1105	Nickel
1125	Potassium
1140	Selenium
1150	Silver
1155	Sodium
1160	Strontium
1165	Thallium

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Analyte Code	Analyte
1175	Tin
1180	Titanium
1185	Vanadium
1190	Zinc

EPA 6020A **10156408** **Inductively Coupled Plasma-Mass Spectrometry**

Analyte Code	Analyte
1000	Aluminum
1005	Antimony
1010	Arsenic
1015	Barium
1020	Beryllium
1025	Boron
1030	Cadmium
1035	Calcium
1040	Chromium
1050	Cobalt
1055	Copper
1070	Iron
1075	Lead
1080	Lithium
1085	Magnesium
1090	Manganese
1100	Molybdenum
1105	Nickel
1125	Potassium
1140	Selenium
1150	Silver
1155	Sodium
1160	Strontium
1165	Thallium
1175	Tin
1180	Titanium
1185	Vanadium
1190	Zinc

EPA 608 **10103603** **Organochlorine Pesticides & PCBs by GC/ECD**

Analyte Code	Analyte
7355	4,4'-DDD
7360	4,4'-DDE
7365	4,4'-DDT
7025	Aldrin
7110	alpha-BHC (alpha-Hexachlorocyclohexane)
7240	alpha-Chlordane
8880	Aroclor-1016 (PCB-1016)
8885	Aroclor-1221 (PCB-1221)
8890	Aroclor-1232 (PCB-1232)
8895	Aroclor-1242 (PCB-1242)
8900	Aroclor-1248 (PCB-1248)
8905	Aroclor-1254 (PCB-1254)
8910	Aroclor-1260 (PCB-1260)
8912	Aroclor-1262 (PCB-1262)
8913	Aroclor-1268 (PCB-1268)
7115	beta-BHC (beta-Hexachlorocyclohexane)
7250	Chlordane (tech.)
7105	delta-BHC
7470	Dieldrin
7510	Endosulfan I
7515	Endosulfan II

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Analyte Code	Analyte
7520	Endosulfan sulfate
7540	Endrin
7530	Endrin aldehyde
7535	Endrin ketone
7120	gamma-BHC (Lindane, gamma-HexachlorocyclohexanE)
7245	gamma-Chlordane
7685	Heptachlor
7690	Heptachlor epoxide
6275	Hexachlorobenzene
7725	Isodrin
7740	Kepone
7810	Methoxychlor
7870	Mirex
8250	Toxaphene (Chlorinated camphene)

EPA 624 **10107207** **Volatile Organic Compounds by purge and trap GC/MS**

Analyte Code	Analyte
5105	1,1,1,2-Tetrachloroethane
5160	1,1,1-Trichloroethane
5110	1,1,2,2-Tetrachloroethane
5195	1,1,2-Trichloro-1,2,2-trifluoroethane (Freon 113)
5165	1,1,2-Trichloroethane
4630	1,1-Dichloroethane
4640	1,1-Dichloroethylene
4670	1,1-Dichloropropene
5150	1,2,3-Trichlorobenzene
5180	1,2,3-Trichloropropane
5155	1,2,4-Trichlorobenzene
5210	1,2,4-Trimethylbenzene
4570	1,2-Dibromo-3-chloropropane (DBCP)
4585	1,2-Dibromoethane (EDB, Ethylene dibromide)
4610	1,2-Dichlorobenzene
4635	1,2-Dichloroethane (Ethylene dichloride)
4655	1,2-Dichloropropane
5215	1,3,5-Trimethylbenzene
4615	1,3-Dichlorobenzene
4660	1,3-Dichloropropane
4675	1,3-Dichloropropene
4620	1,4-Dichlorobenzene
4665	2,2-Dichloropropane
4410	2-Butanone (Methyl ethyl ketone, MEK)
4500	2-Chloroethyl vinyl ether
4535	2-Chlorotoluene
4860	2-Hexanone (MBK)
4540	4-Chlorotoluene
4910	4-Isopropyltoluene (p-Cymene)
4995	4-Methyl-2-pentanone (MIBK)
4315	Acetone
4325	Acrolein (Propenal)
4340	Acrylonitrile
4375	Benzene
4385	Bromobenzene
4390	Bromochloromethane
4395	Bromodichloromethane
4400	Bromoform
4450	Carbon disulfide
4455	Carbon tetrachloride
4475	Chlorobenzene
4575	Chlorodibromomethane
4485	Chloroethane (Ethyl chloride)

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Analyte Code	Analyte
4505	Chloroform
4645	cis-1,2-Dichloroethylene
4680	cis-1,3-Dichloropropene
4555	Cyclohexane
4595	Dibromomethane (Methylene bromide)
4625	Dichlorodifluoromethane (Freon-12)
4627	Dichlorofluoromethane (Freon 21)
4725	Diethyl ether
4810	Ethyl methacrylate
4765	Ethylbenzene
4835	Hexachlorobutadiene
4870	Iodomethane (Methyl iodide)
4875	Isobutyl alcohol (2-Methyl-1-propanol)
4900	Isopropylbenzene
5240	m+p-xylene
4940	Methyl acetate
4950	Methyl bromide (Bromomethane)
4960	Methyl chloride (Chloromethane)
4990	Methyl methacrylate
5000	Methyl tert-butyl ether (MTBE)
4965	Methylcyclohexane
4975	Methylene chloride (Dichloromethane)
5245	m-Xylene
5005	Naphthalene
4435	n-Butylbenzene
4855	n-Hexane
5090	n-Propylbenzene
5250	o-Xylene
5255	p-Xylene
4440	sec-Butylbenzene
5100	Styrene
4420	tert-Butyl alcohol
4445	tert-Butylbenzene
5115	Tetrachloroethylene (Perchloroethylene)
5140	Toluene
4700	trans-1,2-Dichloroethylene
4685	trans-1,3-Dichloropropylene
4605	trans-1,4-Dichloro-2-butene
5170	Trichloroethene (Trichloroethylene)
5175	Trichlorofluoromethane (Fluorotrichloromethane, Freon 11)
5225	Vinyl acetate
5235	Vinyl chloride
5260	Xylene (total)

EPA 625 **10300002** **Base/Neutrals and Acids by GC/MS**

Analyte Code	Analyte
6703	1,1'-Biphenyl (BZ-0)
5150	1,2,3-Trichlorobenzene
6715	1,2,4,5-Tetrachlorobenzene
5155	1,2,4-Trichlorobenzene
4610	1,2-Dichlorobenzene
6221	1,2-Diphenylhydrazine
4615	1,3-Dichlorobenzene
4620	1,4-Dichlorobenzene
4735	1,4-Dioxane (1,4- Diethyleneoxide)
5790	1-Chloronaphthalene
6835	2,4,5-Trichlorophenol
6840	2,4,6-Trichlorophenol
5880	2,4-Diaminotoluene
6000	2,4-Dichlorophenol

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Analyte Code	Analyte
6130	2,4-Dimethylphenol
6175	2,4-Dinitrophenol
6185	2,4-Dinitrotoluene (2,4-DNT)
6005	2,6-Dichlorophenol
6190	2,6-Dinitrotoluene (2,6-DNT)
5795	2-Chloronaphthalene
5800	2-Chlorophenol
6360	2-Methyl-4,6-dinitrophenol (4,6-Dinitro-2-methylphenol)
5145	2-Methylaniline (o-Toluidine)
6385	2-Methylnaphthalene
6400	2-Methylphenol (o-Cresol)
6460	2-Nitroaniline
6490	2-Nitrophenol
6412	3 & 4 Methylphenol
5945	3,3'-Dichlorobenzidine
6465	3-Nitroaniline
7355	4,4'-DDD
7360	4,4'-DDE
7365	4,4'-DDT
5660	4-Bromophenyl phenyl ether (BDE-3)
5700	4-Chloro-3-methylphenol
5745	4-Chloroaniline
5825	4-Chlorophenyl phenylether
6470	4-Nitroaniline
6500	4-Nitrophenol
5500	Acenaphthene
5505	Acenaphthylene
5510	Acetophenone
7025	Aldrin
7110	alpha-BHC (alpha-Hexachlorocyclohexane)
5545	Aniline
5555	Anthracene
5562	Azobenzene
5595	Benzidine
5575	Benzo(a)anthracene
5580	Benzo(a)pyrene
5590	Benzo(g,h,i)perylene
5600	Benzo(k)fluoranthene
5585	Benzo[b]fluoranthene
5610	Benzoic acid
5630	Benzyl alcohol
7115	beta-BHC (beta-Hexachlorocyclohexane)
5760	bis(2-Chloroethoxy)methane
5765	bis(2-Chloroethyl) ether
4659	bis(2-Chloroisopropyl)ether
5670	Butyl benzyl phthalate
5680	Carbazole
7250	Chlordane (tech.)
5855	Chrysene
5862	Cresols, Total
7105	delta-BHC
6065	Di(2-ethylhexyl) phthalate (bis(2-Ethylhexyl)phthalate, DEHP)
5895	Dibenz(a,h) anthracene
5905	Dibenzofuran
7470	Dieldrin
6070	Diethyl phthalate
6135	Dimethyl phthalate
5925	Di-n-butyl phthalate
6200	Di-n-octyl phthalate
7510	Endosulfan I
7515	Endosulfan II

ORELAP Fields of Accreditation

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Analyte Code	Analyte
7520	Endosulfan sulfate
7540	Endrin
7530	Endrin aldehyde
6265	Fluoranthene
6270	Fluorene
7120	gamma-BHC (Lindane, gamma-HexachlorocyclohexanE)
7685	Heptachlor
7690	Heptachlor epoxide
6275	Hexachlorobenzene
4835	Hexachlorobutadiene
6285	Hexachlorocyclopentadiene
4840	Hexachloroethane
6315	Indeno(1,2,3-cd) pyrene
6320	Isophorone
7810	Methoxychlor
5005	Naphthalene
5875	n-Decane
5015	Nitrobenzene
6525	n-Nitrosodiethylamine
6530	n-Nitrosodimethylamine
5025	n-Nitroso-di-n-butylamine
6545	n-Nitrosodi-n-propylamine
6535	n-Nitrosodiphenylamine
6565	n-Nitrosopyrrolidine
6580	n-Octadecane
6590	Pentachlorobenzene
6600	Pentachloronitrobenzene
6605	Pentachlorophenol
6615	Phenanthrene
6625	Phenol
6665	Pyrene
5095	Pyridine
8250	Toxaphene (Chlorinated camphene)

EPA 7196A **10162400** **Chromium Hexavalent colorimetric**

Analyte Code	Analyte
1045	Chromium VI

EPA 7470A **10165807** **Mercury in Liquid Waste by Cold Vapor Atomic Absorption**

Analyte Code	Analyte
1095	Mercury

EPA 8015B **10173601** **Non-halogenated organics using GC/FID**

Analyte Code	Analyte
9369	Diesel range organics (DRO)
9408	Gasoline range organics (GRO)

EPA 8015C **10173805** **Non-halogenated organics using GC/FID**

Analyte Code	Analyte
9369	Diesel range organics (DRO)
9408	Gasoline range organics (GRO)

EPA 8015D **10305609** **Nonhalogenated Organics Using GC/FID**

Analyte Code	Analyte
9369	Diesel range organics (DRO)

ORELAP Fields of Accreditation

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Analyte Code	Analyte
9408	Gasoline range organics (GRO)

EPA 8081A **10178606** **Organochlorine Pesticides by GC/ECD**

Analyte Code	Analyte
7355	4,4'-DDD
7360	4,4'-DDE
7365	4,4'-DDT
7025	Aldrin
7110	alpha-BHC (alpha-Hexachlorocyclohexane)
7240	alpha-Chlordane
7115	beta-BHC (beta-Hexachlorocyclohexane)
7250	Chlordane (tech.)
7260	Chlorobenzilate
7105	delta-BHC
7405	Diallate
7470	Dieldrin
7510	Endosulfan I
7515	Endosulfan II
7520	Endosulfan sulfate
7540	Endrin
7530	Endrin aldehyde
7535	Endrin ketone
7120	gamma-BHC (Lindane, gamma-HexachlorocyclohexanE)
7245	gamma-Chlordane
7685	Heptachlor
7690	Heptachlor epoxide
6275	Hexachlorobenzene
7725	Isodrin
7740	Kepone
7810	Methoxychlor
7870	Mirex
8250	Toxaphene (Chlorinated camphene)

EPA 8081B **10178800** **Organochlorine Pesticides by GC/ECD**

Analyte Code	Analyte
7355	4,4'-DDD
7360	4,4'-DDE
7365	4,4'-DDT
7025	Aldrin
7110	alpha-BHC (alpha-Hexachlorocyclohexane)
7240	alpha-Chlordane
7115	beta-BHC (beta-Hexachlorocyclohexane)
7250	Chlordane (tech.)
7260	Chlorobenzilate
7105	delta-BHC
7405	Diallate
7470	Dieldrin
7510	Endosulfan I
7515	Endosulfan II
7520	Endosulfan sulfate
7540	Endrin
7530	Endrin aldehyde
7535	Endrin ketone
7120	gamma-BHC (Lindane, gamma-HexachlorocyclohexanE)
7245	gamma-Chlordane
7685	Heptachlor
7690	Heptachlor epoxide
6275	Hexachlorobenzene
7725	Isodrin

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Analyte Code	Analyte
7740	Kepone
7810	Methoxychlor
7870	Mirex
8250	Toxaphene (Chlorinated camphene)

EPA 8082 **10179007** **Polychlorinated Biphenyls (PCBs) by GC/ECD**

Analyte Code	Analyte
8880	Aroclor-1016 (PCB-1016)
8885	Aroclor-1221 (PCB-1221)
8890	Aroclor-1232 (PCB-1232)
8895	Aroclor-1242 (PCB-1242)
8900	Aroclor-1248 (PCB-1248)
8905	Aroclor-1254 (PCB-1254)
8910	Aroclor-1260 (PCB-1260)
8912	Aroclor-1262 (PCB-1262)
8913	Aroclor-1268 (PCB-1268)

EPA 8082A **10179201** **Polychlorinated Biphenyls (PCBs) by GC/ECD**

Analyte Code	Analyte
8880	Aroclor-1016 (PCB-1016)
8885	Aroclor-1221 (PCB-1221)
8890	Aroclor-1232 (PCB-1232)
8895	Aroclor-1242 (PCB-1242)
8900	Aroclor-1248 (PCB-1248)
8905	Aroclor-1254 (PCB-1254)
8910	Aroclor-1260 (PCB-1260)
8912	Aroclor-1262 (PCB-1262)
8913	Aroclor-1268 (PCB-1268)

EPA 8151A **10183207** **Chlorinated Herbicides by GC/ECD**

Analyte Code	Analyte
8655	2,4,5-T
8545	2,4-D
8560	2,4-DB
8555	Dalapon
8595	Dicamba
8605	Dichloroprop (Dichlorprop)
8620	Dinoseb (2-sec-butyl-4,6-dinitrophenol, DNBP)
7775	MCPA
7780	MCPP
6605	Pentachlorophenol
8650	Silvex (2,4,5-TP)

EPA 8260B **10184802** **Volatile Organic Compounds by purge and trap GC/MS**

Analyte Code	Analyte
5105	1,1,1,2-Tetrachloroethane
5160	1,1,1-Trichloroethane
5110	1,1,2,2-Tetrachloroethane
5195	1,1,2-Trichloro-1,2,2-trifluoroethane (Freon 113)
5165	1,1,2-Trichloroethane
4630	1,1-Dichloroethane
4640	1,1-Dichloroethylene
4670	1,1-Dichloropropene
5150	1,2,3-Trichlorobenzene
5180	1,2,3-Trichloropropane
5182	1,2,3-Trimethylbenzene

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Analyte Code	Analyte
5155	1,2,4-Trichlorobenzene
5210	1,2,4-Trimethylbenzene
4570	1,2-Dibromo-3-chloropropane (DBCP)
4585	1,2-Dibromoethane (EDB, Ethylene dibromide)
4610	1,2-Dichlorobenzene
4635	1,2-Dichloroethane (Ethylene dichloride)
4655	1,2-Dichloropropane
6800	1,3,5-Trichlorobenzene
5215	1,3,5-Trimethylbenzene
9318	1,3-Butadiene
4615	1,3-Dichlorobenzene
4660	1,3-Dichloropropane
4675	1,3-Dichloropropene
4620	1,4-Dichlorobenzene
4735	1,4-Dioxane (1,4- Diethyleneoxide)
4510	1-Chlorohexane
4665	2,2-Dichloropropane
4410	2-Butanone (Methyl ethyl ketone, MEK)
4500	2-Chloroethyl vinyl ether
4535	2-Chlorotoluene
4538	2-Ethyltoluene
4860	2-Hexanone (MBK)
6385	2-Methylnaphthalene
5020	2-Nitropropane
4531	3-Ethyltoluene
4540	4-Chlorotoluene
4910	4-Isopropyltoluene (p-Cymene)
4995	4-Methyl-2-pentanone (MIBK)
4315	Acetone
4320	Acetonitrile
4325	Acrolein (Propenal)
4340	Acrylonitrile
4355	Allyl chloride (3-Chloropropene)
4375	Benzene
5635	Benzyl chloride
4385	Bromobenzene
4390	Bromochloromethane
4395	Bromodichloromethane
4400	Bromoform
4450	Carbon disulfide
4455	Carbon tetrachloride
4475	Chlorobenzene
4575	Chlorodibromomethane
4485	Chloroethane (Ethyl chloride)
4505	Chloroform
4525	Chloroprene (2-Chloro-1,3-butadiene)
4645	cis-1,2-Dichloroethylene
4680	cis-1,3-Dichloropropene
4555	Cyclohexane
4560	Cyclohexanone
4595	Dibromomethane (Methylene bromide)
4625	Dichlorodifluoromethane (Freon-12)
4627	Dichlorofluoromethane (Freon 21)
4725	Diethyl ether
9375	Di-isopropylether (DIPE)
4745	Epichlorohydrin (1-Chloro-2,3-epoxypropane)
4755	Ethyl acetate
4760	Ethyl acrylate
4810	Ethyl methacrylate
4765	Ethylbenzene
4795	Ethylene oxide

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Analyte Code	Analyte
4770	Ethyl-t-butylether (ETBE) (2-Ethoxy-2-methylpropane)
4835	Hexachlorobutadiene
4870	Iodomethane (Methyl iodide)
4875	Isobutyl alcohol (2-Methyl-1-propanol)
4900	Isopropylbenzene
5240	m+p-xylene
4925	Methacrylonitrile
4940	Methyl acetate
4950	Methyl bromide (Bromomethane)
4960	Methyl chloride (Chloromethane)
4990	Methyl methacrylate
5000	Methyl tert-butyl ether (MTBE)
4965	Methylcyclohexane
4975	Methylene chloride (Dichloromethane)
5245	m-Xylene
5005	Naphthalene
4425	n-Butyl alcohol (1-Butanol, n-Butanol)
4415	n-Butyl-acetate
4435	n-Butylbenzene
4825	n-Heptane
4855	n-Hexane
5090	n-Propylbenzene
5250	o-Xylene
5035	Pentachloroethane
5080	Propionitrile (Ethyl cyanide)
9579	Propylene oxide
5255	p-Xylene
4440	sec-Butylbenzene
5100	Styrene
4370	T-amylmethylether (TAME)
4420	tert-Butyl alcohol
4445	tert-Butylbenzene
5115	Tetrachloroethylene (Perchloroethylene)
5120	Tetrahydrofuran (THF)
9574	Tetrahydrothiophene
5140	Toluene
4700	trans-1,2-Dichloroethylene
4685	trans-1,3-Dichloropropylene
4605	trans-1,4-Dichloro-2-butene
5170	Trichloroethene (Trichloroethylene)
5175	Trichlorofluoromethane (Fluorotrichloromethane, Freon 11)
5225	Vinyl acetate
5235	Vinyl chloride
5260	Xylene (total)

EPA 8260B SIM **10184904** **Volatile Organic Compounds by purge and trap GC/MS-SIM**

Analyte Code	Analyte
4735	1,4-Dioxane (1,4- Diethyleneoxide)

EPA 8260C **10307003** **Volatile Organics: GC/MS (capillary column)**

Analyte Code	Analyte
5105	1,1,1,2-Tetrachloroethane
5160	1,1,1-Trichloroethane
5110	1,1,2,2-Tetrachloroethane
5195	1,1,2-Trichloro-1,2,2-trifluoroethane (Freon 113)
5165	1,1,2-Trichloroethane
4630	1,1-Dichloroethane
4640	1,1-Dichloroethylene
4670	1,1-Dichloropropene

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Analyte Code	Analyte
5150	1,2,3-Trichlorobenzene
5180	1,2,3-Trichloropropane
5182	1,2,3-Trimethylbenzene
5155	1,2,4-Trichlorobenzene
5210	1,2,4-Trimethylbenzene
4570	1,2-Dibromo-3-chloropropane (DBCP)
4585	1,2-Dibromoethane (EDB, Ethylene dibromide)
4610	1,2-Dichlorobenzene
4635	1,2-Dichloroethane (Ethylene dichloride)
4655	1,2-Dichloropropane
6800	1,3,5-Trichlorobenzene
5215	1,3,5-Trimethylbenzene
9318	1,3-Butadiene
4615	1,3-Dichlorobenzene
4660	1,3-Dichloropropane
4675	1,3-Dichloropropene
4620	1,4-Dichlorobenzene
4735	1,4-Dioxane (1,4- Diethyleneoxide)
4510	1-Chlorohexane
4665	2,2-Dichloropropane
4410	2-Butanone (Methyl ethyl ketone, MEK)
4500	2-Chloroethyl vinyl ether
4535	2-Chlorotoluene
4538	2-Ethyltoluene
4860	2-Hexanone (MBK)
6385	2-Methylnaphthalene
5020	2-Nitropropane
4531	3-Ethyltoluene
4540	4-Chlorotoluene
4910	4-Isopropyltoluene (p-Cymene)
4995	4-Methyl-2-pentanone (MIBK)
4315	Acetone
4320	Acetonitrile
4325	Acrolein (Propenal)
4340	Acrylonitrile
4355	Allyl chloride (3-Chloropropene)
4375	Benzene
5635	Benzyl chloride
4385	Bromobenzene
4390	Bromochloromethane
4395	Bromodichloromethane
4400	Bromoform
4450	Carbon disulfide
4455	Carbon tetrachloride
4475	Chlorobenzene
4575	Chlorodibromomethane
4485	Chloroethane (Ethyl chloride)
4505	Chloroform
4525	Chloroprene (2-Chloro-1,3-butadiene)
4645	cis-1,2-Dichloroethylene
4680	cis-1,3-Dichloropropene
4555	Cyclohexane
4560	Cyclohexanone
4590	Dibromofluoromethane
4595	Dibromomethane (Methylene bromide)
4625	Dichlorodifluoromethane (Freon-12)
4627	Dichlorofluoromethane (Freon 21)
4725	Diethyl ether
9375	Di-isopropylether (DIPE)
4745	Epichlorohydrin (1-Chloro-2,3-epoxypropane)
4755	Ethyl acetate

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Analyte Code	Analyte
4760	Ethyl acrylate
4810	Ethyl methacrylate
4765	Ethylbenzene
4795	Ethylene oxide
4770	Ethyl-t-butylether (ETBE) (2-Ethoxy-2-methylpropane)
4835	Hexachlorobutadiene
4870	Iodomethane (Methyl iodide)
4875	Isobutyl alcohol (2-Methyl-1-propanol)
4900	Isopropylbenzene
5240	m+p-xylene
4925	Methacrylonitrile
4940	Methyl acetate
4950	Methyl bromide (Bromomethane)
4960	Methyl chloride (Chloromethane)
4990	Methyl methacrylate
5000	Methyl tert-butyl ether (MTBE)
4965	Methylcyclohexane
4975	Methylene chloride (Dichloromethane)
5245	m-Xylene
5005	Naphthalene
4425	n-Butyl alcohol (1-Butanol, n-Butanol)
4415	n-Butyl-acetate
4435	n-Butylbenzene
4825	n-Heptane
4855	n-Hexane
5090	n-Propylbenzene
5250	o-Xylene
5035	Pentachloroethane
5080	Propionitrile (Ethyl cyanide)
9579	Propylene oxide
5255	p-Xylene
4440	sec-Butylbenzene
5100	Styrene
4370	T-amylmethylether (TAME)
4420	tert-Butyl alcohol
4445	tert-Butylbenzene
5115	Tetrachloroethylene (Perchloroethylene)
5120	Tetrahydrofuran (THF)
9574	Tetrahydrothiophene
5140	Toluene
4700	trans-1,2-Dichloroethylene
4685	trans-1,3-Dichloropropylene
4605	trans-1,4-Dichloro-2-butene
5170	Trichloroethene (Trichloroethylene)
5175	Trichlorofluoromethane (Fluorotrichloromethane, Freon 11)
5225	Vinyl acetate
5235	Vinyl chloride
5260	Xylene (total)

EPA 8260C SIM **10307105** **Volatile Organic Compounds by GC/MS-SIM**

Analyte Code	Analyte
4735	1,4-Dioxane (1,4- Diethyleneoxide)

EPA 8270C **10185805** **Semivolatile Organic compounds by GC/MS**

Analyte Code	Analyte
6703	1,1'-Biphenyl (BZ-0)
6705	1,2,3,4-Tetrachlorobenzene
6710	1,2,3,5-Tetrachlorobenzene
5150	1,2,3-Trichlorobenzene

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Analyte Code	Analyte
6715	1,2,4,5-Tetrachlorobenzene
5155	1,2,4-Trichlorobenzene
4610	1,2-Dichlorobenzene
6221	1,2-Diphenylhydrazine
6800	1,3,5-Trichlorobenzene
6885	1,3,5-Trinitrobenzene (1,3,5-TNB)
4615	1,3-Dichlorobenzene
6160	1,3-Dinitrobenzene (1,3-DNB)
4620	1,4-Dichlorobenzene
6165	1,4-Dinitrobenzene
4735	1,4-Dioxane (1,4- Diethyleneoxide)
6420	1,4-Naphthoquinone
6630	1,4-Phenylenediamine
5790	1-Chloronaphthalene
6380	1-Methylnaphthalene
6425	1-Naphthylamine
5754	1-Phenoxy-2-propanol
6735	2,3,4,6-Tetrachlorophenol
6740	2,3,5,6-Tetrachlorophenol
6014	2,3-Dinitrotoluene
6835	2,4,5-Trichlorophenol
6840	2,4,6-Trichlorophenol
5880	2,4-Diaminotoluene
6000	2,4-Dichlorophenol
6130	2,4-Dimethylphenol
6175	2,4-Dinitrophenol
6185	2,4-Dinitrotoluene (2,4-DNT)
6183	2,6-Diaminotoluene
6005	2,6-Dichlorophenol
6190	2,6-Dinitrotoluene (2,6-DNT)
5515	2-Acetylaminofluorene
5735	2-Chloroaniline
5795	2-Chloronaphthalene
5800	2-Chlorophenol
5866	2-Ethoxyethanol (cellosolve)
6360	2-Methyl-4,6-dinitrophenol (4,6-Dinitro-2-methylphenol)
5145	2-Methylaniline (o-Toluidine)
6385	2-Methylnaphthalene
6400	2-Methylphenol (o-Cresol)
6430	2-Naphthylamine
6460	2-Nitroaniline
6490	2-Nitrophenol
5050	2-Picoline (2-Methylpyridine)
6412	3 & 4 Methylphenol
5945	3,3'-Dichlorobenzidine
6100	3,3'-Dimethoxybenzidine
6120	3,3'-Dimethylbenzidine
5940	3,4-Dichloroaniline
5995	3,4-Dichloronitrobenzene
6355	3-Methylcholanthrene
6405	3-Methylphenol (m-Cresol)
6465	3-Nitroaniline
6365	4,4-Methylenebis(2-chloroaniline)
5540	4-Aminobiphenyl
5660	4-Bromophenyl phenyl ether (BDE-3)
5700	4-Chloro-3-methylphenol
5745	4-Chloroaniline
5825	4-Chlorophenyl phenylether
6105	4-Dimethyl aminoazobenzene
6410	4-Methylphenol (p-Cresol)
6470	4-Nitroaniline

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Analyte Code	Analyte
6500	4-Nitrophenol
6510	4-Nitroquinoline 1-oxide
6516	4-tert-Butylphenol
6570	5-Nitro-o-toluidine
6112	6-Methylchrysene
6115	7,12-Dimethylbenz(a) anthracene
6125	a-a-Dimethylphenethylamine
5500	Acenaphthene
5505	Acenaphthylene
5510	Acetophenone
4330	Acrylamide
5545	Aniline
5555	Anthracene
5560	Aramite
7065	Atrazine
5562	Azobenzene
5570	Benzaldehyde
5567	Benzenethiol (Phenylmercaptan)
5595	Benzidine
5575	Benzo(a)anthracene
5580	Benzo(a)pyrene
5590	Benzo(g,h,i)perylene
5600	Benzo(k)fluoranthene
5585	Benzo[b]fluoranthene
5610	Benzoic acid
5630	Benzyl alcohol
5760	bis(2-Chloroethoxy)methane
5765	bis(2-Chloroethyl) ether
5780	bis(2-Chloroisopropyl) ether
4659	bis(2-Chloroisopropyl)ether
5670	Butyl benzyl phthalate
7180	Caprolactam
5680	Carbazole
7260	Chlorobenzilate
7300	Chlorpyrifos
5855	Chrysene
8906	Coelution - 3-Chlorophenol + 4-Chlorophenol
6414	Coelution - 3-Phenoxyphenol + 4-Phenoxyphenol
5862	Cresols, Total
6065	Di(2-ethylhexyl) phthalate (bis(2-Ethylhexyl)phthalate, DEHP)
7405	Diallate
9354	Dibenz(a, h) acridine
5900	Dibenz(a, j) acridine
5895	Dibenz(a,h) anthracene
9348	Dibenzo(a, h) pyrene
9351	Dibenzo(a, i) pyrene
5890	Dibenzo(a,e) pyrene
5905	Dibenzofuran
6070	Diethyl phthalate
7475	Dimethoate
6135	Dimethyl phthalate
5925	Di-n-butyl phthalate
6200	Di-n-octyl phthalate
8620	Dinoseb (2-sec-butyl-4,6-dinitrophenol, DNBP)
6210	Diphenyl ether (Diphenyl Oxide)
6205	Diphenylamine
8625	Disulfoton
4810	Ethyl methacrylate
6260	Ethyl methanesulfonate
7580	Famphur
6265	Fluoranthene

ORELAP Fields of Accreditation

ORELAP ID: 4062
EPA CODE: OH00048
Certificate: 4062 - 001

TestAmerica Canton

4101 Shuffel Street NW
North Canton OH 44720

Issue Date: 05/01/2015 **Expiration Date:** 02/23/2016

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Analyte Code	Analyte
6270	Fluorene
6275	Hexachlorobenzene
4835	Hexachlorobutadiene
6285	Hexachlorocyclopentadiene
4840	Hexachloroethane
6290	Hexachlorophene
6295	Hexachloropropene
6312	Indene
6315	Indeno(1,2,3-cd) pyrene
7725	Isodrin
6320	Isophorone
6321	Isoquinoline
6325	Isosafrole
7740	Kepone
6345	Methapyrilene
6375	Methyl methanesulfonate
7825	Methyl parathion (Parathion, methyl)
5010	n, n-Dimethyl formamide
6443	n, n-Dimethylacetamide
5005	Naphthalene
5875	n-Decane
6300	n-Hexadecane
5015	Nitrobenzene
6525	n-Nitrosodiethylamine
6530	n-Nitrosodimethylamine
5025	n-Nitroso-di-n-butylamine
6545	n-Nitrosodi-n-propylamine
6535	n-Nitrosodiphenylamine
6550	n-Nitrosomethylethalamine
6555	n-Nitrosomorpholine
6560	n-Nitrosopiperidine
6565	n-Nitrosopyrrolidine
6580	n-Octadecane
8290	o,o,o-Triethyl phosphorothioate
3960	o-Phenylphenol
7955	Parathion, ethyl
6590	Pentachlorobenzene
5035	Pentachloroethane
6600	Pentachloronitrobenzene
6605	Pentachlorophenol
6610	Phenacetin
6615	Phenanthrene
6625	Phenol
7985	Phorate
6650	Pronamide (Kerb)
6665	Pyrene
5095	Pyridine
6670	Quinoline
6685	Safrole
8155	Sulfotepp
8235	Thionazin (Zinophos)
6750	Thiophenol (Benzenethiol)
8262	Tributyl phosphate

EPA 8270C SIM **10242407** **Semivolatile Organic compounds by GC/MS Selective Ion Monitoring**

Analyte Code	Analyte
4835	Hexachlorobutadiene

ORELAP Fields of Accreditation

ORELAP ID: 4062
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EPA 8270D **10186002** **Semivolatile Organic compounds by GC/MS**

Analyte Code	Analyte
6703	1,1'-Biphenyl (BZ-0)
6705	1,2,3,4-Tetrachlorobenzene
6710	1,2,3,5-Tetrachlorobenzene
5150	1,2,3-Trichlorobenzene
6715	1,2,4,5-Tetrachlorobenzene
5155	1,2,4-Trichlorobenzene
4610	1,2-Dichlorobenzene
6221	1,2-Diphenylhydrazine
6800	1,3,5-Trichlorobenzene
6885	1,3,5-Trinitrobenzene (1,3,5-TNB)
4615	1,3-Dichlorobenzene
6160	1,3-Dinitrobenzene (1,3-DNB)
4620	1,4-Dichlorobenzene
6165	1,4-Dinitrobenzene
4735	1,4-Dioxane (1,4- Diethyleneoxide)
6420	1,4-Naphthoquinone
6630	1,4-Phenylenediamine
5790	1-Chloronaphthalene
6380	1-Methylnaphthalene
6425	1-Naphthylamine
5754	1-Phenoxy-2-propanol
6735	2,3,4,6-Tetrachlorophenol
6740	2,3,5,6-Tetrachlorophenol
6014	2,3-Dinitrotoluene
6017	2,4 & 2,6-Toluene Diamine
6835	2,4,5-Trichlorophenol
6840	2,4,6-Trichlorophenol
6000	2,4-Dichlorophenol
6130	2,4-Dimethylphenol
6175	2,4-Dinitrophenol
6185	2,4-Dinitrotoluene (2,4-DNT)
6005	2,6-Dichlorophenol
6190	2,6-Dinitrotoluene (2,6-DNT)
5515	2-Acetylaminofluorene
5735	2-Chloroaniline
5795	2-Chloronaphthalene
5800	2-Chlorophenol
5866	2-Ethoxyethanol (cellosolve)
6360	2-Methyl-4,6-dinitrophenol (4,6-Dinitro-2-methylphenol)
5145	2-Methylaniline (o-Toluidine)
6385	2-Methylnaphthalene
6430	2-Naphthylamine
6460	2-Nitroaniline
6490	2-Nitrophenol
5050	2-Picoline (2-Methylpyridine)
6412	3 & 4 Methylphenol
5945	3,3'-Dichlorobenzidine
6100	3,3'-Dimethoxybenzidine
6120	3,3'-Dimethylbenzidine
5940	3,4-Dichloroaniline
5995	3,4-Dichloronitrobenzene
6355	3-Methylcholanthrene
6405	3-Methylphenol (m-Cresol)
6465	3-Nitroaniline
6365	4,4-Methylenebis(2-chloroaniline)
5540	4-Aminobiphenyl
5660	4-Bromophenyl phenyl ether (BDE-3)
5700	4-Chloro-3-methylphenol

ORELAP Fields of Accreditation

ORELAP ID: 4062
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Analyte Code	Analyte
5745	4-Chloroaniline
5825	4-Chlorophenyl phenylether
6105	4-Dimethyl aminoazobenzene
6410	4-Methylphenol (p-Cresol)
6470	4-Nitroaniline
6500	4-Nitrophenol
6510	4-Nitroquinoline 1-oxide
6516	4-tert-Butylphenol
6570	5-Nitro-o-toluidine
6112	6-Methylchrysene
6115	7,12-Dimethylbenz(a) anthracene
6125	a-a-Dimethylphenethylamine
5500	Acenaphthene
5505	Acenaphthylene
5510	Acetophenone
4330	Acrylamide
5545	Aniline
5555	Anthracene
5560	Aramite
7065	Atrazine
5562	Azobenzene
5570	Benzaldehyde
5567	Benzenethiol (Phenylmercaptan)
5595	Benzidine
5575	Benzo(a)anthracene
5580	Benzo(a)pyrene
5590	Benzo(g,h,i)perylene
5600	Benzo(k)fluoranthene
5585	Benzo[b]fluoranthene
5610	Benzoic acid
5630	Benzyl alcohol
5760	bis(2-Chloroethoxy)methane
5765	bis(2-Chloroethyl) ether
5780	bis(2-Chloroisopropyl) ether
5670	Butyl benzyl phthalate
7180	Caprolactam
5680	Carbazole
7260	Chlorobenzilate
7300	Chlorpyrifos
5855	Chrysene
8906	Coelution - 3-Chlorophenol + 4-Chlorophenol
6414	Coelution - 3-Phenoxyphenol + 4-Phenoxyphenol
5862	Cresols, Total
6065	Di(2-ethylhexyl) phthalate (bis(2-Ethylhexyl)phthalate, DEHP)
7405	Diallate
9354	Dibenz(a, h) acridine
5900	Dibenz(a, j) acridine
5895	Dibenz(a,h) anthracene
9348	Dibenzo(a, h) pyrene
9351	Dibenzo(a, i) pyrene
5890	Dibenzo(a,e) pyrene
5905	Dibenzofuran
6070	Diethyl phthalate
7475	Dimethoate
6135	Dimethyl phthalate
5925	Di-n-butyl phthalate
6200	Di-n-octyl phthalate
8620	Dinoseb (2-sec-butyl-4,6-dinitrophenol, DNBP)
6210	Diphenyl ether (Diphenyl Oxide)
6205	Diphenylamine
8625	Disulfoton

ORELAP Fields of Accreditation

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Analyte Code	Analyte
6260	Ethyl methanesulfonate
7580	Famphur
6265	Fluoranthene
6270	Fluorene
6275	Hexachlorobenzene
4835	Hexachlorobutadiene
6285	Hexachlorocyclopentadiene
4840	Hexachloroethane
6290	Hexachlorophene
6295	Hexachloropropene
6312	Indene
6315	Indeno(1,2,3-cd) pyrene
7725	Isodrin
6320	Isophorone
6321	Isoquinoline
6325	Isosafrole
7740	Kepone
6345	Methapyrilene
6375	Methyl methanesulfonate
7825	Methyl parathion (Parathion, methyl)
5010	n, n-Dimethyl formamide
6443	n, n-Dimethylacetamide
5005	Naphthalene
5875	n-Decane
5015	Nitrobenzene
6525	n-Nitrosodiethylamine
6530	n-Nitrosodimethylamine
5025	n-Nitroso-di-n-butylamine
6545	n-Nitrosodi-n-propylamine
6535	n-Nitrosodiphenylamine
6550	n-Nitrosomethylethalamine
6555	n-Nitrosomorpholine
6560	n-Nitrosopiperidine
6565	n-Nitrosopyrrolidine
6580	n-Octadecane
8290	o,o,o-Triethyl phosphorothioate
3960	o-Phenylphenol
7955	Parathion, ethyl
6590	Pentachlorobenzene
5035	Pentachloroethane
6600	Pentachloronitrobenzene
6605	Pentachlorophenol
6610	Phenacetin
6615	Phenanthrene
6625	Phenol
7985	Phorate
9663	p-Phenylenediamine
6650	Pronamide (Kerb)
6665	Pyrene
5095	Pyridine
6670	Quinoline
6685	Safrole
8155	Sulfotepp
8235	Thionazin (Zinophos)
8262	Tributyl phosphate

EPA 8270D SIM **10242509** **Semivolatile Organic compounds by GC/MS Selective Ion Monitoring**

Analyte Code	Analyte
4835	Hexachlorobutadiene

ORELAP Fields of Accreditation

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EPA 8315A **10188008** **Determination of Carbonyl Compounds by HPLC/UV-VIS**

Analyte Code	Analyte
4815	Formaldehyde

EPA 9012A **10193405** **Total and Amenable Cyanide (automated colorimetric with off-line distillation)**

Analyte Code	Analyte
1510	Amenable cyanide
1645	Total cyanide

EPA 9012B **10243206** **Total and Amenable Cyanide (automated colorimetric with off-line distillation)**

Analyte Code	Analyte
1510	Amenable cyanide
1645	Total cyanide

EPA 9030B **10195605** **Acid-Soluble and Acid-Insoluble sulfides: Distillation**

Analyte Code	Analyte
2005	Sulfide

EPA 9034 **10196006** **Titrimetric Procedure for Acid-Soluble and Acid-Insoluble Sulfides**

Analyte Code	Analyte
2005	Sulfide

EPA 9038 **10196608** **Sulfate (Turbidimetric)**

Analyte Code	Analyte
2000	Sulfate

EPA 9040B **10197203** **pH Electrometric Measurement**

Analyte Code	Analyte
1900	pH

EPA 9040C **10244403** **pH Electrometric Measurement**

Analyte Code	Analyte
1900	pH

EPA 9050A **10198808** **Specific Conductance**

Analyte Code	Analyte
1610	Conductivity

EPA 9056A **10199607** **Determination of Inorganic Anions by Ion Chromatography**

Analyte Code	Analyte
1540	Bromide
1575	Chloride
1730	Fluoride
1810	Nitrate as N
1840	Nitrite as N
2000	Sulfate

EPA 9060 **10200201** **Total Organic Carbon**

Analyte Code	Analyte

ORELAP Fields of Accreditation

ORELAP ID: 4062
EPA CODE: OH00048
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Analyte Code	Analyte
1710	Dissolved organic carbon (DOC)
2040	Total organic carbon

EPA 9060A **10244801** **Total Organic Carbon**

Analyte Code	Analyte
1710	Dissolved organic carbon (DOC)
2040	Total organic carbon

EPA 9065 **10200405** **Phenolics (Spectrophotometric, Manual 4-AAP with Distillation)**

Analyte Code	Analyte
1905	Total phenolics

EPA 9095A **10204203** **Paint Filter Liquids Test**

Analyte Code	Analyte
8031	Extraction/Preparation

EPA 9095B **10245600** **Paint Filter Liquids Test**

Analyte Code	Analyte
8031	Extraction/Preparation

EPA 9251 **10207406** **Chloride (Colorimetric, Automated Ferricyanide AAII)**

Analyte Code	Analyte
1575	Chloride

EPA RSK-175 (GC-FID) **10212905** **Methane, Ethane, and Ethene in water by Headspace GC/FID**

Analyte Code	Analyte
4323	Acetylene
4747	Ethane
4752	Ethene
4926	Methane
5029	n-Propane

SM 2320 B-97 online **20045607** **Alkalinity by Titration Method**

Analyte Code	Analyte
1505	Alkalinity as CaCO3

SM 2340 B-97 online **20046600** **Hardness by calculation**

Analyte Code	Analyte
1755	Total hardness as CaCO3

SM 2340 C-97 online **20047603** **Hardness by EDTA Titration Method**

Analyte Code	Analyte
1755	Total hardness as CaCO3

SM 2510 B-97 online **20048606** **Conductivity by Probe**

Analyte Code	Analyte
1610	Conductivity

ORELAP Fields of Accreditation

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SM 2540 B-97 online **20049405** **Total Solids Dried at 103 - 105C**

Analyte Code	Analyte
1950	Residue-total

SM 2540 C-97 online **20050402** **Total Dissolved Solids Dried at 180C**

Analyte Code	Analyte
1955	Residue-filterable (TDS)

SM 2540 D-97 online **20051201** **Total Suspended Solids Dried at 103 - 105C**

Analyte Code	Analyte
1960	Residue-nonfilterable (TSS)

SM 2540 F-97 online **20052204** **Settleable Solids**

Analyte Code	Analyte
1965	Residue-settleable

SM 3500-Cr B-2009 online **20066255** **Chromium by Colorimetric Method**

Analyte Code	Analyte
1045	Chromium VI

SM 3500-Fe B-97 online **20069005** **Iron by Phenanthroline Method**

Analyte Code	Analyte
1070	Iron

SM 4500-Cl E-93 online **20080404** **Chlorine by Low-Level Amperometric Titration Method**

Analyte Code	Analyte
1575	Chloride

SM 4500-Cl G-2000 online **20081612** **Chlorine (Residual) by DPD Colorimetric Determination**

Analyte Code	Analyte
1940	Total residual chlorine

SM 4500-CN E-1999 **20096417** **Cyanide by Colorimetric Method**

Analyte Code	Analyte
1645	Total cyanide

SM 4500-CN G-1999 online **20097216** **Cyanide Amenable to Chlorination after Distillation**

Analyte Code	Analyte
1510	Amenable cyanide

SM 4500-CN I 20th ED **20093601** **Weak Acid Dissociable Cyanide**

Analyte Code	Analyte
1635	Cyanide

SM 4500-F⁻ C-97 online **20102403** **Fluoride by Ion-Selective Electrode Method**

Analyte Code	Analyte
1730	Fluoride

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SM 4500-H+ B-2000 online **20105219** **pH Value by Electrometric Method .**

Analyte Code	Analyte
1900	pH

SM 4500-NH3 B-97 online **20106007** **Ammonia by Preliminary Distillation Step**

Analyte Code	Analyte
1515	Ammonia as N

SM 4500-NH3 C-97 online **20108401** **Ammonia by Titrimetric Method**

Analyte Code	Analyte
1515	Ammonia as N

SM 4500-NH3 D-97 online **20109404** **Ammonia by Ammonia-Selective Electrode Method .**

Analyte Code	Analyte
1515	Ammonia as N

SM 4500-Norg C-97 online **20120007** **Nitrogen (Organic) by Semi-Micro-Kjeldahl Method**

Analyte Code	Analyte
1795	Kjeldahl nitrogen - total

SM 4500-O G-2001 online **20121657** **Dissolved Oxygen by Membrane Electrode Method**

Analyte Code	Analyte
1880	Oxygen, dissolved

SM 4500-P E-97 online **20124203** **Phosphorus by Ascorbic Acid Method**

Analyte Code	Analyte
1870	Orthophosphate as P
1910	Phosphorus, total

SM 4500-$S2^{-}$ F-2000 online **20126652** **Sulfide by Iodometric Method**

Analyte Code	Analyte
2005	Sulfide

SM 5210 B-2001 online **20135255** **Biochemical Oxygen Demand (BOD), 5-Day**

Analyte Code	Analyte
1530	Biochemical oxygen demand
1555	Carbonaceous BOD, CBOD

SM 5220 D-97 online **20136805** **COD by Closed Reflux, Colorimetric Method**

Analyte Code	Analyte
1565	Chemical oxygen demand

SM 5310 C-2000 online **20138812** **Total Organic Carbon by Persulfate-Ultraviolet Oxidation Method**

Analyte Code	Analyte
2040	Total organic carbon

SM 5540 C-93 online **20145000** **Surfactants by Anionic Surfactants as MBAS**

Analyte Code	Analyte

ORELAP Fields of Accreditation

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Analyte Code	Analyte
2025	Surfactants - MBAS

WI(95) DRO **90019457** **Wisconsin DNR - Modified Method for Determination of Diesel Range Organics by GC-FID**

Analyte Code	Analyte
9369	Diesel range organics (DRO)

WI(95) GRO **90019468** **Wisconsin DNR - Modified Method for Determining Gasoline Range Organics GC-FID**

Analyte Code	Analyte
9408	Gasoline range organics (GRO)

ORELAP Fields of Accreditation

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MATRIX : Solids

Reference	Code	Description
ASTM D3987-06	**30030708**	**Shake Extraction of Solid Waste with Water**

Analyte Code	Analyte
8031	Extraction/Preparation

Reference	Code	Description
EPA 1010	**10116606**	**Pensky-Martens Closed-Cup Method for Determining Ignitability**

Analyte Code	Analyte
1780	Ignitability

Reference	Code	Description
EPA 1010A	**10234807**	**Pensky-Martens Closed-Cup Method for Determining Ignitability**

Analyte Code	Analyte
1780	Ignitability

Reference	Code	Description
EPA 1311	**10118806**	**Toxicity Characteristic Leaching Procedure**

Analyte Code	Analyte
8031	Extraction/Preparation

Reference	Code	Description
EPA 1312	**10119003**	**Synthetic Precipitation Leaching Procedure**

Analyte Code	Analyte
8031	Extraction/Preparation

Reference	Code	Description
EPA 1630	**10122608**	**Methyl Mercury by Purge & Trap Cold Vapor Atomic Fluorescence Spectrometry**

Analyte Code	Analyte
1205	Methyl Mercury

Reference	Code	Description
EPA 1631E	**10237204**	**Mercury in Water by Oxidation, Purge & Trap, and Cold Vapor Atomic Fluorescence**

Analyte Code	Analyte
1095	Mercury

Reference	Code	Description
EPA 3050B	**10135601**	**Acid Digestion of Sediments, Sludges, and soils**

Analyte Code	Analyte
8031	Extraction/Preparation

Reference	Code	Description
EPA 3051	**10135805**	**Microwave Assisted Acid Digestion of Sediments, Sludges, Soils, and Oils**

Analyte Code	Analyte
8031	Extraction/Preparation

Reference	Code	Description
EPA 3051A	**10136002**	**Microwave Assisted Acid Digestion of Sediments, Sludges, Soils, and Oils**

Analyte Code	Analyte
8031	Extraction/Preparation

Reference	Code	Description
EPA 3060A	**10136604**	**Alkaline Digestion for Hexavalent Chromium**

Analyte Code	Analyte
8031	Extraction/Preparation

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EPA 3540B **10140008** **Soxhlet Extraction**

Analyte Code	Analyte
8031	Extraction/Preparation

EPA 3540C **10140202** **Soxhlet Extraction**

Analyte Code	Analyte
8031	Extraction/Preparation

EPA 3546 **10141205** **Microwave Extraction**

Analyte Code	Analyte
8031	Extraction/Preparation

EPA 3550B **10141807** **Ultrasonic Extraction**

Analyte Code	Analyte
8031	Extraction/Preparation

EPA 3550C **10142004** **Ultrasonic Extraction**

Analyte Code	Analyte
8031	Extraction/Preparation

EPA 3580A **10143007** **Waste Dilution**

Analyte Code	Analyte
8031	Extraction/Preparation

EPA 3620B **10145809** **Florisil Cleanup**

Analyte Code	Analyte
8031	Extraction/Preparation

EPA 3620C **10146006** **Florisil Cleanup**

Analyte Code	Analyte
8031	Extraction/Preparation

EPA 3640A **10147203** **Gel Preparation Cleanup**

Analyte Code	Analyte
8031	Extraction/Preparation

EPA 3650B **10147805** **Acid base partition cleanup**

Analyte Code	Analyte
8031	Extraction/Preparation

EPA 3660B **10148400** **Sulfur cleanup**

Analyte Code	Analyte
8031	Extraction/Preparation

EPA 3665A **10148808** **Sulfuric Acid / permanganate Cleanup**

Analyte Code	Analyte
8031	Extraction/Preparation

ORELAP Fields of Accreditation

ORELAP ID: 4062
EPA CODE: OH00048
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EPA 5030B **10153409** **Purge and trap for aqueous samples**

Analyte Code	Analyte
8031	Extraction/Preparation

EPA 5030C **10284603** **Purge-and-Trap for Aqueous Samples**

Analyte Code	Analyte
8031	Extraction/Preparation

EPA 5035 **10154004** **Closed-System Purge-and-Trap and Extraction for Volatile Organics in Soil and Waste Samples**

Analyte Code	Analyte
8031	Extraction/Preparation

EPA 5035A **10284807** **Closed-System Purge-and-Trap and Extraction for Volatile Organics in Soil and Waste Samples**

Analyte Code	Analyte
8031	Extraction/Preparation

EPA 6010B **10155609** **ICP - AES**

Analyte Code	Analyte
1000	Aluminum
1005	Antimony
1010	Arsenic
1015	Barium
1020	Beryllium
1025	Boron
1030	Cadmium
1035	Calcium
1040	Chromium
1050	Cobalt
1055	Copper
1070	Iron
1075	Lead
1080	Lithium
1085	Magnesium
1090	Manganese
1100	Molybdenum
1105	Nickel
1125	Potassium
1140	Selenium
1990	Silica as SiO2
1145	Silicon
1150	Silver
1155	Sodium
1160	Strontium
1165	Thallium
1175	Tin
1180	Titanium
1185	Vanadium
1190	Zinc

EPA 6010C **10155803** **ICP - AES**

Analyte Code	Analyte
1000	Aluminum
1005	Antimony
1010	Arsenic
1015	Barium

ORELAP Fields of Accreditation

ORELAP ID: 4062
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Analyte Code	Analyte
1020	Beryllium
1025	Boron
1030	Cadmium
1035	Calcium
1040	Chromium
1050	Cobalt
1055	Copper
1070	Iron
1075	Lead
1080	Lithium
1085	Magnesium
1090	Manganese
1100	Molybdenum
1105	Nickel
1125	Potassium
1140	Selenium
1990	Silica as SiO2
1145	Silicon
1150	Silver
1155	Sodium
1160	Strontium
1165	Thallium
1175	Tin
1180	Titanium
1185	Vanadium
1190	Zinc

EPA 6020 **10156000** **Inductively Coupled Plasma-Mass Spectrometry**

Analyte Code	Analyte
1000	Aluminum
1005	Antimony
1010	Arsenic
1015	Barium
1020	Beryllium
1025	Boron
1030	Cadmium
1035	Calcium
1040	Chromium
1050	Cobalt
1055	Copper
1070	Iron
1075	Lead
1080	Lithium
1085	Magnesium
1090	Manganese
1100	Molybdenum
1105	Nickel
1125	Potassium
1140	Selenium
1150	Silver
1155	Sodium
1160	Strontium
1165	Thallium
1175	Tin
1180	Titanium
1185	Vanadium
1190	Zinc

ORELAP Fields of Accreditation

ORELAP ID: 4062
EPA CODE: OH00048
Certificate: 4062 - 001

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EPA 6020A **10156408** **Inductively Coupled Plasma-Mass Spectrometry**

Analyte Code	Analyte
1000	Aluminum
1005	Antimony
1010	Arsenic
1015	Barium
1020	Beryllium
1025	Boron
1030	Cadmium
1035	Calcium
1040	Chromium
1050	Cobalt
1055	Copper
1070	Iron
1075	Lead
1080	Lithium
1085	Magnesium
1090	Manganese
1100	Molybdenum
1105	Nickel
1125	Potassium
1140	Selenium
1150	Silver
1155	Sodium
1160	Strontium
1165	Thallium
1175	Tin
1180	Titanium
1185	Vanadium
1190	Zinc

EPA 7196A **10162400** **Chromium Hexavalent colorimetric**

Analyte Code	Analyte
1045	Chromium VI

EPA 7471A **10166208** **Mercury in Solid Waste by Cold Vapor Atomic Absorption**

Analyte Code	Analyte
1095	Mercury

EPA 7471B **10166402** **Mercury by Cold Vapor Atomic Absorption**

Analyte Code	Analyte
1095	Mercury

EPA 8015B **10173601** **Non-halogenated organics using GC/FID**

Analyte Code	Analyte
9369	Diesel range organics (DRO)
9408	Gasoline range organics (GRO)

EPA 8015C **10173805** **Non-halogenated organics using GC/FID**

Analyte Code	Analyte
9369	Diesel range organics (DRO)
9408	Gasoline range organics (GRO)

ORELAP Fields of Accreditation

ORELAP ID: 4062
EPA CODE: OH00048
Certificate: 4062 - 001

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EPA 8015D **10305609** **Nonhalogenated Organics Using GC/FID**

Analyte Code	Analyte
9369	Diesel range organics (DRO)
9408	Gasoline range organics (GRO)

EPA 8081A **10178606** **Organochlorine Pesticides by GC/ECD**

Analyte Code	Analyte
7355	4,4'-DDD
7360	4,4'-DDE
7365	4,4'-DDT
7025	Aldrin
7110	alpha-BHC (alpha-Hexachlorocyclohexane)
7240	alpha-Chlordane
7115	beta-BHC (beta-Hexachlorocyclohexane)
7250	Chlordane (tech.)
7260	Chlorobenzilate
7105	delta-BHC
7405	Diallate
7470	Dieldrin
7510	Endosulfan I
7515	Endosulfan II
7520	Endosulfan sulfate
7540	Endrin
7530	Endrin aldehyde
7535	Endrin ketone
7120	gamma-BHC (Lindane, gamma-HexachlorocyclohexanE)
7245	gamma-Chlordane
7685	Heptachlor
7690	Heptachlor epoxide
6275	Hexachlorobenzene
7725	Isodrin
7740	Kepone
7810	Methoxychlor
7870	Mirex
8250	Toxaphene (Chlorinated camphene)

EPA 8081B **10178800** **Organochlorine Pesticides by GC/ECD**

Analyte Code	Analyte
7355	4,4'-DDD
7360	4,4'-DDE
7365	4,4'-DDT
7025	Aldrin
7110	alpha-BHC (alpha-Hexachlorocyclohexane)
7240	alpha-Chlordane
7115	beta-BHC (beta-Hexachlorocyclohexane)
7250	Chlordane (tech.)
7260	Chlorobenzilate
7105	delta-BHC
7405	Diallate
7470	Dieldrin
7510	Endosulfan I
7515	Endosulfan II
7520	Endosulfan sulfate
7540	Endrin
7530	Endrin aldehyde
7535	Endrin ketone
7120	gamma-BHC (Lindane, gamma-HexachlorocyclohexanE)
7245	gamma-Chlordane

ORELAP Fields of Accreditation

ORELAP ID: 4062
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Analyte Code	Analyte
7685	Heptachlor
7690	Heptachlor epoxide
6275	Hexachlorobenzene
7725	Isodrin
7740	Kepone
7810	Methoxychlor
7870	Mirex
8250	Toxaphene (Chlorinated camphene)

EPA 8082 **10179007** **Polychlorinated Biphenyls (PCBs) by GC/ECD**

Analyte Code	Analyte
8880	Aroclor-1016 (PCB-1016)
8885	Aroclor-1221 (PCB-1221)
8890	Aroclor-1232 (PCB-1232)
8895	Aroclor-1242 (PCB-1242)
8900	Aroclor-1248 (PCB-1248)
8905	Aroclor-1254 (PCB-1254)
8910	Aroclor-1260 (PCB-1260)
8912	Aroclor-1262 (PCB-1262)
8913	Aroclor-1268 (PCB-1268)

EPA 8082A **10179201** **Polychlorinated Biphenyls (PCBs) by GC/ECD**

Analyte Code	Analyte
8880	Aroclor-1016 (PCB-1016)
8885	Aroclor-1221 (PCB-1221)
8890	Aroclor-1232 (PCB-1232)
8895	Aroclor-1242 (PCB-1242)
8900	Aroclor-1248 (PCB-1248)
8905	Aroclor-1254 (PCB-1254)
8910	Aroclor-1260 (PCB-1260)
8912	Aroclor-1262 (PCB-1262)
8913	Aroclor-1268 (PCB-1268)

EPA 8151A **10183207** **Chlorinated Herbicides by GC/ECD**

Analyte Code	Analyte
8655	2,4,5-T
8545	2,4-D
8560	2,4-DB
8555	Dalapon
8595	Dicamba
8605	Dichloroprop (Dichlorprop)
8620	Dinoseb (2-sec-butyl-4,6-dinitrophenol, DNBP)
7775	MCPA
7780	MCPP
6605	Pentachlorophenol
8650	Silvex (2,4,5-TP)

EPA 8260B **10184802** **Volatile Organic Compounds by purge and trap GC/MS**

Analyte Code	Analyte
5105	1,1,1,2-Tetrachloroethane
5160	1,1,1-Trichloroethane
5110	1,1,2,2-Tetrachloroethane
5195	1,1,2-Trichloro-1,2,2-trifluoroethane (Freon 113)
5165	1,1,2-Trichloroethane
4630	1,1-Dichloroethane
4640	1,1-Dichloroethylene

ORELAP Fields of Accreditation

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Analyte Code	Analyte
4670	1,1-Dichloropropene
5150	1,2,3-Trichlorobenzene
5180	1,2,3-Trichloropropane
5182	1,2,3-Trimethylbenzene
5155	1,2,4-Trichlorobenzene
5210	1,2,4-Trimethylbenzene
4570	1,2-Dibromo-3-chloropropane (DBCP)
4585	1,2-Dibromoethane (EDB, Ethylene dibromide)
4610	1,2-Dichlorobenzene
4635	1,2-Dichloroethane (Ethylene dichloride)
4655	1,2-Dichloropropane
6800	1,3,5-Trichlorobenzene
5215	1,3,5-Trimethylbenzene
9318	1,3-Butadiene
4615	1,3-Dichlorobenzene
4660	1,3-Dichloropropane
4675	1,3-Dichloropropene
4620	1,4-Dichlorobenzene
4735	1,4-Dioxane (1,4- Diethyleneoxide)
4510	1-Chlorohexane
4665	2,2-Dichloropropane
4410	2-Butanone (Methyl ethyl ketone, MEK)
4500	2-Chloroethyl vinyl ether
4535	2-Chlorotoluene
4538	2-Ethyltoluene
4860	2-Hexanone (MBK)
6385	2-Methylnaphthalene
5020	2-Nitropropane
4531	3-Ethyltoluene
4540	4-Chlorotoluene
4910	4-Isopropyltoluene (p-Cymene)
4995	4-Methyl-2-pentanone (MIBK)
4315	Acetone
4320	Acetonitrile
4325	Acrolein (Propenal)
4340	Acrylonitrile
4355	Allyl chloride (3-Chloropropene)
4375	Benzene
5635	Benzyl chloride
4385	Bromobenzene
4390	Bromochloromethane
4395	Bromodichloromethane
4400	Bromoform
4450	Carbon disulfide
4455	Carbon tetrachloride
4475	Chlorobenzene
4575	Chlorodibromomethane
4485	Chloroethane (Ethyl chloride)
4505	Chloroform
4525	Chloroprene (2-Chloro-1,3-butadiene)
4645	cis-1,2-Dichloroethylene
4680	cis-1,3-Dichloropropene
4555	Cyclohexane
4560	Cyclohexanone
4595	Dibromomethane (Methylene bromide)
4625	Dichlorodifluoromethane (Freon-12)
4627	Dichlorofluoromethane (Freon 21)
4725	Diethyl ether
9375	Di-isopropylether (DIPE)
4745	Epichlorohydrin (1-Chloro-2,3-epoxypropane)
4755	Ethyl acetate

ORELAP Fields of Accreditation

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Analyte Code	Analyte
4760	Ethyl acrylate
4810	Ethyl methacrylate
4765	Ethylbenzene
4795	Ethylene oxide
4770	Ethyl-t-butylether (ETBE) (2-Ethoxy-2-methylpropane)
4835	Hexachlorobutadiene
4870	Iodomethane (Methyl iodide)
4875	Isobutyl alcohol (2-Methyl-1-propanol)
4900	Isopropylbenzene
5240	m+p-xylene
4925	Methacrylonitrile
4940	Methyl acetate
4950	Methyl bromide (Bromomethane)
4960	Methyl chloride (Chloromethane)
4990	Methyl methacrylate
5000	Methyl tert-butyl ether (MTBE)
4965	Methylcyclohexane
4975	Methylene chloride (Dichloromethane)
5245	m-Xylene
5005	Naphthalene
4425	n-Butyl alcohol (1-Butanol, n-Butanol)
4415	n-Butyl-acetate
4435	n-Butylbenzene
4825	n-Heptane
4855	n-Hexane
5090	n-Propylbenzene
5250	o-Xylene
5035	Pentachloroethane
5080	Propionitrile (Ethyl cyanide)
9579	Propylene oxide
5255	p-Xylene
4440	sec-Butylbenzene
5100	Styrene
4370	T-amylmethylether (TAME)
4420	tert-Butyl alcohol
4445	tert-Butylbenzene
5115	Tetrachloroethylene (Perchloroethylene)
5120	Tetrahydrofuran (THF)
9574	Tetrahydrothiophene
5140	Toluene
4700	trans-1,2-Dichloroethylene
4685	trans-1,3-Dichloropropylene
4605	trans-1,4-Dichloro-2-butene
5170	Trichloroethene (Trichloroethylene)
5175	Trichlorofluoromethane (Fluorotrichloromethane, Freon 11)
5225	Vinyl acetate
5235	Vinyl chloride
5260	Xylene (total)

EPA 8260B SIM **10184904** **Volatile Organic Compounds by purge and trap GC/MS-SIM**

Analyte Code	Analyte
4735	1,4-Dioxane (1,4- Diethyleneoxide)

EPA 8260C **10307003** **Volatile Organics: GC/MS (capillary column)**

Analyte Code	Analyte
5105	1,1,1,2-Tetrachloroethane
5160	1,1,1-Trichloroethane
5110	1,1,2,2-Tetrachloroethane
5195	1,1,2-Trichloro-1,2,2-trifluoroethane (Freon 113)

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Analyte Code	Analyte
5165	1,1,2-Trichloroethane
4630	1,1-Dichloroethane
4640	1,1-Dichloroethylene
4670	1,1-Dichloropropene
5150	1,2,3-Trichlorobenzene
5180	1,2,3-Trichloropropane
5182	1,2,3-Trimethylbenzene
5155	1,2,4-Trichlorobenzene
5210	1,2,4-Trimethylbenzene
4570	1,2-Dibromo-3-chloropropane (DBCP)
4585	1,2-Dibromoethane (EDB, Ethylene dibromide)
4610	1,2-Dichlorobenzene
4635	1,2-Dichloroethane (Ethylene dichloride)
4655	1,2-Dichloropropane
6800	1,3,5-Trichlorobenzene
5215	1,3,5-Trimethylbenzene
9318	1,3-Butadiene
4615	1,3-Dichlorobenzene
4660	1,3-Dichloropropane
4675	1,3-Dichloropropene
4620	1,4-Dichlorobenzene
4735	1,4-Dioxane (1,4- Diethyleneoxide)
4510	1-Chlorohexane
4665	2,2-Dichloropropane
4410	2-Butanone (Methyl ethyl ketone, MEK)
4500	2-Chloroethyl vinyl ether
4535	2-Chlorotoluene
4538	2-Ethyltoluene
4860	2-Hexanone (MBK)
6385	2-Methylnaphthalene
5020	2-Nitropropane
4531	3-Ethyltoluene
4540	4-Chlorotoluene
4910	4-Isopropyltoluene (p-Cymene)
4995	4-Methyl-2-pentanone (MIBK)
4315	Acetone
4320	Acetonitrile
4325	Acrolein (Propenal)
4340	Acrylonitrile
4355	Allyl chloride (3-Chloropropene)
4375	Benzene
5635	Benzyl chloride
4385	Bromobenzene
4390	Bromochloromethane
4395	Bromodichloromethane
4400	Bromoform
4450	Carbon disulfide
4455	Carbon tetrachloride
4475	Chlorobenzene
4575	Chlorodibromomethane
4485	Chloroethane (Ethyl chloride)
4505	Chloroform
4525	Chloroprene (2-Chloro-1,3-butadiene)
4645	cis-1,2-Dichloroethylene
4680	cis-1,3-Dichloropropene
4555	Cyclohexane
4560	Cyclohexanone
4590	Dibromofluoromethane
4595	Dibromomethane (Methylene bromide)
4625	Dichlorodifluoromethane (Freon-12)
4627	Dichlorofluoromethane (Freon 21)

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Analyte Code	Analyte
4725	Diethyl ether
9375	Di-isopropylether (DIPE)
4745	Epichlorohydrin (1-Chloro-2,3-epoxypropane)
4755	Ethyl acetate
4760	Ethyl acrylate
4810	Ethyl methacrylate
4765	Ethylbenzene
4795	Ethylene oxide
4770	Ethyl-t-butylether (ETBE) (2-Ethoxy-2-methylpropane)
4835	Hexachlorobutadiene
4870	Iodomethane (Methyl iodide)
4875	Isobutyl alcohol (2-Methyl-1-propanol)
4900	Isopropylbenzene
5240	m+p-xylene
4925	Methacrylonitrile
4940	Methyl acetate
4950	Methyl bromide (Bromomethane)
4960	Methyl chloride (Chloromethane)
4990	Methyl methacrylate
5000	Methyl tert-butyl ether (MTBE)
4965	Methylcyclohexane
4975	Methylene chloride (Dichloromethane)
5245	m-Xylene
5005	Naphthalene
4425	n-Butyl alcohol (1-Butanol, n-Butanol)
4415	n-Butyl-acetate
4435	n-Butylbenzene
4825	n-Heptane
4855	n-Hexane
5090	n-Propylbenzene
5250	o-Xylene
5035	Pentachloroethane
5080	Propionitrile (Ethyl cyanide)
9579	Propylene oxide
5255	p-Xylene
4440	sec-Butylbenzene
5100	Styrene
4370	T-amylmethylether (TAME)
4420	tert-Butyl alcohol
4445	tert-Butylbenzene
5115	Tetrachloroethylene (Perchloroethylene)
5120	Tetrahydrofuran (THF)
9574	Tetrahydrothiophene
5140	Toluene
4700	trans-1,2-Dichloroethylene
4685	trans-1,3-Dichloropropylene
4605	trans-1,4-Dichloro-2-butene
5170	Trichloroethene (Trichloroethylene)
5175	Trichlorofluoromethane (Fluorotrichloromethane, Freon 11)
5225	Vinyl acetate
5235	Vinyl chloride
5260	Xylene (total)

EPA 8260C SIM **10307105** **Volatile Organic Compounds by GC/MS-SIM**

Analyte Code	Analyte
4735	1,4-Dioxane (1,4- Diethyleneoxide)

ORELAP Fields of Accreditation

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EPA 8270C **10185805** **Semivolatile Organic compounds by GC/MS**

Analyte Code	Analyte
6703	1,1'-Biphenyl (BZ-0)
6705	1,2,3,4-Tetrachlorobenzene
6710	1,2,3,5-Tetrachlorobenzene
5150	1,2,3-Trichlorobenzene
6715	1,2,4,5-Tetrachlorobenzene
5155	1,2,4-Trichlorobenzene
4610	1,2-Dichlorobenzene
6221	1,2-Diphenylhydrazine
6800	1,3,5-Trichlorobenzene
6885	1,3,5-Trinitrobenzene (1,3,5-TNB)
4615	1,3-Dichlorobenzene
6160	1,3-Dinitrobenzene (1,3-DNB)
4620	1,4-Dichlorobenzene
6165	1,4-Dinitrobenzene
4735	1,4-Dioxane (1,4- Diethyleneoxide)
6420	1,4-Naphthoquinone
6630	1,4-Phenylenediamine
5790	1-Chloronaphthalene
6380	1-Methylnaphthalene
6425	1-Naphthylamine
5754	1-Phenoxy-2-propanol
6735	2,3,4,6-Tetrachlorophenol
6740	2,3,5,6-Tetrachlorophenol
6014	2,3-Dinitrotoluene
6835	2,4,5-Trichlorophenol
6840	2,4,6-Trichlorophenol
5880	2,4-Diaminotoluene
6000	2,4-Dichlorophenol
6130	2,4-Dimethylphenol
6175	2,4-Dinitrophenol
6185	2,4-Dinitrotoluene (2,4-DNT)
6183	2,6-Diaminotoluene
6005	2,6-Dichlorophenol
6190	2,6-Dinitrotoluene (2,6-DNT)
5515	2-Acetylaminofluorene
5735	2-Chloroaniline
5795	2-Chloronaphthalene
5800	2-Chlorophenol
5866	2-Ethoxyethanol (cellosolve)
6360	2-Methyl-4,6-dinitrophenol (4,6-Dinitro-2-methylphenol)
5145	2-Methylaniline (o-Toluidine)
6385	2-Methylnaphthalene
6400	2-Methylphenol (o-Cresol)
6430	2-Naphthylamine
6460	2-Nitroaniline
6490	2-Nitrophenol
5050	2-Picoline (2-Methylpyridine)
6412	3 & 4 Methylphenol
5945	3,3'-Dichlorobenzidine
6100	3,3'-Dimethoxybenzidine
6120	3,3'-Dimethylbenzidine
5940	3,4-Dichloroaniline
5995	3,4-Dichloronitrobenzene
6355	3-Methylcholanthrene
6405	3-Methylphenol (m-Cresol)
6465	3-Nitroaniline
6365	4,4-Methylenebis(2-chloroaniline)
5540	4-Aminobiphenyl

ORELAP Fields of Accreditation

ORELAP ID: 4062
EPA CODE: OH00048
Certificate: 4062 - 001

TestAmerica Canton

4101 Shuffel Street NW
North Canton OH 44720

Issue Date: 05/01/2015 **Expiration Date:** 02/23/2016

As of 05/01/2015 ***this list supercedes all previous lists for this certificate number. Customers. Please verify the current accreditation standing with ORELAP.***

Analyte Code	Analyte
5660	4-Bromophenyl phenyl ether (BDE-3)
5700	4-Chloro-3-methylphenol
5745	4-Chloroaniline
5825	4-Chlorophenyl phenylether
6105	4-Dimethyl aminoazobenzene
6410	4-Methylphenol (p-Cresol)
6470	4-Nitroaniline
6500	4-Nitrophenol
6510	4-Nitroquinoline 1-oxide
6516	4-tert-Butylphenol
6570	5-Nitro-o-toluidine
6112	6-Methylchrysene
6115	7,12-Dimethylbenz(a) anthracene
6125	a-a-Dimethylphenethylamine
5500	Acenaphthene
5505	Acenaphthylene
5510	Acetophenone
4330	Acrylamide
5545	Aniline
5555	Anthracene
5560	Aramite
7065	Atrazine
5562	Azobenzene
5570	Benzaldehyde
5567	Benzenethiol (Phenylmercaptan)
5595	Benzidine
5575	Benzo(a)anthracene
5580	Benzo(a)pyrene
5590	Benzo(g,h,i)perylene
5600	Benzo(k)fluoranthene
5585	Benzo[b]fluoranthene
5610	Benzoic acid
5630	Benzyl alcohol
5760	bis(2-Chloroethoxy)methane
5765	bis(2-Chloroethyl) ether
5780	bis(2-Chloroisopropyl) ether
4659	bis(2-Chloroisopropyl)ether
5670	Butyl benzyl phthalate
7180	Caprolactam
5680	Carbazole
7260	Chlorobenzilate
7300	Chlorpyrifos
5855	Chrysene
8906	Coelution - 3-Chlorophenol + 4-Chlorophenol
6414	Coelution - 3-Phenoxyphenol + 4-Phenoxyphenol
5862	Cresols, Total
6065	Di(2-ethylhexyl) phthalate (bis(2-Ethylhexyl)phthalate, DEHP)
7405	Diallate
9354	Dibenz(a, h) acridine
5900	Dibenz(a, j) acridine
5895	Dibenz(a,h) anthracene
9348	Dibenzo(a, h) pyrene
9351	Dibenzo(a, i) pyrene
5890	Dibenzo(a,e) pyrene
5905	Dibenzofuran
6070	Diethyl phthalate
7475	Dimethoate
6135	Dimethyl phthalate
5925	Di-n-butyl phthalate
6200	Di-n-octyl phthalate
8620	Dinoseb (2-sec-butyl-4,6-dinitrophenol, DNBP)

ORELAP Fields of Accreditation

ORELAP ID: 4062
EPA CODE: OH00048
Certificate: 4062 - 001

TestAmerica Canton

4101 Shuffel Street NW
North Canton OH 44720

Issue Date: 05/01/2015 **Expiration Date:** 02/23/2016

As of 05/01/2015 ***this list supercedes all previous lists for this certificate number.***
Customers. Please verify the current accreditation standing with ORELAP.

Analyte Code	Analyte
6210	Diphenyl ether (Diphenyl Oxide)
6205	Diphenylamine
8625	Disulfoton
4810	Ethyl methacrylate
6260	Ethyl methanesulfonate
7580	Famphur
6265	Fluoranthene
6270	Fluorene
6275	Hexachlorobenzene
4835	Hexachlorobutadiene
6285	Hexachlorocyclopentadiene
4840	Hexachloroethane
6290	Hexachlorophene
6295	Hexachloropropene
6312	Indene
6315	Indeno(1,2,3-cd) pyrene
7725	Isodrin
6320	Isophorone
6321	Isoquinoline
6325	Isosafrole
7740	Kepone
6345	Methapyrilene
6375	Methyl methanesulfonate
7825	Methyl parathion (Parathion, methyl)
5010	n, n-Dimethyl formamide
6443	n, n-Dimethylacetamide
5005	Naphthalene
5875	n-Decane
6300	n-Hexadecane
5015	Nitrobenzene
6525	n-Nitrosodiethylamine
6530	n-Nitrosodimethylamine
5025	n-Nitroso-di-n-butylamine
6545	n-Nitrosodi-n-propylamine
6535	n-Nitrosodiphenylamine
6550	n-Nitrosomethylethalamine
6555	n-Nitrosomorpholine
6560	n-Nitrosopiperidine
6565	n-Nitrosopyrrolidine
6580	n-Octadecane
8290	o,o,o-Triethyl phosphorothioate
3960	o-Phenylphenol
7955	Parathion, ethyl
6590	Pentachlorobenzene
5035	Pentachloroethane
6600	Pentachloronitrobenzene
6605	Pentachlorophenol
6610	Phenacetin
6615	Phenanthrene
6625	Phenol
7985	Phorate
9663	p-Phenylenediamine
6650	Pronamide (Kerb)
6665	Pyrene
5095	Pyridine
6670	Quinoline
6685	Safrole
8155	Sulfotepp
8235	Thionazin (Zinophos)
6750	Thiophenol (Benzenethiol)
8262	Tributyl phosphate

ORELAP Fields of Accreditation

ORELAP ID: 4062
EPA CODE: OH00048
Certificate: 4062 - 001

TestAmerica Canton

4101 Shuffel Street NW
North Canton OH 44720

Issue Date: 05/01/2015 **Expiration Date:** 02/23/2016

As of 05/01/2015 ***this list supercedes all previous lists for this certificate number.***
Customers. Please verify the current accreditation standing with ORELAP.

EPA 8270C SIM **10242407** **Semivolatile Organic compounds by GC/MS Selective Ion Monitoring**

Analyte Code	Analyte
4835	Hexachlorobutadiene

EPA 8270D **10186002** **Semivolatile Organic compounds by GC/MS**

Analyte Code	Analyte
6703	1,1'-Biphenyl (BZ-0)
6705	1,2,3,4-Tetrachlorobenzene
6710	1,2,3,5-Tetrachlorobenzene
5150	1,2,3-Trichlorobenzene
6715	1,2,4,5-Tetrachlorobenzene
5155	1,2,4-Trichlorobenzene
4610	1,2-Dichlorobenzene
6221	1,2-Diphenylhydrazine
6800	1,3,5-Trichlorobenzene
6885	1,3,5-Trinitrobenzene (1,3,5-TNB)
4615	1,3-Dichlorobenzene
6160	1,3-Dinitrobenzene (1,3-DNB)
4620	1,4-Dichlorobenzene
6165	1,4-Dinitrobenzene
4735	1,4-Dioxane (1,4- Diethyleneoxide)
6420	1,4-Naphthoquinone
6630	1,4-Phenylenediamine
5790	1-Chloronaphthalene
6380	1-Methylnaphthalene
6425	1-Naphthylamine
5754	1-Phenoxy-2-propanol
6735	2,3,4,6-Tetrachlorophenol
6740	2,3,5,6-Tetrachlorophenol
6014	2,3-Dinitrotoluene
6017	2,4 & 2,6-Toluene Diamine
6835	2,4,5-Trichlorophenol
6840	2,4,6-Trichlorophenol
6000	2,4-Dichlorophenol
6130	2,4-Dimethylphenol
6175	2,4-Dinitrophenol
6185	2,4-Dinitrotoluene (2,4-DNT)
6005	2,6-Dichlorophenol
6190	2,6-Dinitrotoluene (2,6-DNT)
5515	2-Acetylaminofluorene
5735	2-Chloroaniline
5795	2-Chloronaphthalene
5800	2-Chlorophenol
5866	2-Ethoxyethanol (cellosolve)
6360	2-Methyl-4,6-dinitrophenol (4,6-Dinitro-2-methylphenol)
5145	2-Methylaniline (o-Toluidine)
6385	2-Methylnaphthalene
6400	2-Methylphenol (o-Cresol)
6430	2-Naphthylamine
6460	2-Nitroaniline
6490	2-Nitrophenol
5050	2-Picoline (2-Methylpyridine)
6412	3 & 4 Methylphenol
5945	3,3'-Dichlorobenzidine
6100	3,3'-Dimethoxybenzidine
6120	3,3'-Dimethylbenzidine
5940	3,4-Dichloroaniline
5995	3,4-Dichloronitrobenzene
6355	3-Methylcholanthrene

ORELAP Fields of Accreditation

ORELAP ID: 4062
EPA CODE: OH00048
Certificate: 4062 - 001

TestAmerica Canton

4101 Shuffel Street NW
North Canton OH 44720

Issue Date: 05/01/2015 **Expiration Date:** 02/23/2016

As of 05/01/2015 ***this list supercedes all previous lists for this certificate number. Customers. Please verify the current accreditation standing with ORELAP.***

Analyte Code	Analyte
6405	3-Methylphenol (m-Cresol)
6465	3-Nitroaniline
6365	4,4-Methylenebis(2-chloroaniline)
5540	4-Aminobiphenyl
5660	4-Bromophenyl phenyl ether (BDE-3)
5700	4-Chloro-3-methylphenol
5745	4-Chloroaniline
5825	4-Chlorophenyl phenylether
6105	4-Dimethyl aminoazobenzene
6410	4-Methylphenol (p-Cresol)
6470	4-Nitroaniline
6500	4-Nitrophenol
6510	4-Nitroquinoline 1-oxide
6516	4-tert-Butylphenol
6570	5-Nitro-o-toluidine
6112	6-Methylchrysene
6115	7,12-Dimethylbenz(a) anthracene
6125	a-a-Dimethylphenethylamine
5500	Acenaphthene
5505	Acenaphthylene
5510	Acetophenone
4330	Acrylamide
5545	Aniline
5555	Anthracene
5560	Aramite
7065	Atrazine
5562	Azobenzene
5570	Benzaldehyde
5595	Benzidine
5575	Benzo(a)anthracene
5580	Benzo(a)pyrene
5590	Benzo(g,h,i)perylene
5600	Benzo(k)fluoranthene
5585	Benzo[b]fluoranthene
5610	Benzoic acid
5630	Benzyl alcohol
5760	bis(2-Chloroethoxy)methane
5765	bis(2-Chloroethyl) ether
5780	bis(2-Chloroisopropyl) ether
5670	Butyl benzyl phthalate
7180	Caprolactam
5680	Carbazole
7260	Chlorobenzilate
7300	Chlorpyrifos
5855	Chrysene
8906	Coelution - 3-Chlorophenol + 4-Chlorophenol
6414	Coelution - 3-Phenoxyphenol + 4-Phenoxyphenol
5862	Cresols, Total
6065	Di(2-ethylhexyl) phthalate (bis(2-Ethylhexyl)phthalate, DEHP)
7405	Diallate
9354	Dibenz(a, h) acridine
5900	Dibenz(a, j) acridine
5895	Dibenz(a,h) anthracene
9348	Dibenzo(a, h) pyrene
9351	Dibenzo(a, i) pyrene
5890	Dibenzo(a,e) pyrene
5905	Dibenzofuran
6070	Diethyl phthalate
7475	Dimethoate
6135	Dimethyl phthalate
5925	Di-n-butyl phthalate

ORELAP Fields of Accreditation

ORELAP ID: 4062
EPA CODE: OH00048
Certificate: 4062 - 001

TestAmerica Canton

4101 Shuffel Street NW
North Canton OH 44720

Issue Date: 05/01/2015 **Expiration Date:** 02/23/2016

As of 05/01/2015 ***this list supercedes all previous lists for this certificate number.***
Customers. Please verify the current accreditation standing with ORELAP.

Analyte Code	Analyte
6200	Di-n-octyl phthalate
8620	Dinoseb (2-sec-butyl-4,6-dinitrophenol, DNBP)
6210	Diphenyl ether (Diphenyl Oxide)
6205	Diphenylamine
8625	Disulfoton
6260	Ethyl methanesulfonate
7580	Famphur
6265	Fluoranthene
6270	Fluorene
6275	Hexachlorobenzene
4835	Hexachlorobutadiene
6285	Hexachlorocyclopentadiene
4840	Hexachloroethane
6290	Hexachlorophene
6295	Hexachloropropene
6312	Indene
6315	Indeno(1,2,3-cd) pyrene
7725	Isodrin
6320	Isophorone
6321	Isoquinoline
6325	Isosafrole
7740	Kepone
6345	Methapyrilene
6375	Methyl methanesulfonate
7825	Methyl parathion (Parathion, methyl)
5010	n, n-Dimethyl formamide
6443	n, n-Dimethylacetamide
5005	Naphthalene
5875	n-Decane
6300	n-Hexadecane
5015	Nitrobenzene
6525	n-Nitrosodiethylamine
6530	n-Nitrosodimethylamine
5025	n-Nitroso-di-n-butylamine
6545	n-Nitrosodi-n-propylamine
6535	n-Nitrosodiphenylamine
6550	n-Nitrosomethylethalamine
6555	n-Nitrosomorpholine
6560	n-Nitrosopiperidine
6565	n-Nitrosopyrrolidine
6580	n-Octadecane
8290	o,o,o-Triethyl phosphorothioate
3960	o-Phenylphenol
7955	Parathion, ethyl
6590	Pentachlorobenzene
5035	Pentachloroethane
6600	Pentachloronitrobenzene
6605	Pentachlorophenol
6610	Phenacetin
6615	Phenanthrene
6625	Phenol
7985	Phorate
9663	p-Phenylenediamine
6650	Pronamide (Kerb)
6665	Pyrene
5095	Pyridine
6670	Quinoline
6685	Safrole
8155	Sulfotepp
8235	Thionazin (Zinophos)
8262	Tributyl phosphate

ORELAP Fields of Accreditation

ORELAP ID: 4062
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EPA 8270D SIM **10242509** **Semivolatile Organic compounds by GC/MS Selective Ion Monitoring**

Analyte Code	Analyte
4835	Hexachlorobutadiene

EPA 8315A **10188008** **Determination of Carbonyl Compounds by HPLC/UV-VIS**

Analyte Code	Analyte
4815	Formaldehyde

EPA 9012A **10193405** **Total and Amenable Cyanide (automated colorimetric with off-line distillation)**

Analyte Code	Analyte
1510	Amenable cyanide
1645	Total cyanide

EPA 9012B **10243206** **Total and Amenable Cyanide (automated colorimetric with off-line distillation)**

Analyte Code	Analyte
1510	Amenable cyanide
1645	Total cyanide

EPA 9023 **10195003** **Extractable Organic Halides (EOX) in Solids**

Analyte Code	Analyte
1720	Extractable organics halides (EOX)

EPA 9030B **10195605** **Acid-Soluble and Acid-Insoluble sulfides: Distillation**

Analyte Code	Analyte
2005	Sulfide

EPA 9034 **10196006** **Titrimetric Procedure for Acid-Soluble and Acid-Insoluble Sulfides**

Analyte Code	Analyte
2005	Sulfide

EPA 9038 **10196608** **Sulfate (Turbidimetric)**

Analyte Code	Analyte
2000	Sulfate

EPA 9040B **10197203** **pH Electrometric Measurement**

Analyte Code	Analyte
1900	pH

EPA 9040C **10244403** **pH Electrometric Measurement**

Analyte Code	Analyte
1900	pH

EPA 9045C **10198400** **Soil and Waste pH**

Analyte Code	Analyte
1900	pH

EPA 9045D **10244607** **Soil and Waste pH**

Analyte Code	Analyte

ORELAP Fields of Accreditation

ORELAP ID: 4062
EPA CODE: OH00048
Certificate: 4062 - 001

TestAmerica Canton

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North Canton OH 44720

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Analyte Code	Analyte
1900	pH

EPA 9050A **10198808** **Specific Conductance**

Analyte Code	Analyte
1610	Conductivity

EPA 9056A **10199607** **Determination of Inorganic Anions by Ion Chromatography**

Analyte Code	Analyte
1540	Bromide
1575	Chloride
1730	Fluoride
1810	Nitrate as N
1840	Nitrite as N
2000	Sulfate

EPA 9065 **10200405** **Phenolics (Spectrophotometric, Manual 4-AAP with Distillation)**

Analyte Code	Analyte
1905	Total phenolics

EPA 9095A **10204203** **Paint Filter Liquids Test**

Analyte Code	Analyte
8031	Extraction/Preparation

EPA 9095B **10245600** **Paint Filter Liquids Test**

Analyte Code	Analyte
8031	Extraction/Preparation

EPA 9251 **10207406** **Chloride (Colorimetric, Automated Ferricyanide AAII)**

Analyte Code	Analyte
1575	Chloride

Walkley-Black 1969 **60012002** **Total Organic Carbon in Soils and Sediments by Titration**

Analyte Code	Analyte
2040	Total organic carbon

WI(95) DRO **90019457** **Wisconsin DNR - Modified Method for Determination of Diesel Range Organics by GC-FID**

Analyte Code	Analyte
9369	Diesel range organics (DRO)

WI(95) GRO **90019468** **Wisconsin DNR - Modified Method for Determining Gasoline Range Organics GC-FID**

Analyte Code	Analyte
9408	Gasoline range organics (GRO)

State of Wisconsin
Department of Natural Resources

WISCONSIN
DEPT. OF NATURAL RESOURCES

recognizes

Wisconsin Certification under NR 149

of

TestAmerica Chicago

Laboratory Id: **999580010**

as a laboratory licensed to perform environmental sample analysis in support of covered environmental programs (ch. NR149.02 Note) for the parameter(s) specified in the attached Scope of Accreditation.

August 31, 2015

Expiration Date

August 5, 2014

Issued on

Steven Geis, Chief
Environmental Science Services

Cathy Stepp, Secretary
Department of Natural Resources

This certificate does not guarantee validity of data generated, but indicates the methodology, equipment, quality control practices, records, and proficiency of the laboratory have been reviewed and found to satisfy the requirements of ch. NR 149, Wis. Adm. Code.

Scope of Accreditation

TestAmerica Chicago
2417 Bond Street
University Park, IL 60484

Laboratory Id: **999580010**
Expiration Date: **08/31/15**
Issued Date: **08/05/14**

Wisconsin Certification under NR 149
Matrix: Aqueous (Non-potable Water)

Class: General Chemistry

- Alkalinity *by Titration*
- Ammonia as N *by Colorimetry*
- Biochemical Oxygen Demand (BOD) *by 5-d Assay*
- Bromide *by IC*
- Carbonaceous Oxygen Demand (cBOD) *by 5-d Assay*
- Chemical Oxygen Demand (COD) *by Titration*
- Chloride *by Colorimetry*
- Chloride *by IC*
- Chlorine, Total Residual (TRC) *by Titration*
- Cyanide, Available *by Colorimetry*
- Cyanide, Total *by Colorimetry*
- Fluoride *by IC*
- Fluoride *by ISE*
- Hardness, Total as CaCO3 *by ICP*
- Kjeldahl Nitrogen, Total *by Colorimetry*
- Nitrate *by Colorimetry*
- Nitrate *by IC*
- Nitrate + Nitrite *by Colorimetry*
- Nitrate + Nitrite *by IC*
- Nitrite *by Colorimetry*
- Nitrite *by IC*
- Oil&Grease, Hexane Ext. Material (HEM) *by Grav-HEM*
- Organic Carbon, Total (TOC) *by Comb-Ox*
- Organic Halides, Total (TOX) *by Comb-Ox*
- Orthophosphate *by Colorimetry*
- Orthophosphate *by IC*
- Oxygen, Dissolved *by ISE*
- Phenolics, Total *by Colorimetry*
- Phosphorus, Total *by Colorimetry*
- Residue, Filterable (TDS) *by Grav*
- Residue, Nonfilterable (TSS) *by Grav*
- Residue, Settleable *by Grav*
- Residue, Total *by Grav*
- Residue, Volatile (TVS) *by Grav*
- Residue, Volatile, Nonfilterable (TVSS) *by Grav*
- Silica *by ICP*
- Specific Conductance *by ISE*
- Sulfate *by Colorimetry*
- Sulfate *by IC*
- Sulfide *by Titration*
- Sulfides, Acid-Soluble and Acid-Insoluble *by Titration*
- pH *by ISE*

Class: Metals

- Aluminum *by ICP*
- Aluminum *by ICP-MS*

Class: Metals

- Antimony *by ICP*
- Antimony *by ICP-MS*
- Arsenic *by ICP*
- Arsenic *by ICP-MS*
- Barium *by ICP*
- Barium *by ICP-MS*
- Beryllium *by ICP*
- Beryllium *by ICP-MS*
- Boron *by ICP*
- Boron *by ICP-MS*
- Cadmium *by ICP*
- Cadmium *by ICP-MS*
- Calcium *by ICP*
- Calcium *by ICP-MS*
- Chromium (Hexavalent) *by Colorimetry*
- Chromium (Total) *by ICP*
- Chromium (Total) *by ICP-MS*
- Cobalt *by ICP*
- Cobalt *by ICP-MS*
- Copper *by ICP*
- Copper *by ICP-MS*
- Iron *by ICP*
- Iron *by ICP-MS*
- Lead *by ICP*
- Lead *by ICP-MS*
- Magnesium *by ICP*
- Magnesium *by ICP-MS*
- Manganese *by ICP*
- Manganese *by ICP-MS*
- Mercury *by Hyd-CVAA*
- Molybdenum *by ICP*
- Molybdenum *by ICP-MS*
- Nickel *by ICP*
- Nickel *by ICP-MS*
- Potassium *by ICP*
- Potassium *by ICP-MS*
- Selenium *by ICP*
- Selenium *by ICP-MS*
- Silver *by ICP*
- Silver *by ICP-MS*
- Sodium *by ICP*
- Sodium *by ICP-MS*
- Strontium *by ICP*
- Strontium *by ICP-MS*
- Thallium *by ICP*

The laboratory named above is hereby licensed under ch. NR 149, Wis. Adm. Code for the parameters listed in this attachment.
* Analyte groups are defined and listed at http://dnr.wi.gov by searching keywords "Lab Certification:".

Scope of Accreditation

TestAmerica Chicago
2417 Bond Street
University Park, IL 60484

Laboratory Id: **999580010**
Expiration Date: **08/31/15**
Issued Date: **08/05/14**

Wisconsin Certification under NR 149
Matrix: Aqueous (Non-potable Water)

Class: Metals
- Thallium *by ICP-MS*
- Tin *by ICP*
- Tin *by ICP-MS*
- Titanium *by ICP*
- Titanium *by ICP-MS*
- Vanadium *by ICP*
- Vanadium *by ICP-MS*
- Zinc *by ICP*
- Zinc *by ICP-MS*

Class: BNA Semivolatiles
- ## SEMIVOLATILES [BNA] (group) *by GC/MS*

Class: PAH - Polynuclear Aromatic Hydrocarbons (BN)
- ## PAH (group) *by HPLC*

Class: Pesticides, Acid (Herbicides)
- 2,4,5-T *by GC*
- 2,4-D *by GC*
- 2,4-DB *by GC*
- 4-Nitrophenol *by GC*
- Dalapon *by GC*
- Dicamba *by GC*
- Dichlorprop (2,4-DP) *by GC*
- Dinoseb (2-sec-butyl-4,6-Dinitrophenol) *by GC*
- Pentachlorophenol *by GC*
- Picloram *by GC*
- Silvex (2,4,5-TP) *by GC*

Class: Pesticides, Organochlorine
- ## PESTICIDES, ORGANOCHLORINE (group) *by GC*
- Kepone *by GC/MS*
- Pentachloronitrobenzene (PCNB) *by GC/MS*

Class: Pesticides, Nitrogen
- Propanamide *by GC/MS*

Class: Pesticides, Carbamate and Urea
- Diallate (cis or trans) *by GC/MS*

Class: Petroleum Hydrocarbons
- Diesel Range Organics (DRO) *by GC*
- Gasoline Range Organics (GRO) *by GC*
- Petroleum VOC (PVOC) *by GC/MS*

Class: PCBs as Aroclors
- ## PCB as AROCLORS (group) *by GC*

Class: Volatile Organics
- ## VOLATILE ORGANICS [VOC] (group) *by GC/MS*

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Scope of Accreditation

TestAmerica Chicago
2417 Bond Street
University Park, IL 60484

Laboratory Id: **999580010**
Expiration Date: **08/31/15**
Issued Date: **08/05/14**

Wisconsin Certification under NR 149
Matrix: Solid (Waste, Soil & Tissue)

Class: General Chemistry

Ammonia as N *by Colorimetry*
Bromide *by IC*
Chemical Oxygen Demand (COD) *by Titration*
Chloride *by Colorimetry*
Chloride *by IC*
Cyanide, Available *by Colorimetry*
Cyanide, Total *by Colorimetry*
Fluoride *by IC*
Fluoride *by ISE*
Kjeldahl Nitrogen, Total *by Colorimetry*
Nitrate *by Colorimetry*
Nitrate *by IC*
Nitrate + Nitrite *by Colorimetry*
Nitrate + Nitrite *by IC*
Nitrite *by Colorimetry*
Nitrite *by IC*
Organic Carbon, Total (TOC) *by Comb-Ox*
Organic Halides, Total (TOX) *by Comb-Ox*
Orthophosphate *by Colorimetry*
Orthophosphate *by IC*
Phenolics, Total *by Colorimetry*
Phosphorus, Total *by Colorimetry*
Residue, Total *by Grav*
Residue, Volatile (TVS) *by Grav*
Specific Conductance *by ISE*
Sulfate *by Colorimetry*
Sulfate *by IC*
Sulfide *by Titration*
Sulfides, Acid-Soluble and Acid-Insoluble *by Titration*
pH *by ISE*

Class: Metals

Aluminum *by ICP*
Aluminum *by ICP-MS*
Antimony *by ICP*
Antimony *by ICP-MS*
Arsenic *by ICP*
Arsenic *by ICP-MS*
Barium *by ICP*
Barium *by ICP-MS*
Beryllium *by ICP*
Beryllium *by ICP-MS*
Boron *by ICP*
Boron *by ICP-MS*
Cadmium *by ICP*
Cadmium *by ICP-MS*
Calcium *by ICP*
Calcium *by ICP-MS*
Chromium (Hexavalent) *by Colorimetry*
Chromium (Total) *by ICP*
Chromium (Total) *by ICP-MS*
Cobalt *by ICP*
Cobalt *by ICP-MS*
Copper *by ICP*
Copper *by ICP-MS*
Iron *by ICP*
Iron *by ICP-MS*
Lead *by ICP*
Lead *by ICP-MS*
Magnesium *by ICP*
Magnesium *by ICP-MS*
Manganese *by ICP*
Manganese *by ICP-MS*
Mercury *by Hyd-CVAA*
Molybdenum *by ICP*
Molybdenum *by ICP-MS*
Nickel *by ICP*
Nickel *by ICP-MS*
Potassium *by ICP*
Potassium *by ICP-MS*
Selenium *by ICP*
Selenium *by ICP-MS*
Silver *by ICP*
Silver *by ICP-MS*
Sodium *by ICP*
Sodium *by ICP-MS*
Strontium *by ICP*
Strontium *by ICP-MS*
Thallium *by ICP*
Thallium *by ICP-MS*
Tin *by ICP*
Tin *by ICP-MS*
Titanium *by ICP*
Titanium *by ICP-MS*
Vanadium *by ICP*
Vanadium *by ICP-MS*
Zinc *by ICP*
Zinc *by ICP-MS*

Class: BNA Semivolatiles

SEMIVOLATILES [BNA] (group) *by GC/MS*

The laboratory named above is hereby licensed under ch. NR 149, Wis. Adm. Code for the parameters listed in this attachment.
* Analyte groups are defined and listed at http://dnr.wi.gov by searching keywords "Lab Certification:".

Scope of Accreditation

TestAmerica Chicago
2417 Bond Street
University Park, IL 60484

Laboratory Id: **999580010**
Expiration Date: **08/31/15**
Issued Date: **08/05/14**

Wisconsin Certification under NR 149
Matrix: Solid (Waste, Soil & Tissue)

Class: PAH - Polynuclear Aromatic Hydrocarbons (BN)
PAH (group) *by HPLC*

Class: Pesticides, Acid (Herbicides)
2,4,5-T *by GC*
2,4-D *by GC*
2,4-DB *by GC*
Dalapon *by GC*
Dicamba *by GC*
Dichlorprop (2,4-DP) *by GC*
Dinoseb (2-sec-butyl-4,6-Dinitrophenol) *by GC*
Pentachlorophenol *by GC*
Picloram *by GC*
Silvex (2,4,5-TP) *by GC*

Class: Pesticides, Organochlorine
PESTICIDES, ORGANOCHLORINE (group) *by GC*

Class: Pesticides, Carbamate and Urea
Diallate (cis or trans) *by GC/MS*

Class: Petroleum Hydrocarbons
Diesel Range Organics (DRO) *by GC*
Gasoline Range Organics (GRO) *by GC*
Petroleum VOC (PVOC) *by GC/MS*

Class: PCBs as Aroclors
PCB as AROCLORS (group) *by GC*

Class: Volatile Organics
VOLATILE ORGANICS [VOC] (group) *by GC/MS*

Class: Waste Characterization Extractions
Reagent Water Shake Extraction (ASTM Leach Test) *by Waste Extractions*
SPLP Extraction *by Waste Extractions*
TCLP Extraction *by Waste Extractions*

Class: Waste Characterization Assays
Corrosivity, Liquids *by Waste Assays*
Ignitability, Pensky-Martens Closed Cup *by Waste Assays*
Paint Filters Liquids Test *by Waste Assays*

The laboratory named above is hereby licensed under ch. NR 149, Wis. Adm. Code for the parameters listed in this attachment.
* Analyte groups are defined and listed at http://dnr.wi.gov by searching keywords "Lab Certification:".

Wisconsin Accreditation for the analyte group,
*** BNA ANALYTE GROUP by Gas Chromatography-Mass Spectrometry (GC/MS),**
in either the Aqueous or Solid Matrix
indicates that the laboratory is accredited to perform compliance testing for any of the analytes in the list below.

CLASS: BNA Semivolatiles

Gas Chromatography-Mass Spectrometry (GC/MS)

○ ** BNA ANALYTE GROUP*

- ✓ *Class: Phenols (acids)*
- ✓ *Class: Benzidines*
- ✓ *Class: Chlorinated Hydrocarbons*
- ✓ *Class: Haloethers*
- ✓ *Class: Nitroaromatics*
- ✓ *Class: Nitrosamines*
- ✓ *Class: Non-Halogenated Organics*
- ✓ *Class: Phthalates*
- ✓ *Class: PAHs*

CLASS: Phenols (Acids)

Analyte	CASRN
2,3,4,6-Tetrachlorophenol	58-90-2
2,3,5,6-Tetrachlorophenol	935-95-5
2,4,5-Trichlorophenol	95-95-4
2,4,6-Trichlorophenol	88-06-2
2,4-Dichlorophenol	120-83-2
2,4-Dimethylphenol	105-67-9
2,4-Dinitrophenol	51-28-5
2,6-Dichlorophenol	87-65-0
2,6-Dichlorosyringaldehyde	76330-06-8
2-Chlorophenol	95-57-8
2-Chlorosyringaldehyde	76341-69-0
2-Cyclohexyl-4,6-dinitro-phenol	131-89-5
2-Methylphenol (o-Cresol)	95-48-7
2-Nitrophenol	88-75-5
3,4,5-Trichlorocatechol	56961-20-7
3,4,5-Trichloroguaiacol	57057-83-7
3,4,6-Trichlorocatechol	32139-72-3
3,4,6-Trichloroguaiacol	60712-44-9
3,4-Dichlorocatechol	3978-67-4
3,4-Dichloroguaiacol	77102-94-4
3,6-Dichlorocatechol	3938-16-7
3-Methylphenol (m-Cresol)	108-39-4
4,5,6-Trichloroguaiacol	2668-24-8
4,5-Dichlorocatechol	3428-24-8
4,5-Dichloroguaiacol	2460-49-3
4,6-Dichlorocatechol	
4,6-Dichloroguaiacol	16766-31-7
4,6-Dinitro-2-methylphenol	534-52-1
4-Chloro-3-methylphenol (4-Chloro-m-cresol)	59-50-7
4-Chlorocatechol	2138-22-9
4-Chloroguaiacol	16766-30-6
4-Chlorophenol	106-48-9
4-Methylphenol (p-Cresol)	106-44-5
4-Nitrophenol	100-02-7
5,6-Dichlorovanillin	18268-69-4
5-Chlorovanillin	19463-48-0
6-Chlorovanillin	18268-76-3
Dinoseb (2-sec-butyl-4,6-Dinitrophenol)	88-85-7
Pentachlorophenol	87-86-5
Phenol	108-95-2
Tetrachlorocatechol	1198-55-6
Tetrachloroguaiacol	2539-17-5
Trichlorosyringol	2539-26-6

CLASS: Benzidines (BN)

Analyte	CASRN
3,3'-Dichlorobenzidine	91-94-1
3,3'-Dimethoxybenzidine	119-90-4
3,3'-Dimethylbenzidine	119-93-7
Benzidine	92-87-5

CLASS: Chlorinated Hydrocarbons (BN)

1,2,4,5-Tetrachlorobenzene	95-94-3
1,2,4-Trichlorobenzene	120-82-1
1,2-Dichlorobenzene	95-50-1
1,3-Dichlorobenzene	541-73-1
1,4-Dichlorobenzene	106-46-7
1-Chloronaphthalene	90-13-1
2-Chloronaphthalene	91-58-7
3-(Chloromethyl)pyridine Hydrochloride	6959-48-4
Benzyl chloride	100-44-7
Chlorobenzilate	510-15-6
Hexachlorobenzene	118-74-1
Hexachlorobutadiene	87-68-3
Hexachlorocyclopentadiene	77-47-4
Hexachloroethane	67-72-1
Hexachlorophene	70-30-4
Hexachloropropene	1888-71-7
Pentachlorobenzene	608-93-5
Pentachloroethane	76-01-7

CLASS: Haloethers (BN)

4-Bromophenyl phenyl ether	101-55-3
4-Chlorophenyl phenyl ether	7005-72-3
Bis(2-chloroethoxy)methane	111-91-1
Bis(2-chloroethyl) ether	111-44-4
Bis(2-chloroisopropyl) ether	108-60-1

Wisconsin Accreditation for the analyte group,
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in either the Aqueous or Solid Matrix
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CLASS: Nitroaromatics & Cyclic Ketones (BN)

1,2-Dinitrobenzene	528-29-0
1,3,5-Trinitrobenzene	99-35-4
1,3-Dinitrobenzene	99-65-0
1,4-Dinitrobenzene	100-25-4
1,4-Naphthoquinone	130-15-4
1,4-Phenylenediamine	106-50-3
1-Naphthylamine	134-32-7
2,4,5-Trimethylaniline	137-17-7
2,4-Diaminotoluene	95-80-7
2,4-Dinitrotoluene	121-14-2
2,6-Dinitrotoluene	606-20-2
2-Naphthylamine	91-59-8
2-Nitroaniline	88-74-4
2-Picoline (2-Methylpyridine)	109-06-8
3-Amino-9-ethylcarbazole	132-32-1
3-Nitroaniline	99-09-2
4,4'-Methylenebis (2-chloroaniline)	101-14-4
4,4'-Methylenebis(N,N-dimethylaniline)	101-61-1
4,4'-Oxydianiline	101-80-4
4-Aminobiphenyl	92-67-1
4-Chloro-1,2-phenylenediamine	95-83-0
4-Chloro-1,3-phenylenediamine	5131-60-2
4-Chloroaniline	106-47-8
4-Nitroaniline	100-01-6
4-Nitrobiphenyl	92-93-3
5-Chloro-2-methylaniline	95-79-4
5-Nitroacenaphthene	602-87-9
5-Nitro-o-anisidine	99-59-2
5-Nitro-o-toluidine	99-55-8
a,a-Dimethylphenethylamine	122-09-8
Isophorone	78-59-1
Nitrobenzene	98-95-3

CLASS: Nitrosamines (BN)

N-Nitrosodiethylamine	55-18-5
N-Nitrosodimethylamine	62-75-9
N-Nitrosodi-n-butylamine	924-16-3
N-Nitrosodiphenylamine	86-30-6
N-Nitrosodipropylamine	621-64-7
N-Nitrosomethylethylamine	10595-95-6
N-Nitrosomorpholine	59-89-2
N-Nitrosopiperidine	100-75-4
N-Nitrosopyrrolidine	930-55-2

CLASS: Non-Halogenated Organics (BN)

1,4-Dioxane	123-91-1
1-Acetyl-2-thiourea	591-08-2
2-Acetylaminofluorene	53-96-3
2-Aminoanthraquinone	117-79-3
2-Hydroxypropionitrile	78-97-7
4-Chloroaniline	106-47-8
4-Nitroquinoline 1-oxide	56-57-5
5,5-Diphenylhydantoin	57-41-0
Acetophenone	98-86-2
Aminoazobenzene	60-09-3
Aniline	62-53-3
o-Anisidine	90-04-0
Aramite	140-57-8
Azobenzene	103-33-3
Benzoic Acid	65-85-0
p-Benzoquinone	106-51-4
Benzyl Alcohol	100-51-6
Biphenyl	92-52-4
Carbazole	86-74-8
p-Cresidine	120-71-8
Dibenzofuran	132-64-9
Diethyl Sulfate	64-67-5
Diethylstilbestrol	56-53-1
Dihydrosaffrole	94-58-6
Dimethylaminoazobenzene	60-11-7
Diphenylamine	122-39-4
Ethyl Methanesulfonate	62-50-0
Fluchloralin	33245-39-5
Hydroquinone	123-31-9
Isosafrole	120-58-1
Maleic Anhydride	108-31-6
Mestranol	72-33-3
Methapyrilene	91-80-5
Methyl Methanesulfonate	66-27-3
Nicotine	54-11-5
Nitrofen	1836-75-5
O,O,O-Triethyl Phosphorothioate	126-68-1
Octamethyl Pyrophosphoramide	152-16-9
Phenacetin	62-44-2
Phenobarbital	50-06-6
Phthalic Anhydride	85-44-9
Piperonyl Sulfoxide	120-62-7
Propylthiouracil	51-52-5
Pyridine	110-86-1
Resorcinol	108-46-3
Safrole	94-59-7
Tetraethyl Dithiopyrophosphate	3689-24-5
Tetraethyl Pyrophosphate	107-49-3
Thionazin (*O,O-Diethyl O-2-pyrazinyl phosphorothioate*)	297-97-2
Thiophenol (Benzenethiol)	108-98-5
Toluene Diisocyanate	584-84-9
o-Toluidine	95-53-4
Trimethyl Phosphate	512-56-1
Tri-p-tolyl Phosphate	78-32-0
Tris(2,3-dibromopropyl) phosphate	126-72-7

Wisconsin Accreditation for the analyte group,
* **BNA ANALYTE GROUP by Gas Chromatography-Mass Spectrometry (GC/MS),**
in either the Aqueous or Solid Matrix
indicates that the laboratory is accredited to perform compliance testing for any of the analytes in the list below.

CLASS: Phthalates (BN)

Benzyl Butyl Phthalate	85-68-7
Bis(2-ethylhexyl)phthalate	117-81-7
Diethyl Phthalate	84-66-2
Dimethyl Phthalate	131-11-3
Di-n-butyl Phthalate	84-74-2
Di-n-octyl Phthalate	117-84-0

CLASS: PAH –Polynuclear Aromatic Hydrocarbons (BN)

1-Methylnaphthalene	90-12-0
2-Methylnaphthalene	91-57-6
3-Methylcholanthrene	56-49-5
7,12-Dimethylbenz(a)-anthracene	57-97-6
Acenaphthene	83-32-9
Acenaphthylene	208-96-8
Anthracene	120-12-7
Benzo(a)anthracene	56-55-3
Benzo(a)pyrene	50-32-8
Benzo(b)fluoranthene	205-99-2
Benzo(g,h,i)perylene	191-24-2
Benzo(k)fluoranthene	207-08-9
Chrysene	218-01-9
Dibenz(a,j)acridine	224-42-0
Dibenzo(a,e)pyrene	192-65-4
Dibenzo(a,h)anthracene	53-70-3
Fluoranthene	206-44-0
Fluorene	86-73-7
Indeno(1,2,3-cd)pyrene	193-39-5
Naphthalene	91-20-3
Phenanthrene	85-01-8
Pyrene	129-00-0

Rev. 2 May 2009

VOC ANALYTE GROUP (GC/MS)

Wisconsin Accreditation for the analyte group,
*** VOC ANALYTE GROUP by Gas Chromatography-Mass Spectrometry (GC/MS),**
in either the Aqueous or Solid Matrix
indicates that the laboratory is accredited to perform compliance testing
for any of the analytes in the list below.

Analyte	CASRN
1,1,1,2-Tetrachloroethane	630-20-6
1,1,1-Trichloroethane	71-55-6
1,1,2,2-Tetrachloroethane	79-34-5
1,1,2-Trichloroethane	79-00-5
1,1-Dichloroethane	75-34-3
1,1-Dichloroethene	75-35-4
1,1-Dichloropropene	563-58-6
1,2,3,4-Diepoxybutane	1464-53-5
1,2,3-Trichlorobenzene	87-61-6
1,2,3-Trichloropropane	96-18-4
1,2,4-Trichlorobenzene	120-82-1
1,2,4-Trimethylbenzene	95-63-6
1,2-Dibromo-3-chloropropane (DBCP)	96-12-8
1,2-Dibromoethane (EDB)	106-93-4
1,2-Dichlorobenzene	95-50-1
1,2-Dichloroethane	107-06-2
cis-1,2-Dichloroethene	156-59-4
trans-1,2-Dichloroethene	156-60-5
1,2-Dichloropropane	78-87-5
1,3,5-Trimethylbenzene	108-67-8
1,3-Dichloro-2-propanol	96-23-1
1,3-Dichlorobenzene	541-73-1
1,3-Dichloropropane	142-28-9
cis-1,3-Dichloropropene	10061-01-5
trans-1,3-Dichloropropene	10061-02-6
1,4-Dichlorobenzene	106-46-7
trans-1,4-Dichloro-2-butene	110-57-6
1,4-Dioxane	123-91-1
1-Chlorohexane	544-10-5
1-Propanol	71-23-8
2,2-Dichloropropane	590-20-7
2,3-Dichloropropene	78-88-6
2-Butanone (Methyl Ethyl Ketone)	78-93-3
2-Chloroethanol	107-07-3
2-Chloronaphthalene	91-58-7
2-Chlorotoluene	95-49-8
2-Hexanone	591-78-6
2-Nitropropane	79-46-9
2-Pentanone	107-87-9
2-Picoline (2-Methylpyridine)	109-06-8
3-Chloropropionitrile	542-76-7
4-Chlorotoluene	106-43-4
4-Methyl-2-pentanone (Methyl Isobutyl Ketone)	108-10-1
Acetone	67-64-1
Acetonitrile	75-05-8
Acrolein	107-02-8
Acrylonitrile	107-13-1
Allyl Alcohol	107-18-6
Allyl Chloride	107-05-1
Benzene	71-43-2
Bis(2-chloroethyl)sulfide	505-60-2
Bromoacetone	598-31-2
Bromobenzene	108-86-1
Bromochloromethane	74-97-5
Bromodichloromethane	75-27-4
Bromoform	75-25-2
Bromomethane	74-83-9
n-Butyl Alcohol (1-Butanol)	71-36-3
t-Butyl Alcohol	75-65-0
n-Butylbenzene	104-51-8

Analyte	CASRN
sec-Butylbenzene	135-98-8
tert-Butylbenzene	98-06-6
Carbon Disulfide	75-15-0
Carbon Tetrachloride	56-23-5
Chlorobenzene	108-90-7
Chloroethane	75-00-3
Chloroform	67-66-3
Chloromethane	74-87-3
Chloromethyl Methyl Ether	107-30-2
Chloroprene	126-99-8
Crotonaldehyde	4170-30-3
Dibromochloromethane	124-48-1
Dibromomethane	74-95-3
Dichlorodifluoromethane	75-71-8
Diethyl Ether	60-29-7
Diisopropyl ether	108-20-3
Epichlorohydrin	106-89-8
Ethanol	64-17-5
Ethyl Acetate	141-78-6
Ethyl Methacrylate	97-63-2
Ethylbenzene	100-41-4
Ethylene Glycol	107-21-1
Ethylene Oxide	75-21-8
Hexachlorobutadiene	87-68-3
Hexachloroethane	67-72-1
n-Hexane	110-54-3
Isobutyl alcohol (2-Methyl-1-propanol)	78-83-1
Isopropyl alcohol (2-Propanol)	67-63-0
Isopropylbenzene	98-82-8
p-Isopropyltoluene	99-87-6
Malononitrile	109-77-3
Methacrylonitrile	126-98-7
Methanol	67-56-1
Methyl Acrylate	96-33-3
Methyl Iodide	74-88-4
Methyl Methacrylate	80-62-6
Methyl tert-Butyl Ether	1634-04-4
Methylene Chloride	75-09-2
Naphthalene	91-20-3
Paraldehyde	123-63-7
Pentachlorethane	76-01-7
Propargyl Alcohol	107-19-7
ß-Propiolactone	57-57-8
Propionitrile (Ethyl Cyanide)	107-12-0
n-Propylamine	107-10-8
n-Propylbenzene	103-65-1
Pyridine	110-86-1
Styrene	100-42-5
Tetrachloroethene	127-18-4
Tetrahydrofuran	109-99-9
Toluene	108-88-3
o-Toluidine	95-53-4
Trichloroethene	79-01-6
Trichlorofluoromethane	75-69-4
Vinyl Acetate	108-05-4
Vinyl Chloride	75-01-4
m-Xylene	108-38-3
o-Xylene	95-47-6
p-Xylene	106-42-3

PAH ANALYTE GROUP (HPLC or GC)

Wisconsin Accreditation for the analyte group,
*** PAH ANALYTE GROUP**
by Technology: **Gas Chromatography (GC)**
by Technology: **High Performance Liquid Chromatography (HPLC)**
in either the Aqueous or Solid Matrix

indicates that the laboratory is accredited to perform compliance testing for any of the analytes in the list below.

Analyte	CASRN
1-Methylnaphthalene	90-12-0
2-Methylnaphthalene	91-57-6
Acenaphthene	83-32-9
Acenaphthylene	208-96-8
Anthracene	120-12-7
Benzo(a)anthracene	56-55-3
Benzo(a)pyrene	50-32-8
Benzo(b)fluoranthene	205-99-2
Benzo(g,h,i)perylene	191-24-2
Benzo(k)fluoranthene	207-08-9
Chrysene	218-01-9
Dibenzo(a,h)anthracene	53-70-3
Fluoranthene	206-44-0
Fluorene	86-73-7
Indeno(1,2,3-cd)pyrene	193-39-5
Naphthalene	91-20-3
Phenanthrene	85-01-8
Pyrene	129-00-0

Rev. 0 August 2008

PESTICIDES, ORGANOCHLORINE ANALYTE GROUP (GC)

Wisconsin Accreditation for the analyte group,
*** PESTICIDES, ORGANOCHLORINE ANALYTE GROUP**
by Technology: **Gas Chromatography (GC)**
in either the Aqueous or Solid Matrix

indicates that the laboratory is accredited to perform compliance testing for any of the analytes in the list below.

Analyte	CASRN
4,4'-DDD	72-54-8
4,4'-DDE	72-55-9
4,4'-DDT	50-29-3
Aldrin	309-00-2
α-BHC	319-84-6
β-BHC	319-85-7
δ-BHC	319-86-8
γ-BHC (Lindane)	58-89-9
Captafol	2425-06-1
Captan	133-06-2
Chlordane (N.O.S.)	57-74-9
Chloroneb	2675-77-6
Dichlone	117-80-6
Dieldrin	60-57-1
Endosulfan I	959-98-8
Endosulfan II	3213-65-9
Endosulfan Sulfate	1031-07-8
Endrin	72-20-8
Endrin Aldehyde	7421-93-4
Endrin Ketone	3494-70-5
Heptachlor	76-44-8
Heptachlor Epoxide	1024-57-3
Isodrin	465-73-6
Kepone	143-50-0
Methoxychlor	72-43-5
Mirex	2385-85-5
Pentachloronitrobenzene (PCNB)	82-68-8
Perthane	72-56-0
Strobane	8001-50-1
Toxaphene	8001-35-2

Rev. 0 August 2008

PCB AS AROCLORS ANALYTE GROUP

Wisconsin Accreditation for the analyte group,
*** PCB AS AROCLORS ANALYTE GROUP**
by Technology: **Gas Chromatography (GC),** or
Gas Chromatography-Mass Spectrometry (GC/MS)
in either the Aqueous or Solid Matrix

indicates that the laboratory is accredited to perform compliance testing for any of the analytes in the list below.

Analyte	CASRN
Aroclor 1016	12674-11-2
Aroclor 1221	11104-28-2
Aroclor 1232	11141-16-5
Aroclor 1242	53469-21-9
Aroclor 1248	12672-29-6
Aroclor 1254	11097-69-1
Aroclor 1260	11096-82-5

Rev. 0 August 2008

State of Wisconsin
DEPARTMENT OF NATURAL RESOURCES
101 S Webster St
PO Box 7921
Madison, WI 53707-7921

Scott Walker, Governor
Cathy Stepp, Secretary
Telephone 608-266-2621
Fax 608-267-3579
TTY Access via relay - 711

August 5, 2014

FID: 999580010

RECEIVED

AUG 18 2014

TESTAMERICA LABORATORIES
CHICAGO

MS. NADINE JERNBERG
TESTAMERICA CHICAGO
2417 BOND STREET
UNIVERSITY PARK, IL 60484

Dear Ms. Nadine Jernberg:

Enclosed is your new Laboratory Certification or Registration certificate. This certificate supersedes all previous certificates.

YOUR CERTIFICATE IS AN IMPORTANT DOCUMENT. PLEASE REVIEW IT CAREFULLY FOR ERRORS AND COMPARE IT TO YOUR PREVIOUS YEAR'S CERTIFICATE. MAKE SURE THAT THIS CERTIFICATE REFLECTS THE TESTS FOR WHICH YOU APPLIED TO BE CERTIFIED. If you believe your certificate contains errors, contact the Laboratory Certification and Registration Program immediately at (608) 267-7633 or by e-mail at DNRLabCert@wisconsin.gov.

Sincerely,

Steven Geis, Chief
Environmental Science Services

State of Wisconsin
Department of Natural Resources

WISCONSIN
DEPT. OF NATURAL RESOURCES

recognizes

Wisconsin Certification under NR 149

of

TestAmerica Nashville

Laboratory Id: **998020430**

as a laboratory licensed to perform environmental sample analysis in support of covered environmental programs (ch. NR149.02 Note) for the parameter(s) specified in the attached Scope of Accreditation.

August 31, 2015

Expiration Date

August 5, 2014

Issued on

Steven Geis, Chief
Environmental Science Services

Cathy Stepp, Secretary
Department of Natural Resources

This certificate does not guarantee validity of data generated, but indicates the methodology, equipment, quality control practices, records, and proficiency of the laboratory have been reviewed and found to satisfy the requirements of ch. NR 149, Wis. Adm. Code.

Scope of Accreditation

TestAmerica Nashville
2960 Foster Creighton Dr
Nashville, TN 37204-0566

Laboratory Id: **998020430**
Expiration Date: **08/31/15**
Issued Date: **08/05/14**

Wisconsin Certification under NR 149
Matrix: Solid (Waste, Soil & Tissue)

Class: General Chemistry
- Bromide *by IC*
- Chloride *by IC*
- Cyanide, Total *by Colorimetry*
- Fluoride *by IC*
- Nitrate *by IC*
- Nitrate + Nitrite *by IC*
- Nitrite *by IC*
- Organic Carbon, Total (TOC) *by Comb-Ox*
- Organic Halides, Extractable (EOX) *by ISE*
- Phenolics, Total *by Colorimetry*
- Residue, Total *by Grav*
- Sulfate *by IC*
- Sulfide *by Titration*

Class: Metals
- Aluminum *by ICP*
- Aluminum *by ICP-MS*
- Antimony *by ICP*
- Antimony *by ICP-MS*
- Arsenic *by ICP*
- Arsenic *by ICP-MS*
- Barium *by ICP*
- Barium *by ICP-MS*
- Beryllium *by ICP*
- Beryllium *by ICP-MS*
- Boron *by ICP*
- Cadmium *by ICP*
- Cadmium *by ICP-MS*
- Calcium *by ICP*
- Chromium (Hexavalent) *by Colorimetry*
- Chromium (Total) *by ICP*
- Chromium (Total) *by ICP-MS*
- Cobalt *by ICP*
- Cobalt *by ICP-MS*
- Copper *by ICP*
- Copper *by ICP-MS*
- Iron *by ICP*
- Iron *by ICP-MS*
- Lead *by ICP*
- Lead *by ICP-MS*
- Magnesium *by ICP*
- Manganese *by ICP*
- Manganese *by ICP-MS*
- Mercury *by Hyd-CVAA*
- Molybdenum *by ICP*
- Molybdenum *by ICP-MS*
- Nickel *by ICP*
- Nickel *by ICP-MS*
- Potassium *by ICP*
- Selenium *by ICP*
- Selenium *by ICP-MS*
- Silver *by ICP*
- Silver *by ICP-MS*
- Sodium *by ICP*
- Strontium *by ICP*
- Thallium *by ICP*
- Thallium *by ICP-MS*
- Tin *by ICP*
- Tin *by ICP-MS*
- Titanium *by ICP*
- Titanium *by ICP-MS*
- Vanadium *by ICP*
- Vanadium *by ICP-MS*
- Zinc *by ICP*
- Zinc *by ICP-MS*

Class: BNA Semivolatiles
- ## SEMIVOLATILES [BNA] (group) *by GC/MS*

Class: PAH - Polynuclear Aromatic Hydrocarbons (BN)
- ## PAH (group) *by GC/MS*
- ## PAH (group) *by HPLC*

Class: Aldehydes and Ketones
- Acetaldehyde *by HPLC*
- Formaldehyde *by HPLC*

Class: Pesticides, Acid (Herbicides)
- 2,4,5-T *by GC*
- 2,4-D *by GC*
- 2,4-DB *by GC*
- Dinoseb (2-sec-butyl-4,6-Dinitrophenol) *by GC*
- Silvex (2,4,5-TP) *by GC*

Class: Pesticides, Organochlorine
- ## PESTICIDES, ORGANOCHLORINE (group) *by GC*

Class: Petroleum Hydrocarbons
- Diesel Range Organics (DRO) *by GC*
- Gasoline Range Organics (GRO) *by GC*
- Petroleum VOC (PVOC) *by GC*

Class: PCBs as Aroclors
- ## PCB as AROCLORS (group) *by GC*

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* Analyte groups are defined and listed at http://dnr.wi.gov by searching keywords "Lab Certification:".

Scope of Accreditation

TestAmerica Nashville
2960 Foster Creighton Dr
Nashville, TN 37204-0566

Laboratory Id: **998020430**
Expiration Date: **08/31/15**
Issued Date: **08/05/14**

Wisconsin Certification under NR 149
Matrix: Solid (Waste, Soil & Tissue)

Class: Volatile Organics ## VOLATILE ORGANICS [VOC] (group) *by GC/MS*
Class: Waste Characterization Extractions SPLP Extraction *by Waste Extractions* TCLP Extraction *by Waste Extractions*
Class: Waste Characterization Assays Corrosivity Toward Steel *by Waste Assays* Corrosivity, Liquids *by Waste Assays* Ignitability, Pensky-Martens Closed Cup *by Waste Assays*

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Scope of Accreditation

TestAmerica Nashville
2960 Foster Creighton Dr
Nashville, TN 37204-0566

Laboratory Id: **998020430**
Expiration Date: **08/31/15**
Issued Date: **08/05/14**

Wisconsin Certification under NR 149
Matrix: Aqueous (Non-potable Water)

Class: General Chemistry

Acidity as CaCO3 *by Titration*
Alkalinity *by Titration*
Ammonia as N *by Colorimetry*
Biochemical Oxygen Demand (BOD) *by 5-d Assay*
Bromide *by IC*
Carbonaceous Oxygen Demand (cBOD) *by 5-d Assay*
Chemical Oxygen Demand (COD) *by Colorimetry*
Chloride *by Colorimetry*
Chloride *by IC*
Cyanide, Available *by Colorimetry*
Cyanide, Total *by Colorimetry*
Fluoride *by IC*
Fluoride *by ISE*
Hardness, Total as CaCO3 *by ICP*
Kjeldahl Nitrogen, Total *by Colorimetry*
Nitrate *by Colorimetry*
Nitrate *by IC*
Nitrate + Nitrite *by Colorimetry*
Nitrite *by Colorimetry*
Nitrite *by IC*
Oil&Grease, Hexane Ext. Material (HEM) *by Grav-HEM*
Organic Carbon, Total (TOC) *by Comb-Ox*
Organic Halides, Total (TOX) *by Comb-Ox*
Orthophosphate *by Colorimetry*
Phenolics, Total *by Colorimetry*
Phosphorus, Total *by Colorimetry*
Residue, Filterable (TDS) *by Grav*
Residue, Nonfilterable (TSS) *by Grav*
Residue, Total *by Grav*
Residue, Volatile (TVS) *by Grav*
Sulfate *by Colorimetry*
Sulfate *by IC*
Sulfide *by Colorimetry*
Sulfide *by Titration*

Class: Metals

Aluminum *by ICP*
Aluminum *by ICP-MS*
Antimony *by ICP*
Antimony *by ICP-MS*
Arsenic *by ICP*
Arsenic *by ICP-MS*
Barium *by ICP*
Barium *by ICP-MS*
Beryllium *by ICP*
Beryllium *by ICP-MS*

Class: Metals

Boron *by ICP*
Cadmium *by ICP*
Cadmium *by ICP-MS*
Calcium *by ICP*
Chromium (Hexavalent) *by Colorimetry*
Chromium (Total) *by ICP*
Chromium (Total) *by ICP-MS*
Cobalt *by ICP*
Cobalt *by ICP-MS*
Copper *by ICP*
Copper *by ICP-MS*
Iron *by Colorimetry*
Iron *by ICP*
Iron *by ICP-MS*
Lead *by ICP*
Lead *by ICP-MS*
Magnesium *by ICP*
Manganese *by ICP*
Manganese *by ICP-MS*
Mercury *by Hyd-CVAA*
Molybdenum *by ICP*
Molybdenum *by ICP-MS*
Nickel *by ICP*
Nickel *by ICP-MS*
Potassium *by ICP*
Selenium *by ICP*
Selenium *by ICP-MS*
Silver *by ICP*
Silver *by ICP-MS*
Sodium *by ICP*
Strontium *by ICP*
Thallium *by ICP*
Thallium *by ICP-MS*
Tin *by ICP*
Tin *by ICP-MS*
Titanium *by ICP*
Titanium *by ICP-MS*
Vanadium *by ICP*
Vanadium *by ICP-MS*
Zinc *by ICP*
Zinc *by ICP-MS*

Class: BNA Semivolatiles

SEMIVOLATILES [BNA] (group) *by GC/MS*

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Nashville, TN 37204-0566

Laboratory Id: **998020430**
Expiration Date: **08/31/15**
Issued Date: **08/05/14**

Wisconsin Certification under NR 149
Matrix: Aqueous (Non-potable Water)

Class: PAH - Polynuclear Aromatic Hydrocarbons (BN)
PAH (group) *by GC/MS*
PAH (group) *by HPLC*

Class: Aldehydes and Ketones
Acetaldehyde *by HPLC*
Formaldehyde *by HPLC*

Class: Pesticides, Acid (Herbicides)
2,4,5-T *by GC*
2,4-D *by GC*
2,4-DB *by GC*
Dinoseb (2-sec-butyl-4,6-Dinitrophenol) *by GC*
Silvex (2,4,5-TP) *by GC*

Class: Pesticides, Organochlorine
PESTICIDES, ORGANOCHLORINE (group) *by GC*

Class: Petroleum Hydrocarbons
Diesel Range Organics (DRO) *by GC*
Gasoline Range Organics (GRO) *by GC*
Petroleum VOC (PVOC) *by GC*

Class: PCBs as Aroclors
PCB as AROCLORS (group) *by GC*

Class: Volatile Organics
VOLATILE ORGANICS [VOC] (group) *by GC/MS*

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APPENDIX C – LABORATORY QA MANUAL AND SOPS

APPENDIX C
Laboratory Analytical SOPs and Quality Assurance Manuals
(Located on CD)

Test America SOPs & Quality Assurance Manual - Chicago

SOP_UP-GE-8081_Pest_14, Gas Chromatography Semi-Volatiles Pesticides

SOP_UP-GE-8082_PCBs_14, Gas Chromatography Semi-Volatiles Analysis of PCBs

SOP_UP-GE-WI DRO_14, Gas Chromatography: Diesel Range Organics

SOP_UP-GV-GRO_14, Gas Chromatography Volatiles Gasoline Range Organics (GRO)

SOP_UP-MB-8270D_BNA_14, Gas Chromatography / Mass Spectrometry - Semi-Volatiles

SOP_UP-MW-245.1_HG_14, Metals Analysis: Mercury

SOP_UP-MW-6010C_ICAP Trace_13, Metals Analysis Trace Inductively Coupled Argon Plasma

SOP_UP-MW-6020_ICP14, Metals Analysis Inductively Coupled Plasma/Mass Spectrometry

SOP_UP-MV-8260_MSVOA_13, Gas Chromatography / Mass Spectrometry: Volatiles

SOP_UP-SP-1311_TCLP_14, Toxicity Characteristic Leaching Procedure (TCLP)

SOP_UP-SP-3000_SW846MetDig_14, Sample Preparation Metals Digestion

SOP_UP-SP-3510_SepFunnel_14a, Sample Preparation Semivolatile and Nonvolatile Organic Compounds from a Wastewater or Leachate Matrix using Separatory Funnel Extraction

SOP_UP-SP-3541_Soxhlett_14a, Sample Preparation Semivolatile and Nonvolatile Organic Compounds from a Soil/Sediment Matrix Using Soxhlet Extraction

SOP_UP-SP-5035_13, Laboratory Handling, Transfer and Preservation of VOA Soil Samples Received in EnCoreTM Samplers for SW-846 Method 5035/5035A Low Concentration and 5030B

SOP_UP-WC-300.0_IC_14, Wet Chemistry Inorganic Ions by Ion Chromatography

SOP_UP-WC-1010_Flashpoint_13, Wet Chemistry Flash Point

SOP_UP-WC-3500CrB_14, Wet Chemistry Hexavalent and Trivalent Chromium

SOP_UP-WC-9095_Pnt Filter_14, Wet Chemistry Paint Filter

SOP_UP-WC-Alkalinity_14, Wet Chemistry Alkalinity

SOP_UP-WC-CN_13, Cyanide (Total/Weak Acid Dissociable/Amenable/Reactive)

SOP_UP-WC-pH_14, Wet Chemistry pH

SOP_UP-WC-Phosphorus_14, Wet Chemistry Phosphorus and Orth-Phosphorus

SOP_UP-SP-2540G_Solids_14, Determination of Total, Fixed, Volatile Solids in Solid and Semisolid Samples and Organic Matter/Fractional Organic Carbon Determination

SOP_CHI_UP_QA-QAM_Rev5_2013, Quality Assurance Manual, Revision 5, 02/04/13

Test America SOPs & Quality Assurance Manual - Knoxville

KNOX-MS-0001, VOA Canister Analysis

KNOXMS0022R3 Canister Cleaning UNC, Canister Cleaning and Preparation

Knoxville-QA-Manual-Revision-4-0_13OCT2014, Quality Assurance Manual, Revision 4.0, 10/31/2014

Test America SOPs & Quality Assurance Manual - Canton

NCWC018TOC Non Water Rev.3, Total Organic Carbon (TOC) Analysis for Non-Waters

Canton_QAM_Rev-3, Quality Assurance Manual, Revision 3, 7/15/14

Test America SOPs & Quality Assurance Manual - Nashville

2870_NV_SA04-22.16b, Method 8270C/D: Semivolatile Organic Compounds by Gas Chromatography / Mass Spectrometry (GC/MS)

QAM_R24, Quality Assurance Manual, Revision 24, August 1, 2014

CT Laboratories SOPs & Quality Assurance Manual

MT 004_Acid Digestion of Waters for Total Metals by ICP, Acid Digestion of Waters for Total Metals by ICP

MT 005_ Acid Digestion of Waters for Arsenic and Selenium by GFAA, Acid Digestion of Waters for Arsenic and Selenium by GFAA

MT 006_ Acid Digestion of Waters for Total Metals by GFAA, Acid Digestion of Waters for Total Metals by GFAA

MT 007_Acid Digestion of Solids and Semi-solids for Total Metals by GFAA and ICP, Acid Digestion of Solids and Semi-solids for Total Metals by GFAA and ICP

MT 009_Inductively Coupled Plasma (ICP) Emission – ICP-OES 6000, Inductively Coupled Plasma (ICP) Emission – ICP-OES 6000

MT 011_Graphite Furnace Atomic Absorption (GFAA), Graphite Furnace Atomic Absorption (GFAA)

MT 012_Mercury Cold Vapor Atomic Absorption (CV), Mercury Cold Vapor Atomic Absorption (CV)

PR 002_TCLP and SPLP Extraction, Volatile Fraction (ZHE), TCLP and SPLP Extraction, Volatile Fraction (ZHE)

PR 003_TCLP/SPLP Extraction, Non- Volatile Fraction, TCLP/SPLP Extraction, Non- Volatile Fraction

SV 002_Organochlorine Pesticide by GC with Extended List, Organochlorine Pesticide by GC with Extended List

SV 004_Polychlorinated biphenyls (PCBs) as aroclors by GC, Polychlorinated biphenyls (PCBs) as aroclors by GC

SV 006_Semi-volatile Organic Compounds by 8270D, Semi-volatile Organic Compounds by 8270D

SV 008_Polynuclear Aromatic Hydrocarbons by HPLC, Polynuclear Aromatic Hydrocarbons by HPLC

SV 012_Wisconsin's Diesel Range Organics by GC, Wisconsin's Diesel Range Organics by GC

SV 015_HEM-Oil Grease, HEM-Oil Grease

VO001_Dissolved methane, ethene, ethane, and carbon dioxide in water, Dissolved methane, ethene, ethane, and carbon dioxide in water

VO004_Analysis of Volatile Organic Compounds by GCMS, Analysis of Volatile Organic Compounds by GCMS

VO007_Analysis of BTEX and GRO by GC (Wisconsin), Analysis of BTEX and GRO by GC (Wisconsin)

WC001_Reactive Cyanide Screen, Reactive Cyanide Screen

WC003_Cyanide Total Amendable to Chlorination, Cyanide Total Amendable to Chlorination

WC 008_Alkalinity, Automated Colorimetric.pdf, Alkalinity, Automated Colorimetric

WC 017_Phosphorus, Total, Total Phosphorus

WC026_Solids,total, Total Soilds

WC 028_Reactive Sulfide Screen, Reactive Sulfide Screen

WC 030_Sulfide, Sulfide

WC 032_Hex Chrom, Automated Colormetric, Automated Colormetric Hex Chrom

WC 034_Flash-Point by Pensky-Martens Closed Cup Tester, Flash-Point by Pensky-Martens Closed Cup Tester

WC 037_Ion Chromatography, Ion Chromatography

WC 039_Total Organic Carbon in Water, Total Organic Carbon in Water

WC 040_Total Organic Carbon in Soil, Total Organic Carbon in Soil

QA001_Quality Assurance Manual, Quality Assurance Manual, Revision 15.1, 03/28/14

Legend Technical Services, Inc. (Legend) SOPs & Quality Assurance Manual

LABIN-003.12, Bulk Sample Identification Using Polarized Light Microscopy (EPA 600)

LABENV-039.10, Analysis of Samples by Axial ICP-AES OES (200.7, 6010C)

LEGEND QA Manual Vol 26 – Oct 2014, Legend Technical Services Quality Assurance Manual, Volume 26, October 2014

Environmental Monitoring and Technologies, Inc. (EMT) SOPs and Quality Assurance Manual

EMT-QAM Rev 12.0 2014 Final Uncontrolled; Quality Assurance Manual, Revision 12.0, 1/14/2015

SOP#	Parameter
001	Acidity/Alkalinity
029	Anions by IC
008	BOD
088	Bomb Prep. by Method 5050
8081/608/508	Chlorinated Pesticides by GC/ECD
012	COD
016	Cyanide by Midi-CN Distillation
8015/DRO/WDNR	DRO by the Wisconsin DNR Method
009	Flash Point Closed Cup
010	Flash Point Open Cup
044	FOG 1664
8015/GRO/WDNR	GRO by the Wisconsin DNR Method
8321/555	Herbicides by Method 8321
027	Hexchromium (Colorimetric)
102	Method 245.1/7470A Hg for Liquid

SOP#	Parameter
101	Method 3015 MW for WW
116	Method 3050B HB for Solid
104	Method 3051 MW for Solid
109	Method 6010C ICP-AES
119	Method 6020A ICP-MS
103	Method 7471BA Hg for Solid
013	Nitrate (NO3/NO2) by HACH 8171, Modified Cadmium Reduction
039	Paint filter
8082/608	PCBs by Method 8082 and 608
082	pH in Soil
034	Phosphorus (Total & Ortho)
8310	PNA by HPLC (Method 8310 and 610)
550	PNA by Method 550
3510	Separatory Funnel Liquid-Liquid Extraction by Method 3510C
3540	Soxlet Extraction by Method 3540C
3540/DRO/WDNR	Soxlet Extraction by Method 3540C for Diesel Range Organics (DRO) by the WDNR
055	Sulfide Total by distillation
8270C/625	SVOC by GC/MS
059	TCLP
3550B	Ultrasonic Extraction by Method 3550 B
8260B/624	VOC by Method 8260B and 624
070	ZHE

APPENDIX D – FIELD DATA SHEETS

SOP-01
Attachment A
PID Field Form

Boring Number	Sample Number	Sample Depth (feet)	Sample Odor	Sample Description	PID Headspace Analysis				Comments
					Date Collected	Time Collected	Time Analyzed	PID Response (IUI)	

Key:
PID = Photoionization Detector
iui = Instruments units as isobutylene
* = Submitted for laboratory analysis
--- = Not Analyzed or Unknown

WATER LEVEL DATA

PROJECT: _____ **WELL NUMBER:** _____

LOCATION: _____ **WELL LOCATION:** _____

PERSONNEL: _____ **RISER ELEVATION:** _____

GRADE ELEVATION: _____

DATE	TIME	MEASURING DEVICE	WATER LEVEL			COMMENTS
			DEPTH (FEET BELOW TOP OF RISER)	DEPTH (FEET BELOW GRADE)	ELEVATION (FT SD)	

MEASURING DEVICE = OWLP: Olympic Water Level Probe
TAPE: Steel or Fiberglass Measuring Tape

NOTE: All water level elevations are referenced to site datum. To convert to approximate mean sea level datum, add approximately

FIELD WATER QUALITY SAMPLING AND ANALYSIS

SHEET _____ of _____

PROJECT: _____ **PERSONNEL:** _____

LOCATION: _____

GENERAL					
Location:					
Water Source:					
Date:					
Time:					

SAMPLING CONDITIONS:					
Sampling Method:					
Sampling Depth (feet):					
Well Depth (feet):					
Static Water Level: (feet below measurement point)					
Final Purge Volume (Gal):					

FIELD MEASUREMENTS AND ANALYSIS:					
Temperature (°C):					
Specific Conductance:					
(µmhos/cm) at ambient °C: Corrected to 25°C:					
pH:					
OVM-2 (PID)					

Sampling Instruments:
Temperature:
Conductivity:
pH:
PID:

SAMPLES COLLECTED AND TREATED:					
Volatile Organic Compounds (VOCs)					
Oil and Grease					
Laboratory Sent To:					
Date:					
Sampled/Analyzed By:					

WELL DEVELOPMENT SAMPLING WORKSHEET

PROJECT ID # _____ **WELL #** _____

$V_1 + V_2$ = Well Volume

V_1 = Volume of Water in Casing

V_2 = Volume of Water in Filter Pack

D_1 = Inside Diameter of Well Casing = 0.17 feet (2.0-inch diameter)

D_2 = Outside Diameter of Well Casing = 0.20 feet (2.3-inch diameter)

D_3 = Diameter of Borehole - 8.25 inches = 0.69 feet (8.75 inches use 0.72 feet)

H_1 = Depth of Well (A) in feet minus Depth to Water (B) in feet (from ground surface)

H_2 = Height of Sandpack from Water Level to Bottom of Borehole

N = Percent Porosity of Sandpack is Constant = 35% = 0.35

$$V_1 = 3.14 \quad \frac{D_1^2 H_1}{2}$$

$$V_1 = 3.14 \quad \frac{0.17^2}{2} H_1$$

V_1 = 3.14 x .01 x _____
(H1)

V_1 = _____ cubic ft

$$V_2 = N \times 3.14 \times H_2 \quad \frac{D_3^2}{2} - \frac{D_2^2}{2}$$

$$V_2 = 0.35 \times 3.14 \times H_2 \frac{0.69^2}{2} - \frac{0.20^2}{2}$$

V_2 = 0.35 x 3.14 x _____ x (0.119 - .01)
(H2)

V2 = _____ cubic ft

$V_1 + V_2$ = ___ cubic ft + ___ cubic ft

= _____ cubic feet

_____ cubic ft x 7.48 gal/cubic ft =

_____ gal/well volume

If well cannot be purged dry:
Three consistent readings of pH, temperature, and conductivity, and try to obtain sediment free water and ten well volumes if practical

10 x _____ gal/well volume
= _____ gallons (or when sediment free)

If well can be purged dry:
Three consistent readings of pH, temperature, and conductivity, and try to obtain sediment free water and three well volumes if practical.

3 x _____ gal/well volume
= _____ gallons (or when sediment free)

Water Sampling Procedure Record

Project Name:_____

Project No.: _____

1. Water Level Before Purging:_____ ft. below top of PVC well pipe (Meter Used:)

2. Purging:
   Start: Date: _____ Time: _____
   End: Date: _____ Time: _____

   Purging Device:_____
   Volume of Water Removed (approximate): ____ gallons _____ well volumes

3. Sampling:
   Start: Date: _____ Time: _____
   End: Date: _____ Time: _____

   Time Elapsed Between Purging and Sampling: ____ hours _____minutes
   Sampling Device: _____
   Procedure for Cleaning Sampler:_____

4. Field Parameters (____ pre-filtered _____ post-filtered):

   a. Conductivity: _____ µmhos/cm
      Meter Used: _____
   b. pH: _____ SU
      Method Used: _____
   c. Temperature: _____ ° F _____ ° C
   d. Dissolved O_2: _____ ppm
      Method Used: _____
   e. Color: _____
   f. Odor: _____
   g. Turbidity:_____

5. Sample Transportation: **packed in ice, placed in Cooler No.**

6. Well Condition: _____

7. Site/Weather Conditions:_____

8. Sample Collection Information (Volume, Preservatives, Containers, etc.):

_____
_____
_____
_____
_____
_____
_____

WELL DEVELOPMENT/PURGE SUMMARY

Well - _____

Project:
Project #:
Location:
Personnel:

Well Coordinates:
PVC Riser Elevation:
Ground Level Elevation:
Constructed Well Depth:
Well Casing Inside Diameter:

Instruments
Temperature:
Conductivity:
pH Meter:
Water Level Probe:
Other:

Date	Time	Method	Water Level (ft./msl)	Measured Well Depth (ft.msl)	Volume Purged** (gallons)	Apppearance Color/Odor/Clarity	pH (s.u.)	Temp. (^oC)	Elec. Cond. (umhos/cm) Measured	Elec. Cond. (umhos/cm) at 25^oC	Comments

NOTE:

* Record both initial and final measurements when using as Well Development Summary
** Purge four borehole volumes, if possible, prior to sampling.

SOP NO. 5 - SHALLOW SURFACE WATER SAMPLE COLLECTION

SURFACE-WATER DATA: PHYSICAL PARAMETERS

Date: _____ Lake: _____

Location	Secchi Disk (feet)	Dissolved Oxygen (mg/l)	Temperature #VALUE!	Conductivity µmhos per/cm	pH	Comments (i.e. Instrumentation)

SOP NO. 5 - SHALLOW SURFACE WATER SAMPLE COLLECTION

SURFACE-WATER PROFILE DATA

Date: _____ Lake: _____

Depth (feet below surface)	Temperature #VALUE!	Dissolved Oxygen (mg/l)	Conductivity µmhoms per/cm"	pH	Comments (i.e. Instrumentation)

Example Sample Labels and Custody Seals

CUSTODY SEAL

DATE _____

SIGNATURE _____

QEC
Quality Environmental Containers
800-255-3950 • 304-255-3900

QEC
Quality Environmental Containers

P.O. Box 1160
Beaver, WV 25813
800-255-3950 • 304-255-3900

PROJECT NAME	
SAMPLE ID	SAMPLE DATE
SAMPLED BY	SAMPLE TIME
PRESERVATIVE	_____ GRAB _____ COMPOSITE
ANALYSIS REQUESTED	

Pace Analytical®
www.pacelabs.com

Pace Analytical Services, Inc.
1241 Bellevue Street, Ste. 9
Green Bay, WI 54302
(920) 469-2436

Client: _____

Client Sample ID: _____

Date Collected: _____ Time: _____

Collected by: _____

Analysis: _____

Preservatives: ☐None ☐HNO_3 ☐H_2SO_4 ☐NaOH ☐HCl
☐$Na_2S_2O_3$ ☐MeOH ☐Zn Acetate ☐Other: _____

TestAmerica Chicago
2417 Bond Street

University Park, IL 60484
phone 708.534.5200 fax 708.534.5363

Chain of Custody Record

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

TestAmerica Laboratories, Inc.

Regulatory Program: ☐ DW ☐ NPDES ☐ RCRA ☐ Other:

Client Contact	**Project Manager:**	**Site Contact:**	**Date:**	COC No:
Your Company Name here	**Tel/Fax:**	**Lab Contact:**	**Carrier:**	_____ of _____ COCs
Address	**Analysis Turnaround Time**			Sampler:
City/State/Zip	☐ CALENDAR DAYS ☐ WORKING DAYS			**For Lab Use Only:**
(xxx) xxx-xxxx Phone	TAT if different from Below _____			Walk-in Client:
(xxx) xxx-xxxx FAX	☐ 2 weeks			Lab Sampling:
Project Name:	☐ 1 week			
Site:	☐ 2 days			Job / SDG No.:
P O #	☐ 1 day			

Sample Identification	**Sample Date**	**Sample Time**	**Sample Type** (C=Comp, G=Grab)	**Matrix**	**# of Cont.**	**Filtered Sample (Y / N)**	**Perform MS / MSD (Y / N)**																	Sample Specific Notes:

Preservation Used: 1= Ice, 2= HCl; 3= H2SO4; 4=HNO3; 5=NaOH; 6= Other _____

Possible Hazard Identification:
Are any samples from a listed EPA Hazardous Waste? Please List any EPA Waste Codes for the sample in the Comments Section if the lab is to dispose of the sample.

☐ Non-Hazard ☐ Flammable ☐ Skin Irritant ☐ Poison B ☐ Unknown

Sample Disposal (A fee may be assessed if samples are retained longer than 1 month)

☐ Return to Client ☐ Disposal by Lab ☐ Archive for_____ Months

Special Instructions/QC Requirements & Comments:

Custody Seals Intact: ☐ Yes ☐ No | Custody Seal No.: | Cooler Temp. (^{o}C): Obs'd:_____ Corr'd:_____ Therm ID No.:_____

Relinquished by:	Company:	Date/Time:	Received by:	Company:	Date/Time:
Relinquished by:	Company:	Date/Time:	Received by:	Company:	Date/Time:
Relinquished by:	Company:	Date/Time:	Received in Laboratory by:	Company:	Date/Time:

APPENDIX E – STANTEC FIELD SOPS

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Identifier: SOP-01	Revision: 0	Effective Date: 10/31/2012	Stantec
Author: Stu Gross			

Standard Operating Procedure

for:

VOLATILE ORGANIC COMPOUND FIELD SCREENING FOR SOIL AND SEDIMENT

Responsible QA Manager:	
Richard J. Binder, P.G.	

SOP-01
Volatile Organic Compound Field Screening for Soil and Sediment

Revision Log

Revision No.	***Effective Date***	***Prepared By***	***Description of Revisions***	***Affected Pages***
0	10/31/2012	Stu Gross	New Procedure	All

SOP-01
Volatile Organic Compound Field Screening for Soil and Sediment

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List of Acronyms and Abbreviations

eV	electronvolt
FID	flame ionization detector
IWD	integrated work document
PPE	personal protective equipment
ppm	part per million
PID	photoionization detector
FID	Flame ionization detector
SOP	standard operating procedure
SSHASP	site-specific health and safety plan
uV	ultraviolet
VOC	volatile organic compound

SOP-01
VOLATILE ORGANIC COMPOUND FIELD SCREENING FOR SOIL AND SEDIMENT

1.0 PURPOSE

The purpose of this standard operating procedure (SOP) is to ensure qualitative field screening of soil and sediment samples is performed consistently.

2.0 SCOPE

All Stantec project participants shall implement this procedure when performing headspace vapor screening on soil or sediment samples using a photoionization detector (PID). A PID is capable of detecting and measuring real-time concentrations of many organic vapors in air. This screening technique is used primarily to identify and soil samples (if any) that may contain volatile organic compounds (VOCs) and to select samples for possible subsequent laboratory analysis. This vapor screening SOP is <u>not</u> for screening to be performed as part of health and safely monitoring.

3.0 TRAINING

3.1 Stantec project participants shall train (e.g., by reading and/or completing on-the-job or classroom training) to and use the current version of this procedure.

3.2 The responsible Stantec project leader shall monitor the proper implementation of this procedure.

3.3 The responsible field leader shall ensure that Stantec project participants complete all training assignments applicable to this procedure.

4.0 DEFINITIONS

4.1 <u>Integrated work document (IWD)</u> - Hazard control documentation that integrates work definition, hazards, and controls for work authorization and user-friendly communication to the workers. The IWD may be a subset of a larger “work package,” such as the field readiness review package, that includes other documents and information relating to an activity, but not addressing hazard controls.

4.2 <u>Photoionization detector (PID)</u> - The PID is a portable, nonspecific, vapor/gas detector employing the principle of photoionization to detect and measure real-time concentrations of a variety of chemical compounds, both organic and inorganic, in air.

4.3 <u>Stantec project participant</u> - An inclusive term for any Stantec employee, deployed worker, or subcontractor, inclusive of project leaders, team leaders, and project personnel, who participates in activities conducted as part of Stantec projects.

4.4 Site-specific health and safety plan (SSHASP) - Health and safety plan that is specific to a site or related field activity that has been approved by a Stantec health and safety representative. This document contains information specific to the project including scope of work, relevant history, descriptions of hazards by activity associated with the project site(s), and techniques for exposure mitigation (e.g., personal protective equipment [PPE]) and hazard mitigation.

5.0 RESPONSIBLE PERSONNEL

The following identifies the personnel responsible for actions in this procedure:

- Field Leader
- Project Leader
- Quality Assurance/Quality Control Officer
- Project Participants

6.0 BACKGROUND AND PRECAUTIONS

6.1 Use this procedure in conjunction with an approved SSHASP.

6.2 Record any deviation from this procedure in the field notebook.

6.3 As with any field instrument, accurate results depend on the operator's complete familiarity with the operator's manual. Follow the instructions in the operating manual explicitly in order to obtain accurate results, while taking care to prevent the PID's exposure to excessive moisture, dirt, or contamination.

6.4 The PID employs the principle of photoionization. The analyzer responds to most vapors that have an ionization potential less than or equal to that supplied by the ionization source, which is an ultraviolet (UV) lamp. Photoionization occurs when an atom or molecule absorbs a photon of sufficient energy to release an electron and form a positive ion. This occurs when the ionization potential of the molecule in electron volts (eV) is less than the energy of the photon. The sensor is housed in a probe and consists of a sealed ultraviolet light source that emits photons with an energy level high enough to ionize many trace organics, but not enough to ionize the major components of air (e.g., nitrogen, oxygen, carbon dioxide). The ionization chamber exposed to the light source contains a pair of electrodes, one a bias electrode, and the second the collector electrode. When a positive potential is applied to the bias electrode, it creates an electro-magnetic field in the chamber. Ions formed by the adsorption of photons are driven to the collector electrode. The current produced is then measured and the corresponding concentration displayed on a meter, directly, in units above background, usually parts per million (ppm). Three probes, each having a different eV lamp and a different ionization potential, are available for use with the PID; the light energies are 9.5, 10.2, and 11.7 eV. All three probes detect various aromatic and large molecular hydrocarbons. In addition, the 10.2 eV and 11.7 eV probes detect some smaller organic molecules and halogenated hydrocarbons. Gases with ionization potentials near to or less than those of the lamp are ionized. These gases are thus detected and measured by the analyzer. Gases with ionization potentials higher than that of the lamp are not detected. The

selection of the appropriate probe is essential in obtaining useful field results. Though it can be calibrated to a particular compound, the instrument cannot distinguish between detectable compounds in a mixture of gases and, therefore, indicates an integrated response to the mixture. A PID is similar to a flame ionization detector (FID) in application. However, the PID is unable to respond to certain low molecular weight hydrocarbons, such as methane and ethane that are readily detected by FID instruments.

6.5 In all instances, document and associate the ultimate procedures employed with the final report.

6.6 PID Instrument Limitations

- The PID is a nonspecific total vapor detector. Do not use to identify unknown substances; it only roughly quantifies them.
- The PID is calibrated to the concentration of a specific compound.
- The PID does not respond to certain low molecular weight hydrocarbons, such as methane and ethane.
- The PID does not detect a compound if the probe has a lower energy than the compound's ionization.
- The PID does not detect certain toxic gases and vapors, such as carbon tetrachloride and hydrogen cyanide, which possess high ionization potentials.
- Certain models of PID instruments are not intrinsically safe; use in conjunction with a combustible gas indicator.
- Electrical power lines or power transformers may cause interference with the instrument and thus cause measurement errors. Static voltage sources such a power lines, radio transmissions, or transformers may also interfere with measurements.
- High winds and high humidity affects measurement readings. The PID may become unusable under foggy or humid conditions. An indication of this is a slow constant climb on the read-out dial.
- Periodically clean the lamp window to ensure ionization of the new compounds by the probe (i.e., new air contaminants).
- The PID measures concentrations from about 1-2,000 ppm, although the response is not linear over this entire range. For example, if calibrated to benzene, the response is linear from about 0-600 units (ppm) above background. This means the PID reads a true concentration of benzene only between 0 and 600 ppm. Greater concentrations are detected at a lower level than the true value.
- Do not expose this instrument to precipitation (e.g., rain). The units are not designed for operation under wet conditions.
- Do not use this instrument for headspace analysis where liquids are inadvertently drawn into the probe.

7.0 EQUIPMENT

- Photoionization Detector (PID)
- Ziploc® bags or similar locking-type bags
- Glass mason jars

- Aluminum foil
- Permanent Marker (i.e., Sharpie®)
- Field book

8.0 PROCEDURE

Field screening of potential soil or sediment contamination is accomplished by performing a headspace analysis on air in contact with a soil or sediment sample enclosed within a new Ziploc® bag or clean glass jar. Samples used for field screening shall not be used for other analyses for chemical constituents.

8.1 Perform Field Calibration

Calibrate PID in accordance with the manufacturer's specifications. The PID is calibrated using zero air and 254 ppm isobutylene gas. Refer to SOP-09 for the instructions on daily calibration of the PID prior to use.

8.2 Headspace Field Screening

(a) Label new Ziploc® bag with the sample identification number.

(b) Place representative soil or sediment sample in Ziploc® or similar "locking-type" bag until bag is approximately one-half full. Capture approximately 1 quart of air in the bag. Seal Ziploc® bag and homogenize sample (i.e., shake well).

(c) Place bag on a stationary surface preferably in a warm environment to allow the headspace to come to equilibrium with the soil or sediment sample. The length of time the headspace is allowed to equilibrate will depend on the ambient temperature and humidity conditions. The following are general guidelines for minimum equilibration times in different ambient air conditions:

Ambient Temperature (°F)	Minimum equilibration times
> 90°	2 minutes
> 70° but ≤ 90°	5 minutes
> 50° but ≤ 70°	10 minutes
≤ 50°	15 minutes

It should be noted that in very hot conditions, a buildup of water vapor in the bag may occur if the bag and sample are heated for too long that may interfere with the operation of the PID.

(d) Insert the tip of the PID probe into the headspace of the Ziploc® bag by piercing it with the probe. Avoid making contact with the soil or sediment sample with the instrument tip to prevent the sample from being drawn into the instrument.

(e) Move soil or sediment around in the bag while the instrument is reading. Record the highest sustained reading in the field book.

(f) A clean glass jar (1 pint size or larger “mason” type jar with screw on metal cap) can be substituted for the Ziploc® bag in the procedure described above.

8.3 Visual and Olfactory Screening

Visual and olfactory screening consists of inspecting the soil and sediment for the presence of stains and odor indicative of residual petroleum hydrocarbons.

(a) Visually inspect and smell soil or sediment sample. Indications of the presence of petroleum hydrocarbons typically include a mottled appearance or dark discoloration of the soil or sediment.

(b) Record observations in the field book. Visual observations do not definitely indicate the presence of petroleum hydrocarbons.

8.4 Quality Assurance Blanks

Blank samples will be measured to determine if any contamination is being introduced as part of the measurement procedure. One PID blank sample will be performed for each 10 samples measured. The measurement procedure for field PID blanks is given below:

The headspace measurement procedure outlined in Section 8.2 should be followed, but no sample should be placed in the Ziploc® bag or glass jar, as no universal soil blank has been accepted. A headspace reading of the Ziploc® bag or glass jar should be taken after the Ziploc® bag or glass jar has been opened, resealed, and allowed to sit until it reaches ambient temperature as noted above.

9.0 RECORDS

The project leader shall submit the following records to central filing.

- Completed field notebook
- Completed field forms, where appropriate

10.0 ATTACHMENTS

Attachment A – Stantec Field PID Data Recording Form (1 page)

SOP-01
Attachment A
PID Field Form

Boring Number	Sample Number	Sample Depth (feet)	Sample Odor	Sample Description	PID Headspace Analysis				Comments
					Date Collected	Time Collected	Time Analyzed	PID Response (IUI)	

Identifier: SOP-02	Revision: 2	Effective Date: 04/24/2015	Stantec
Author: Stu Gross			

Standard Operating Procedure

for:

SOIL SAMPLE COLLECTION

Responsible QA Manager: Richard J. Binder, P.G.	

SOP-02
Soil Sample Collection

Revision Log

Revision No.	*Effective Date*	*Prepared By*	*Description of Revisions*	*Affected Pages*
0	10/31/12	Stu Gross	New Procedure	All
1	04/15/13	Michael Nied	QAPP revisions per request	9 & 10
2	04/23/15	Dave Constant	Removed Subcontractor Reference from Section 2	5

SOP-02
Soil Sample Collection

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List of Acronyms and Abbreviations

ASTM	American Society for Testing and Materials
C	Centigrade
DRO	Diesel range organics
FL	field leader
G	Gram
GRO	Gasoline range organics
LCD	Liquid crystal display
PAHs	Polynuclear aromatic hydrocarbon
PCBs	Polychlorinated biphenyls
PID	Photoionization detector
PPE	personal protective equipment
PL	Project Leader
QAPP	quality assurance project plan
QP	quality procedure
QA/QC	quality assurance/quality control
SAP	Sampling and analysis plan
SOP	standard operating procedure
SSHASP	site-specific health and safety plan
SSWP	Site-specific work plan
SVOCs	Semi-volatile organic compounds
TOC	Total organic carbon
VOC	volatile organic compound

SOP-02
SOIL SAMPLE COLLECTION

1.0 PURPOSE

The purpose of this standard operating procedure (SOP) is to describe the procedures for the collection of representative soil samples. Sampling locations and depths are assumed to be those that can be reached with the use of direct-push or conventional hollow-stem drilling methods (i.e., Geoprobe® or hand operated hydraulic push-probe system).

These are standard (i.e., typically applicable) operating procedures which may be varied or changed as required, dependent upon site conditions, equipment limitations or limitations imposed by the procedure. In all instances, the actual procedures used should be documented and described in an appropriate site report.

2.0 SCOPE

2.1 All project participants shall implement this mandatory SOP.

3.0 TRAINING

3.1 Stantec project participants shall train to and use the current version of this SOP; contact the author if the SOP text is unclear.

3.2 The responsible Project Leader (PL) shall monitor the proper implementation of this procedure and ensure that the appropriate personnel complete all applicable training assignments.

4.0 DEFINITIONS

4.1 Shelby tube - A single-piece metal tube, of thin gauge, which is forcefully driven into the soil or sediment at the bottom of a borehole to collect an undisturbed subsurface soil or sediment sample.

4.2 Split-spoon sampler - A multi-piece sampler which is threaded onto the end of a drill rod or hand auger and forcefully driven into the soil or sediment at the bottom of a borehole to collect an undisturbed subsurface soil or sediment sample.

4.3 Site-specific health and safety plan (SSHASP) - Health and safety plan that is specific to a site or related field activity that has been approved by the project health and safety representative. This document contains information specific to the project including scope of work, relevant history, descriptions of hazards by activity associated with the project site(s), and techniques for exposure mitigation (e.g., personal protective equipment [PPE]) and hazard mitigation.

5.1 RESPONSIBLE PERSONNEL

The following personnel are responsible for activities identified in this procedure:

- Data Steward
- Field Leader
- Field Member
- Geologist
- Project Leader
- QA/QC Officer
- Project Participants

6.0 BACKGROUND AND PRECAUTIONS

6.1 Project participants shall use this SOP in conjunction with an approved SSHASP.

6.2 Background

6.2.1 Split-Spoon Sampler

6.2.1.1 A split-spoon sampler is used to take subsurface soil or sediment samples by forcefully driving the sampler into the soil or sediment at the bottom of a borehole. Samples may be retrieved along the entire length of the borehole to obtain an unbroken record of the subsurface layers, or samples may be retrieved at selected intervals.

6.2.1.2 The split spoon is threaded onto the end of the drill rod and lowered to the bottom of the boring by a heavy steel cable connected to the drilling mast. The sampler is forced into the soil by a drive weight that is dropped repeatedly onto the drive head located at the top of the drill rod. In some designs, the split-spoon sampler is threaded onto a drill stem and placed inside a hollow stem auger. As the auger is rotated and lowered, the split-spoon sampler is advanced along with the drill bit, using the drill rig's drive weight.

6.2.1.3 The sampler is driven into the soil to a depth about six inches shorter than the length of the sampler itself. Split-spoon samplers are available in a variety of lengths and diameters for use in a variety of applications. Occasionally, bedrock or extremely compacted sediments are encountered which make further advance of the sampler extremely difficult or impossible without damage to the sample. This condition is known

as “refusal” and is defined as a “penetration of less than one foot for 100 blows” (a blow is the act of striking a drive rod with a drive weight). Six inches for 50 blows is also commonly recognized as “refusal.” Upon “refusal,” either abandon the borehole or remove and replace the sampler with a drill bit.

6.2.1.4 A hand auger may also perform split-spoon sampling. The split spoon is threaded onto the end of a hand-driven drill rod, in place of the auger/bit. The split spoon is advanced into the borehole by manually turning the hand auger. In all other respects, hand-augured, split-spoon sampling is identical to hydraulically-driven, split-spoon sampling.

6.2.2 Shelby-Tube Sampler

The Shelby tube is a similar type of sampling apparatus. The split spoon is a multi-piece sampler; the Shelby tube is a single-piece metal tube of thinner gauge. Like the split spoon, soil is forced into the Shelby tube and stored inside. However, because the Shelby tube is typically advanced hydraulically, it allows the capture of a relatively undisturbed sample. Due to the Shelby tube’s thinner walls and sharp cutting edge, the Shelby tube requires much less effort to push into the soil. Take care not to compress the soil sample by forcing the tube in deeper than its own length.

6.2.3 GeoProbe® Soil Sampling

Geoprobe® is a brand name for hydraulically-powered, direct push machines that use both static force and percussion to advance sampling and logging tools into the subsurface. The first Geoprobe® brand machine was built for the Environmental Protection Agency in 1988. A Geoprobe® direct push machine is a common method for obtaining continuous soil cores or discrete soil samples.

6.3 Precautions

This procedure is limited to the activities of collecting soil and sediment samples for (1) field monitoring and laboratory analysis of concentrations of hazardous constituents, (2) soil/sediment physical characteristics, or (3) geologic logging. This SOP does not address drilling activities, removal of time-sensitive geologic analytical samples, core documentation, lithologic description, packaging of core material, or temporary storage of borehole materials.

7.0 EQUIPMENT

A checklist of suggested equipment and supplies needed to implement this procedure is provided below.

EQUIPMENT AND SUPPLIES CHECKLIST FOR SOIL SAMPLE COLLECTION

√	Quantity	Description
		Sampling and Analysis Plan (SAP)
		Site Specific Health and Safety Plan (SSHASP)
		SOP-1
		SOP-8
		Field book
		Waterproof ink pen and permanent marker
		Camera
		Plastic Sheeting
		Auger rig, Geoprobe®, or hand operated direct push sampling system (i.e., KV sampling system)
		Plastic sampling sleeves
		Utility knife
		Wrenches
		55-gallon steel drums
		Bentonite
		Assorted geology supplies (e.g., hand lens, grain size card, scales, etc.)
		Field boring log forms
		Munsell soil color chart
		Photoionization Detector (PID)
		Ziploc® bags or similar “locking” standard quart-sized plastic bags
		Sample containers
		Sample labels
		Stainless steel or plastic spoon
		Stainless steel, plastic, or other appropriate homogenization bucket, bowl or pan
		Appropriate soil sample containers
		Power-Stop® handle and plastic syringes, if sampling for GRO, DRO, and/or VOCs
		Pre-measured methanol provided by the laboratory, if sampling for GRO and/or VOCs
		Portable standard balance
		AA Batteries
		Sample labels
		Appropriate PPE (i.e., disposable gloves, steel toe boots, hard hat)
		Insulated cooler, ice and chain-of-custody seals
		Decontamination equipment (SOP-8)
		Other -
		Other -

8.0 PROCEDURE

Field team members shall follow the procedures outlined below for collecting soil samples:

(a) Review proposed sample locations and mark with stakes or flags. If required, the proposed locations may be adjusted based on site access, property boundaries, underground utilities, or subsurface obstructions.

(b) Confirm that all utilities have been cleared before beginning work.

(c) Complete sample container labels with the sample identification number, the analysis type, sampler's initials, and date on appropriate sample containers.

(d) Set up soil sample log table in field book as follows:

Sample ID	Depth	T/T (Time Taken)	T/A (Time Analyzed)	PID Reading	Odor	Sample Description

(e) Operate Geoprobe® or KV system in accordance with manufacturer's instructions. Drill to first sampling depth as described in the SAP.

(f) If probe is refused, up to two additional attempts should be made, slightly varying the position of the sampling device. If it becomes obvious that major subsurface impediment is precluding sampling, an alternate sampling location must be selected, if necessary.

(g) Photograph sample location.

(h) Once the sleeve with the soil sample is retrieved from the direct-push system, place the soil sleeve on a sheet of plastic and cautiously slice the top of the sleeve open with a clean utility knife or sleeve knife so as not to disturb the soil.

(i) Calibrate standard portable balance in accordance with manufacturer's instructions.

(j) Collect the VOC and field screening samples first followed by gasoline range organics (GRO) portion of the soil samples next, if specified in the SAP, using the same procedure. However, if approved by the laboratory, GRO analysis may be preformed on the same jar as the VOC analysis (methanol preserved samples only). Place remaining soil in a Ziploc® bag for field screening analysis and follow the soil field screening procedures in SOP-1.

The VOC soil sample will be collected using a pre-cleaned, disposable, small-diameter core sampler (i.e., Terra Core, Easy-Draw Syringe, or Power-Stop Handle). The small-diameter core sampler must be able to deliver a minimum of a 5-gram sample into a 40-mL VOA vial.

VOCs are to be collected as quickly as possible after the soil is removed from the ground, from as undisturbed portion of the soil as possible or from a freshly exposed part of the sample. Once the soil sample is collected, remove any excess material that extends beyond the end of the syringe and cap. Remove the syringe from the handle and extrude the required number of 5-gram soil "plugs" into the laboratory provided pre-tared amber glass containers containing laboratory supplied methanol preservative in the appropriate quantities to achieve an approximate 1:1 ratio of soil to preservative. For 40-mL vials containing 10 mL of methanol, insert two 5-gram plugs of soil (10 grams total). For 60 mL jars containing 25 mL methanol, a larger TerraCore sampler that can collect 25 grams of soil should be used. After the addition of the soil to the vials, the vials will be gently swirled to totally immerse the soil in the methanol preservative.

Please note that some laboratories may supply pre-tared sample vials or jars with the methanol preservative in a separate ampoule. In the instance, add the methanol immediately following the placement of soil plugs into the container.

For each sample collected, fill an additional empty container without preservative for dry weight analysis.

The small-diameter core samplers cannot be used for storage or shipment to the laboratory. The soil samples must be transferred into appropriate sample containers immediately upon sample collection for proper preservation.

(k) Collect the diesel range organics (DRO) portion of the soil samples, if specified in the SAP. Place 2 or 4 ounce glass sample jar on the balance's platform and press the "ZERO" button until the LCD display reads "0 g". Using a stainless steel or plastic spoon place soil in jar until the LCD display reads "25 g". Remove the sample jar from the balance platform and immediately cap the jar tightly.

(l) Describe soil in accordance with American Society Testing Materials (ASTM) Method D2488: *Practice for Description and Identification of Soils* on a field boring log form.

(m) Place the remainder of the soil from the sleeve into a stainless steel, plastic, or other appropriate homogenization container, and mix thoroughly with a stainless steel or plastic spoon to obtain a homogenous sample representative of the entire sampling interval. Then place a level amount of soil into appropriate sample containers and secure the caps tightly. Fill sample containers in the order of most volatile to least volatile, in accordance with the SAP: semi-volatile organic compounds (SVOCs), polynuclear aromatic hydrocarbons (PAHs), polychlorinated biphenyls (PCBs), pesticides, herbicides, metals, total organic carbon (TOC), and percent solids. Place remaining soil in a Ziploc® bag for field screening analysis and follow the soil field screening procedures in SOP-1.

(n) Finish labeling sample containers with the time of collection. Place the samples in bubble-wrap bags. Then place the bubble wrapped samples in a Ziploc® bag. Label Ziploc® bag with the sample identification and project number. Place soil samples in an insulated cooler and chill to </= 6° Centigrade (C).

(o) Complete sample log table in the field book.

(p) Dispose of used sample sleeve in a plastic bag and decontaminate soil sampling equipment (i.e., sample tube, stainless steel spoons and homogenizing bowls) in accordance with SOP-8 and change sampling gloves. Discard gloves in a plastic bag for disposal. Containerize any remaining unused soil from the sample sleeve and from the PID bag in a 55-gallon drum.

(q) Continue drilling to the next sampling interval and collect samples as outlined in Steps G through O.

(r) Upon reaching the final depth of the borehole and the completion of soil sample collection, abandon the borehole with bentonite.

(s) Move to next proposed sample/borehole location and repeat above procedure.

9.1 RECORDS

The Field Leader shall supervise all data entry activities and submit the following records to central filing:

- Complete field notebook
- Field boring logs for each soil boring location

10.1 REFERENCES

To properly implement this SOP, project participants should become familiar with the contents of the following documents:

- ASTM Method D2488: Practice for Description and Identification of Soils
- SOP-01, Volatile Organic Compound Field Screening for Soil and Sediment
- SOP-08, Equipment Decontamination

Identifier: SOP-03	Revision: 1	Effective Date: 4/23/2015	
Author: Stu Gross			

Standard Operating Procedure

for:

SEDIMENT SAMPLE COLLECTION IN SHALLOW SURFACE WATER

Responsible QA Manager: Richard J. Binder, P.G.	

SOP-03
Sediment Sample Collection in Shallow Surface Water

Revision Log

Revision No.	***Effective Date***	***Prepared By***	***Description of Revisions***	***Affected Pages***
0	10/31/12	Stu Gross	New Procedure	All
1	04/23/15	Dave Constant	Removed Subcontractor Reference from Section 2	5

SOP-03
Sediment Sample Collection in Shallow Surface Water

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List of Acronyms and Abbreviations

ASTM	American Society for Testing and Materials
C	Centigrade
FL	Field Leader
PID	Photoionization detector
PPE	personal protective equipment
PL	Project Leader
QAPP	Quality assurance project plan
QA/QC	Quality Assurance/Quality Control
SAP	Sampling and analysis plan
SOP	standard operating procedure
SSHASP	site-specific health and safety plan
SSWP	Site specific work plan
VOC	volatile organic compound

SOP-03
SEDIMENT SAMPLE COLLECTION IN SHALLOW SURFACE WATER

1.0 PURPOSE

The purpose of this standard operating procedure (SOP) is to describe the procedures for the collection of representative sediment samples in shallow surface water.

These are standard (i.e., typically applicable) operating procedures which may be varied or changed as required, dependent upon site conditions, equipment limitations or limitations imposed by the procedure. In all instances, the actual procedures used should be documented and described in an appropriated site report.

2.0 SCOPE

2.1 All Stantec project participants shall implement this mandatory SOP.

3.0 TRAINING

3.1 Stantec project participants shall train to and use the current version of this SOP; contact the author or the QA/QC Officer if the SOP text is unclear.

3.2 The responsible Project Leader (PL) shall monitor the proper implementation of this procedure and ensure that the appropriate personnel complete all applicable training assignments.

4.0 DEFINITIONS

4.1 Site-specific health and safety plan (SSHASP) – A health and safety plan that is specific to a site or related field activity that has been approved by a Stantec health and safety representative. This document contains information specific to the project including scope of work, relevant history, descriptions of hazards by activity associated with the project site(s), and techniques for exposure mitigation (e.g., personal protective equipment [PPE]) and hazard mitigation.

5.1 RESPONSIBLE PERSONNEL

The following personnel are responsible for activities identified in this procedure:

- Field Leader
- Field Member
- Project Leader
- QA/QC Officer
- Stantec project participants
- User

6.0 BACKGROUND AND PRECAUTIONS

6.1 Stantec project participants shall use this SOP in conjunction with an approved SSHASP.

6.2 Depending upon the constituents expected at a sampling location, a site-specific safety screening may be required prior to sample collection. The SSHASP details these requirements, on a site-specific basis.

7.0 EQUIPMENT

A checklist of suggested equipment and supplies needed to implement this procedure is provided below.

EQUIPMENT AND SUPPLIES CHECKLIST FOR SEDIMENT SAMPLE COLLECTION IN SHALLOW SURFACE WATER

√	Quantity	Description	Comments
		Site Specific Sampling and Analysis Plan (SSSAP)	
		Health and Safety Plan (HASP)	
		SOP-1 (Volatile Organic Compound Field Screening for Soil and Sediment)	
		SOP-2 (Soil Sample Collection)	
		SOP-8 (Equipment Decontamination)	
		Field book	
		Waterproof ink pen and permanent marker	
		Camera	
		Stainless steel shovel, trowel, or spoon	
		Photoionization Detector (PID)	
		Ponar® grab (or equivalent), in deep water, if applicable	
		Sample containers	
		Sample labels	
		Assorted geology field logging equipment and supplies (e.g., hand lens, grain size card, scales, etc.)	
		Insulated cooler	
		Chain-of-custody seals	
		Ziploc® bags or similar “locking” plastic bags	
		Ice	
		Decontamination equipment (per SOP-8)	
		Other -	
		Other -	
		Other -	
		Other -	
		Other -	

8.0 PROCEDURE

Field team members shall follow the procedures outlined below when performing sediment sampling in shallow surface water.

(a) After collection of surface water samples at a location (if applicable), use a clean stainless steel shovel or trowel to scrape away surficial organic material (grass, leaves, etc.).

(b) Collect sediment for analysis using a stainless steel shovel, trowel, or spoon from the surface to approximately 4 inches below sediment surface. Place sediment in a stainless steel bowl and fill volatile organic compounds (VOCs) sample containers for laboratory analysis as discrete grab samples. Samples collected for VOC analysis should not be composited but collected and should be collected from a discrete location within the depth interval.

(c) Samples on which VOC analysis may be performed should be collected in accordance with the Steps I through M outlined in SOP-2. Empty remaining contents of shovel/trowel into a clean stainless steel bowl or pan. Place a representative amount of sediment (i.e. approximately one-half full) in a quart-size Ziploc® bag for field screening analysis. Properly label sample jars and bag with appropriate sample labels.

(d) Homogenize remaining sediment within bowl/pan with a clean stainless steel trowel or spoon. Remove rocks, twigs, leaves and other debris as appropriate. If laboratory analysis for additional parameters is required, fill the appropriate sample containers. Repeat Step B until enough sediment is collected to fill all other required sample containers in accordance with the Steps I through M outlined in SOP-2.

(e) Field screen sediment samples in accordance with SOP-1. Record the result on the sample log form and in the field book.

(f) Describe sediment in accordance with American Society for Testing and Materials (ASTM) *D2488, Standard Practice for Description and Identification for Soils* on the sample log form and in the field book.

(g) Complete sample logs, labels, custody seals, and chain-of-custody forms. Record sample information in the field book.

(e) Place the analytical samples in coolers for shipment and chill to </= 6° Centigrade (C).

(f) Decontaminate sampling equipment in accordance with SOP-8.

(g) EnCore sampling tubes should not be used for collection of sediment samples due to the possibility of the tubes cracking when frozen.

9.1 RECORDS

The FL shall complete data entry tasks and submit the following records to central filing.

- Completed field notebook

10.0 REFERENCES

ASTM D2488, *Standard Practice for Description and Identification for Soils*

Stantec. 2012. Standard Operating Procedure No. 1, Volatile Organic Compound Field Screening for Soil and Sediment (Revision 0, October 31, , 2012)

Stantec. 2012. Standard Operating Procedure No. 2, Soil Sample Collection (Revision 0, November 23, 2012),

Stantec. 2012. Standard Operating Procedure No. 6, Equipment Decontamination (Revision 0, October 31, 2012)

Identifier: SOP-04	Revision: 2	Effective Date: 04/23/2015	Stantec
Author: Stu Gross			

Standard Operating Procedure

for:

GROUNDWATER SAMPLE COLLECTION

Responsible QA Manager: Richard J. Binder, P.G.	

SOP-04
Groundwater Sample Collection

Revision Log

Revision No.	*Effective Date*	*Prepared By*	*Description of Revisions*	*Affected Pages*
0	10/31/2012	Stu Gross	New Procedure	All
1	04/17/2013	Michael Nied	QAPP revisions per request	7, 10
2	04/23/2015	Dave Constant	Removed Subcontractor Reference from Section 2. Removed field preservation of groundwater samples in Section 8.3.7	5, 19

SOP-04
Groundwater Sample Collection

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List of Acronyms and Abbreviations

CO_2	Carbon dioxide
DO	Dissolved oxygen
DTB	Depth to bottom
DTW	Depth to water
FL	Field leader
Ft	feet
ms/cm	Millisiemens per centimeter
mV	Millivolt
NTU	Nephelometric turbidity unit
ORP	Oxygen reduction potential
PPE	personal protective equipment
QAPP	Quality assurance project plan
QA/QC	Quality Assurance/Quality Control
SAP	Sampling and analysis plan
s/cm	Siemens per centimeter
SOP	standard operating procedure
SSHASP	site-specific health and safety plan
µmhos/cm	Micromhos per centimeter
VOCs	Volatile organic compounds

SOP-04
GROUNDWATER SAMPLE COLLECTION

1.0 PURPOSE

The purpose of this standard operating procedure (SOP) is to describe the procedures for the collection of representative groundwater samples.

These are standard (i.e., typically applicable) operating procedures which may be varied or changed as required, dependent upon site conditions, equipment limitations or limitations imposed by the procedure. In all instances, the actual procedures used should be documented and described in an appropriated site report.

2.0 SCOPE

2.1 This SOP is a mandatory document and shall be implemented by all Stantec project participants when performing purging and sampling of single completion wells.

3.0 TRAINING

3.1 Stantec project personnel using this SOP are trained by reading the procedure, and receiving the appropriate training.

3.2 The Field Leader (FL) shall monitor the proper implementation of this procedure and ensures that relevant team members have completed all applicable training assignments.

4.0 DEFINITIONS

4.1 Hydrogen-ion activity (pH) - The effective negative log base 10 of hydrogen ion [H+] activity. A measure of how acidic or a basic solution is (numerically equal to 7 for neutral solutions and increasingly basic above and acidic below that value).

4.2 Redox potential (Eh in millivolts [mV]) - Chemical reactions whereby a participating element changes its oxidation state by losing or gaining valence electrons. This may be referred to as oxidation-reduction potential (ORP), which is corrected to Eh.

4.3 Single completion well - A well constructed with a single well screen across a zone of groundwater saturation.

4.4 Site-Specific Health and Safety Plan (SSHASP) - A health and safety plan that is specific to a site or related field activity that has been approved by a Stantec health and safety representative. This document contains information specific to the project including scope of work, relevant history, descriptions of hazards by activity associated with the project site(s), and techniques for exposure mitigation (e.g., personal protective equipment [PPE]) and hazard mitigation.

4.5 Conductance, or conductivity - A measure of the ease with which an electrical current flows through a substance under the influence of an applied electrical field. It is dependent upon the presence of dissolved ions (total and relative concentrations, valence, and mobility) and temperature. It is the reciprocal (inverse) of resistivity.

4.6 Specific conductance - Defined as the electrical conductance that would occur between the faces of a 1-cm cube of water. It is generally measured in Siemens per centimeter (S/cm), which was previously called micromhos per centimeter (μmhos/cm), or milliSiemens per centimeter (mS/cm). Since specific conductance is temperature sensitive, it is commonly corrected to its equivalent value at 25°C for data comparison. Some equipment makes this conversion automatically, in which case these readings should be noted as "at 25°C." Otherwise, the water temperature at the time of the conductance reading should be recorded along with the conductance measurement so that the reading can later be corrected to 25°C.

4.7 Turbidity - Refers to inorganic solids, gas bubbles and organic matter suspended in water. Turbidity, in nephelometric turbidity units (NTU), is measured as the intensity of light scattered by the suspended particulates in a water sample relative to a standard reference suspension. The goal of well purging for water sampling is to minimize turbidity to a level as low as reasonably achievable.

4.8 Volatile Organic Compounds (VOCs) - A class of chemical compounds, predominantly hydrocarbons and halogenated hydrocarbons, with low molecular weights and low boiling points that are insoluble or slightly soluble in water.

4.9 Well casing volume (bore volume) - The volume of water standing in a well. One casing volume, in gallons, is computed as the measured length (feet [ft]) of the water column times the cross-sectional area (ft^2) of the well casing times the constant 7.48 gal/ft^3.

5.0 BACKGROUND AND PRECAUTIONS

This SOP shall be used in conjunction with an approved SSHASP. Also, consult the SSHASP for information on and use of all PPE.

5.1 Background

5.1.1 Groundwater that is stagnant in the well bore is subject to chemical reactions that may significantly alter the composition of the formation water. This stagnant water may no longer be representative of the groundwater surrounding the well.

5.1.2 Prior to collecting a representative ground water sample for laboratory analysis, ground water must be purged from the well according to the following guidelines:

- Under optimum conditions, four well casing volumes should be removed from the well (see Section 8.1 for method of calculation) before sampling.

- Preferably, turbidity values prior to sampling should be less than 5 NTU. A value of less than 5 NTU is not always obtainable under some circumstances such as excess biogenic carbon dioxide (CO_2) poorly developed wells and invasive sampling techniques that agitate the water in the well casing (variable pumping rates and bailing). Under these circumstances a sample may still be collected.

- Allow readings to stabilize for pH (±0.1 pH unit) and conductivity (±3%). Record stabilized measurements and time collected in the field books. Wait until you have collected at least three stable readings to record the final measurements.

- Occasionally select wells are developed in aquifers that have poor recharge characteristics due to low hydraulic conductivity, shallow hydraulic gradients or a combination of both. Removal of three well casing volumes under these conditions may not be possible due to time constraints, site accessibility, sample volume requirements and prohibitive costs. When these circumstances are encountered, purge a minimum of one well casing volume and sample after specific conductance and pH have stabilized to within (±0.1 pH unit) for pH, and within (±3%) for conductivity for at least three consecutive stable readings.

- The choice of equipment for well purging depends on the well yield, depth to groundwater, casing diameter, the required analysis, and the requirements in the appropriate work plan. The decision to use any well-purging system should be based solely on what is appropriate for that particular situation.

5.2 Precautions

All waste generated from well development must be handled in accordance with SOP-10.

6.0 RESPONSIBLE PERSONNEL

The following personnel are responsible for activities identified in this procedure.

6.1 Stantec project personnel

6.2 FL

6.3 QA/QC Officer

6.4 Subcontractors

7.0 EQUIPMENT

A checklist of suggested equipment and supplies needed to implement this procedure is provided in Attachment A. A brief description of commonly used pieces of equipment, their advantages, and their limitations are listed below.

7.1 Bailer - A hollow tube or pipe fitted with a valve that is lowered into a well and retrieved to purge groundwater from a well.

7.1.1 Bailers may be constructed of stainless steel, polyethylene, or Teflon. When lowered into well, water enters the tube, the valve closes, and the filled bailer is retrieved with a rope or cable. Bailing purges the well casing and screen of standing water. Between bailing cycles, groundwater recovers in the well from the screen interval.

7.1.2 For shallow, small-diameter wells with low yields, well purging by the bailer method is feasible in the absence of a dedicated low-flow pump. Bailers are mechanically simple, lightweight and highly portable, constructed in many sizes, and require no external power source. Disposable bailers are easily operated and inexpensive. If disposable bailers are not used, considerable time and cost savings are possible by using dedicated bailers to reduce the decontamination task and to limit the possibility of cross-contamination (EPA, 1991).

7.1.3 The primary limitations of bailers are:

- Limited-volume purging capability; especially in deep wells where purging is labor intensive and time consuming.
- Tendency to disturb the water by the pressure changes created by purging.
- Sampling personnel are directly exposed to any contaminants present.
- Care must taken to prevent dropping or catching the bailer in the well, and not let the bailer line or bailer come in contact with the ground.

7.2 Electric submersible pump - An electric-motor-operated submersible pump that uses an internal rotating turbine to intake well water and force it to the surface.

7.2.1 The pump assembly is suspended by the discharge tubing and submerged in the well. The turbine in the pump bowl creates sufficient pressure to force water up the discharge pipe.

7.2.2 The submersible pump may be used for purging shallow, small-diameter wells and deep, large-diameter wells that require large rates of discharge. Manufacturers offer small-diameter pumps constructed of stainless steel and Teflon that are capable of efficient purging at significant depths. The pump may be portable and self-contained.

Disadvantages of the submersible pump are that:

- the pump can be difficult to decontaminate and transport along with auxiliary equipment
- the pump motor may be damaged by dry pumping

- the gears may be damaged by water that contains high levels of suspended sediment
- large-capacity pumps are expensive
- with negative displacement, pumps can significantly aerate the sample, thus changing the in situ chemistry and stripping dissolved VOCs.

Careful monitoring during operation is needed to obtain optimum pump performance and to preclude the possibility of equipment damage.

A checklist of suggested equipment and supplies needed to implement this procedure is provided in Attachment A.

8.0 PROCEDURE

8.1Field Preparation

(a) Start at the least contaminated well, if known.

(b) Lay plastic sheeting, or other suitable material, around the well to minimize the likelihood of contamination of equipment from soil adjacent to the well.

(c) Remove protective well cap (i.e., flush mount or Pro-top cover).

(d) Remove locking well casing cap.

(e) Lower electronic water level indicator into well until water surface is encountered.

(f) Measure distance from water surface to reference measure point (north side) on well casing and record the depth to water (DTW) to the nearest ± 0.01 foot in the field book. Record the time the measurement was collected.

(g) Measure total depth of well (depth to bottom [DTB]) and record in the field book. Decontaminate water level indicator in accordance with SOP-8 prior to inserting into the next well.

(h) Determine the well casing volume as defined by the following relationship:

$$V = ((d^2 \pi)/4) \times (h_2 - h_1) \times 7.48$$

Where:

- V = well casing volume, in gallons
- π = 3.1416
- d = well diameter, in feet
- h_1 = depth to water, in feet
- h_2 = well total depth, in feet
- 7.48 = gallons per cubic foot

Determine the height of the water column standing in the well by subtracting depth to water, in feet, from the total well depth. Measure the well diameter, in

feet. Calculate the volume in gallons and enter these data on the Well Development Sampling Worksheet (Attachment B).

A minimum of four casing volumes should be purged before collecting a sample. If a sample must be collected before three casing volumes have been purged due to poor recharge, this activity will be documented in the field notebook or appropriate field form.

(i) Select appropriate purging and sampling equipment.

(j) Fill sample containers in the following order:

1) Unfiltered samples for in-field quality measurements (not necessary if down well or flow-through-cell measurements are taken)
2) VOCs
3) Non-filtered, non-preserved (e.g., sulfate, chromium VI, semi- and non-volatiles, pesticides, polychlorinated biphenyls)
4) Non-filtered, preserved (e.g., nitrogen series [ammonia, nitrates, nitrites, etc.], phenolics, total phosphorous, total metals, cyanide, total organic carbon)
5) Filtered, non-preserved (e.g., dissolved chromium VI)
6) Filtered, preserved immediately (e.g., dissolved metals)
7) Miscellaneous parameters

8.2 Special Considerations for VOC Sampling

The following procedures should be followed when filling VOC containers:

(a) Allow readings to stabilize for pH (±0.1 pH unit) and conductivity (±3%). Record stabilized measurements and time collected in the field books. Wait until you have collected at least three stable readings to record the final measurements.

(b) Once pH and conductivity are stabilized, open one vial at a time, set cap in a clean place, and begin collecting the sample.

(c) When filling a VOC vial, tip it at a slight angle and allow a steady stream of water run down its inner wall.

(d) Fill the vial until it appears that it is ready to overflow and a positive meniscus forms on the top of the vial.

(e) Check that the cap has not been contaminated (splashed) and carefully cap the vial. Place the cap directly over the top and screw down firmly. Do not over tighten and break the cap.

(f) Invert the sample vial and tap gently to check for air bubbles. If an air bubble appears, discard the sample and fill another VOC vial. It is imperative that no entrapped air is in the sample vial. If it is not possible to collect a sample vial without air bubbles, make a note in the field book and on the chain of custody form, and submit sample vial to the lab.

(g) Immediately place the sample vial in a protective bubble-wrap bag and place into the cooler.

8.3Purging and Sampling Methods

8.3.1Disposable Bailer

This method describes purging and sampling with a disposable bailer. The quality of the samples collected with a bailer highly depends on the skill and care of the operator using it. Take great care when lowering a bailer in and out of the water column. Carefully lift the bailer up and out of the well without allowing it to bang against the casing and use a bottom emptying device to dispense samples.

(a) Equipment needed includes a disposable bailer, nylon rope, scissors, and plastic sheeting.

(b) Determine the volume of water to be purged as described in Section 8.1, Field Preparation.

(c) Attach the nylon rope to the bailer and slowly lower until the bailer is completely submerged, being careful not to drop the bailer to the water, causing turbulence and the possible loss of volatile organic contaminants.

(d) Pull bailer out ensuring that the rope either falls onto a clean area of the plastic sheeting, or is wound on a reel or hand, and never touches the ground.

(e) Empty the bailer into a graduated vessel or container of known volume in order to determine the number of bails necessary to achieve the required purge volume.

(f) Periodically, collect samples of the purge water in two clean 2 ounce plastic sample cups for pH, temperature, and electrical conductivity measurements. Insert pH/temperature probe into one cup and the conductivity probe into the second cup. Allow readings to stabilize for pH (±0.1 pH unit) and conductivity (±3%). Record stabilized measurements and time collected in the field books. Wait until you have collected at least three stable readings to record the final measurements.

(g) Thereafter, pour the purge water into a 55-gallon drum that is temporarily stored on-site pending proper disposal arrangements.

(h) Upon the completion of removing the appropriate purge volume from the well, allow monitoring well to recharge. Assemble and label appropriate sample containers. Change into new clean gloves.

(i) Attach the nylon rope to a clean disposable bailer

(j) Lower the bailer slowly and gently into the well, taking care not to shake the casing side or to splash the bailer into the water. Stop lowering at a point adjacent to the screen.

(k) Allow bailer to fill and then slowly and gently retrieve bailer from the well avoiding contact with the casing.

(l) Remove cap from sample container, insert appropriate sampling tip (i.e., bottom emptying device) into bottom of the bailer and begin to slowly fill the pre-labeled sample container or filtering device. Fill VOC sample containers first.

(m) Filter and preserve samples if required by Sampling and Analysis Plan (SAP). Filter samples in accordance with Section 8.3.6. Preserve samples in accordance with Section 8.3.7.

(n) Cap the sample container tightly and place pre-labeled sample container in a bubble-wrap bag. Then place the bubble wrapped sample in a Ziploc® bag. Label Ziploc® bag with the sample identification and project number. Place groundwater sample in an insulated cooler with ice and chill to </= 6° C.

(o) Replace the well casing cap and well protective cover.

(p) Log all samples in the field book.

(q) Discard bailers in a plastic garbage bag for proper disposal

8.3.2 Submersible Pump and Bailer

This method describes purging with a submersible pump and sampling with a disposable bailer. This method may be appropriate when low-flow pumping equipment is not available by sensitive samples will be collected.

(a) Determine the volume of water to be purged as described in Section 8.1, Field Preparation.

(b) Assemble pump and tubing, and slowly lower the pump into the middle of the water column of the well. Place discharge tube in a graduated vessel or container of known volume in order to measure the amount of water removed from the well to achieve the required purge volume.

(c) Connect pump's alligator clips to 12-volt battery and begin pumping. Turn on YSI-556 Multi-meter and allow probes to equalize approximately 15 minutes in preparation of collecting field water quality measurements. Periodically, collect field water quality measurements (i.e., temperature, conductivity, pH, dissolved oxygen (DO) and/or oxidation reduction potential (ORP)) by lowering YSI-556 Multi-meter probe into well to a depth at which the well water is flowing past the probe during measuring. Allow readings of to stabilize. Record stabilized measurements and time collected in the field book.

(d) During purging of the well, slowly lower the pump so that, after four well volumes are purged, the pump's inlet is within approximately 1 foot of the bottom of the well in order to remove stagnant water before collecting samples with a bailer.

(e) Purge well until specified volume of water has been removed and/or until field parameters, such as temperature, pH, conductivity, etc., have stabilized.

Stabilization is achieved after all parameters have stabilized for three successive readings. Three successive readings should be within plus or minus .1 for pH, 3% for conductivity, 10 mV for ORP, and 10% for DO. Three successive readings for temperature are not required. *Note: If you are collecting sensitive samples (i.e., VOCs or trace metals), keep the purging rate as low as possible.*

(f) Thereafter, pour the purge water into a 55-gallon drum that is temporarily stored on-site pending proper disposal arrangements.

(g) Upon the completion of removing the appropriate purge volume from the well, to recharge. Assemble and label appropriate sample containers.

(h) Attach the nylon rope to a clean disposable bailer.

(i) Lower the bailer slowly and gently into the well, taking care not to shake the casing side or to splash the bailer into the water. Stop lowering at a point adjacent to the screen.

(j) Allow bailer to fill and then slowly and gently retrieve bailer from the well avoiding contact with the casing.

(k) Remove cap from sample container, insert appropriate sampling tip (i.e., bottom emptying device) into bottom of the bailer and begin to slowly fill the pre-labeled sample container or filtering device.

(l) Filter and preserve samples if required by SAP.

(m) Cap the sample container tightly and place pre-labeled sample container in a bubble-wrap bag. Then place the bubble wrapped sample in a Ziploc® bag. Label Ziploc® bag with the sample identification and project number. Place groundwater sample in an insulated cooler with ice and chill to </= 6° C.

(n) Remove pump and assembly and fully decontaminate pump in accordance with SOP-8 prior to setting into the next sample well. Discard tubing in a plastic garbage bag for proper disposal.

(o) Replace the well casing cap and well protective cover.

(p) Log all samples in the field book.

<u>8.3.3 Submersible Pump</u>

This method describes purging and sampling with a submersible pump. This method may be appropriate when low-flow pumping equipment is not available and sensitive samples will be collected.

(a) Determine the volume of water to be purged as described in Section 8.1, Field Preparation.

(b) Assemble pump and tubing, and slowly lower the pump into the middle of the water column of the well. Place discharge tube in a graduated vessel or

container of known volume in order to measure the amount of water removed from the well to achieve the required purge volume.

(c) Connect pump's alligator clips to 12-volt battery and begin pumping. Turn on YSI-556 Multi-meter and allow probes to equalize approximately 15 minutes in preparation of collecting field water quality measurements. Periodically, collect field water quality measurements (i.e., temperature, conductivity, pH, DO, and/or ORP) by lowering YSI-556 Multi-meter probe into well to a depth at which the well water is flowing past the probe during measuring. Allow readings of to stabilize. Record stabilized measurements and time collected in the field book.

(d) During purging of the well, slowly lower the pump so that, after four well volumes are purged, the pump's inlet is within approximately 1 foot of the bottom of the well in order to remove stagnant water before collecting samples with a bailer.

(e) Purge well until specified volume of water has been removed and/or until field parameters, such as temperature, pH, conductivity, etc., have stabilized. Stabilization is achieved after all parameters have stabilized for three successive readings. Three successive readings should be within plus or minus .1 for pH, 3% for conductivity, 10 mV for ORP, and 10% for DO. Three successive readings for temperature are not required. *Note: If you are collecting sensitive samples (i.e., VOCs or trace metals), keep the purging rate as low as possible*

(f) Thereafter, pour the purge water into a 55-gallon drum that is temporarily stored on-site pending proper disposal arrangements.

(g) Upon the completion of removing the appropriate purge volume from the well, allow monitoring well to recharge. Assemble and label appropriate sample containers.

(h) Carefully move pump to just above the screened section.

(i) Attach gate valve (or other flow control device) to hose (if not already fitted), and reduce flow of water to a manageable sampling rate (several hundred milliliters per minute is preferred).

(j) If no gate valve or other flow-control device is available, run the water down the side of a clean jar and fill the sample containers from a jar.

(k) Remove cap from sample container and slowly fill the pre-labeled sample container or filtering device.

(l) Filter and preserve samples if required by SAP.

(m) Cap the sample container tightly and place pre-labeled sample container in a bubble-wrap bag. Then place the bubble wrapped sample in a Ziploc® bag. Label Ziploc® bag with the sample identification and project number. Place groundwater sample in an insulated cooler with ice and chill to </= 6° C.

(n) Remove pump and assembly and fully decontaminate pump in accordance with SOP-8 prior to setting into the next sample well. Discard tubing in a plastic bag for proper disposal.

(o) Replace the well casing cap and well protective cover.

(p) Log all samples in the field book.

8.3.4 Peristaltic Pump and Disposable Bailer

This method describes purging with a peristaltic pump and sampling with a disposable 1-inch bailer. This method may be appropriate on 1-inch in diameter wells when low-flow pumping equipment is not available and sensitive samples will be collected.

(a) Determine the volume of water to be purged as described in Section 8.1, Field Preparation.

(b) Assemble pump and tubing, and slowly lower the tubing into the middle of the water column of the well. Place discharge tube in a graduated vessel or container of known volume in order to measure the amount of water removed from the well to achieve the required purge volume.

(c) Plug pump into power source, turn “ON” pump and begin pumping. Periodically, collect samples of the purge water in two clean 2 ounce plastic sample cup for pH, temperature, and electrical conductivity measurements. Insert pH/temperature probe into one cup and the conductivity probe into the second cup. Allow readings to stabilize. Record stabilized measurements and time collected in the field books. Wait until you have collected at least three stable readings to record the final measurements.

(d) During purging of the well, slowly lower the tubing so that, after four well volumes are purged, the tubing is within approximately 1 foot of the bottom of the well in order to remove stagnant water before collecting samples with a bailer.

(e) Purge well until specified volume of water has been removed and/or until field parameters, such as temperature, pH, conductivity, etc., have stabilized. Stabilization is achieved after all parameters have stabilized for three successive readings. Three successive readings should be within plus or minus .1 for pH, 3% for conductivity, 10 mV for ORP, and 10% for DO. Three successive readings for temperature are not required. *Note: If you are collecting sensitive samples (i.e., VOCs or trace metals), keep the purging rate as low as possible.*

(f) Thereafter, pour the purge water into a 55-gallon drum that is temporarily stored on-site pending proper disposal arrangements.

(g) Upon the completion of removing the appropriate purge volume from the well, to recharge. Assemble and label appropriate sample containers.

(h) Attach the nylon rope to a clean disposable 1-inch bailer.

(i) Lower the bailer slowly and gently into the well, taking care not to shake the casing side or to splash the bailer into the water. Stop lowering at a point adjacent to the screen.

(j) Allow bailer to fill and then slowly and gently retrieve bailer from the well avoiding contact with the casing.

(k) Remove cap from sample container, insert appropriate sampling tip (i.e., bottom emptying device) into bottom of the bailer and begin to slowly fill the pre-labeled sample container or filtering device.

(l) Filter and preserve samples if required by SAP.

(m) Cap the sample container tightly and place pre-labeled sample container in a bubble-wrap bag. Then place the bubble wrapped sample in a Ziploc® bag. Label Ziploc® bag with the sample identification and project number. Place groundwater sample in an insulated cooler with ice and chill to </= 6° C.

(n) Remove tubing and assembly and fully decontaminate pump in accordance with SOP-8 prior to setting into the next sample well. Discard tubing in a plastic bag for proper disposal.

(o) Replace the well casing cap and well protective cover.

(p) Log all samples in the field book.

8.3.5 Low Flow Purging and Sampling

This method describes purging and sampling with a peristaltic pump. Low flow purging and sampling results in collection of groundwater samples from monitoring wells that representative of groundwater conditions in the geological formation. This is accomplished by setting the intake velocity of the sampling pump to a flow rate that limits drawdown inside the well casing. The low flow purging and sampling method is fully described in American Society for Testing and Materials (ASTM) Standard Practice D 6771, in which the benefits are described as including:

- Improved sample quality, accuracy, precision and variability through reduced disturbance to the well and formation, reduced mixing, analyte dilution, aeration and degassing.

- Reduced purge water volume (90-95%), leads to savings in disposal costs, and reduced time for purging and sampling may reduce field labor costs.

- Minimization of the aeration of the groundwater sample during collection, improving the sample quality for VOC analysis.

- Improved detection and resolution of contaminant distribution through sampling a smaller section of the formation.

- Improved ability to quantify total mobile contaminant load, without need for filtration.

- Increased well life, through reduced pumping stress.

Peristaltic pumps and other suction lift devices are not suitable for use in wells containing contaminants and/or measurable parameters that may be affected by the vacuum and degassing that occurs when these devices are used. Grab samplers, such as bailers and inertia-lift pumps are also unsuitable as they create too much disturbance to the water column.

Problems that may be encountered using this technique include; difficulty in sampling wells with insufficient yield, failure of one or more key indicator parameters to stabilize, and the cascading of water or the formation of air bubbles in the tubing.

The low flow purging and sampling technique is described as follows:

(a) Measure DTW and DTB in each well as described in Section 8.1.

(b) Review well construction diagram in the field book to determine the screen length of each well. Calculate the depth of mid-screen of the well as the pumping level will need to be at the middle of the well screen.

(c) Assemble tubing to pump, and slowly lower the tubing into the water column of the well. Once the tubing is placed within the well and fixed (rubber strap) set up the pump, water quality multi-meter probe and flow through cell. Assemble and label appropriate sample containers.

(d) Set the pumping rate with control device so it is between 0.1 to 0.5 liters per minute. The goal is to achieve minimal drawdown (< 0.1 m) during purging.

(e) Once the equipment is in place begin purging the well. (Note: After the pump is turned on set the flow rate and do not alter it throughout the development process.) Note your start time as soon as the pump is turned on and containerize purge water in a graduated container so the flow rate can be calculated following completion of development. Make sure the time that the indicator parameters are taken is documented.

(f) Record indicator parameters for temperature, pH, dissolved oxygen, specific conductivity, and ORP, time, and turbidity, if applicable, while purging by placing multi-meter probe in the purge water that has been captured in the flow through cell. Set up the following table in the site's field book to record all necessary information:

Well ID:	**Pumping Rate:**			**Pump Start Time:**		
Time	Temperature	Specific Conductivity	DO	pH	ORP	Turbidity
Total Volume Pumped:				Sample Collection Time:		

Note: Total Volume Pumped is the volume removed upon collection of third consecutive reading (i.e. last measurement).

(g) Measurements should be taken every three to five minutes and stabilization is achieved after all parameters have stabilized for three successive readings.

(h) In general, the order of stabilization is pH, and specific conductivity, followed by ORP, DO, and turbidity. Three successive readings should be within plus or minus .1 for pH, 3% for conductivity, 10 mV for ORP, and 10% for turbidity and DO. Three successive readings for temperature are not required. *Note: DO and turbidity usually require the longest time for stabilization*.

(i) Once parameters have stabilized disconnect the flow through cell and begin collecting samples in the order as specified in Section 8.1. The flow can be decreased if needed to allow attachment of any filtering devices and to minimize aeration of the samples. Record the pumping rate so you have a reference for the next sampling event.

(j) Remove cap from sample container and slowly fill the pre-labeled sample container or filtering device.

(k) Filter and preserve samples if required by SAP.

(l) Cap the sample container tightly and place pre-labeled sample container in a bubble-wrap bag. Then place the bubble wrapped sample in a Ziploc® bag. Label Ziploc® bag with the sample identification and project number. Place groundwater sample in an insulated cooler with ice and chill to </= 6° C.

(m) Remove pump and assembly and fully decontaminate pump in accordance with SOP-8 prior to setting into the next sample well. Discard tubing in a plastic garbage bag for proper disposal.

(n) Replace the well casing cap and well protective cover.

(o) For a low flow purging and sampling event the following data should be recorded, as described in ASTM Practice D 6771:

- Equipment Calibration
- Equipment Decontamination
- Equipment Configuration for Purging and Sampling
- Pump Placement
- Initial Static Water Level
- Initial Pump Rate
- Drawdown Measurements
- Stabilized Pumping Water Level
- Final Pump Rate
- Water Quality and Turbidity Measurements, with Times
- Final Sampling Flow Rate

8.3.6Field Filtering of Groundwater Samples

If filtering of samples is required, a disposable in-line filter should be used to minimize contact with air to avoid precipitation of metals. The typical filter media size used is 0.45 µm because this is commonly accepted as the demarcation between dissolved and non-dissolved species.

The first 500 to 1000 milliliters of a ground-water sample (depending on sample turbidity) taken through the in-line filter will not be collected for a sample in order to ensure that the filter media has equilibrated to the sample (manufacturer's recommendations also should be consulted).

8.3.7 Field Preservation of Groundwater Samples

Please note that except as approved the QA/QC Officer, groundwater samples requiring preservation should be collected only in bottles supplied by the laboratory with the preservative in appropriate quantities pre-added to the bottles by the laboratory. Care must be taken when filling the bottles to avoid spillage of any preservative, both to ensure that samples are properly preserved and to avoid potential health and safety hazards associated with contact with the preservatives.

9.1 REFERENCES

Project personnel using this procedure should become familiar with the contents of the following documents to properly implement this SOP, as applicable and appropriate.

- ASTM, Standard Practice D 6771, *Standard Practice for Low-Flow Purging and Sampling for Wells and Devices Used for Ground Water Quality Investigations*
- EPA, 1991 *Handbook of Suggested Practices for the Design and Installation of Ground-Water Wells.* EPA-600-4-88-034, March, 1991.
- SOP-8, Equipment Decontamination.
- SOP-10, Management of Investigative Wastes

10.0 RECORDS

The FL is responsible for data entry and submitting the following records to central filing, where applicable:

10.1 Completed field notebook

10.2 Well Development Sampling Worksheet (Attachment B)

11.0 ATTACHMENTS

Attachment A: Equipment and Supplies Checklist for Purging and Sampling of Wells

Attachment B: Well Development Sampling Worksheet

Attachment A

Equipment and Supplies Checklist for Purging and Sampling of Wells

√	Quantity	Description
		SAP
		SSHASP
		SOP-8
		Field book
		Waterproof ink pen and permanent marker
		Camera
		Tool Box (includes at a minimum socket wrench, screwdriver, pliers, hammer, scissors, flashlight)
		Keys for well cap locks
		Electronic water-level indicator
		Calculator
		Appropriate pre-preserved laboratory sample containers
		Sample labels
		Adjustable rate peristaltic or submersible pump and appropriate tubing
		Flow measurement supplies
		Flow cell
		Water quality multi-meter (e.g., YSI 556 multi meter) for measuring temperature, specific conductance, pH, DO and ORP. Separate individual meters may also be used.
		Single check valve disposable bailers
		Sampling tips
		Nylon rope
		Appropriate PPE
		5-gallon plastic pails
		55-gallon steel drums
		Insulated cooler
		Chain-of-custody seals,
		Ziploc® bags
		Ice
		Decontamination equipment (SOP-8)
		Garbage bags

ATTACHMENT B
WELL DEVELOPMENT SAMPLING WORKSHEET

PROJECT ID #_____ WELL # _____

$V_1 + V_2$ = Well Volume
V_1 = Volume of Water in Casing
V_2 = Volume of Water in Filter Pack
D_1 = Inside Diameter of Well Casing = 0.17 feet (2.0-inch diameter)
D_2 = Outside Diameter of Well Casing = 0.20 feet (2.3-inch diameter)
D_3 = Diameter of Borehole - 8.25 inches = 0.69 feet (8.75 inches use 0.72 feet)
H_1 = Depth of Well (A) in feet minus Depth to Water (B) in feet (from surface)
H_2 = Height of Sandpack from Water Level to Bottom of Borehole
N = Percent Porosity of Sandpack is Constant = 35% = 0.35

$$V_1 = 3.14 \quad \frac{D_1^2 H_1}{2}$$

$$V_1 = 3.14 \quad \frac{0.17^2}{2} H_1$$

V_1 = 3.14 x .01 x _____
(H1)

V_1 =_____cubic ft

$$V_2 = N \times 3.14 \times H_2 \quad \frac{D_3^2}{2} - \frac{D_2^2}{2}$$

$$V_2 = 0.35 \times 3.14 \times H_2 \quad \frac{0.69^2}{2} - \frac{0.20^2}{2}$$

V_2 = 0.35 x 3.14 x_____ x (0.119 - .01)
(H2)

V2 =_____cubic ft

$V_1 + V_2$ =_____cubic ft +_____cubic ft

=_____cubic feet

_____cubic ft x 7.48 gal/cubic ft =

_____gal/well volume

If well cannot be purged dry:
Three consistent readings of pH, temperature, and conductivity, and try to obtain sediment free water and ten well volumes if practical

10 x gal/well volume
=_____gallons (or when sediment free)

If well can be purged dry:
Three consistent readings of pH, temperature, and conductivity, and try to obtain sediment free water and three well volumes if practical.

3 x_____gal/well volume
=_____gallons (or when sediment free)

Identifier: SOP-05	Revision: 1	Effective Date: 04/27/2015	
Author: Stu Gross			

Standard Operating Procedure

for:

SHALLOW SURFACE WATER SAMPLE COLLECTION

Responsible QA Manager: Richard J. Binder, P.G.	

SOP-05
Shallow Surface Water Sample Collection

Revision Log

Revision No.	***Effective Date***	***Prepared By***	***Description of Revisions***	***Affected Pages***
0	10/31/12	Stu Gross	New Procedure	All
1	04/27/15	Dave Constant	Removed Subcontractor Reference from Section 2	5

SOP-05
Shallow Surface Water Sample Collection

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List of Acronyms and Abbreviations

C	Centigrade
DO	Dissolved oxygen
FL	Field leader
GPS	Global positioning satellite
ORP	Oxidation reduction potential
PCB	Polychlorinated biphenyl
PL	Project leader
PPE	Personal protection equipment
QAPP	Quality assurance project plan
QA/QC	Quality assurance/quality control
SAP	Sampling and analysis plan
SSHASP	Site-specific health and safety plan
SOP	Standard operating procedure
TOC	Total organic carbon
VOC	Volatile organic compound

SOP-05
SHALLOW SURFACE WATER SAMPLE COLLECTION

1.0 PURPOSE

The purpose of this standard operating procedure (SOP) is to describe the procedures for the collection of representative shallow surface water samples.

These are standard (i.e., typically applicable) operating procedures which may be varied or changed as required, dependent upon site conditions, equipment limitations or limitations imposed by the procedure. In all instances, the actual procedures used should be documented and described in an appropriated site report.

2.0 SCOPE

2.1 This SOP is a mandatory document and shall be implemented by all Stantec project personnel when collecting surface water samples.

3.0 TRAINING

3.1 Stantec project personnel using this SOP are trained by reading the procedure.

3.2 The Field Leader (FL) shall monitor the proper implementation of this procedure and ensure that relevant team members complete all applicable training assignments.

4.0 DEFINITIONS

4.1 Grab samples - A specific location at a given time is represented by a discrete aliquot. The sample is collected all at once and at only one particular point in the sample medium.

4.2 Site-Specific Health and Safety Plan (SSHASP) - A health and safety plan that is specific to a site or related field activity that has been approved by a Stantec health and safety representative. This document contains information specific to the project including scope of work, relevant history, descriptions of hazards by activity associated with the project site(s), and techniques for exposure mitigation (e.g., personal protective equipment [PPE]) and hazard mitigation.

4.3 Surface water samples - Water collected from streams, ponds, lagoons, seeps, springs, rivers, lakes, or other water flowing or impounded at the ground surface comprise surface water samples.

4.4 Automated samplers - Automated samplers collect surface water without sampler being present. There are many types of automatic samplers. Follow manufacturer's instructions when using an automatic sampler.

5.0 BACKGROUND AND PRECAUTIONS

5.1 This SOP shall be used in conjunction with an approved SSHASP. Also, consult the SSHASP for information on and use of all PPE.

5.2 There are several methods for collecting surface water samples. The Sampler or Field Leader should decide which of the following methods is most appropriate. The method used to collect samples should be documented in the Field Notebook.

5.2.1 The method used by Stantec is to collect surface water is grab sampling. Samples can be collected using a transfer device constructed of polyethylene, Teflon™, stainless steel, or glass. The transfer device is used to transfer liquid and liquid wastes from surface waters to a sample bottle. Field personnel must avoid using metal transfer devices for trace-metal analysis or plastic devices for sampling trace organics.

5.2.2 The water sample can be collected directly by dipping the collection bottle into the water and filling, removing, and capping it. This direct grab method requires the exterior of the sample container to be rinsed after collection to avoid spreading possible contamination.

5.2.3 Samples may be collected using automated samplers. There are many types of automatic samplers. Follow manufacturer's instructions when using an automated sampler.

5.2.4 Samples may be collected at depth by using a Kemmerer Bottle. A Kemmerer bottle can also be used to collect surface water samples from elevated locations, such as a bridge or overpass.

5.2.6 Depth-integrated samples may be collected using a DH-48.

6.0 RESPONSIBLE PERSONNEL

6.1 Stantec project personnel

6.2 Field leader (FL)

6.3 Project leader (PL)

6.4 Subcontractors

7.0 EQUIPMENT

Please note that except as approved by the QA/QC Officer, shallow surface water samples requiring preservation should be collected only in bottles supplied by the laboratory with the preservative in appropriate quantities pre-added to the bottles by the laboratory. Care must be taken when filling the bottles to avoid spillage of any preservative, both to ensure that samples are properly preserved and to avoid potential health and safety hazards associated with contact with the preservatives. A checklist of suggested equipment and supplies needed to implement this procedure is provided below.

EQUIPMENT AND SUPPLIES CHECKLIST FOR SHALLOW SURFACE WATER SAMPLE COLLECTION

√	Quantity	Description	Comments
		Sampling and Analysis Plan (SAP)	
		Site-specific Health and Safety Plan (HASP)	
		SOP-4	
		SOP-8	
		Field book	
		Waterproof ink pen and permanent marker	
		Camera	
		Sample containers	
		Sample labels	
		Insulated cooler	
		Chain-of-custody seals	
		Ziploc® bags or similar “locking” plastic bags	
		Ice	
		Decontamination equipment (SOP-8)	
		Teflon or stainless steel scoop with a Teflon or stainless steel handle	Depending on proposed sampling method
		Stainless steel beaker clamped to a pole	Depending on proposed sampling method
		Sample bottles (direct fill)	Depending on proposed sampling method.
		Portable peristaltic pump with Teflon tubing	Depending on proposed sampling method
		Water quality multi-meter (e.g., YSI 556 multi meter) for measuring temperature, specific conductance, pH, dissolved oxygen (DO) and oxidation reduction potential (ORP).	Separate individual meters may also be used
		Other -	
		Other -	

8.1 PROCEDURE

Surface water samples shall be collected moving in an upstream direction utilizing the following procedure:

(a) Calibrate instruments to be used for water quality readings per manufacturer's instructions. The Sampler or Field Leader should record calibration and instrument model information in Field Notebook.

(b) Immediately before collecting the sample, record the temperature, dissolved oxygen, pH, turbidity, and specific conductance using the water quality multi-meter or equivalent and following manufacturer's specifications by placing the instrument probe into the area of water to be sampled.

(c) Submerge the bottle, beaker or scoop and collect a sample. When pouring the water from the beaker or scoop into another bottle container, care should be taken so as not to aerate the sample. Samples to be analyzed for volatile organic compounds (VOCs) will be collected first.

(d) A peristaltic pump may also be used to collect the samples, if necessary. If Sampler or Field Team Leader collects samples with a peristaltic pump, follow the procedure outlined below:

1. Install clean peristaltic pump tubing according to manufacturer's instructions.
2. Review the QAPP or SAP for the appropriate size of sample containers and preservatives.
3. Place intake end of the tubing into the water to be sampled and turn on the pump.
4. Keep the tubing away from the bottom to minimize the amount of sediment collected.
5. Fill the bottles without agitating the water if possible.
6. To collect filtered samples, connect the appropriate filter to the outlet end of the pump tube.
7. Label and preserve sample containers and complete documentation.
8. Perform field chemistry measurements on surface water being sampled (if required).
9. Record the final, stable-parameter readings on the appropriate field forms or the field notebook.

(e) The following procedures should be followed when filling VOC containers:

1. Open one vial at a time, set cap in a clean place, and begin collecting the sample.
2. When filling a VOC vial, tip it at a slight angle and allow a steady stream of water run down its inner wall.
3. Fill the vial until it appears that it is ready to overflow and a positive meniscus forms on the top of the vial.
4. Check that the cap has not been contaminated (splashed) and carefully cap the vial. Place the cap directly over the top and screw down firmly. Do not over tighten and break the cap.

5. Invert the sample vial and tap gently to check for air bubbles. If an air bubble appears, discard the sample and fill another VOC vial.
6. Immediately place the sample vial in a protective bubble-wrap bag and place into the cooler.

(f) Continue to collect samples in the following order based on the type of analysis to be performed, preservation requirements, and whether the samples are filtered or unfiltered:

1. Non-filtered, non-preserved (e.g., sulfate, chromium VI, semi- and non-volatiles, pesticides, PCBs).
2. Non-filtered, preserved (e.g., nitrogen series [ammonia, nitrates, nitrites, etc.], phenolics, total phosphorous, total metals, cyanide, total organic carbon [TOC]).
3. Filtered, non-preserved (e.g., dissolved chromium VI).
4. Filtered, preserved immediately (e.g., dissolved metals).
5. Miscellaneous parameters.

(g) Occasionally it may be necessary to collect a sample in the field and filter at another location. Reasons include it may not be practical to use filtration apparatus at a remote site or the water sample is too turbid to filter at the time of collection. If the latter is the case, allow the suspension in the water sample to settle before filtering and preserving. An appropriate container must be used when collecting water to be filtered off-site. For example, water destined for metals and anions analysis should be collected in a polyethylene bottle or carboy; organics must be transported in a glass container. Do not use the same container that is used to transport the unfiltered water from the field as the final container that is shipped to the analytical laboratory.

(h) Complete sample labels, custody seals, and chain-of-custody forms. Record sample information in the field book.

(i) Place the samples in a cooler with ice and chill to </= 6° Centigrade (C).

(j) Decontaminate sampling equipment in accordance with SOP-8.

(k) Where appropriate, the Sampler or Field Leader should place a reference marker (e.g., a wooden or metal stake with flagging) that includes the location identification number as close to the sampling location as possible. As an alternative, the sampler may record the sample location with a sub-meter global positioning system (GPS) unit.

9.0 REFERENCES

Project personnel using this procedure should become familiar with the contents of the following documents to properly implement this SOP.

SOP-04, Groundwater Sample Collection
SOP-08, Equipment Decontamination

10.0 RECORDS

The FL is responsible for submitting the following records to the PL, who will review the records, and forward them to central filing.

10.1 Field Forms

10.2 Completed Field Notebook

Identifier: SOP-06	Revision: 1	Effective Date: 04/23/2015	
Author: Stu Gross			

Standard Operating Procedure

for:

ASBESTOS BULK SAMPLE COLLECTION

Responsible QA Manager: Richard J. Binder, P.G.	

SOP-06
Asbestos Bulk Sample Collection

Revision Log

Revision No.	*Effective Date*	*Prepared By*	*Description of Revisions*	*Affected Pages*
0	10/31/2012	Stu Gross	New Procedure	All
1	04/23/2015	Dave Constant	Removed Subcontractor Reference from Section 2	5

SOP-06
Asbestos Bulk Sample Collection

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SOP-06
Asbestos Bulk Sample Collection

List of Acronyms and Abbreviations

ACM	Asbestos containing materials
AHERA	Asbestos Hazard Emergency Response Act
CFR	Code of Federal Regulations
COC	Chain of custody
EPA	Environmental Protection Agency
FL	Field leader
HEPA	High efficiency particulate air
NESHAP	National Emission Standards for Hazardous Air Pollutants
PPE	personal protective equipment
QAPP	Quality assurance project plan
QA/QC	Quality Assurance/Quality Control
SAP	Sampling and analysis plan
SOP	Standard Operating Procedure
SSHASP	site-specific health and safety plan

SOP-06
ASBESTOS BULK SAMPLE COLLECTION

1.0 PURPOSE

The purpose of this standard operating procedure (SOP) is to describe the procedures for the collection of representative samples of suspected asbestos containing materials (ACM).

These are standard (i.e., typically applicable) operating procedures which may be varied or changed as required, dependent upon site conditions, equipment limitations or limitations imposed by the procedure. In all instances, the actual procedures used should be documented and described in an appropriated site report.

2.0 SCOPE

This SOP is a mandatory document and shall be implemented by all Stantec project participants when collecting chip samples of porous surfaces.

3.0 TRAINING

3.1 Stantec project personnel using this SOP are trained by reading the procedure, and receiving the appropriate training.

3.2 The Field Leader (FL) shall monitor the proper implementation of this procedure and ensures that relevant team members have completed all applicable training assignments.

4.0 DEFINITIONS

4.1 Asbestos Inspector – Individuals conducting and supervising the asbestos sampling survey will be Asbestos Hazard Emergency Response Act (AHERA) trained, and Wisconsin Department of Health Services certified asbestos inspectors specifically trained to identify and sample building materials that may contain asbestos.

4.2 Non-porous inclusions - Materials such as stone, glass, or metal, embedded in porous material.

4.3 Porous surface - For the purpose of this procedure, a surface capable of allowing the passage of liquid through pores or small crevices. Examples of porous materials applicable to the ECR project include asphalt, concrete, wood, brick, unglazed clay pipe, and tuff.

4.4 Site-Specific Health and Safety Plan (SSHASP) - A health and safety plan that is specific to a site or related field activity that has been approved by the health and safety representative. This document contains information specific to the project including scope of work, relevant

history, descriptions of hazards by activity associated with the project site(s), and techniques for exposure mitigation (e.g., personal protective equipment [PPE]) and hazard mitigation.

4.5 Wipe Sample – A wipe sample consists of using a wipe and a wetting agent that is wiped over a specified area using a template. The wipe picks up settled dust in the template area and provides an estimate of the number of fibers per area.

5.0 BACKGROUND AND PRECAUTIONS

5.1 This SOP shall be used in conjunction with an approved SSHASP. Also, consult the SSHASP for information on and use of all PPE.

5.2 All waste generated from sampling operations should be handled in accordance with SOP-10, Management of Investigative Wastes.

5.3 This SOP shall not be used in environments potentially contaminated with flammable or explosive components.

6.0 RESPONSIBLE PERSONNEL

The following personnel are responsible for activities identified in this procedure.

6.1 Author

6.2 Stantec project personnel

6.3 FL

6.4 QA/QC Officer

7.0 EQUIPMENT

A checklist of suggested equipment and supplies needed to implement this procedure is provided in Attachment A.

8.0 PROCEDURE (PREVIOUSLY 3.0)

The asbestos inspection will be conducted in accordance with the Environmental Protection Agency (EPA) Asbestos National Emission Standard for Hazardous Air Pollutants (NESHAP) regulations for building demolitions or renovations (40 Code of Federal Regulations [CFR] 61 Subpart M). The quantity of samples collected and analyzed will meet the NESHAP and AHERA requirements.

Asbestos bulk samples will be collected in accordance with the guidelines established by EPA AHERA (40 CFR 763), OSHA 29 CFR 1926.1101, and EPA Asbestos NESHAP 40 CFR 61, Subpart M. Specifically, samples will be collected in accordance AHERA Federal Regulations Chapter 40, Part 763, Subpart E, Sections 763.86 and 763.87(c)(2) as detailed below.

Steps for sampling surfacing material, thermal insulation, and miscellaneous materials are set forth below:

8.1Surfacing and Miscellaneous Materials

(a) Spread a plastic drop cloth and set up other equipment, e.g. ladder.

(b) Put on appropriate PPE. For contaminated areas, areas where ACMs are deteriorated, or any active containment, use Tyvek® suit, disposable gloves, and half-faced respirator at a minimum. For areas with little likelihood that asbestos will be disturbed or contamination is not evident, at a minimum use disposable gloves. Inspectors must use judgment when deciding appropriate PPE to use that will minimize the potential for contamination and exposure.

(c) Label sample container or new Ziploc® bag with the sample identification number and record number, sample location and type of material sampled in the field book. If using containers, always place the label on the container itself, not on the lid, as lids can be inadvertently switched by a laboratory when handling numerous sample containers.

(d) Mark the location of the sample and the sample identification number on the sampling diagram in the field book.

(e) Moisten area where sample is to be extracted (spray the immediate area with water).

(f) Extract sample using a clean knife to cut out or scrape off a small piece of the material. Be sure to penetrate all layers of material. Be careful not to disrupt adjacent material.

(g) Place sample in the labeled container or Ziploc® bag and seal.

(h) Wipe the exterior of the container or Ziploc® bag with a wet wipe to remove any material that may have adhered to it during sampling.

(i) Clean sampling tools with wet wipes. Vacuum area with a high efficiency particulate air (HEPA) vacuum to clean all debris, if necessary.

(j) Fill hole with caulking compound on highly friable material and/or spray with an encapsulant (to minimize subsequent fiber release) or for appearance.

(k) Repeat above steps at each sample location. Place sample containers in Ziploc® bags labeled with the project number, date, and sample identification number.

(l) Discard PPE, wipe wipes, cartridge filters, and drop cloth in a labeled plastic bag. Seal and retain the bag until lab results are received, at which time dispose of the bag as asbestos-contaminated waste if tests were positive for asbestos. (Labels should read: “Danger – Contains Asbestos Fibers – Avoid Creating Dust – Cancer and Lung Disease Hazard”. Disposal should be made at a state-approved landfill). Unless every sample tests negative for asbestos, discard waste as ACM.

8.2Thermal System Insulation

Sampling thermal insulation materials follows the same procedural sequence as described above. Obtain samples from exposed/damaged areas if possible. However, random sampling will require sampling of some intact material. Sampling holes can be patched with spackling, caulk, or fibrous glass plus wettable-glass cloth.

8.3Sample Handling

Care must be taken in identifying and transporting bulk samples. A chain-of-custody (COC) form should be initiated to track possession of sample from sampling point to laboratory. Refer to SOP-07 for COC procedures.

9.1 REFERENCES

Project personnel using this procedure should become familiar with the contents of the following documents to properly implement this SOP.

- SOP-07, Chain of Custody, Sample Control, and Field Documentation Procedures
- SOP-10, Management of Investigative Wastes

10.0 RECORDS

The FL is responsible for data entry and submitting the following records to central filing.

10.1 Completed field notebook.

11.0 ATTACHMENTS

The document user may employ documentation formats different from those attached to/named in this procedure—as long as the substituted formats in use provide, as a minimum, the information required in the official forms developed by the procedure.

Attachment A: Equipment and Supplies Checklist for Asbestos Bulk Sample Collection (1 page).

Attachment A

EQUIPMENT AND SUPPLIES CHECKLIST FOR ASBESTOS BULK SAMPLE COLLECTION

√	Quantity	Description	Comments
		SOP-7, SOP-10	
		Appropriate PPE (i.e., Tyvek® suit, safety glasses, disposable gloves, half-faced respirator)	
		Spray mister bottle	
		Utility knife	
		Core borer	
		Wood chisel	
		Hammer	
		Flashlight	
		Ladder	
		Tape measure	
		Drop cloth, as necessary	
		HEPA vacuum, as necessary	
		Plastic sample containers or Ziploc® bags	
		Indelible ink pen	
		Sharpie marker	
		Field book	
		Camera	
		Pre-moistened clothes (i.e., wet wipes)	
		Sealant materials, as necessary (i.e., caulking gun, filling compound, adhesives, duct tape, encapsulant)	
		Plastic garbage bags	

Identifier: SOP-07	Revision: 2	Effective Date: 04/23/2015	Stantec
Author: Stu Gross			

Standard Operating Procedure

for:

CHAIN OF CUSTODY, SAMPLE CONTROL AND FIELD DOCUMENTATION PROCEDURES

Responsible QA Manager: Richard J. Binder, P.G.	

SOP-07
Chain-of-Custody, Sample Control, and Field Documentation Procedures

Revision Log

Revision No.	***Effective Date***	***Prepared By***	***Description of Revisions***	***Affected Pages***
0	10/31/2012	Stu Gross	New Procedure	All
1	04/17/2013	Michael Nied	QAPP revisions per request	11
2	04/23/2015	Dave Constant	Removed Subcontractor Reference from Section 2	5

SOP-07
Chain-of-Custody, Sample Control and Field Documentation Procedures

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List of Acronyms and Abbreviations

COC	chain of custody
ECR	environmental characterization and/or remediation
FL	Field Leader
HAZWOPER	Hazardous Waste Operations & Emergency Response Training for General Site Workers
ID	identification
N/A	not applicable
POC	point of contact
PPE	personal protective equipment
PL	Project Leader
QA/QC	quality assurance/quality control
QC	quality control
SOP	standard operating procedure
SSHASP	site-specific health and safety plan

SOP-07
CHAIN-OF-CUSTODY, SAMPLE CONTROL AND FIELD DOCUMENTATION PROCEDURES

1.1 PURPOSE

This standard operating procedure (SOP) states the responsibilities and describes the process for documenting the traceability of samples collected for environmental characterization and/or remediation projects performed by Stantec using sample control and field documentation, specifically, container labels, Sample Collection Logs, Chain of Custody (COC) forms, and Daily Activity Log forms or field notebooks.

COC procedures are established to provide sample integrity. This custody is in two parts: sample collection and laboratory analysis. A sample is under a person's custody if it meets the following requirements:

- It is in the person's possession;
- It is in the person's view, after being in the person's possession;
- It was in the person's possession and it was placed in a secured location; or
- It is in a designated secure area.

All samples submitted to a laboratory shall be accompanied by a properly completed COC form. Field documentation shall be performed in accordance with this SOP.

2.0 SCOPE

Participants shall implement this procedure when collecting samples for Stantec projects.

2.1 All participants shall implement this mandatory SOP when documenting the traceability of samples collected for Stantec projects.

3.0 TRAINING

3.1 Participants shall train to (e.g., read and/or attend a class) and use the current version of this SOP; contact the author of this SOP of the QA/QC Officer if the text is unclear.

3.1.1 Participants who provide oversight for sampling activities shall read and/or complete training on this SOP.

3.1.2 Participants who collect samples and complete and sign sample collection logs shall read and/or complete training on this SOP.

3.2 The responsible project leader (PL) shall monitor the proper implementation of this procedure.

3.3 The responsible team leader shall ensure that the appropriate personnel complete all applicable training assignments.

4.0 DEFINITIONS

4.1 Site-specific health and safety plan (SSHASP) - Health and safety plan that is specific to a site or related field activity approved by a Stantec health and safety representative. This document contains information specific to the project, including the scope of work, relevant history, descriptions of hazards by activity associated with the project site(s), and techniques for exposure mitigation (e.g., personal protective equipment [PPE]) and hazard mitigation.

4.2 Standard operating procedure (SOP) – A document that describes work processes to be used by Stantec in performing work on environmental characterization and/or remediation (ECR) projects.

4.3 Chain of custody (COC) – The procedural steps to ensure the traceability of a sample from its initial collection to its final disposition. A sample is in one's custody when one or more of the criteria listed below are satisfied:

- The sample is in one or more of the field team members' physical possession,
- The sample is in one's view after being in one's physical possession, or,
- The sample is in a locked or secured area (accessible only to authorized personnel) and maintained in a manner that would make any tampering evident.
- Documentation of these criteria provides evidence that the COC was maintained. The Field COC form documents the traceability of the sample and the sample location.

4.4 Technical team members – The individuals working on the project.

4.5 Field team members – Those authorized individuals present at a sampling site during sample collection. Their presence at the site must be documented. This is done with site access lists or sign-in sheets that are kept outside the exclusion zone. The documentation is required through Hazardous Waste Operations & Emergency Response Training for General Site Workers (HAZWOPER). In the case of an emergency the Field Leader (FL) must know who is on site.

5.1 RESPONSIBLE PERSONNEL

The following identifies the personnel responsible for actions in this procedure:

- Data Management Staff
- project participants (hereinafter referred to as “participants” or “users”)
- Field Leader or designee
- Project leader

- Team leader
- Users

6.0 BACKGROUND AND PRECAUTIONS

6.1 Use this procedure in conjunction with an approved SSHASP.

6.2 All work performed for Stantec projects must be thoroughly and accurately documented. Sample control and field documentation are necessary to document the work performed in the field, to ensure traceability and defensibility of resulting data, and to be legally defensible. Lack of complete documentation may render the fieldwork invalid.

7.0 EQUIPMENT

A checklist of suggested equipment and supplies needed to implement this procedure is provided below.

CHECKLIST FOR FIELD DOCUMENTATION AND CHAIN-OF-CUSTODY PROCEDURES

√	Quantity	Description	Comments
		Sample containers	
		Sample labels	
		Waterproof ink pen	
		Bubble-wrap packaging	
		Chain-of-custody form	
		Strapping tape	
		Chain-of-custody seal	
		Shipment container (i.e., cooler, box, or envelope)	
		Field notebook	
		Field Activity Log forms	

8.0 PROCEDURE

8.1Sample Labels

The FL or designee shall ensure that sample labels (Attachment A) that provide information regarding the samples are affixed to the sample containers before or immediately following the sampling activity. Each label may include the following information:

- Location: A unique number that allows the entry of location information into the analytical laboratory database.
- Special Instructions: Special instructions requested of the laboratory.
- Date, Time: Date and time of sample collection.
- Sample ID: Sample identification number and container number for each sample in a shipment.
- Analysis: Analytical method requested for type of contaminant for which the sample is analyzed.
- Preservative: Type of preservative needed for a particular analysis (e.g., ice, $HN0_3$, none).
- Field POC Initials: Printed name and initials of point of contact (POC).

Note: The Date/Time and Field POC Initials must be completed in the field; all other fields are pre-populated based on information provided by the laboratory.

8.2Field Notebooks and Recording of Sample Collection and Field Screening Data

The FL or designee shall record all information pertinent to the collection of sample media, and additional relevant information, in the field notebook. The FL or designee shall complete the field notebook by signing the bottom of each page to document the collection of the sample and recording of activities.

If collecting field screening data, record results in the field notebook with the following entry fields:

- Sample ID: A unique identification number assigned to each sample. The samples IDs are unique and are assigned prior to field activities.
- Event ID and Event Name: The unique identification number and name assigned to the sampling event during its generation.
- Date and Time Collected: Date and time of sample collection.
- Location ID: This unique identifier allows the entry of location information into the appropriate database and ties the exact location with the analytical results.
- Location Type: A general location description based on the sampling event, planning document, and site knowledge.
- Top and Bottom Depth: Sample beginning and end depths in inches or feet, including the unit (e.g., depth of sample in feet, distance on the transect in feet).
- Field Matrix: Description of the sample's matrix as perceived by the field person collecting the sample.
- Field Quality Control (QC) Type: The type of quality assurance/quality control (QA/QC) sample, if not a regular sample. These include field duplicates and

triplicates, field rinsates, field prepared blanks, field splits, and collocated and performance-evaluation samples.

- Composite Type: If composite samples are collected, identify the type of composite sample.
- Field Prep: The appropriate field-preparation method applied, in the field, on the sample collected.
- Special Instructions: Any comments or special instructions for the sample may be preplanned or completed in the field.
- Sample Description: A description of the sample material collected.
- Sample Location Description: General description of the sampling location (e.g., borehole HDH-1 by TA-16-03, outfall samples in Root River, etc.).
- Field Screening/Measurement Results: The results of field screening conducted on a given sample (for example, photoionization detector or flame ionization detector readings in ppm). List the field-screening method, calibration values, and the sample measurements.
- Collected by Printed Name, Signature and Date: Printed name and signature of the person who collected the sample and the date the COC was completed.

8.3 Field Specific Custody Procedures

The sample packaging and shipment procedures summarized below will assure that the samples will arrive at the laboratory with the COC intact.

8.3.1 Field procedures are as follows:

(a) The field sampler is personally responsible for the care and custody of the samples until they are transferred or properly dispatched. As few people as possible should handle the samples.

(b) All sample containers should be labeled with sample numbers and locations.

(c) Sample labels should be filled out using waterproof ink for each sample.

(d) The project manager should review all field activities to determine whether proper custody procedures were followed during the field work and decide if additional samples are required.

8.3.2 Transfer of Custody and Shipment Procedures are as follows:

(a) Samples should be accompanied by a properly completed COC form as detailed in Section 8.4. The sample numbers, locations, media, time of collection, preservatives and required analyses will be listed on the COC form. When transferring the possession of samples, the individuals relinquishing and receiving will sign, date, and note the time on the COC form. This COC form documents transfer of custody of samples from the sampler to another person, to a mobile laboratory, to the permanent laboratory, to the freight shipper, or to/from a secure storage area.

(b) Samples will be properly packaged for shipment and dispatched to the appropriate laboratory for analysis with a separate signed COC form enclosed in each sample cooler, box, or envelope. Samples will be packaged and transported in a manner that maintains the integrity of the samples and permits the analysis to be performed with the prescribed holding time. Samples in glass containers will be packaged in coolers with bubble-wrap packaging materials to prevent breakage during shipping. Shipping containers (i.e., coolers, boxes, and envelopes) will be locked and/or secured with one COC seal and strapping tape in at least two locations for shipment to the laboratory. The COC seal must be signed by the sampler (i.e., relinquisher) and dated.

(c) All shipments will be accompanied by the COC record identifying the contents. The original record (white) and laboratory copy (yellow) will be sealed in a plastic Ziploc bag and accompany the samples in the shipping container. The field copy (pink) will be retained by the sampler for filing in the project file.

(d) If samples are sent by common carrier, a bill of lading should be used. Receipts of bills of lading will be retained as part of the permanent documentation. If sent by mail, the package will be registered with a return receipt requested or with a tracking number. Commercial carriers are not required to sign off on the custody form as long as the custody forms are sealed in the shipping container (i.e., sample cooler, box or envelope).

The COC records will be kept with the analytical laboratory reports in the project file.

8.4 Field COC Forms

The FL or designee shall ensure the use of the Field COC forms (Attachment B) to document the integrity of all samples and to maintain a record of sample collection and transfer between personnel. The FL or designee shall ensure that information is supplied in all blank spaces on the Field COC form; if the space is not applicable, enter "N/A."

The Field COC form contains the following information:

- Event Name: The name assigned to the sampling event during the generation of the field-sampling paperwork.
- COC ID: A unique number assigned to the individual form.
- Sample ID: A unique identification number assigned to each sample. Do not fill in by hand or modify the Sample IDs. The sample IDs are unique and not field assigned.
- Sample Order Matrix: Sample matrix description provided to analytical laboratory.
- Team Leader: Team Leader, or designee, as appropriate.
- FL: The FL responsible for collection of the sample.
- Destination: The analytical laboratory where samples are sent.
- Destination POC: The analytical laboratory point of contact.
- Container ID: The container number for each container that makes up the sample.

- Order: The analytical method requested for the type of contaminant for which sample is analyzed.
- Container Description: Volume and type of container used.
- Preservative: Type of preservation needed for the particular analysis (e.g., ice, $HN0_3$, none).
- Collected Y/N: Indicate whether the container was collected by filling in "Y" or "N."
- Reason: Fill in the reason for not collecting a container. This is required if a container is not collected.
- Special Instructions: Additional relevant information pertaining to the samples (e.g., condition on receipt).
- Relinquished by and Date/Time: Printed name and signature of field team member transferring the possession of samples to the mobile analytical laboratory(s) or fixed base laboratory, or to any other authorized person and the date and time the samples are relinquished.
- Received by and Date/Time: Printed name and signature of the individual receiving the samples and the date and time the samples are received.

Note: The individual accepting custody of a sample or set of samples must verify that all containers identified on the Field COC Form are contained in the package(s) requiring acceptance. The signature on the form acknowledges receipt of all the sample containers.

8.5Use Custody Seals

The FL or designee shall ensure the use of Custody seals (Attachment C) in order to ensure that samples are not tampered with during transport to the analytical laboratory. The FL or designee shall ensure delivery of the sealed sample containers to the analytical laboratory.

Note: Seals are not required on each sample bottle, nor should they ever be placed on the soil VOC vials. Document in field notebooks if custody seals are not used and the reason that they are not used.

8.6Complete Field Investigation Summaries

8.6.1 Field personnel shall use bound field notebooks or Daily Activity Log forms (for use in loose-leaf notebooks), in addition to the sample control and field documentation, to record all pertinent field data; this includes detailed summaries of information pertaining to the field investigation and additional field data (e.g., unusual events such as storms).

Note: If Daily Activity Log Forms are used, paginate each sheet of the Daily Activity Log for each day (e.g., 1 of 4, 2 of 4, etc.). Entries in the Field Notebooks or Daily Activity Log forms include the following:

- Date: Month, day, and year at the start of each day and at the top of each page.
- Time: The time of each activity.
- Site Specific Work Plan: If applicable, include the Site Specific Work Plan number and/or name.
- Signature: Preparer must sign the entries at the end of each day.

- Comments: Comments may include, but are not limited to the following:
    - a general description of work performed;
    - deviations from approved plans or procedures;
    - names and affiliations of all participants on site (field team members and/or visitors);
    - a description of general field conditions (such as weather) encountered;
    - problems encountered/ resolutions implemented;
    - sketches and calculations pertaining to the job;
    - supplies and equipment used;
    - when photographs are taken in the field, the time, date, location, roll identification number, frame number, general compass direction, a description of the subject matter, and the photographer's name must be recorded;
    - decontamination practices, such as the time at which decontamination is performed;
    - a description of waste generated as a result of the field investigation; and/or
    - any additional field observations pertinent to the investigation.

9.1 RECORDS

The FL shall maintain the following records, and ensure records are submitted to Central Filing as appropriate:

- Field Notebooks.
- Electronic files on the "Touchpad" computer or equivalent, if used.
- Daily Activity Logs (if used).
- Sample collection information.
- Any other pertinent information.

10.0 ATTACHMENTS

Example Sample Labels and Custody Seals

Example Blank Chain-of-Custody Form

Example Sample Labels and Custody Seals

CUSTODY SEAL

DATE _____

SIGNATURE _____

QEC

Quality Environmental Containers

800-255-3950 • 304-255-3900

P O Box 1160
Beaver, WV 25813
800-255-3950 • 304-255-3900

Quality Environmental Containers

PROJECT NAME

SAMPLE ID	SAMPLE DATE
SAMPLED BY	SAMPLE TIME
PRESERVATIVE	_____GRAB COMPOSITE
ANALYSIS REQUESTED	

ae Analytical"

Pace Analytical Services, Inc.
1241 BellevueStreet ,Ste.9
Green Bay, WI 54302
(920) 469-2436

www.pacelabs.com

Client_____

Client Sample ID:_____

Date Collected:_____Time:_____

Collected by:_____

Analysis:_____

Preservatives: ONone OHN03 ONaOH OHCI

0Na2S203 0MeOH OZnAcetate OOther:_____

CHAIN-OF-CUSTODY / Analytical Request Document

The Chain-of-Custody is a LEGAL DOCUMENT. All relevant fields must be completed accurately.

Pace Analytical™ www.pacelabs.com

Page: of

Section A **Required** Client Information:	Section B **Required** Project Information:	Section C Invoice Information:
Company:	Report To:	Attention:
Address:	Copy To:	Company Name:
		Address:
Email To:	Purchase Order No.:	Pace Quote Reference:
Phone: Fax:	Project Name:	Pace Project Manager:
Requested Due Date/TAT:	Project Number:	Pace Profile #:

REGULATORY AGENCY

☐ NPDES ☐ GROUND WATER ☐ DRINKING WATER

☐ UST ☐ RCRA ☐ OTHER_____

SITE LOCATION: ☐ GA ☐ IL ☐ IN ☐ MI ☐ NC ☐ OH ☐ SC ☐ WI ☐ OTHER____

Section D **Required** Client Information

SAMPLE ID

One Character per box.
(A-Z, 0-9 / ,-)
Sample IDs MUST BE UNIQUE

Valid Matrix Codes

MATRIX	CODE
DRINKINGWATER	DW
WATER	WT
WASTE WATER	WW
PRODUCT	P
SOIL/SOLID	SL
OIL	OL
WIPE	WP
AIR	AR
OTHER	OT
TISSUE	TS

ITEM #	SAMPLE ID	MATRIX CODE	SAMPLE TYPE G=GRAB C=COMP	COLLECTED COMPOSITE START DATE	COLLECTED COMPOSITE START TIME	COLLECTED COMPOSITE END/GRAB DATE	COLLECTED COMPOSITE END/GRAB TIME	SAMPLE TEMP AT COLLECTION	# OF CONTAINERS	Preservatives: Unpreserved	H_2SO_4	HNO_3	HCl	NaOH	$Na_2S_2O_3$	Methanol	Other	Requested Analysis:	Residual Chlorine (Y/N)	Pace Project No. Lab I.D.
1																				
2																				
3																				
4																				
5																				
6																				
7																				
8																				
9																				
10																				
11																				
12																				

Additional Comments:

RELINQUISHED BY / AFFILIATION	DATE	TIME	ACCEPTED BY / AFFILIATION	DATE	TIME	SAMPLE CONDITIONS			
							Y/N	Y/N	Y/N
							Y/N	Y/N	Y/N
							Y/N	Y/N	Y/N
							Y/N	Y/N	Y/N
						Temp in °C	Received on Ice	Custody Sealed Cooler	Samples Intact

SAMPLER NAME AND SIGNATURE

PRINT Name of SAMPLER:

SIGNATURE of SAMPLER: DATE Signed (MM / DD / YY)

Identifier: SOP-08	Revision: 1	Effective Date: 04/28/2015	Stantec
Author: Stu Gross			

Standard Operating Procedure

for:

EQUIPMENT DECONTAMINATION

Responsible QA Manager: Richard J. Binder, P.G.	

SOP-08
Equipment Decontamination

Revision Log

Revision No.	***Effective Date***	***Prepared By***	***Description of Revisions***	***Affected Pages***
0	10/31/12	Stu Gross	New Procedure	All
1	04/28/15	Dave Constant	Removed Reference to Subcontractor from Section 2	5

SOP-08
Equipment Decontamination

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List of Acronyms and Abbreviations

ASTM	American Society for Testing and Materials
FL	field leader
HASP	health and safety plan
PPE	personal protective equipment
PL	project leader
QA/QC	quality assurance/quality control
SSHASP	Site-Specific Health and Safety Plan
SOP	standard operating procedure
SSO	site safety officer

SOP-08
EQUIPMENT DECONTAMINATION

1.0 PURPOSE

This standard operating procedure (SOP) states the responsibilities and describes the process to ensure that sampling equipment, drilling equipment and other tools that could come in contact with contaminated media are properly decontaminated. Personnel performing the decontamination procedures will wear the appropriate protective personal equipment (PPE) as specified in Stantec's Corporate Health and Safety Plan (HASP).

2.0 SCOPE

This SOP is a mandatory document and will be implemented by all Stantec personnel when performing decontamination of drilling and sampling equipment.

3.0 TRAINING

3.1 Participants shall train to (e.g., read and/or classroom) and use the current version of this SOP; contact the author of this SOP or the project QA/QC Officer if the text is unclear.

3.2 The Field Leader (FL) will ensure that field team members who are engaged in the collection of samples for Stantec projects are familiar with sampling equipment field decontamination objectives and procedures. This would include personnel who are collecting environmental media samples using hand tools, mechanical drilling and sampling equipment, or excavation equipment.

3.3 The responsible project leader (PL) shall monitor the proper implementation of this procedure.

3.4 The FL shall monitor the proper implementation of this procedure and ensure that relevant team members have completed all applicable training assignments.

4.0 DEFINITIONS

Note: Definitions are specific to this procedure.

4.1 Container - A portable device in which a material is stored, transported, treated, disposed of, or otherwise handled.

4.2 Cross contamination - The inadvertent introduction of contaminated materials from one location to another.

4.3 Site-Specific Health and Safety Plan (SSHASP) - A health and safety plan that is specific to a site or related field activity that has been approved by a Stantec health and safety representative. This document contains information specific to the project including scope of work, relevant history, descriptions of hazards by activity associated with the project site(s), and techniques for exposure mitigation (e.g., PPE) and hazard mitigation.

5.0 RESPONSIBLE PERSONNEL

The following identifies the personnel responsible for actions in this procedure:

5.1 Field Leader (FL)

5.2 Site Workers

5.3 Project Leader (PL)

5.4 Site Safety Officer (SSO)

6.0 BACKGROUND AND PRECAUTIONS

Note: This SOP is to be used in conjunction with an approved SSHASP. Also, consult the SSHASP for information on use of all PPE.

6.1 To help ensure that samples collected for the purpose of characterizing a potentially contaminated site are representative of the point place where they are collected, the equipment used to collect those samples should be decontaminated between each sampling event. Decontamination helps minimize the potential for cross contamination between sampling locations and helps protect site and community personnel by requiring that equipment not be removed from the site without proper decontamination. The decontamination process should be tailored to the types of contaminants anticipated. The volume of decontamination wastes generated should be kept to a minimum.

6.2 This procedure addresses decontamination for hazardous chemical constituents. A dry decontamination process is used first for the primary purpose of removing soil that may be contaminated by hazardous constituents, followed by a wet decontamination process intended to remove the remaining constituents. Dry decontamination is essentially the mechanical and/or chemical cleaning of the equipment without the excessive use of liquids. Dry decontamination is used first to minimize liquid waste production, especially the production of liquid mixed wastes. The solid waste produced by the dry decontamination process, however, may contain hazardous chemical constituents and become a mixed waste. Wet decontamination is essentially a washing process to remove constituents that are not removed by the dry decontamination process.

6.3 Wastes generated from drilling operations should be managed according to SOP-10.

6.4 Decontamination procedures shall be conducted in accordance with the applicable SSHASP to help ensure that personnel performing the decontamination are protected from equipment-related accidents and from exposures to hazardous and/or mixed wastes. Implementation of these procedures may involve steam cleaning of drilling, excavation, and sampling equipment.

7.0 EQUIPMENT

A checklist of suggested equipment and supplies needed to implement this procedure is provided below.

EQUIPMENT AND SUPPLIES CHECKLIST
FOR EQUIPMENT DECONTAMINATION

√	Quantity	Description	Comments
		SOP-07	
		SOP-10	
		Plastic sheeting	
		Pressure washer and collection basin (if required)	
		55-gallon steel drums (if required)	
		Non-phosphate detergent (e.g., Alconox® or Liquinox®)	
		Acid Rinses (inorganic desorbing agent) made from reagent grade diluted nitric or hydrochloric acid and deionized water (if required)	
		Solvent Rinses (organic desorbing agent) shall be pesticide grade methanol, hexane, isopropanol or acetone (if required)	
		Deionized water, organic-free reagent grade received from laboratory	
		Control water (i.e., tap water rinse from a local water system)	
		5-gallon buckets	
		Scrub brushes	
		Gloves (e.g., nitrile or polyethylene)	
		Personal protective clothing	

Participants shall use only the equipment and supplies authorized by the responsible PL and included on the equipment and supply checklist for this procedure. Participants shall report to the PL any equipment or supply item listed on the checklist that is not available for use and the need for equipment or supply items in addition to or different from the equipment and supplies listed on the checklist.

8.0 PROCEDURE

Field equipment used during the sampling activities will be decontaminated prior to sample collection to minimize the potential for cross-contamination. Whenever possible, disposable sampling equipment will be used to minimize the need for decontaminating equipment.

8.1Hand-held Sample Contact Equipment

Hand-held equipment may include split spoons, barrel or electric hand auger, spoons, knives, mixing bowls and pans, pumps, bailers, water level probe, and other devices.

(a) Minimum decontamination procedures are:

1. Wash all sample contact equipment with a non-phosphate detergent solution (e.g., Alconox® or Liquinox®).

2. Thoroughly rinse the equipment with control water.

(b) More rigorous decontamination procedures are:

1. Wash equipment with a non-phosphate detergent solution (e.g., Alconox® or Liquinox®) and scrub with an inert brush. For internal mechanisms and tubing, circulate the detergent solution through the equipment.

2. Thoroughly rinse the equipment with control water.

3. Rinse with an inorganic desorbing agent (i.e., acid rinse). This step may be deleted if samples will not undergo inorganic chemical analyses.

4. Rinse equipment with control water.

5. Rinse with organic desorbing agent (i.e., solvent rinse). This step may be deleted if samples will not undergo organic chemical analyses.

6. Rinse equipment with deionized water.

7. Allow equipment to air dry prior to next use.

8. Place equipment in an inert container or wrap with clean plastic or aluminum foil for storage or transport to prevent direct contact with potentially contaminated material.

(c) Decontaminate sampling equipment before use, between samples and locations, and upon completion of sampling operations.

(d) Depending on site conditions, it may be appropriate to contain spent decontamination rinse fluids. If appropriate, the rinse fluids shall be placed in a 55-gallon steel drum and secured. The drum shall be stored on-site until pending proper disposal arrangements.

(e) All equipment decontamination shall be performed at a centralized location on-site away from the location the equipment is expected to be used. Care must be taken to transport the equipment to the decontamination area so that the spread of potential contaminants is minimized.

8.2Large Sample and Non-contact Sample Equipment

Large sample contact equipment may include larger pieces of equipment such as casings, auger flights, pipe, rods, and those portions of a drill rig and Geoprobe® that may stand directly over a boring or well location or that come into contact with casing, auger flights pipe, or rods. Non-contact equipment is described as portions of the equipment that assist in sample collection but does not come in contact with the sample.

The following procedure shall be used to decontaminate the equipment:

(a) Wash external surfaces of the equipment with high-pressure hot water and a non-phosphate detergent solution (e.g., Alconox® or Liquinox®). Alternatively, scrub the equipment with inert brush until all visible dirt, grime, grease, oil, loose paint, rust flakes, etc.

(b) Wash the inside surfaces of casings, drill rods, and auger flights with high-pressure hot water and a non-phosphate detergent solution (e.g., Alconox® or Liquinox®). Alternatively, scrub the equipment with inert brush until all visible dirt, grime, grease, oil, loose paint, rust flakes, etc. are removed.

(c) Rinse equipment with control water.

(d) Decontaminate sampling equipment before use, between samples and locations, and upon completion of sampling operations.

(e) Depending on site conditions, it may be appropriate to contain spent decontamination rinse fluids. If appropriate, ultimately the rinse fluids shall be placed in a 55-gallon steel drum and secured. The drum shall be stored on-site until pending proper disposal arrangements.

(f) Depending on site conditions, spent decontamination rinse water can be allowed to drain directly on the ground surface on a location of the site away from the sampling locations.

(g) All equipment decontamination shall be performed at a centralized location on-site away from the location the equipment is expected to be used. Care must be taken to transport the equipment to the decontamination area so that the spread of potential contaminants is minimized.

(h) In addition, the contractor shall take care to prevent the sample from coming into contact with potentially contaminating substances, such as tape, oil, engine exhaust, corroded surfaces and dirt.

8.3Decontamination Documentation

Decontamination documentation shall include at a minimum the following:

(a) The location where decontamination occurred.

(b) The individuals performing the decontamination.

(c) The decontamination procedures, including the wash solution and rinse water used (e.g., tap water or reagent grade water).

(d) Equipment storage and transportation procedures.

(e) The handling and disposal of decontamination wastewater.

If this information has already been included in a site sampling plan, re-documentation shall not be necessary.

9.0 RECORDS

The FL is responsible for maintaining the following records.

9.1 Training documentation checklist

9.2 Field notebook

Note: General decontamination activities shall be documented in the field notebook. Should deviations in conditions or problems occur, they should be noted in the field notebook per SOP-07.

10.1 REFERENCES

To implement this procedure properly, participants should become familiar with the contents of the following documents:

- SOP-07, Chain-of-Custody, Sample Control and Field Documentation Procedures
- SOP-10, Management of Investigative Wastes
- American Society for Testing and Materials (ASTM), “Standard Practice for Decontamination of Field Equipment Used at Nonradioactive Waste Sites, ASTM D 5088”, American Society for Testing and Materials, 2002, revised 2008.
- U.S. Department of Energy, 1987, “Appendix G: Decontamination Guidance,” in The Environmental Survey Manual, Report DOE/EH-0053. Washington, D.C.
- U.S. Environmental Protection Agency, 1994, Sampling Equipment Decontamination, EPA SOP No. 2006, Rev. 0.0, August 11, 1994.

11.1 ATTACHMENTS

Attachment A: U.S. Environmental Protection Agency, 1994, Sampling Equipment Decontamination, EPA SOP No. 2006, Rev. 0.0, August 11, 1994.

SAMPLING EQUIPMENT DECONTAMINATION

SOP#: 2006
DATE: 08/11/94
REV. #: 0.0

1.0 SCOPE AND APPLICATION

The purpose of this Standard Operating Procedure (SOP) is to provide a description of the methods used for preventing, minimizing, or limiting cross-contamination of samples due to inappropriate or inadequate equipment decontamination and to provide general guidelines for developing decontamination procedures for sampling equipment to be used during hazardous waste operations as per 29 Code of Federal Regulations (CFR) 1910.120. This SOP does not address personnel decontamination.

These are standard (i.e. typically applicable) operating procedures which may be varied or changed as required, dependent upon site conditions, equipment limitation, or limitations imposed by the procedure. In all instances, the ultimate procedures employed should be documented and associated with the final report.

Mention of trade names or commercial products does not constitute U.S. Environmental Protection Agency (U.S. EPA) endorsement or recommendation for use.

2.0 METHOD SUMMARY

Removing or neutralizing contaminants from equipment minimizes the likelihood of sample cross contamination, reduces or eliminates transfer of contaminants to clean areas, and prevents the mixing of incompatible substances.

Gross contamination can be removed by physical decontamination procedures. These abrasive and non-abrasive methods include the use of brushes, air and wet blasting, and high and low pressure water cleaning.

The first step, a soap and water wash, removes all visible particulate matter and residual oils and grease. This may be preceded by a steam or high pressure water wash to facilitate residuals removal. The second step involves a tap water rinse and a distilled/deionized water rinse to remove the detergent. An acid rinse provides a low pH media for trace metals removal and is included in the decontamination process if metal samples are to be collected. It is followed by another distilled/deionized water rinse. If sample analysis does not include metals, the acid rinse step can be omitted. Next, a high purity solvent rinse is performed for trace organics removal if organics are a concern at the site. Typical solvents used for removal of organic contaminants include acetone, hexane, or water. Acetone is typically chosen because it is an excellent solvent, miscible in water, and not a target analyte on the Priority Pollutant List. If acetone is known to be a contaminant of concern at a given site or if Target Compound List analysis (which includes acetone) is to be performed, another solvent may be substituted. The solvent must be allowed to evaporate completely and then a final distilled/deionized water rinse is performed. This rinse removes any residual traces of the solvent.

The decontamination procedure described above may be summarized as follows:

1. Physical removal
2. Non-phosphate detergent wash
3. Tap water rinse
4. Distilled/deionized water rinse
5. 10% nitric acid rinse
6. Distilled/deionized water rinse
7. Solvent rinse (pesticide grade)
8. Air dry
9. Distilled/deionized water rinse

If a particular contaminant fraction is not present at the site, the nine (9) step decontamination procedure specified above may be modified for site specificity. For example, the nitric acid rinse may be eliminated if metals are not of concern at a site. Similarly, the solvent rinse may be eliminated if organics are not of

concern at a site. Modifications to the standard procedure should be documented in the site specific work plan or subsequent report.

3.0 SAMPLE PRESERVATION, CONTAINERS, HANDLING, AND STORAGE

The amount of sample to be collected and the proper sample container type (i.e., glass, plastic), chemical preservation, and storage requirements are dependent on the matrix being sampled and the parameter(s) of interest.
More specifically, sample collection and analysis of decontamination waste may be required before beginning proper disposal of decontamination liquids and solids generated at a site. This should be determined prior to initiation of site activities.

4.0 INTERFERENCES AND POTENTIAL PROBLEMS

- The use of distilled/deionized water commonly available from commercial vendors may be acceptable for decontamination of sampling equipment provided that it has been verified by laboratory analysis to be analyte free (specifically for the contaminants of concern).

- The use of an untreated potable water supply is not an acceptable substitute for tap water. Tap water may be used from any municipal or industrial water treatment system.

- If acids or solvents are utilized in decontamination they raise health and safety, and waste disposal concerns.

- Damage can be incurred by acid and solvent washing of complex and sophisticated sampling equipment.

5.1 EQUIPMENT/APPARATUS

Decontamination equipment, materials, and supplies are generally selected based on availability. Other considerations include the ease of decontaminating or disposing of the equipment. Most equipment and supplies can be easily procured. For example, soft-bristle scrub brushes or long-handled bottle brushes can be used to remove contaminants. Large galvanized wash tubs, stock tanks, or buckets can hold wash and rinse solutions. Children's wading pools can also be used. Large plastic garbage cans or other similar containers lined with plastic bags can help segregate contaminated equipment. Contaminated liquid can be stored temporarily in metal or plastic cans or drums.

The following standard materials and equipment are recommended for decontamination activities:

5.2 Decontamination Solutions

- Non-phosphate detergent
- Selected solvents (acetone, hexane, nitric acid, etc.)
- Tap water
- Distilled or deionized water

5.3 Decontamination Tools/Supplies

- Long and short handled brushes
- Bottle brushes
- Drop cloth/plastic sheeting
- Paper towels
- Plastic or galvanized tubs or buckets
- Pressurized sprayers (H_2O)
- Solvent sprayers
- Aluminum foil

5.4 Health and Safety Equipment

Appropriate personal protective equipment (i.e., safety glasses or splash shield, appropriate gloves, aprons or coveralls, respirator, emergency eye wash)

5.5 Waste Disposal

- Trash bags
- Trash containers
- 55-gallon drums
- Metal/plastic buckets/containers for storage and disposal of decontamination solutions

6.0 REAGENTS

There are no reagents used in this procedure aside from the actual decontamination solutions. Table 1 (Appendix A) lists solvent rinses which may be required for elimination of particular chemicals. In

general, the following solvents are typically utilized for decontamination purposes:

- 10% nitric acid is typically used for inorganic compounds such as metals. An acid rinse may not be required if inorganics are not a contaminant of concern.
- Acetone (pesticide grade)[1]
- Hexane (pesticide grade)[1]
- Methanol[1]

[1] - Only if sample is to be analyzed for organics.

7.0 PROCEDURES

As part of the health and safety plan, a decontamination plan should be developed and reviewed. The decontamination line should be set up before any personnel or equipment enter the areas of potential exposure. The equipment decontamination plan should include:

- The number, location, and layout of decontamination stations.
- Decontamination equipment needed.
- Appropriate decontamination methods.
- Methods for disposal of contaminated clothing, equipment, and solutions.
- Procedures can be established to minimize the potential for contamination. This may include: (1) work practices that minimize contact with potential contaminants; (2) using remote sampling techniques; (3) covering monitoring and sampling equipment with plastic, aluminum foil, or other protective material; (4) watering down dusty areas; (5) avoiding laying down equipment in areas of obvious contamination; and (6) use of disposable sampling equipment.

7.1 Decontamination Methods

All samples and equipment leaving the contaminated area of a site must be decontaminated to remove any contamination that may have adhered to equipment. Various decontamination methods will remove contaminants by: (1) flushing or other physical action, or (2) chemical complexing to inactivate contaminants by neutralization, chemical reaction, disinfection, or sterilization.

Physical decontamination techniques can be grouped into two categories: abrasive methods and non-abrasive methods, as follows:

7.1.1 Abrasive Cleaning Methods

Abrasive cleaning methods work by rubbing and wearing away the top layer of the surface containing the contaminant. The mechanical abrasive cleaning methods are most commonly used at hazardous waste sites. The following abrasive methods are available:

Mechanical

Mechanical methods of decontamination include using metal or nylon brushes. The amount and type of contaminants removed will vary with the hardness of bristles, length of time brushed, degree of brush contact, degree of contamination, nature of the surface being cleaned, and degree of contaminant adherence to the surface.

Air Blasting

Air blasting equipment uses compressed air to force abrasive material through a nozzle at high velocities. The distance between nozzle and surface cleaned, air pressure, time of application, and angle at which the abrasive strikes the surface will dictate cleaning efficiency. Disadvantages of this method are the inability to control the amount of material removed and the large amount of waste generated.

Wet Blasting

Wet blast cleaning involves use of a suspended fine abrasive. The abrasive/water mixture is delivered by compressed air to the contaminated area. By using a very fine abrasive, the amount of materials removed can be carefully controlled.

7.1.2 Non-Abrasive Cleaning Methods

Non-abrasive cleaning methods work by forcing the contaminant off a surface with pressure. In general, the equipment surface is not removed using non-abrasive methods.

Low-Pressure Water

This method consists of a container which is filled with water. The user pumps air out of the container to create a vacuum. A slender nozzle and hose allow the user to spray in hard-to-reach places.

High-Pressure Water

This method consists of a high-pressure pump, an operator controlled directional nozzle, and a high-pressure hose. Operating pressure usually ranges from 340 to 680 atmospheres (atm) and flow rates usually range from 20 to 140 liters per minute.

Ultra-High-Pressure Water

This system produces a water jet that is pressured from 1,000 to 4,000 atmospheres. This ultra-high-pressure spray can remove tightly-adhered surface films. The water velocity ranges from 500 meters/second (m/s) (1,000 atm) to 900 m/s (4,000 atm). Additives can be used to enhance the cleaning action.

Rinsing

Contaminants are removed by rinsing through dilution, physical attraction, and solubilization.

Damp Cloth Removal

In some instances, due to sensitive, non-waterproof equipment or due to the unlikelihood of equipment being contaminated, it is not necessary to conduct an extensive decontamination procedure. For example, air sampling pumps hooked on a fence, placed on a drum, or wrapped in plastic bags are not likely to become heavily contaminated. A damp cloth should be used to wipe off contaminants which may have adhered to equipment through airborne contaminants or from surfaces upon which the equipment was set.

Disinfection/Sterilization

Disinfectants are a practical means of inactivating infectious agents. Unfortunately, standard sterilization methods are impractical for large equipment. This method of decontamination is typically performed off-site.

7.2 Field Sampling Equipment Decontamination Procedures

The decontamination line is setup so that the first station is used to clean the most contaminated item. It progresses to the last station where the least contaminated item is cleaned. The spread of contaminants is further reduced by separating each decontamination station by a minimum of three (3) feet. Ideally, the contamination should decrease as the equipment progresses from one station to another farther along in the line.

A site is typically divided up into the following boundaries: Hot Zone or Exclusion Zone (EZ), the Contamination Reduction Zone (CRZ), and the Support or Safe Zone (SZ). The decontamination line should be setup in the Contamination Reduction Corridor (CRC) which is in the CRZ. Figure 1 (Appendix B) shows a typical contaminant reduction zone layout. The CRC controls access into and out of the exclusion zone and confines decontamination activities to a limited area. The CRC boundaries should be conspicuously marked. The far end is the hotline, the boundary between the exclusion zone and the contamination reduction zone. The size of the decontamination corridor depends on the number of stations in the decontamination process, overall dimensions of the work zones, and amount of space available at the site. Whenever possible, it should be a straight line.

Anyone in the CRC should be wearing the level of protection designated for the decontamination crew. Another corridor may be required for the entry and exit of heavy equipment. Sampling and monitoring equipment and sampling supplies are all maintained outside of the CRC. Personnel don their equipment away from the CRC and enter the exclusion zone through a separate access control point at the hotline. One person (or more) dedicated to decontaminating equipment is recommended.

7.2.1 Decontamination Setup

Starting with the most contaminated station, the decontamination setup should be as follows:

Station 1: Segregate Equipment Drop

Place plastic sheeting on the ground (Figure 2, Appendix B). Size will depend on amount of

equipment to be decontaminated. Provide containers lined with plastic if equipment is to be segregated. Segregation may be required if sensitive equipment or mildly contaminated equipment is used at the same time as equipment which is likely to be heavily contaminated.

Station 2: Physical Removal With A High-Pressure Washer (Optional)

As indicated in 7.1.2, a high-pressure wash may be required for compounds which are difficult to remove by washing with brushes. The elevated temperature of the water from the high-pressure washers is excellent at removing greasy/oily compounds. High pressure washers require water and electricity.

A decontamination pad may be required for the high-pressure wash area. An example of a wash pad may consist of an approximately 1 1/2 foot-deep basin lined with plastic sheeting and sloped to a sump at one corner. A layer of sand can be placed over the plastic and the basin is filled with gravel or shell. The sump is also lined with visqueen and a barrel is placed in the hole to prevent collapse. A sump pump is used to remove the water from the sump for transfer into a drum.

Typically heavy machinery is decontaminated at the end of the day unless site sampling requires that the machinery be decontaminated frequently. A separate decontamination pad may be required for heavy equipment.

Station 3: Physical Removal With Brushes And A Wash Basin

Prior to setting up Station 3, place plastic sheeting on the ground to cover areas under Station 3 through Station 10.
Fill a wash basin, a large bucket, or child's swimming pool with non-phosphate detergent and tap water. Several bottle and bristle brushes to physically remove contamination should be dedicated to this station. Approximately 10 - 50 gallons of water may be required initially depending upon the amount of equipment to decontaminate and the amount of gross contamination.

Station 4: Water Basin

Fill a wash basin, a large bucket, or child's swimming pool with tap water. Several bottle and bristle brushes should be dedicated to this station. Approximately 10-50 gallons of water may be required initially depending upon the amount of equipment to decontaminate and the amount of gross contamination.

Station 5: Low-Pressure Sprayers

Fill a low-pressure sprayer with distilled/deionized water. Provide a 5-gallon bucket or basin to contain the water during the rinsing process. Approximately 10-20 gallons of water may be required initially depending upon the amount of equipment to decontaminate and the amount of gross contamination.

Station 6: Nitric Acid Sprayers

Fill a spray bottle with 10% nitric acid. An acid rinse may not be required if inorganics are not a contaminant of concern. The amount of acid will depend on the amount of equipment to be decontaminated. Provide a 5-gallon bucket or basin to collect acid during the rinsing process.

Station 7: Low-Pressure Sprayers

Fill a low-pressure sprayer with distilled/deionized water. Provide a 5-gallon bucket or basin to collect water during the rinsate process.

Station 8: Organic Solvent Sprayers

Fill a spray bottle with an organic solvent. After each solvent rinse, the equipment should be rinsed with distilled/deionized water and air dried. Amount of solvent will depend on the amount of equipment to decontaminate. Provide a 5-gallon bucket or basin to collect the solvent during the rinsing process.

Solvent rinses may not be required unless organics are a contaminant of concern, and may be eliminated from the station sequence.

Station 9: Low-Pressure Sprayers

Fill a low-pressure sprayer with distilled/deionized water. Provide a 5-gallon bucket or basin to collect water during the rinsate process.

Station 10: Clean Equipment Drop

Lay a clean piece of plastic sheeting over the bottom

plastic layer. This will allow easy removal of the plastic in the event that it becomes dirty. Provide aluminum foil, plastic, or other protective material to wrap clean equipment.

7.2.2 Decontamination Procedures

Station 1: Segregate Equipment Drop

Deposit equipment used on-site (i.e., tools, sampling devices and containers, monitoring instruments radios, clipboards, etc.) on the plastic drop cloth/sheet or in different containers with plastic liners. Each will be contaminated to a different degree. Segregation at the drop reduces the probability of cross contamination. Loose leaf sampling data sheets or maps can be placed in plastic zip lock bags if contamination is evident.

Station 2: Physical Removal With A High-Pressure Washer (Optional)

Use high pressure wash on grossly contaminated equipment. Do not use high- pressure wash on sensitive or non-waterproof equipment.

Station 3: Physical Removal With Brushes And A Wash Basin

Scrub equipment with soap and water using bottle and bristle brushes. Only sensitive equipment (i.e., radios, air monitoring and sampling equipment) which is waterproof should be washed. Equipment which is not waterproof should have plastic bags removed and wiped down with a damp cloth. Acids and organic rinses may also ruin sensitive equipment. Consult the manufacturers for recommended decontamination solutions.

Station 4: Equipment Rinse

Wash soap off of equipment with water by immersing the equipment in the water while brushing. Repeat as many times as necessary.

Station 5: Low-Pressure Rinse

Rinse sampling equipment with distilled/deionized water with a low-pressure sprayer.

Station 6: Nitric Acid Sprayers (required only if metals are a contaminant of concern)

Using a spray bottle rinse sampling equipment with nitric acid. Begin spraying (inside and outside) at one end of the equipment allowing the acid to drip to the other end into a 5-gallon bucket. A rinsate blank may be required at this station. Refer to Section 9.

Station 7: Low-Pressure Sprayers

Rinse sampling equipment with distilled/deionized water with a low-pressure sprayer.

Station 8: Organic Solvent Sprayers

Rinse sampling equipment with a solvent. Begin spraying (inside and outside) at one end of the equipment allowing the solvent to drip to the other end into a 5-gallon bucket. Allow the solvent to evaporate from the equipment before going to the next station. A QC rinsate sample may be required at this station.

Station 9: Low-Pressure Sprayers

Rinse sampling equipment with distilled/deionized water with a low-pressure washer.

Station 10 : Clean Equipment Drop

Lay clean equipment on plastic sheeting. Once air dried, wrap sampling equipment with aluminum foil, plastic, or other protective material.

7.2.3 Post Decontamination Procedures

1. Collect high-pressure pad and heavy equipment decontamination area liquid and waste and store in appropriate drum or container. A sump pump can aid in the collection process. Refer to the Department of Transportation (DOT) requirements for appropriate containers based on the contaminant of concern.

2. Collect high-pressure pad and heavy equipment decontamination area solid waste and store in appropriate drum or container. Refer to the DOT requirements for appropriate containers based on the contaminant of concern.

3. Empty soap and water liquid wastes from basins and buckets and store in appropriate

drum or container. Refer to the DOT requirements for appropriate containers based on the contaminant of concern.

4. Empty acid rinse waste and place in appropriate container or neutralize with a base and place in appropriate drum. pH paper or an equivalent pH test is required for neutralization. Consult DOT requirements for appropriate drum for acid rinse waste.

5. Empty solvent rinse sprayer and solvent waste into an appropriate container. Consult DOT requirements for appropriate drum for solvent rinse waste.

6. Using low-pressure sprayers, rinse basins, and brushes. Place liquid generated from this process into the wash water rinse container.

7. Empty low-pressure sprayer water onto the ground.

8. Place all solid waste materials generated from the decontamination area (i.e., gloves and plastic sheeting, etc.) in an approved DOT drum. Refer to the DOT requirements for appropriate containers based on the contaminant of concern.

9. Write appropriate labels for waste and make arrangements for disposal. Consult DOT regulations for the appropriate label for each drum generated from the decontamination process.

8.0 CALCULATIONS

This section is not applicable to this SOP.

9.0 QUALITYASSURANCE / QUALITY CONTROL

A rinsate blank is one specific type of quality control sample associated with the field decontamination process. This sample will provide information on the effectiveness of the decontamination process employed in the field.

Rinsate blanks are samples obtained by running analyte free water over decontaminated sampling equipment to test for residual contamination. The blank water is collected in sample containers for handling, shipment, and analysis. These samples are treated identical to samples collected that day. A rinsate blank is used to assess cross contamination brought about by improper decontamination procedures. Where dedicated sampling equipment is not utilized, collect one rinsate blank per day per type of sampling device samples to meet QA2 and QA3 objectives.

If sampling equipment requires the use of plastic tubing it should be disposed of as contaminated and replaced with clean tubing before additional sampling occurs.

10.0 DATA VALIDATION

Results of quality control samples will be evaluated for contamination. This information will be utilized to qualify the environmental sample results in accordance with the project's data quality objectives.

11.0 HEALTH AND SAFETY

When working with potentially hazardous materials, follow OSHA, U.S. EPA, corporate, and other applicable health and safety procedures.

Decontamination can pose hazards under certain circumstances. Hazardous substances may be incompatible with decontamination materials. For example, the decontamination solution may react with contaminants to produce heat, explosion, or toxic products. Also, vapors from decontamination solutions may pose a direct health hazard to workers by inhalation, contact, fire, or explosion.

The decontamination solutions must be determined to be acceptable before use. Decontamination materials may degrade protective clothing or equipment; some solvents can permeate protective clothing. If decontamination materials do pose a health hazard, measures should be taken to protect personnel or substitutions should be made to eliminate the hazard. The choice of respiratory protection based on contaminants of concern from the site may not be appropriate for solvents used in the decontamination process.

Safety considerations should be addressed when using abrasive and non-abrasive decontamination

equipment. Maximum air pressure produced by abrasive equipment could cause physical injury. Displaced material requires control mechanisms.

Material generated from decontamination activities requires proper handling, storage, and disposal. Personal Protective Equipment may be required for these activities.

Material safety data sheets are required for all decontamination solvents or solutions as required by the Hazard Communication Standard (i.e., acetone, alcohol, and trisodiumphosphate).

In some jurisdictions, phosphate containing detergents (i.e., TSP) are banned.

12.0 REFERENCES

Field Sampling Procedures Manual, New Jersey Department of Environmental Protection, February, 1988.

A Compendium of Superfund Field Operations Methods, EPA 540/p-87/001.

Engineering Support Branch Standard Operating Procedures and Quality Assurance Manual, USEPA Region IV, April 1, 1986.

Guidelines for the Selection of Chemical Protective Clothing, Volume 1, Third Edition, American Conference of Governmental Industrial Hygienists, Inc., February, 1987.

Occupational Safety and Health Guidance Manual for Hazardous Waste Site Activities, NIOSH/OSHA/USCG/EPA, October, 1985.

APPENDIX A

Table

Table 1. Soluble Contaminants and Recommended Solvent Rinse

TABLE 1 Soluble Contaminants and Recommended Solvent Rinse		
SOLVENT [1]	EXAMPLES OF SOLVENTS	SOLUBLE CONTAMINANTS
Water	Deionized water Tap water	Low-chain hydrocarbons Inorganic compounds Salts Some organic acids and other polar compounds
Dilute Acids	Nitric acid Acetic acid Boric acid	Basic (caustic) compounds (e.g., amines and hydrazines)
Dilute Bases	Sodium bicarbonate (e.g., soap detergent)	Acidic compounds Phenol Thiols Some nitro and sulfonic compounds
Organic Solvents [2]	Alcohols Ethers Ketones Aromatics Straight chain alkalines (e.g., hexane) Common petroleum products (e.g., fuel, oil, kerosene)	Nonpolar compounds (e.g., some organic compounds)
Organic Solvent [2]	Hexane	PCBs

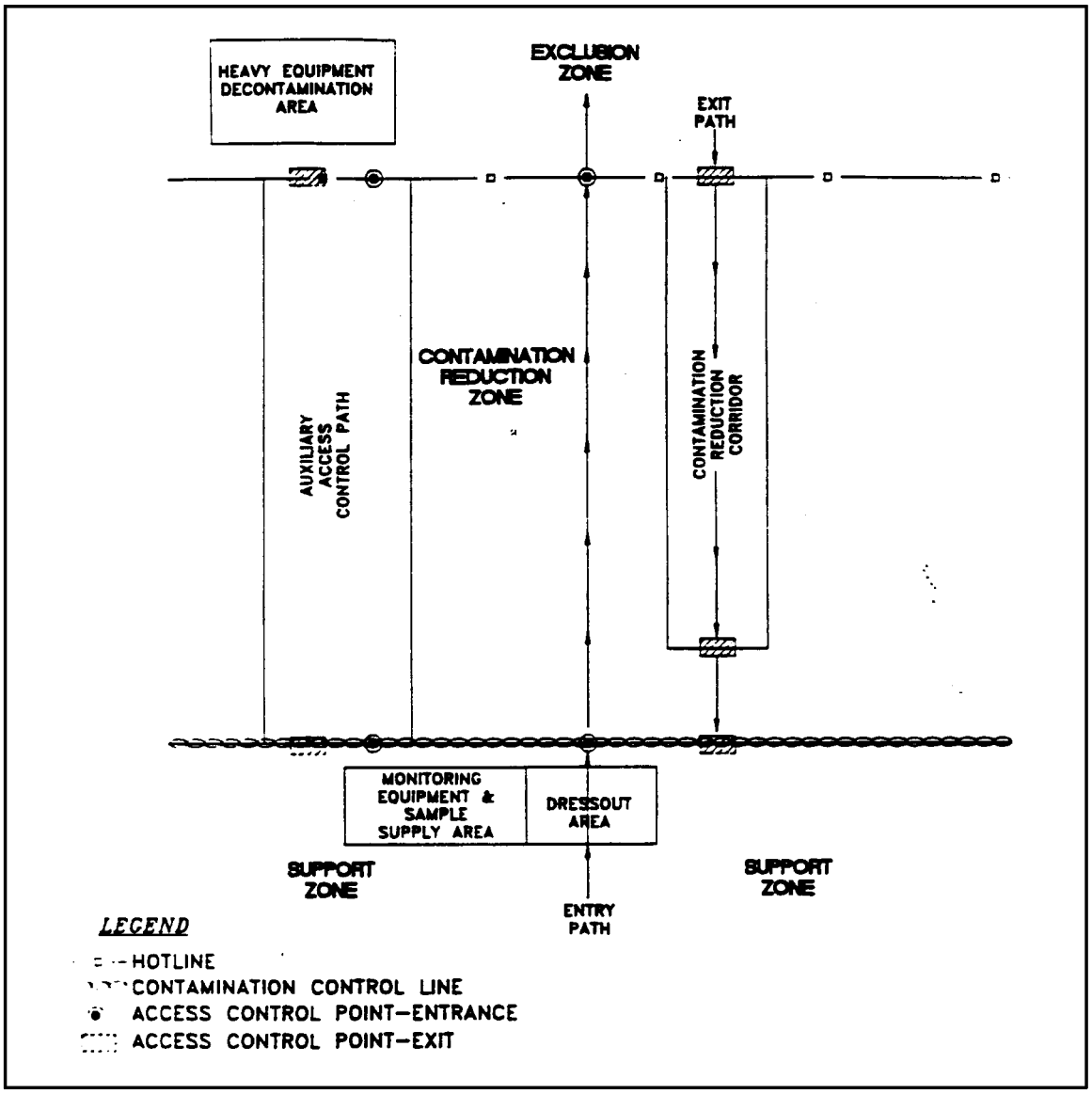
[1] - Material safety data sheets are required for all decontamination solvents or solutions as required by the Hazard Communication Standard

[2] - WARNING: Some organic solvents can permeate and/or degrade the protective clothing

APPENDIX B

Figures

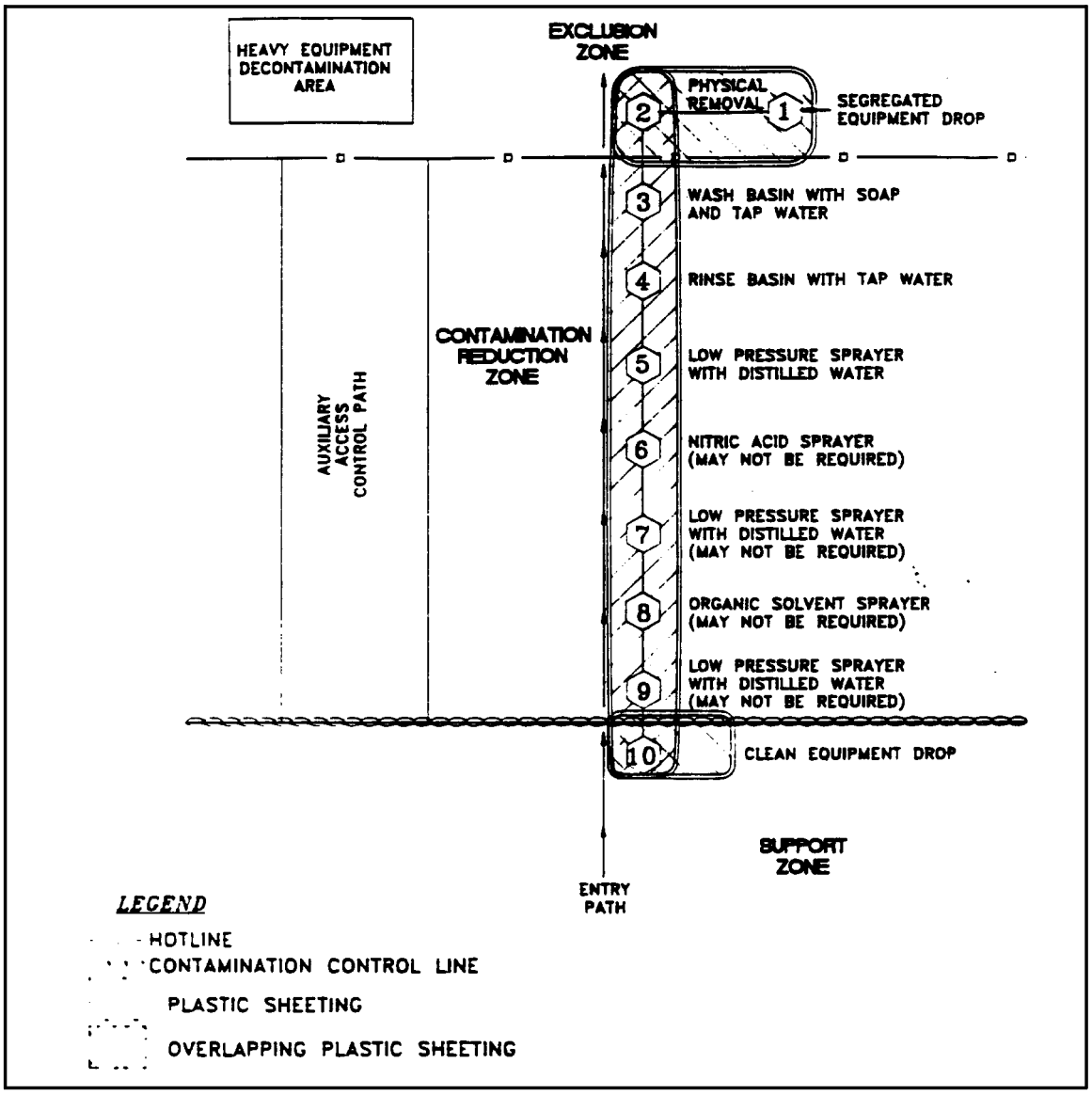
Figure 1. Contamination Reduction Zone Layout



APPENDIX B (Cont'd.)

Figures

Figure 2. Decontamination Layout



Identifier: SOP-09	Revision: 1	Effective Date: 04/17/2013	Stantec
Author: Stu Gross			

Standard Operating Procedure

for:

CALIBRATION, MAINTENANCE, AND OPERATION OF FIELD EQUIPMENT

Responsible QA Manager: Richard J. Binder, P.G.	

SOP-09
Calibration, Maintenance, and Operation of Field Equipment

Revision Log

Revision No.	***Effective Date***	***Prepared By***	***Description of Revisions***	***Affected Pages***
0	10/31/12	Stu Gross	New Procedure	All
1	04/17/2013	Michael Nied	QAPP revisions per request	13
2	1/13/14	Lynelle Caine	Changed stabilization criteria	11

SOP-09
Calibration, Maintenance, and Operation of Field Equipment

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List of Acronyms and Abbreviations

C	centigrade
DO	Dissolved oxygen
DTW	depth to water
ECR	environmental characterization and/or remediation
F	Fahrenheit
FL	Field Leader
HAZWOPER	Hazardous Waste Operations & Emergency Response Training for General Site Workers
LCD	liquid crystal display
Mg/L	milligrams per liter
ORP	oxygen release potential
PID	photoionization detector
PL	Project Leader
PPE	personal protective equipment
Ppm	parts per million
QA/QC	quality assurance/quality control
SOP	standard operating procedure
SSHASP	site-specific health and safety plan

SOP-09
CALIBRATION, MAINTENANCE, AND OPERATION OF FIELD EQUIPMENT

1.0 PURPOSE

This standard operating procedure (SOP) describes the procedures for calibration, operation, and maintenance of field measurement and testing equipment commonly utilized by Stantec on environmental assessment and other environmental projects. The purpose for this SOP is to ensure accurate and consistent field chemistry, water level, and organic vapor measurements using measuring and testing equipment such as:

(1) Photoionization Detector (PID)
(2) Portable Standard Balance
(3) Electronic water level indicator
(4) YSI 55 Dissolved Oxygen (DO)/temperature meter
(5) YSI 556 Multi-meter
(6) pH/Temperature/Conductivity meter
(7) Oxidation Reduction Potential (ORP) pen

2.0 SCOPE

Participants shall implement this procedure when collecting samples for Stantec projects.

2.1 All participants shall implement this mandatory SOP when performing operation, maintenance, or calibration of field instruments used on Stantec environmental projects.

2.2 If field measurement instruments not included in this SOP are utilized on a project, Section 8.0 of this SOP should be modified to include procedures specific to that instrument.

3.0 TRAINING

3.1 Participants shall train to (e.g., read and/or attend a class) and use the current version of this SOP; contact the author of this SOP or the Project QA/QC Officer if the text is unclear.

3.1.1 Participants who provide oversight for field sampling activities that utilize one or more field instruments shall complete training on this SOP.

3.1.2 Participants who calibrate, maintain, or operate field instruments shall complete training and on this SOP, as well as review equipment manufacturers manuals for each field instrument utilized.

3.2 The responsible project leader (PL) shall monitor the proper implementation of this procedure.

3.3 The responsible team leader shall ensure that the appropriate personnel complete all applicable training assignments.

4.0 DEFINITIONS

4.1 Site-specific health and safety plan (SSHASP) - Health and safety plan that is specific to a site or related field activity approved by a Stantec health and safety representative. This document contains information specific to the project, including the scope of work, relevant history, descriptions of hazards by activity associated with the project site(s), and techniques for exposure mitigation (e.g., personal protective equipment [PPE]) and hazard mitigation.

4.2 Standard operating procedure (SOP) – A document that describes work processes to be used by Bonestroo in performing work on environmental characterization and/or remediation (ECR) projects.

4.3 Technical team members – The individuals working on the project.

4.4 Field team members – Those authorized individuals present at a sampling site during sample collection. Their presence at the site must be documented. This is done with site access lists or sign-in sheets that are kept outside the exclusion zone. The documentation is required through Hazardous Waste Operations & Emergency Response Training for General Site Workers (HAZWOPER). In the case of an emergency the Field Leader (FL) must know who is on site.

5.0 RESPONSIBLE PERSONNEL

The following identifies the personnel responsible for actions in this procedure:

- Data Management Staff
- project participants (hereinafter referred to as “participants” or “users”)
- Field Leader or designee
- Project leader
- Team leader
- Users

6.0 BACKGROUND AND PRECAUTIONS

6.1 Handle all gas canisters in accordance with an approved SSHASP.

6.2 Field measurements form a critical component of data collection as part of site assessments or other environmental projects. Making certain that field equipment is properly maintained, calibrated, and operated is critical to the reliably of the decision process and/or evaluations made based on the field measurement data. As such, equipment maintenance, calibration should be carefully documented as part of the project record keeping to ensure defensibility of resulting data.

7.0 EQUIPMENT

A checklist of suggested equipment and supplies needed to implement this procedure is provided below.

CHECKLIST FOR FIELD EQUIPMENT CALIBRATION, MAINTENANCE, AND OPERATION

√	Quantity	Description	Comments
		Thermo Environmental Instruments, Inc. PID	
		PID calibration gases (i.e., Zero air and 254 parts per million [ppm] isobutylene)	
		CS2000 Portable Standard Balance	
		Weight Set or 1-1,000 gram test mass	
		pH/temperature/Conductivity meter	
		Buffer solutions of pH 4, 7 and 10	
		ORP pen	
		Electronic water level indicator	
		YSI-556 Multi-meter	
		YSI-55 DO meter	
		SOP-8	

8.0 PROCEDURE

Field personnel are responsible for the calibration, calibration verification and maintenance of the measuring and testing equipment in accordance with this procedure and documented maintenance and calibration schedules.

8.1 PID

8.1.1 Calibration Frequency:

PIDs require calibration at the beginning of each day and as necessary during use.

8.1.2 Calibration Standards and Procedure:

Calibrate PID in accordance with the manufacturer's specifications. The PID is calibrated using zero air and 254 ppm isobutylene gas.

8.1.3 Maintenance:

Maintain the instrument as follows:

1) Calibrate at the beginning and end of each day, and as necessary during use.

2) Recharge battery at the end of each day.

3) Clean lamp and dust filter as necessary.

4) Replace water traps if they become wet.

8.1.4 Operation:

Operate the instrument as follows:

1) Label new quart-size Ziploc® bag (or similar "locking" plastic bag, or glass mason jar) with the sample identification number.

2) Place representative soil or sediment sample in Ziploc® bag until bag is approximately one-half full. Capture approximately 1 quart of air in the bag. Seal Ziploc® bag (or glass jar with aluminum foil seal and screw cap ring) and homogenize sample (i.e., shake gently).

3) Place bag on a stationary surface, to allow the headspace to come to equilibrium with the soil or sediment sample. The following are general guidelines for minimum equilibration times in different ambient air conditions:

Ambient Temperature (°F)	**Minimum equilibration times**
> 90°	2 minutes
> 70° but ≤ 90°	5 minutes
> 50° but ≤ 70°	10 minutes
≤ 50°	15 minutes

It should be noted that in very hot conditions, a buildup of water vapor in the bag may occur if the bag and sample are heated for too long that may interfere with the operation of the PID.

4) Turn on PID. Calibrate PID prior to first measurement each day. After instrument is calibrated and warmed up, insert the tip of the PID probe into the headspace of: (a) the Ziploc® bag by piercing it with the probe, or (b) the glass jar by piercing the aluminum foil seal with the probe tip. Avoid making contact with the soil or sediment sample with the instrument tip to prevent the sample from being sucked into the instrument.

5) Move soil or sediment around in the bag while the instrument is reading. Record the highest sustained reading in the field book. Turn off PID if no other samples are ready for testing.

8.2 Portable Standard Balance

8.2.1 Calibration Frequency:

At the beginning of each day and as needed during use.

8.2.2 Calibration Standards and Procedure:

Calibrate balance in accordance with the manufacturer's specifications using a 10 - gram test mass or weight.

8.2.3 Maintenance:

Maintain the instrument as follows:

1) Calibrate at the beginning of each day, and as necessary during use.

2) Clean platform at the end of each day, and as necessary during use.

3) Replace batteries as needed.

8.2.4 Operation:

Operate the instrument as follows:

1) Turn on balance by pressing the "ON/OFF/ZERO" button. "0" should read on the LCD display. If not, the "ON/OFF/ZERO" button until the scale reads "0".

2) Press the "CAL/UNIT" button briefly to change the weighing unit. The following weighing units may be selected: grams (g) or pounds-ounces (lb-oz). Use grams as the default weighing unit. Measure in pounds and ounces only if specifically required by a particular laboratory or field method.

3) Place glass sample jar on balance platform. Press "ON/OFF/ZERO" button until the scale reads "0". Slowly fill sample jar with soil until your specified mass in grams is achieved and stable on the liquid crystal display (LCD) unit. A down arrow will appear in the lower left corner of the display when a stable reading has been achieved. Be careful to not spill loose soil onto top of balance platform, as this will cause the weight of the sample jar to be incorrect.

4) Remove sample jar from balance platform, add appropriate preservative (if necessary), and cap jar tightly.

5) Wipe off balance platform before next use, if necessary, to remove any stray soil particles. Turn balance off by pressing the "ON/OFF/ZERO" button.

8.3 Electronic Water Level Indicator

8.3.1 Calibration Frequency:

Calibration is not required.

8.3.2 Maintenance:

Maintain the instrument as follows:

1) Decontaminate at the beginning and end of each day, and in between measurement locations.

2) Replace batteries as needed.

8.3.3 Operation:

Operate the instrument as follows:

1) Turn on indicator. Lower electronic water level indicator probe and tape into the monitoring well until water surface is encountered. An alarm will sound indicating that the probe has reached the top of the water surface.

2) Measure the distance from water surface to the reference measure point marked on the north side of well casing and record the depth to water (DTW) measurement on the tape to the nearest ± 0.01 foot in the field book. Record the time the measurement was collected.

3) Reel the water level indicator tape up and remove from the well. Turn off the indicator and decontaminate the water level indicator in accordance with SOP-8.

8.4 YSI-556 Multi-meter (DO/pH/temperature/Conductivity/ORP)

8.4.1 Calibration Frequency:

Calibrate at the beginning and end of each day in accordance with manufacturer's specifications.

1) DO calibration in mg/L is preformed in a water sample which has a known concentration of dissolved oxygen (usually determined by a Winkler titration).

2) The 3-point option will be selected to calibrate the pH sensor using three calibration standard solutions of 4, 7 and 11 pH. In this procedure, the pH sensor is first calibrated with a pH buffer and two additional buffers (pH 4and 11). The 3-point calibration method assures maximum accuracy when the pH of the media to be monitored cannot be anticipated.

3) For maximum accuracy, the conductivity chosen should be within the same conductivity range as the samples being prepared to measure. Using standards less than 1 mS/cm are not recommended. The following conductivity standards are recommended:

   - For fresh water use a 1 mS/cm conductivity standard.
   - For brackish water use a 10 mS/cm conductivity standard.
   - For seawater use a 50 mS/cm conductivity standard.

4) ORP calibration will be completed to the sample temperature using the Zorbell solution as per the table below:

Temperature ºC	Zorbell Solution Value, mV
-5	270.0
0	263.5
5	257.0
10	250.5
15	244.0
20	237.5
25	231.0
30	224.5
35	218.0
40	211.5
45	205.0
50	198.5

8.4.2 Maintenance:

Maintain the instrument as follows:

1) Decontaminate at the beginning and end of each day, and in between measurement locations.

2) Replace batteries as needed.

3) Replace DO membrane cap prior to each use.

8.4.3 Operation:

Operate the instrument as follows:

1) Turn on multi-meter and allow probes to equalize approximately 15 minutes prior to taking first readings. Lower the multi-meter probe into the monitoring well to approximately the middle of the water column.

2) Allow readings to stabilize. Readings are considered to be stabilized when 3 consecutive measurements taken 3 to 5 minutes apart until the following stabilization criteria are met.

   Temperature: ± 0.2° Centigrade (C).
   pH: ± 0.1 unit
   D.O.: ± 0.3 milligrams per liter (mg/L)
   Conductivity: > 100 ± 5% or < 100 ± 3%

   It should be noted that readings typically stabilize in the following order (1) pH, (2) temperature, (3) conductivity, (4) ORP and (5) DO.

3) Record stabilized measurements and time collected in the field book.

4) Remove probe from well and decontaminate in accordance with SOP-8.

8.5 YSI-55 DO/Temperature meter

8.5.1 Calibration Frequency:

Calibrate at the beginning and end of each day in accordance with manufacturer's specifications.

8.5.2 Maintenance:

Maintain the instrument as follows:

1) Decontaminate at the beginning and end of each day, and in between measurement locations.

2) Replace batteries as needed

3) Replace DO membrane paper prior to each use.

8.5.3 Operation:

Operate the instrument as follows:

1) Turn on DO/Temperature meter and allow probe to equalize approximately 15 minutes prior to taking first readings. Lower the DO/Temperature probe into the monitoring well to approximately the middle of the water column.

2) Allow readings to stabilize.

3) Record stabilized measurements and time collected in the field book.

4) Remove probe from well and decontaminate in accordance with SOP-8.

8.6 ORP Pen

8.6.1 Calibration Frequency:

ORP pens are factory calibrated.

8.6.2 Maintenance:

Maintain the instrument as follows:

1) Decontaminate at the beginning and end of each day, and in between measurement locations.

2) Replace batteries as needed

3) Clean probe glass with cotton swab and methanol when needed.

8.6.3 Operation:

Operate the instrument as follows:

1) Place sample in a clean 2 ounce plastic sample cup. Insert ORP pen into sample.

2) Allow readings to stabilize.

3) Record stabilized measurements and time collected in the field book.

4) Remove probe from well decontaminate in accordance with SOP-8.

8.7 pH/Temperature/Conductivity Meter

8.7.1 Calibration Frequency:

The pH probe is calibrated at the beginning and end of each day in accordance with manufacturer's specifications. This calls for using standards with a pH value of 4.0, 7.0, and 10.0 in the calibration process. The conductivity meter is also calibrated at the beginning and end of each day in accordance with manufacturer's specifications using a potassium chloride standard solution that has a conductivity of 1413 µS at 25° C.

8.7.2 Maintenance:

Maintain the instrument as follows:

1) Decontaminate at the beginning and end of each day, and in between measurement locations.

2) Replace batteries as needed.

3) Clean pH probe glass with cotton swab and methanol when needed.

8.7.3 Operation:

Operate the instrument as follows:

1) Place sample in two clean 2 ounce plastic sample cups. Insert pH and temperature probes into one sample cup and the conductivity probe into the other sample cup and allow readings to stabilize.

2) Record stabilized measurements and time collected in the field book.

3) Remove probe from well decontaminate in accordance with SOP-8.

9.0 RECORDS

The FL shall maintain the following records, and ensure records are submitted to Central Filing as appropriate:

- Field Notebooks.
- Equipment calibration logs, if used.
- Daily Activity Logs (if used).

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Author: Stu Gross			

Standard Operating Procedure

for:

MANAGEMENT OF INVESTIGATIVE WASTES

Responsible QA Manager: Richard J. Binder, P.G.	

SOP-10
Management of Investigative Wastes

Revision Log

Revision No.	***Effective Date***	***Prepared By***	***Description of Revisions***	***Affected Pages***
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SOP-10
Management of Investigative Wastes

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SOP-10
Management of Investigative Wastes

List of Acronyms and Abbreviations

AK	Acceptable knowledge
AOC	Area of contamination
CH	Closed head
DOT	Department of Transportation
ECR	Environmental characterization and/or remediation
EPA	Environmental Protection Agency
FL	Field leader
IDW	Investigative-derived waste
Lbs	pounds
OH	Open head
PCB	Polychlorinated biphenyl
PL	Project leader
PPE	Personal protection equipment
Ppm	Part per million
QA/QC	Quality assurance/quality control
SSHASP	Site-specific health and safety plan
SSSAP	Site-specific sampling and analysis plan
SOP	Standard operating procedure
SSA	Satellite Accumulation Area
US	United States
WMC	Waste Management Coordinator
WMP	Waste management plan
40 CFR	Title 40, Code of Federal Regulations

SOP-10
MANAGEMENT OF INVESTIGATIVE WASTES

1.0 PURPOSE

This Standard Operating Procedure (SOP) describes the process for managing investigative-derived waste (IDW) generated during environmental characterization and/or remediation (ECR) projects performed by Stantec. IDW include drill cuttings, unused core samples, monitoring well development/purge water, discarded soil and groundwater sampling equipment, discarded personal protective equipment (PPE), and other waste generated during environmental investigation projects. The purpose for this SOP is to assure that these waste materials are properly disposed in a manner consistent with the protection of human health and the environment.

2.0 SCOPE

2.1 This SOP is a mandatory document and shall be implemented by all Stantec project personnel when they anticipate the generation of ECR project wastes.

2.2 The process described herein includes planning and implementation/management requirements associated with ECR project waste management activities.

2.3 This procedure outlines the preparation, approval, and retention of all required documents associated with waste generation.

3.0 TRAINING

3.1 Stantec project personnel using this SOP are trained by reading the procedure.

3.2 The Field Leader (FL) shall monitor the proper implementation of this procedure and ensure that relevant team members have completed all applicable training assignments.

4.0 DEFINITIONS

Acceptable knowledge (AK): A waste stream characterization method that can be used to meet all or part of the waste analysis requirements appropriate for the waste media. The method may include documented process knowledge, supplemental waste analysis data, and/or facility records of analysis.

Accumulation date: The date a hazardous waste is first generated, or the date that hazardous waste collected in a satellite accumulation area exceeds 55 gallons of hazardous waste or 1 kilogram of acute hazardous waste or 100 kilograms of any residue or contaminated soil, waste, or other debris resulting from the cleanup of a spill, into or on any land or water of any acute hazardous waste.

Acute hazardous waste: Environmental Protection Agency (EPA) hazardous waste number designated with an (H) in the "hazard code" column of Title 40, Code of Federal Regulations (40 CFR) § 261.31-33.

Area of contamination (AOC): Existing area of continuous contamination of varying amounts and types that are identified on a case-by-case basis.

Construction and demolition debris: Materials generally considered to be not water soluble and non-hazardous in nature, including, but not limited to, steel, glass, brick, concrete, asphalt roofing materials, pipe, gypsum wallboard, lumber, and other materials discarded during the construction or destruction of a structure or project. It also includes rocks, soil, tree remains, trees, and other vegetative matter that normally results from land clearing.

Environmental Media: Borehole cuttings and core, soil, rock, sediments, surface water, and groundwater that are displaced during corrective action.

Hazardous waste: A solid waste that is not excluded from regulation as a hazardous waste and

- exhibits any of the defined characteristics of hazardous waste (ignitability, corrosively, reactivity, or toxicity), or
- is a listed hazardous waste, or
- is a mixture of solid waste and hazardous waste, or
- is derived from a listed hazardous waste.

Investigation-derived waste (IDW): Solid or hazardous waste that was generated as a result of investigation/characterization corrective action activities.

> Note: IDW includes, but is not limited to sample media, personal protective equipment, contaminated sampling supplies, plastic, and decontamination fluids.

Polychlorinated biphenyl (PCB): Any chemical substance that is limited to the biphenyl molecule that has been chlorinated to varying degrees or any combination of substances which contains such substance. {40 CFR §761.3}

PCB remediation waste: Waste containing PCBs as a result of a spill, release, or other unauthorized disposal, at the following concentrations:

- materials disposed of prior to April 18, 1978, that are currently at concentrations greater than or equal to 50 part per million (ppm) PCBs, regardless of the concentration of the original spill;
- materials that are currently at any volume or concentration where the original source was greater than or equal to 500 ppm PCBs beginning on April 18, 1978, or greater than or equal to 50 ppm beginning on July 2, 1979; and
- materials that are currently at any concentration if the PCBs are spilled or released from a source not authorized for use under 40 CFR Part 761. {40 CFR § 761.3}

Note: PCB remediation waste means soil, rags, and other debris generated as a result of any PCB spill cleanup, including, but not limited to

- Environmental media containing PCBs, such as soil and gravel; dredged materials (e.g., sediments); settled sediment fines; and aqueous decantate from sediment.
- Sewage sludge containing less than 50 ppm PCBs and not in use according to 40 CFR § 761.20(a)(4); PCB sewage sludge; commercial or industrial sludge contaminated as the result of a spill of PCBs including sludges located in or removed from any pollution control device; or aqueous decantate from an industrial sludge.
- Building and other man-made structures (such as concrete floors, wood floors, or walls contaminated with a leaking PCB or PCB-contaminated transformer), porous surfaces, and non-porous surfaces.

Recycled: A material that is used, reused, or reclaimed.

Reclaimed: A material that is processed to recover usable products or is regenerated.

Satellite accumulation area: A designated space for accumulating hazardous where the volume of waste shall not exceed 55 gallons or the volume of acutely hazardous/mixed waste shall not exceed 1 kilogram. {40 CFR § 262.34, 20.4.1.300}.

Segregate: To separate wastes that can be managed together based on similar characteristics and ultimate handling approach.

Site-Specific Health and Safety Plan (SSHASP): A health and safety plan that is specific to a site or related field activity that has been approved by a Stantec health and safety representative. This document contains information specific to the project including scope of work, relevant history, descriptions of hazards by activity associated with the project site(s), and techniques for exposure mitigation (e.g., PPE) and hazard mitigation.

Solid waste: Any garbage; refuse; sludge from a waste treatment plant, water-supply treatment plant, or air-pollution-control facility; and other discarded material including solid, liquid, semisolid, or contained gaseous material resulting from industrial, commercial, mining, and agricultural operations and from community activities.

Special waste: Solid waste identified in State regulations as requiring unique handling, transportation, or disposal to assure protection of the environment and the public health, welfare, and safety.

> **Note:** Special waste includes: treated formerly characteristic hazardous waste, asbestos waste, ash, infectious waste, sludge, industrial solid waste, spill of a commercial chemical product, dry chemicals that become

characteristic hazardous waste when wetted, and petroleum-contaminated soil.

Use or reuse: A material that is either employed as an ingredient in an industrial process to make a product or employed in a particular function or application as an effective substitute for a commercial product.

Waste generator: ECR Project person, by site, whose act or process produces hazardous waste or whose act first causes a hazardous waste to become subject to regulation. {40 CFR §260.10}

Note: The definition above is specific to hazardous waste because it is defined in the hazardous waste management regulations.

Waste Management Coordinator (WMC): The person responsible for coordinating waste-management activities on behalf of waste generators, line managers, facility managers.

Waste management record: A complete package of documents constituting the written record for a waste stream.

Waste stream: A group of wastes from one site than can be managed together because of the similar characteristics and ultimate handling approach.

5.0 BACKGROUND AND PRECAUTIONS

5.1 This SOP shall be used in conjunction with an approved SSHASP. Consult the SSHASP for information on and use of all PPE.

Note: Potential waste management hazards (i.e., chemical, physical, or other) at each waste-generating site are documented in the SSHASP. Hazards that are not addressed in the SSHASP (i.e., pinch points, drum and container lifting and moving, etc.) are addressed and documented at daily tailgate safety meetings.

5.2 The waste generator or the waste management coordinator shall verify the most recent documentation requirements and facility waste acceptance criteria prior to waste characterization or waste profile form submittal to avoid redundant or unnecessary activities.

5.3 Conflicting requirements between this document and other regulations or criteria shall be resolved by implementing the requirements that are regulatory drivers.

Note: Identified discrepancies shall be noted to the author of this procedure so that they can be included in subsequent revisions of this SOP.

5.5 This SOP does not address all conceivable situations. For waste management assistance, contact a waste management coordinator or Stantec regulatory specialist.

6.0 RESPONSIBLE PERSONNEL

The following personnel are responsible for activities identified in this procedure.

- Author
- Stantec project personnel
- Project leader (PL)
- Project Quality Assurance/Quality Control (QA/QC) Officer
- Subcontractors
- Team leader
- Waste generator
- Waste hauler
- Field Leader

7.0 EQUIPMENT

A checklist of suggested equipment and supplies needed to implement this procedure is provided below.

EQUIPMENT AND SUPPLIES CHECKLIST
FOR MANAGEMENT OF INVESTIGATIVE WASTES

√	General Description	Description
	Waste management area signage, as appropriate	"Satellite Accumulation Area (SAA)"
		"Less-than-90-day Accumulation Area"
		"Universal Waste Storage Area"
		Other -
		Other -
	Labels, as appropriate	"Analysis Pending"
		"Hazardous Waste"
		"Asbestos"
		Department of Transportation (DOT) labels
		Other -
	Health & Safety/Decontamination Equipment	Eye wash
		Field shower station (or water supply source of adequate volume and pressure to accommodate decontamination of personnel)

√	General Description	Description
	Spill control equipment, as appropriate	Regular or non-sparking shovels
		Absorbent
		Broom
		Container
		Secondary containment pallets
		Plastic sheeting
	Fire extinguishers, as appropriate	Fire extinguishers are required for less-than-90-day accumulation areas that store ignitable waste. The type of extinguisher shall be appropriate for the waste being stored.
	Tools, as needed	Bung wrench
		Hammer
		Socket wrench and sockets
		Wire brush
		Screwdriver
		Pliers
		Non-sparking tools
	Barricade tape/rope and stands (to cordon off/delineate storage area).	
	Waste containers that meet DOT shipping requirements for the waste	
	Pallets for drummed waste to prevent deterioration of containers and provide for stable storage	
	PPE, as appropriate. (Specific PPE will be identified in the SSHASP).	Gloves
		Eye protection
		Protective coveralls
		Respirator
	Decontamination equipment, as appropriate	Spray washers
		Brushes
		Water
		Wipes
		Tub/bucket

8.0 PROCEDURE

Note: It is each person's responsibility to ensure that they use and are trained to the current version of this procedure. The author or Project QA/QC Officer may be contacted if text is unclear.

8.1 Waste Identification and Characterization

8.1.1 Waste characterization shall be adequate enough to enable compliance with on-site or off-site waste acceptance criteria.

8.1.2 Characterization of Stantec ECR project wastes shall be completed through a specified process.

8.1.3 Where appropriate, project-specific waste management procedures should be developed as a stand alone waste management plan (WMP) or incorporated into a site-specific sampling and analysis plan (SSSAP) prior to the start of field activities that would generate waste. Development of the procedures should include the following steps:

- Review historical site documentation;
- Where existing chemical data are lacking, development of a waste analysis suite and identification of test methods to be used to identify and quantify potential contaminants;
- Specification of the type of sample(s) to be collected;
- Listing of the anticipated amount of waste, per type expected to be generated as part of the Stantec ECR project activity;
- Listing of packaging requirements;
- Identification of preliminary classifications of wastes to be generated.

8.1.4 The WMP or waste management procedures in the SSSAP shall be updated when

- A new waste type or classification not previously identified is generated,
- A strategy changes, or
- A field activity changes.

8.1.5 Appropriate project personnel shall complete the WMP.

8.2 Waste Generation and Storage

8.2.1 Means to store, control, and transport each potential waste type and classification shall be determined prior to the start of field operations that generate waste.

8.2.2 A waste storage area shall be established prior to generating waste. Requirements may differ for each waste type and classification; therefore, Stantec project personnel shall plan to manage all waste types/classifications specified in the WMP. Vehicle traffic, site drainage, accessibility for container-handling equipment, site egress for emergency access, and fire protection shall be considered for siting a storage area.

8.2.3 The general location of the waste storage area shall be specified in the WMP.

8.2.4 Waste storage areas in publicly accessible locations shall be fenced and locked.

8.2.5 Each container of waste generated shall be individually labeled as to waste classification, and item identification number immediately following containerization.

8.2.6 After a sample has been used for its intended purpose, it no longer enjoys an exclusion under 40 CFR § 261.4(d). Returned contaminated sample material shall be characterized and managed as waste. Management requirements for the returned samples are dependent on the waste classification.

8.2.7 Each storage area or container shall have a posted authorized user list or key control. Absolute control shall be maintained while adding, removing, sampling, labeling, or shipping waste.

8.2.8 At the end of daily field activities, an inspection shall be conducted to confirm that all waste containers are properly closed, and stored on level ground. This inspection shall be documented in a field logbook.

8.2.9 Containerized waste shall meet appropriate DOT requirements.

8.2.10 The waste storage duration for hazardous and mixed waste, special waste, and PCB waste are regulated and shall be adhered to.

8.3 Media Specific Protocols for Management of Investigative Wastes

8.3.1 Drill Cuttings and Unused Core Samples

a) All cuttings and unused core samples generated during drilling (e.g., hollow stem auger, air rotary, Geoprobe®, hand auger methods) shall be placed in a 55-gallon steel drum. The drums should be secured with a sealed cover. The drums shall be tagged with a “Non-hazardous” waste label and characterized as a solid waste. The generator name and phone number, site address, drum contents, and the state’s identification number, if applicable, shall be completed on the label with a waterproof pen. The number of drill cutting drums shall be recorded in the field book.

b) The drill cutting drums shall be stored on-site until receipt of laboratory analytical analysis. Upon a receipt of laboratory analysis, a review of the laboratory analysis should be performed and a determination shall be made as to whether the drill cuttings remain characterized as a non-hazardous waste (i.e., solid waste). If it is determined that the cuttings are characterized as a hazardous waste, a “Hazardous” waste label shall be placed over the “Non-hazardous” waste label. The generator name and phone number, site address, drum contents, and the state’s identification number, if applicable, shall be completed on the label with a waterproof pen.

c) The drill cutting drums shall be temporarily stored on-site until disposal arrangements are made with a proper waste disposal facility.

8.3.2 Monitoring Well Development/Purge Water and Decontamination Water

a) All water generated during the development and purging of monitoring wells and decontamination of equipment shall be placed in a 55-gallon steel drum. The drums should be secured with a sealed cover. The drums shall be tagged with a “Non-hazardous” waste label and characterized as a solid waste. The generator

name and phone number, site address, drum contents, and the state's identification number, if applicable, shall be completed on the label with a waterproof pen. The number of drill cutting drums shall be recorded in the field book.

b) The water drums shall be stored on-site until receipt of laboratory analytical analysis. Upon a receipt of laboratory analysis, a review of the laboratory analysis should be performed and a determination shall be made as to whether the drill cuttings remain characterized as a non-hazardous waste (i.e., solid waste). If it is determined that the cuttings are characterized as a hazardous waste, a "Hazardous" waste label shall be placed over the "Non-hazardous" waste label. The generator name and phone number, site address, drum contents, and the state's identification number, if applicable, shall be completed on the label with a waterproof pen.

c) The water drums shall be temporarily stored on-site until disposal arrangements are made with a proper disposal waste facility.

8.3.3 Discarded Soil and Groundwater Sampling Equipment

Discarded soil and groundwater sampling equipment (e.g., soil sleeves from drilling, disposable bailers) will be placed in plastic bags and disposed as a solid waste material.

8.3.4 Discarded PPE

Discarded PPE (e.g., gloves) will be placed in plastic bags and disposed as a solid waste material.

8.4 Segregation

8.4.1 Proper segregation is essential for appropriate storage, treatment, or disposal of waste. Appropriate segregation eliminates the potential of mixing incompatible wastes.

8.4.2 All waste shall be segregated by classification and compatibility to prevent cross-contamination. Classifications of waste include, but are not limited to:

- Hazardous waste;
- Special waste;
- Mixed waste;
- Solid waste; and
- PCB waste.

8.4.3 Liquid, sludge, and solid physical form wastes shall be segregated.

8.4.4 Adequate space or a physical barrier shall be left between various waste classifications and any incompatible waste streams within a classification.

8.5 Packaging and Transportation

8.5.1 All waste shall be packaged appropriately.

8.5.2 All waste shall be packaged to meet the on-site and/or off-site waste acceptance criteria, as appropriate.

8.5.3 All waste containers shall be labeled as to the chemical hazards in accordance with DOT requirements.

8.5.4 The FL shall take appropriate measures to accurately identify the weight of containers to ensure that the DOT rating for maximum container weight is observed. The FL shall be able to measure or estimate the weight of the container (tare weight of the container plus contents) within +/- 10% of the actual weight. When practical, a calibrated scale shall be utilized to establish container weight. However, when mobilization or use of a scale at a field site is not practical, the following table shall be used as a reference guide to accurately estimated container weights.

Container Type	**Tare Weight**
55 gallon steel open head (OH) drum	55 pounds (lbs)
55 gallon steel closed head (CH) drum	50 lbs
30 gallon steel OH drum	35 lbs
30 gallon steel CH drum	30 lbs
Waste Type	**Average Density**
Soil (typical Midwestern United States)	10-12 lbs/gallon
Aqueous solution (decontamination water	8.3 lbs/gallon
Concrete	20 lbs/gallon
Sampling debris, PPE	0.5 lbs/gallon
Base course	13 lbs/gallon

8.5.5 Used containers can be reused if the container is inspected in accordance with Department of Transportation requirements.

8.5.6 Rusted, dented, or otherwise damaged containers shall not be used for waste packaging.

8.5.7 No more than 1% solid physical form material shall be present in a container containing liquid waste.

8.5.8 No more that 1% free liquid shall be present in a container containing solid physical form waste.

8.5.9 Some commercial disposal facilities require that containers be “sealed” by the generator prior to shipment. The date the container was sealed shall be recorded in a field logbook.

8.5.10 A record of appropriate vehicle placarding and container labeling shall be documented in a field logbook.

8.5.11 Waste transportation can be coordinated directly with the disposal facility by the PL or FL.

8.5.12 Waste containers shall be inspected prior to shipment and the evaluation shall be documented.

8.5.13 All containers shall be secured by the waste hauler prior to transportation.

8.5.14 The generator shall submit copies of the Uniform Hazardous Waste Manifest, special waste manifest, non-hazardous waste manifest, and other shipping papers such as bills of lading, as applicable, to the PL who will store the records in Central Filing.

8.6 Contained in Policy

8.6.1 Environmental media contaminated with hazardous waste shall be managed as hazardous waste until the media no longer “contains” the hazardous waste. Environmental media “contains” hazardous waste when:

- It exhibits a characteristic of a hazardous waste; or
- It is contaminated with concentrations of hazardous constituents from listed hazardous waste that are above health-based levels.

8.6.2 Environmental media is considered to no longer “contain” hazardous waste when:

- It no longer exhibits a characteristic of hazardous waste; or
- Concentrations of hazardous constituents from listed hazardous waste are below health-based levels.

8.6.3 In the case of environmental media that “contains” a characteristic hazardous waste, the determination that the environmental media no longer “contains” the hazardous waste can be made through relatively straightforward analytical testing and requires no formal determination by the regulatory authority. The environmental media shall not be diluted to meet this requirement.

8.6.4 For environmental media contaminated with hazardous constituents from listed hazardous waste, Stantec project personnel shall submit a letter to the regulatory agency along with all applicable data to justify that the hazardous constituents are below health-based levels.

9.0 REFERENCES

Project personnel using this procedure shall become familiar with the contents of the following documents to properly implement this SOP.

- SOP-07, Chain-of-Custody, Sample Control and Field Documentation Procedures.
- SOP-08, Equipment Decontamination
- 40 CFR Parts 260-270
- 40 CFR Part 761, Polychlorinated Biphenyls (PCBs) Manufacturing, Processing, Distribution in Commerce, and Use Prohibitions.
- 49 CFR Part 173, Shippers - General Requirements for Shipments and Packaging.
- United States Environmental Protection Agency, "Management of Remediation Waste Under RCRA," (Solid Waste and Emergency Response Division, EPA530-F-98-062, October 1998).

10.0 RECORDS

10.1 The FL is responsible for submitting the following records to the PL.

10.2 Completed and reviewed notebook.

10.3 Notebook attachments and/or data, applicable

10.4 Completed document signature form.

10.5 A copy of the generator's copies of the Uniform Hazardous Waste Manifest, special waste manifest, non-hazardous waste manifest, and other shipping papers such as bills of lading, as applicable.

Identifier: SOP-11	Revision: 2	Effective Date: 04/28/2015	Stantec
Author: Stu Gross			

Standard Operating Procedure

for:

VAPOR SAMPLE COLLECTION

Responsible QA Manager: Richard J. Binder, P.G.	

SOP-11
Vapor Sample Collection

Revision Log

Revision No.	***Effective Date***	***Prepared By***	***Description of Revisions***	***Affected Pages***
0	01/21/11	Stu Gross	New Procedure	All
1	04/17/2013	Michael Nied	QAPP revisions per request	10,11
2	04/28/2015	Dave Constant	Removed Subcontractor Reference from Section 2. Added Vacuum Canister Sampling to Section 8.2.3.	5, 12

SOP-11
VAPOR SAMPLE COLLECTION

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SOP-11
VAPOR SAMPLE COLLECTION

List of Acronyms and Abbreviations

CVOC Chlorinated Volatile Organic Compound
EPA Environmental Protection Agency
FL Field leader HDPE
High density polyethylene ID
identification
L liter
NPT National pipe thread
OSHA Occupational Safety and Health Administration
PAL Preventive action limit
PID photoionization detector PPE
personal protective
equipment PVC Polyvinyl chloride
PVF Polyvinyl fluoride QAPP
Quality assurance project plan
QA/QC Quality Assurance/Quality Control
SAP Sampling and analysis plan
SOP standard operating procedure
SSHASP site-specific health and safety plan
TO Toxic organic
VOCs Volatile organic compounds
WAC Wisconsin Administrative Code
WDNR Wisconsin Department of Natural Resources

SOP-11
VAPOR SAMPLE COLLECTION

1.0 PURPOSE

The purpose of this standard operating procedure (SOP) is to describe the procedures for the collection of representative vapor samples to evaluate the vapor intrusion pathway.

These are standard (i.e., typically applicable) operating procedures which may be varied or changed as required, dependent upon site conditions, equipment limitations or limitations imposed by the procedure. In all instances, the actual procedures used should be documented and described in an appropriated site report.

2.0 SCOPE

2.1 This SOP is a mandatory document and shall be implemented by all Stantec project participants when collecting vapor samples.

3.0 TRAINING

3.1 Stantec project personnel using this SOP are trained by reading the procedure, and receiving the appropriate training.

3.2 The Field Leader (FL) shall monitor the proper implementation of this procedure and ensures that relevant team members have completed all applicable training assignments.

4.0 DEFINITIONS

4.1 GeoProbe® – a hydraulically-operated sampling device mounted on a truck or four-wheel drive vehicle. The sampling device is deployed from the vehicle and positioned over a sample location. The base of the sampling device is positioned on the ground. The weight of the vehicle is hydraulically raised on the base. As the weight of the vehicle is transferred to the probe, the probe is pushed into the ground. When the probe reaches the sample depth, up to 50 feet under favorable geologic situations, samples can be collected.

4.2 Level D – Defined by Occupational Safety and Health Administration (OSHA) as a work uniform affording minimal protection used for nuisance contamination only. Level D is appropriate when the atmosphere contains no known hazard and work functions

preclude splashes, immersion, or the potential for unexpected inhalation of or contact with hazardous levels of any chemicals.

4.3 Site-Specific Health and Safety Plan (SSHASP) - A health and safety plan that is specific to a site or related field activity that has been approved by a Stantec health and safety representative. This document contains information specific to the project including scope of work, relevant history, descriptions of hazards by activity associated with the project site(s), and techniques for exposure mitigation (e.g., personal protective equipment [PPE]) and hazard mitigation.

4.4 Volatile Organic Compounds (VOCs) - A class of chemical compounds, predominantly hydrocarbons and halogenated hydrocarbons, with low molecular weights and low boiling points that are insoluble or slightly soluble in water.

5.0 BACKGROUND AND PRECAUTIONS

This SOP shall be used in conjunction with an approved SSHASP. Also, consult the SSHASP for information on and use of all PPE.

5.1 Background

Vapor intrusion "pathway screening" is used to determine whether or not the potential for vapor intrusion exists on or off a contaminated property. Vapor intrusion problems most often arise from light end petroleum products and chlorinated VOCs.

5.1.1 Screening for Petroleum Vapors

- Vapor Intrusion of petroleum constituents occurs most often when free phase product is located near building foundations, where petroleum contaminated groundwater has entered a building, or where groundwater contamination is in contact with the building foundation.
- Vapor intrusion from petroleum contaminated sites tends to occur in proximity to the source of the release and is often detected by smelling petroleum odor in the building.
- When no petroleum odors are detected, vapor intrusion can be ruled out at most petroleum releases based on the presence of 5 feet (in the horizontal and vertical direction) of clean, unsaturated soil with an oxygen content greater or equal to 5% between the residual petroleum and the building. Investigation of the vapor intrusion pathway should be undertaken in situations where 5 feet of clean, aerated soils are not present or where any of the following conditions exist:
    - Free phase product that has the potential for off-gassing vapors underlies a building or is within 30 feet, horizontally or vertically, of a building foundation.
    - Petroleum contaminated soils with the potential for off-gassing vapors are within 5 feet or less of a building foundation.
    - Benzene concentration in groundwater underlying a building is >1,000 ppb and there is less than 20 feet of unsaturated soil between the groundwater and the building foundation.

- Groundwater contaminated with petroleum product above Chapter NR140 Wisconsin Administrative Code (WAC) preventive action limit (PAL) is entering a building or in contact with the building's foundation, or is in water intercepted by the building's foundation drain system, including sumps.
- Petroleum vapors are present that may migrate for the petroleum source and move through preferential pathways.

5.1.2 Screening for Chlorinated VOC (CVOC) Vapors

- The vapor intrusion pathway should be investigated at all source properties where a release of CVOC has occurred.

5.2 Precautions

5.2.1 All waste generated from vapor monitoring must be handled in accordance with SOP-10.

5.2.2 Fires or explosions from soil vapors are rare and typically associated with methane vapor migration. Petroleum products can cause fires and explosions, but their odor thresholds are less than their lower explosive limit in air, so a strong odor provides a warning well before any threat exists. If a fire or explosion threat is perceived due to odors or other reasons, evacuate the area immediately and call the local fire department.

6.1 RESPONSIBLE PERSONNEL

The following personnel are responsible for activities identified in this procedure:

- Data Steward
- Field Leader
- Field Member
- Project Leader
- QA/QC Officer
- Project participants

7.0 EQUIPMENT

A checklist of suggested equipment and supplies needed to implement this procedure is provided in Attachment A. A brief description of commonly used pieces of equipment, their advantages, and their limitations are listed below.

7.1Tedlar® Bag - manufactured from polyvinyl fluoride (PVF; Tedlar®) film. They are generally considered inert and can be used to collect samples containing common solvents, hydrocarbons, chlorinated solvents, and many other classes of compounds. They are commonly used to collect low-level sulfur vapors, but only if the bag fittings are non-metallic (polypropylene, Teflon, or Nylon).

7.1.1 Never reuse a Tedlar® bag.

7.1.2 Sample hold time will vary for different classes of compounds:

- 24 hours sulfur vapors (especially hydrogen sulfide and methyl mercaptan)

- 24 hours chemically active compounds like 1,3-Butadiene
- 72 hours chlorinated solvents and aromatic compounds
- 72 hours atmospheric vapors like oxygen, nitrogen, carbon dioxide, etc.

.

7.1.3 Disadvantages of the Tedlar® bags are:

- If the sampling container is somehow crushed or damaged, sample integrity is doubtful
- When samples are shipped to the lab by air carrier, the negative pressures in plane cargo holds can cause the sample to expand – if the Tedlar® bag was filled too full, it can burst
- Photosensitive sample constituents should be shielded from sunlight

7.2 Summa™ Canister – refers to electropolished, passivated stainless steel vacuum sampling devices, such as toxic organic (TO) canisters, SilcoCans, MiniCans, etc, which are cleaned, evacuated, and used to collect whole-air samples for laboratory analysis.

7.2.1 The canister has a hand valve and fixed orifice to regulate flow. A grab sample of ambient air is drawn into a pre-evacuated Summa canister or through a sampling pump.

7.2.2 Disadvantages of the Summa™ canisters are:

- Contamination may occur in the sampling system if canisters are not properly cleaned before use.
- All sampling equipment should be thoroughly cleaned.

A checklist of suggested equipment and supplies needed to implement this procedure is provided in Attachment A.

8.0 PROCEDURE

Sub-slab, soil gas, and indoor/outdoor air samples are commonly collected to directly measure vapor concentrations. Sub-slab, soil vapor and air data results reported to the Wisconsin Department of Natural Resources must include a description of the quality control procedures used in the field and laboratory (NR 716.13 and 716.15). Consultants should instruct the laboratory to report vapor and air results in units of $\mu g/m^3$.

8.1Sub-Slab Sampling

The purpose of sub-slab sampling is to characterize the degree and extent of contaminated vapor directly beneath a building foundation regardless of whether the foundation is a basement or slab-on-grade; determine the likelihood of an exposure pathway due to vapor intrusion; and initially evaluate whether mitigation of the pathway is needed. Sub-slab samples are strongly preferred to other vapor samples in assessing vapor concentrations at specific buildings. Sub-slab vapor samples can be collected in vacuum gas canisters fitted with a controller to limit vapor flow to no more than 200 ml/min (a 6 L canister will fill in approximately 30 minutes at this flow rate). Vapor samples should be analyzed using Method TO-15 or Method TO-14a for the chemicals

of concern identified from soil and groundwater sampling conducted at the site. The sub-slab screening technique is described as follows:

a) Each sub-slab vapor probe will be installed by drilling a 1/2 inch diameter hole through the slab until it punctures the floor slab and barely enters the underlying sub-slab material. The upper few inches of the hole will be reamed using a 1-inch drill bit. The probe insert (consisting of a brass coupling, nipple and head plug) will be set in the drilled hole and grouted into place using a hydro-cement. The cement would be allowed to set prior to sampling. When the monitoring is to be completed the head plug will be replaced with a brass or stainless steel valve with male national pipe thread (NPT) threads on one side and a 1/4 –inch compression or barb fittings on the other side. These fittings will connect to ¼-inch high-density polyethylene (HDPE) or nylon tubing. All fittings will be sealed using Teflon tape.

b) Prior to each sampling event, vapor points should be purged to eliminate stagnant air trapped within the sub-slab sample point air space. A high-density polyethylene or nylon tubing connected to the vapor point should be connected to a peristaltic pump and Tedlar® bag. Use of a peristaltic pump will ensure that sampled air does not circulate through a pump causing potential cross contamination and leakage. Purge each vapor probe by filling two dedicated 1-liter (L) Tedlar® bags. A purge volume of 2 L is based upon the assumption of a ¼" air space beneath a slab and an affected sample diameter of 2 feet.

c) Prior to sampling, check the vacuum of the canisters prior to use to confirm that they are not leaking. There should not be a difference of 4" Hg or more; if there is then canister should not be used.

d) A shut-in test will be completed prior to sampling to ensure there are no leaks at the compression fittings. The shut-in test will be completed by connecting a vacuum gauge into the sampling line between the sub-slab probe and the Summa canister. Valves to the probe and Summa Canister will be shut and air will be removed from the sampling line, inducing a vacuum in the line of 50 to 100 inches of water. When all the external valves to the sampling line are shut, the vacuum gage should remain steady for at least one minute. If a loss of a vacuum is observed during the time period, it would indicate a leak and the fittings would be adjusted until the line can hold a vacuum.

e) A tracer gas (helium) will be also used to ensure there are no leaks at the probe seal. Specifically, helium will be introduced to a shroud covering the sub-slab probe to create concentrations in the shroud that are above 40% by volume. The air under the shroud will be screened with a handheld helium detector to confirm the concentrations. Then sub-slab vapor samples will be withdrawn from the probe into a Tedlar® bag and field screened. If the tracer gas is detected in the air sample, adjustments will be made to the fittings and probe seal prior to sampling. A sub-slab sample will not be collected until each probe passes the shut-in and tracer tests.

f) After the helium and shut-in test are performed, a sub-slab vapor sample will be collected from each probe using a 6-liter evacuated stainless steel canister (Summa™ canister) fitted with an air flow control regulator to limit air flow to less

then 200 ml/min. Low sample volume and flow rates will decrease breakthrough by ambient air. When sampling is complete, a partial vacuum should be present in the canister and the vacuum reading should be recorded and provided to the laboratory. Vapor samples collected in the Summa™ canisters will be laboratory analyzed for chemicals of concern using the Environmental Protection Agency (EPA) Modified Method TO-15.

g) Three sub-slabs will be completed at buildings with a footprint less than 5,000 square feet. For larger buildings, an additional sub-slab sample will be collected for each additional 2,000 square feet. At the end of sampling, a partial vacuum should be present in the canister; this vacuum should be recorded for the lab.

8.2Soil Gas Samples

Soil gas samples are best used as a survey tool to identifying buildings at risk of vapor intrusion where follow-up sub slab vapor testing will be performed. Soil gas samples will be collected considering these guidelines:

- If the vapors originate from contaminants in groundwater, soil gas samples should be collected 1 to 2 feet above the water table and as near the building being assessed as possible. If the water table is greater than 30 feet below ground surface, a soil gas sample will be collected half the distance to the water table
- Where groundwater conditions permit, soil gas samples will be collected from a depth of at least 5 feet or more below the building foundation. Where no building exists, soil gas samples will be collected at least 5 feet below ground surface.
- Soil gas samples will be collected from zones of more permeable material.
- If site conditions preclude the application of the above distances, alternative vapor sampling methods and approaches will be discussed with the EPA and WDNR project managers.

8.2.1 Soil Gas Probe Construction Materials

(a) Sample probes consist of a probe tip through which the soil gas sample is collected, and probe tubing that extends from the probe tip to the ground surface.

(b) Sample probe tubing will be 1/8 to ¼ inch in diameter. Diameter selection should take into account soil types as smaller diameter tubing can result in higher vacuum conditions thus making sample collection more difficult.

(c) The sample probe will be constructed of materials that will not react or interact with target compounds. Materials such as nylon, polyethylene, copper, stainless steel, or poly vinyl chloride (PVC) should be used. If copper is used, the copper will first be adequately cleaned to remove any oil residue that may still be present from the manufacturing process.

(d) The probe tip will be covered with a fine screen or connected to a short section of perforated pipe, tubing or screen mesh.

8.2.2 Soil Gas Probe Installation

Soil gas samples will be collected from specific depths in two general ways:

(a) Boreholes will be installed using direct push, hollow-stem auger drilling equipment or hand-driven by use of a rotary hammer drill or hand auger. Caution must be taken with the use of direct push probes as smearing of sidewalls can occur in fine-grained soils. Such smearing could inhibit the passage of gases from the soil into the borehole.

(b) The installation area will be cleared of all utilities prior to any drilling activities.

(c) The borehole will be advanced to the desired target depth. If multiple samples are to be collected at varying depths within the same borehole, the borehole will be advanced to the deepest sampling point with the deepest sampling point installed first.

(d) The probe tip will be placed midway between the top and bottom of the sampling interval within a sand pack extending 6 inches above and below the sampling interval. The sand pack grain size should be appropriately sized according to the adjacent formation and installed to minimize any disruption of airflow to the sampling tip.

(e) At least 1 foot of dry granular bentonite will be placed on top of the sand pack to preclude the infiltration of hydrated bentonite grout into the sand pack.

(f) The borehole will be grouted to the surface (for nested samplers, the bottom of the next sampling interval) with hydrated bentonite. Great care will be taken to adequately seal soil gas sampling probes as it is important to minimize the exchange of atmospheric air with the soil gas therefore maximizing the representativeness of the sample. The surface seal will be a minimum of 2.5 feet thick. If conditions warrant shallow sampling depths, extra care should be taken in installing the surface seal to limit atmospheric exchange.

(g) If multiple sampling points are installed within a single borehole, the borehole will be grouted between sampling points. One foot of dry bentonite will be placed between the filter pack sand and the grout at each sampling interval within the boring.

(h) Tubing will be marked properly at the surface to identify probe number and depth. This is particularly important when multiple probes are installed within a single borehole. Tubing will be labeled immediately upon installing to identify each individual sampling probe.

(i) To minimize any separation between soils and the outside of the probe, lateral movement of probes must be avoided once they have been installed.

(j) Unless soil probes are abandoned the same day in which they are installed, probes will be properly secured, capped, and completed to prevent infiltration of water or ambient air into the subsurface and to prevent damage or vandalism.

Gas tight valves or fittings will be connected to the vapor point along with any connections that may be used for future sampling events. Protective flush mount or above ground well vaults can be installed as necessary along with guard posts if added protection is needed.

8.2.3 Collecting Soil Gas Samples

The soil gas sampling technique is described below. Soil gas samples may be collected using vacuum canisters or Tedlar® Bags.

Vacuum Canister Sampling

a) Prior to sampling, soil gas probes should be purged on one well volume to eliminate stagnant air trapped within the soil gas probe. A high-density polyethylene or nylon tubing connected to the soil gas probe should be connected to a peristaltic pump and vacuum canister (Summa™ Canister). Use of a peristaltic pump will ensure that sampled air does not circulate through a pump causing potential cross contamination and leakage.

b) Prior to sampling, and check the vacuum of the canisters to confirm that they are not leaking. There should not be a difference of 4" Hg or more; if there is then canister should not be used.

c) A shut-in test will be completed prior to sampling to ensure there are no leaks at the compression fittings. The shut-in test will be completed by connecting a vacuum gauge into the sampling line between the soil gas probe and the Summa canister. Valves to the probe and Summa Canister will be shut and air will be removed from the sampling line, inducing a vacuum in the line of 50 to 100 inches of water. When all the external valves to the sampling line are shut, the vacuum gage should remain steady for at least one minute. If a loss of a vacuum is observed during the time period, it would indicate a leak and the fittings would be adjusted until the line can hold a vacuum.

d) A tracer gas (helium) will be also used to ensure there are no leaks at the soil gas probe seal. Specifically, helium will be introduced to a shroud covering the vapor probe to create concentrations in the shroud that are above 40% by volume. The air under the shroud will be screened with a handheld helium detector to confirm the concentrations. Then soil gas samples will be withdrawn from the soil gas probe into a Tedlar® bag and field screened. If the tracer gas is detected in the air sample, adjustments will be made to the fittings and probe seal prior to sampling. A soil gas sample will not be collected until each soil gas probe passes the shut-in and tracer tests.

e) After the helium and shut-in test are performed, a soil gas sample will be collected from each soil gas probe using a 6-liter evacuated stainless steel canister (Summa™ canister) fitted with an air flow control regulator to limit air flow to less then 200 ml/min. Low sample volume and flow rates will decrease breakthrough by ambient air. When sampling is complete, a partial vacuum should be present in the canister and the vacuum reading should be recorded and provided to the laboratory. Soil gas samples collected in the Summa

canisters will be laboratory analyzed for chemicals of concern using the Environmental Protection Agency (EPA) Modified Method TO-15.

Tedlar® Bag Sampling

(a) Prior to sampling, evacuate one well volume of air from soil sample probe.

(b) Attach soil probe sample port to sampling pump and Tedlar® bag. The soil probe is attached to the sample port via Teflon tubing and a "Quick Connect" fitting. The vacuum from the pump causes the bag to inflate.

(c) Break the vacuum by removing the tubing from the pump.

(d) Remove the bagged sample and close valve.

(e) Record data on data sheets or field books.

(f) Record the date, time, sample location identification (ID), and the photoionization detector (PID) instrument reading(s) on the sample bag label.

CAUTION: Labels should not be pasted directly onto the bags, nor should bags be labeled directly using a marker or pen. Inks and adhesive may diffuse through the bag material, contaminating the sample. Place labels on the edge of the bags, or tie the labels to metal eyelets provided on the bags. Markers with inks containing VOCs (i.e., permanent ink markers) should not be used.

8.3Indoor and Outdoor Air Sampling

The goal of indoor air sampling is to determine if there is a complete exposure pathway due to vapor intrusion and determine if mitigation or remediation is necessary to address unacceptable risks. An outdoor air sample should be collected whenever indoor air samples are collected.

(a) Prior to collecting indoor air samples conduct a survey for any items that may contribute VOCs to the indoor air and remove these items from the building at least 24 hours prior to sampling.
(b) Indoor air samples should be collected at residences should be collected as 24-hour time-weighted samples using vacuum gas canisters.
(c) Indoor air samples collected at commercial/industrial buildings should be collected as 8 hour time weighted samples.
(d) Indoor air samples should be sampled on the lowest occupied level of the building and in commonly occupied spaces with the sampling canister placed approximately 3 to 5 feet above the floor and near the center of the room away from windows.

(e) One indoor air sample will be collected from every level of a typical residential home and multiple samples will be collected from commercial and industrial facilities.
(f) Outdoor samples will be collected using the same procedure as indoor samples.

9.1 REFERENCES

ER Project personnel using this procedure should become familiar with the contents of the following documents to properly implement this SOP, as applicable and appropriate.

- SOP-07, Chain of Custody, Sample Control and Field Documentation Procedures
- SOP-08, Equipment Decontamination
- SOP-09, Calibration, Maintenance, and Operation of Field Equipment
- SOP-10, Management of Investigative Wastes

10.0 RECORDS

The FL is responsible for data entry and submitting the following records to central filing, where applicable:

10.1 Completed field notebook

11.1 ATTACHMENTS

Attachment A: Equipment and Supplies Checklist for Soil Vapor Collection

Attachment B: WDNR, Addressing Vapor Intrusion at Remediation and Redevelopment Sites in Wisconsin, Publication PUB-RR-800, December 2010

SOP-11 Vapor Sample Collection

Attachment A

Equipment and Supplies Checklist for Vapor Sample Collection

√	Quantity	Description
		SAP
		SSHASP
		SOP-11
		Field book
		Waterproof ink pen and permanent marker
		Camera
		Tool Box (includes at a minimum socket wrench, screwdriver, pliers, hammer, scissors, flashlight)
		Keys for well cap locks
		PID
		Calculator
		Appropriate pre-preserved laboratory sample containers
		Sample labels
		Adjustable rate air sampling pump and appropriate tubing
		Tedlar® bags, 1.0 L, at least 1 bag per sample
		Summa canisters (plus their shipping cases) for sample, storage and transportation.
		Appropriate PPE
		Insulated cooler
		Chain-of-custody seals,
		Ziploc® bags
		Ice
		Decontamination equipment (SOP-8)
		Garbage bags
		Bentonite
		Filter Sand

SOP-11 Vapor Sample Collection

Attachment B

Addressing Vapor Intrusion at Remediation and Redevelopment Sites in Wisconsin, Publication PUB-RR-800, December 2010, Updated July 2012

CORRESPONDENCE/MEMORANDUM

State of Wisconsin

DATE: June 24, 2015

TO: Remediation and Redevelopment Staff and Supervisors

FROM: Darsi Foss, Director
Remediation and Redevelopment Program

SUBJECT: EFFECTIVE IMMEDIATELY: Interim Modifications to "Addressing Vapor Intrusion at Remediation & Redevelopment Sites in Wisconsin" (RR-800)
Update: Residential Sub-slab Attenuation Factor and Vapor Risk Screening Levels

Because EPA has now issued a revised vapor intrusion attenuation factor (AF) for residential buildings, DNR will accept the new AF effective immediately.

U.S. EPA recently finalized and released its most current Vapor Intrusion Guidance, which can be found at http://www.epa.gov/oswer/vaporintrusion/.

EPA's guidance now recommends a sub-slab attenuation factor of 0.03 (or 33.33 times the indoor air vapor action level). EPA's AF is based on new data (since 2002) as well as on a revised assessment of sub-slab and indoor air data.

Effective immediately in Wisconsin, the new attenuation factor may be applied to current as well as past vapor investigations at residential buildings to determine whether vapor mitigation or other actions are necessary to prevent vapor intrusion under the ch. NR 700 WI administrative rule series.

The Wisconsin DNR's vapor intrusion guidance, *Addressing Vapor Intrusion at Remediation & Redevelopment Sites in Wisconsin* (DNR PUB-RR-800), will be updated in the future, and includes sub-slab AF that are based on EPA's AF. Attenuation factors affect the vapor risk screening levels used to determine whether vapor concentrations beneath a building pose a risk to occupants.

cc. Henry Nehls-Lowe – DHS

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Addressing Vapor Intrusion at Remediation & Redevelopment Sites in Wisconsin (RR-800) Update: July 2012

The Remediation & Redevelopment Program is revising its approach regarding the timing of collecting sub-slab vapor and indoor air samples. Current guidance allows sub-slab vapor samples to be collected followed by indoor air sampling if vapor risk screening levels (VRSL) are exceeded in sub-slab vapors.

For state-lead projects, we will now require that sub-slab vapor samples and indoor air samples be collected concurrently (referred to as paired samples) whenever buildings housing a residential setting are sampled for vapor intrusion. For responsible party (RP) lead projects, we *strongly* encourage the RP's consultant to conduct concurrent sampling in these situations. In addition, an outdoor sample should always be collected concurrent with an indoor air sample. If multiple buildings within a short distance of each other are sampled on the same day for indoor air, a single outdoor sample will suffice for background. A residential setting includes the following: single and multi-family homes, apartments, child and elder day care, and schools.

This procedural change is based on our recent experience. If indoor air concentrations are known at the same time that a sub-slab VRSL is exceeded, DNR and state/local health will immediately know whether or not a significant (i.e., acute or chronic) situation exists in that residential setting. Further, this will allow a landlord, homeowner or school administrator to determine if it would be prudent or necessary to undertake certain immediate mitigation efforts (e.g., operating the HVAC system at maximum circulation rates) or to limit the use of all or a portion of a structure for a short period of time, if circumstances warrant such actions. Without that indoor air data, decisions based solely on the sub-slab sampling may lead to risk decisions that overestimate the actual exposure conditions at the residential setting.

Standard sampling procedure includes collecting 24 hour indoor and outdoor air samples in residential settings. The length of time for collection of sub-slab samples depends on the size of the Summa canister. Flow into a Summa canister should be restricted to no more than 200 ml/min during the collection period. Please refer to the guidance for other sampling details such as leak detection of the sub-slab probe.

The Program guidance on Vapor Intrusion will be updated after the final U.S. EPA vapor intrusion guidance is released (expected November 2012).

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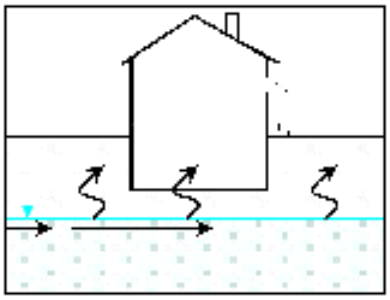

Addressing Vapor Intrusion at Remediation & Redevelopment Sites in Wisconsin

PUB-RR-800 December 2010

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2. Flow Diagram for Evaluating the Vapor Intrusion Pathway

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I. Purpose and Applicability

The purpose of this program guidance is to identify the conditions where assessment of the vapor intrusion pathway at contaminated sites is necessary, set out the criteria for determining health risk at vapor migration sites, identify appropriate responses to vapor intrusion and delineate when sites with a complete or potential vapor migration pathway may achieve closure. Several vapor migration scenarios are provided as examples. Anyone applying this guidance to a contaminated site must also comply with the Chapter NR 700 rule series, including assessment and remediation of all pathways of concern.

This procedural guidance is applicable to all contaminated sites where volatilization of subsurface contaminants has the potential to migrate to current or future occupied buildings. Readers are referred to U.S. EPA[1], ITRC[2], and similar documents for guidance on methods of sample collection, calculation of exposure risk, laboratory methodology, and similar topics. Unless otherwise noted, all provisions in this guidance apply to the responsible party and/or property owner of a contaminated site. The process outlined in this guidance for assessing and investigating the vapor intrusion pathway applies, as appropriate, to undeveloped properties (where no buildings are currently present) as well as developed properties.

II. Overview of the Vapor Intrusion Pathway

The term "vapor intrusion pathway" generally refers to subsurface contamination that can move through the air-filled pores of vadose zone soils and enter the breathing space of buildings. Vapor intrusion can also occur when contaminated groundwater infiltrates buildings and contaminants directly volatilize from the groundwater into indoor air of the building. The "pathway" for vapor movement may be through permeable soils, through fractures in bedrock or clay tills, through man-made subsurface structures such as utility lines, through basement sumps, cracks in the building foundation, or through other mechanisms.

The potential for the vapor intrusion pathway should be assessed at all sites contaminated with organic and inorganic volatile chemicals. The volatility of the contaminant(s), potential for degradation and/or sorption in the vadose zone, and contaminant concentration should be considered during the initial site assessment in order to determine whether the potential for a vapor intrusion pathway exists. Other considerations include subsurface stratigraphy, soil moisture, depth to groundwater, distance of a building from the contaminant source, the building structure, competence of the foundation, presence of utilities and preferential flow paths, etc. If it is determined that there is potential for vapor intrusion into occupied or proposed building locations, NR 716.05(1) requires the vapor migration pathway be investigated as part of site investigation activities.

The details for this assessment are beyond the scope of this document. The reader is referred to ITRC's "Vapor Intrusion Pathway: A Practical Guide"[2] for information on the screening and site

[1] U.S. EPA guidance on Vapor Intrusion - http://www.epa.gov/osw/hazard/correctiveaction/eis/vapor.htm
[2] Interstate Technology Regulatory Council, Vapor Intrusion Pathway: A Practical Guide, January 2007. http://www.itrcweb.org/Documents/VI-1.pdf

investigation process for the vapor migration pathway. It is important to note, when preparing a vapor intrusion assessment, that in most cases the Department requires the use of empirical data representing the pathway of exposure. In general, the Department does not accept the use of models (such as the Johnson & Ettinger Model for Subsurface Vapor Intrusion into Buildings) for screening out the vapor intrusion pathway.

Due to their high volatility and health risk, volatile organic chemicals – particularly chlorinated volatile organic chemicals (CVOC) and petroleum – are the contaminants that most commonly trigger assessment of the vapor intrusion pathway. Depending upon site conditions, semi-volatile contaminants (such as PAHs, dioxins, PCBs, etc.) and mercury (a volatile metal) may also present a risk of vapor intrusion. This guidance does not address semi-volatile organic or volatile metal contamination. If vapor intrusion from these contaminants is suspected at a property, specific screening and investigation methods should be discussed with the DNR Project Manager.

Where a risk to human health exists due to the vapor intrusion pathway, mitigation of the vapor pathway will usually be necessary to protect building occupants. In addition, remediation of the vapor source will be necessary to minimize long-term risks.

III. Background Indoor Air VOCs

Modifications to assessment and investigation of the vapor intrusion pathway will likely be needed for situations that contribute VOCs to indoor air but where the indoor air VOCs may not have originated from the hazardous substance release.

- *OSHA Regulated Settings*. When the contaminant of concern is also a chemical used in a manufacturing or commercial process, OSHA (Occupational Safety and Health Administration) standards[3] or other occupational inhalation exposure guidelines apply to the indoor occupational exposure as long as the entity continues to use the chemical in question. When the building use changes and occupational standards and guidelines no longer apply, then the applicable indoor air health risk levels are determined by current land use. When investigating the vapor intrusion pathway, indoor air is usually <u>not</u> analyzed at OSHA regulated facilities.

  When a release to the environment has occurred, both OSHA and non-OSHA regulated facilities are expected to comply with the Chapter NR 700 rule series for environmental cleanup. Investigation of sub-slab vapors, soil vapors, etc. to identify the risk of vapor intrusion, as discussed in this guidance, are applicable to these facilities. Section VI of this guidance discusses the appropriate sub-surface screening levels that apply to commercial and industrial facilities.

- *Typical Indoor Air Concentrations*. Volatile organic chemicals routinely exist in indoor air due to outdoor air quality or to the presence of routine items such as recently dry

[3] This guidance does not address OSHA requirements. Those subject to OSHA are responsible for compliance to those rules.

cleaned clothes, oil based paints, spray can propellants, etc. in the building. For the purpose of assessment, the types and levels of these typical indoor air VOCs are considered to be "background" VOCs. Adjacent industrial or commercial facilities may also release certain VOCs to outdoor air, which may affect indoor concentrations of these VOCs. Where possible, background sources should be identified and preferably eliminated (usually by removing materials that contain VOCs from the building) prior to indoor air sampling. Vapor intrusion as an exposure risk may be ruled out if indoor air contaminants are determined to be solely or primarily due to background sources in indoor or outdoor air.

- *VOCs not related to a hazardous substance discharge*. Measured concentrations of contaminants that are not the result of a hazardous substance discharge do not require further action by the RR Program. However, action may be required by other regulatory or health agencies. Indoor air affected by a hazardous substance discharge, regardless of whether the discharge took place inside or outside the building, does require assessment as discussed in this guidance.

IV. **Vapor Intrusion Pathway Screening**

Vapor intrusion "pathway screening" is used to determine whether or not the potential for vapor intrusion exists on or off a contaminated property. If screening indicates the possible existence of a vapor pathway, the next step is to conduct an appropriate site investigation of the pathway(s). In any event, the ch. NR 716 Site Investigation Report will document the steps that were taken at the site to screen for the vapor pathway and will specify why an investigation was or was not conducted for vapor intrusion. The site investigation report will include all investigative methods and results, as required by ch. NR 716.

Vapor intrusion problems most often arise from light end petroleum products (such as gasoline) and chlorinated VOCs. Properties contaminated with volatile organic chemicals *other than* petroleum or chlorinated VOCs should consult with the DNR Project Manager to confirm appropriate screening criteria. Screening criteria specified for petroleum vapors are applicable to aerobically degradable VOCs.

A. Screening for Petroleum Vapors

Vapor intrusion of benzene and other petroleum constituents occurs most often when free phase product (or LNAPL - light non-aqueous phase liquid) is located near building foundations, where petroleum contaminated groundwater has entered a building, or where contaminated groundwater is in contact with the building foundation. Preferential pathways between the source and a building (e.g. fractured bedrock, utility line backfills, openings or cracks in the building foundation, etc.) can play a major role in the movement and accumulation of petroleum vapors to indoor air.

The most toxic of the petroleum constituents, benzene, readily degrades in unsaturated, oxygenated soils. Vapor intrusion from petroleum contaminated sites tends to occur in proximity

to the source of the petroleum release and is often detected by smelling petroleum odor in the building. **High concentrations of petroleum vapors can create an explosion risk; therefore the detection of petroleum odors in a building should immediately trigger an investigation into the source of the odors and, if necessary, evacuation of the building. Appropriate immediate or interim action, per ch. NR 708, Wis. Adm. Code, should be taken to eliminate the vapors**.

Vapors from petroleum can cause eye and nasal passage irritation to building occupants, even when no chemicals are detected above a health risk level. If building occupants complain petroleum odors or of mucus membrane irritation, investigate to determine if the vapor complaints are related to a release of petroleum product to the environment. If complaints of irritation from vapors are related to a petroleum product release, the vapor intrusion pathway must be investigated. When screening the vapor pathway, occupants of buildings near a petroleum release that is likely to off-gas vapors into the building should be asked if they have detected petroleum odors in the building.

Where no petroleum odors are detected, vapor intrusion can be ruled out at most petroleum releases based on the presence of 5 feet (in the horizontal and vertical direction) of clean, unsaturated soil with an oxygen content ≥ 5% between the residual petroleum and the building[4, 5]. Investigation of the vapor intrusion pathway should be undertaken in situations where 5 feet of clean, aerated soils are not present or where any of the following conditions exist:

- Free-phase product that has the potential for off-gassing vapors[6] underlies a building or is within 30 feet, horizontally or vertically, of a building foundation.
- Petroleum contaminated soils with the potential for off-gassing vapors are within 5 feet or less of a building foundation.
- Benzene concentration in groundwater underlying a building is >1,000 ppb and there is less than 20 feet of unsaturated soil between the groundwater and the building foundation.
- Groundwater contaminated with petroleum product above Wisconsin's groundwater preventive action limit (PAL) is entering a building or in contact with the building's foundation, or is in water intercepted by the building's foundation drain system, including sumps.
- Petroleum vapors are present that may migrate from the petroleum source and move through preferential pathways (sewer lines, fractured bedrock, etc.) into a building.

If none of the bulleted criteria are present, the investigator can assume that the necessary 5-feet of clean, aerated soil are present and rule out the vapor intrusion pathway. If one or more of the bulleted criteria is present, the investigator may need to confirm through soil testing that a 5-foot

[4] Luo, H., et.al., Spacial Variability of Soil-Gas Concentrations near and beneath a Building Overlying Shallow Petroleum Hydrocarbon-Impacted Soils, Ground Water Monitoring & Remediation, v. 29, no. 1, pp. 81 – 91.
[5] Davis, Robin, Update on Recent Studies and Proposed Screening Criteria for the Vapor Intrusion Pathway, LUSTLine Bulletin 61, May 2009, pp. 11 – 14, http://www.neiwpcc.org/lustline/lustline_pdf/lustline_61.pdf.
[6] This includes light end distillates such as gasoline. Heavier end petroleum products (diesel, fuel oil) or heavily weathered light end distillates that no longer contain compounds that are detectable by TO-14a or TO-15 analysis are less likely to be a source of vapors.

clean, aerated soil zone exists horizontally and vertically beneath the building in order to rule out the vapor intrusion pathway. If the vapor intrusion pathway can not be ruled out through this screening process, investigation should proceed as outlined in this guidance.

B. Screening for Chlorinated Volatile Organic Chemical Vapors

Chlorinated volatile organic chemicals (CVOC) generally do not degrade in vadose zone soils and tend to migrate greater distances from the source of contamination than petroleum hydrocarbons. Vapor intrusion investigations should be undertaken at almost all CVOC sites because of the mobility and toxicity of CVOC combined with the fact that these chemicals can not be detected by their odor at concentrations that present a human health risk. Vapor intrusion is a common risk at buildings located on the CVOC source property. Chlorinated VOCs can migrate from the source of contamination through unsaturated soils and enter near-by buildings through cracks or other openings in foundations. Groundwater can carry CVOC over long distances, allowing the CVOC to volatilize off the surface of the water table, move through the vadose zone soils, and enter buildings. The presence of on-site or adjacent utilities, such as sewers, sumps, French drains, and other subsurface migration pathways should be assessed for on-site and off-site migration pathways. The absence of an on-site VI concern does not rule out an off-site migration concern for the VI pathway. Contaminated groundwater entering buildings may also lead to vapor intrusion as the CVOC volatilize directly into the indoor air.

The vapor intrusion pathway should be investigated at all source properties where a release of CVOC has occurred. The screening criteria listed here apply to developed properties as well as to undeveloped properties (where no buildings currently exist). In addition to CVOC source properties, the VI pathway should be investigated in the following situations, regardless of whether these conditions exist on or off the source property:

- Any buildings overlying a CVOC soil source.
- Any buildings within 100 feet[7] of a CVOC soil source.
- Any buildings overlying a CVOC groundwater plume located at the water table with groundwater concentrations above Wisconsin's groundwater enforcement standards (ES).
- CVOC contaminated groundwater above Wisconsin's groundwater preventive action limit (PAL) is entering a building or in contact with the building's foundation, or is in water intercepted by the building's foundation drain system, including sumps.
- CVOC vapors have the potential to enter preferential pathways (sewer lines, fractured bedrock, foundation cracks or openings, etc.) that connect contaminated areas to a building and migrate into that building.

C. Factors Affecting Screening Distances for Vapor Migration

The actual extent of vapors emanating from contaminated soil or groundwater is affected by factors such as soil type, soil moisture, water level variation, extent of the groundwater plume, presence of preferential pathways, contaminant concentration, age of release, etc. As stated

[7] See Lowell, P.S. and B. Eklund, VOC Emission Fluxes as a Function of Lateral Distance from the Source, Environmental Progress, Vol. 23, No. 1, April 2004.

above, understanding the role of preferential pathways (such as utility corridors)[8] between the source and a building are critical to assessing the movement and accumulation of contaminated vapors to indoor air. The distances listed in this document are intended to be guidelines – the actual distances assessed will rely on site specific conditions and the results of the site investigation. Actual vapor assessment distance from the contaminant source may be more or less than the distances listed here, based on the factors listed previously in this document.

V. Investigation of the Vapor Intrusion Pathway

If vapor intrusion pathway screening indicates the potential for vapor intrusion, a plan for site specific vapor sampling should be developed. The purpose of vapor sampling is to identify which on or off-site receptors may be at risk for vapor intrusion and to determine appropriate responses to the sampling results. This section only provides guidelines for proceeding with a vapor intrusion investigation. The investigative approach taken in any instance will always be site specific.

In addition to the investigative approaches discussed here, it is critical to assess the building(s) where vapor sampling takes place. The type and condition of the building foundation, the location and condition of utility and foundation penetrations, and any other condition that would allow vapors to migrate into the building should be noted. This information, along with other pertinent observations and preparation of the building for sampling (e.g., removal of materials that contain VOCs, etc.) should be documented when vapor samples results are submitted to the Department.

The vapor intrusion pathway can be preemptively mitigated at any time during the site investigation. Section VII of this document and Chapter 4 of the ITRC guidance on vapor intrusion discuss approaches to vapor mitigation.

A. Investigating Vapor Intrusion at Properties with Existing Structures

In most cases, investigation of vapor intrusion will begin with buildings nearest the contaminant source and move outward from the source based on initial investigation results, distance to nearby receptors, extent of impermeable surface, preferential pathways, etc. This may require extending the vapor investigation beyond the source property. Each vapor assessment is unique to the characteristics of the site, and as such, a well-reasoned conceptual site model is critical to properly assessing the pathway.

Usually, a step-wise approach to investigating the vapor pathway is undertaken that includes collecting evidence at each step to determine the likelihood of vapor migration to a receptor. Groundwater and soil matrix sample concentrations should be used to help direct the vapor investigation. The most common situations contributing to vapor intrusion are listed here, along with a basic approach to initial site investigation of vapor migration. If initial investigative

[8] See the Department's "Guidance for Documenting the Investigation of Utility Corridors", http://dnr.wi.gov/org/aw/rr/archives/pubs/RR649.pdf

results indicate a risk of vapor intrusion, then additional investigation and delineation will be necessary to assess risk from the VI pathway.

1. *The original contaminant release is located directly below or adjacent to a building*. In addition to the standard soil matrix and groundwater investigation efforts, sub-slab vapor samples should be collected from beneath the building foundation. Site-specific conditions such as location of nearby buildings, degree and extent of contaminant migration in groundwater, subsurface conditions, etc. will dictate the need for collecting vapor samples beyond the source building.

2. *Vapors migrating from contaminated soil to nearby buildings*. Soil vapor samples, collected at approximately the same depth as the contaminant source, can help identify the extent of sub-surface vapor movement and identify buildings at risk of vapor intrusion. An alternative to soil vapor sampling is to collect sub-slab vapor samples from nearby buildings deemed to be at risk for vapor intrusion. If vapor concentrations in soil gas exceed screening levels (see section VI), sub-slab vapor samples of adjacent buildings will be necessary.

3. *Vapors migrating from contaminants located at the groundwater table*. A soil vapor survey can be conducted to identify buildings at risk of vapors migrating from contaminated groundwater. Soil vapor samples should be collected near the water table to assess the risk of vapor migration to overlying buildings. Soil vapor concentrations that exceed screening levels (see section VI) must be followed up with sub-slab vapor sampling at buildings deemed to be at risk. Alternatively, sub-slab vapor samples can be collected at buildings overlying the plume instead of soil vapor samples.

4. *Vapors migrating through preferential pathways, such as utility lines*. Soil vapor samples collected along underground utility service lines may be the most helpful in identifying this pathway. Sub-slab vapor samples should be collected from buildings served by utility service lines contaminated with volatile chemical vapors. If it is known that discharges are already migrating or suspected to be migrating through a utility corridor, the nature and extent of those discharges must be determined during the site investigation.

5. *Contaminated groundwater entering a building.* Sump pumps are often used to control shallow groundwater movement into buildings with basements. In situations where shallow, contaminated groundwater intercepts a building, it may not be possible to collect soil vapor or sub-slab vapor samples. In this case, the building sump should then be sealed and allowed to equilibrate for some period of time. Vapor samples should then be collected from head space overlying the contaminated groundwater. In addition, water should be collected from the sump and analyzed.

B. Investigating Vapor Intrusion at Properties without Existing Structures

Wisconsin administrative code ch. NR 716 requires that the VI pathway be evaluated whether or not a building is present at a property. Properties with residual soil and/or groundwater contamination may pose a threat of vapor exposure if buildings are constructed in the future. The potential for future exposure can be assessed through methods such as soil gas, groundwater

samples, and flux chambers. However, these techniques can not assess the effect a building will have on the migration of vapors. The most cost-effective approach to address the potential for vapor migration at a property without a building is to incorporate vapor controls into the new building design, such as a vapor barrier with passive or active venting. Moisture barriers are not vapor barriers. Vapor barriers must be designed specifically for the building, perforations through the barrier must be sealed and a passive or active venting system must underlie the vapor barrier.

In many cases, the Department's conditions of closure will require that vapor control measures be included in the new building design. If the new building will be constructed at some point in the distant future, the property owner can conduct further evaluation of the VI pathway at that time to determine if building control measures are needed.[9]

C. Collecting Vapor Samples to Investigate the Vapor Intrusion Pathway

Sub-slab, soil gas, and indoor/outdoor air samples are commonly collected to directly measure vapor concentrations. This discussion presents the Department's general expectations regarding when these samples are collected and basic quality control procedures. The work plan for every vapor intrusion investigation should contain standard operating procedures and quality assurance data objectives to ensure adequate collection and analysis of vapor samples. Sub-slab, soil vapor and air data results reported to the Department must include a description of the quality control procedures used in the field and laboratory (NR 716.13 and 716.15). Consultants should instruct the laboratory to report vapor and air results in units of $\mu g/m^3$.

1. *Sub-slab sampling*. The purpose of sub-slab vapor samples is to characterize the degree and extent of contaminated vapor directly beneath a building foundation, regardless of whether the foundation is a basement or slab-on-grade; determine the likelihood of an exposure pathway due to vapor intrusion; and initially evaluate whether mitigation of the pathway is needed. The Department strongly prefers sub-slab vapor samples to groundwater or soil gas samples for determining the risk posed by vapor intrusion to occupants of a building. The results of the sub-slab sampling can be used to rule out the vapor pathway or to determine that additional investigation or action is necessary to address the vapor pathway (see Section VI below).

   Sub-slab sampling at commercial and industrial buildings should target the areas where contaminant releases are known to have (or may have) occurred. At buildings where a release has not occurred but where the vapor intrusion pathway is a concern (such as homes, nearby businesses, etc.), the Department recommends that 3 sub-slab samples be collected at buildings with a footprint less than 5,000 square feet. For larger buildings, an additional sub-slab sample should be collected for each additional 2,000 square feet. At large commercial/industrial facilities where this sampling density is unworkable, other approaches,

[9] See U.S. EPA's Brownfield Technology Primer for more information. http://www.brownfieldstsc.org/pdfs/BTSC%20Vapor%20Intrusion%20Considerations%20for%20Redevelopment%20EPA%20542-R-08-001.pdf

such as modified soil venting assessment techniques, can be effective in assessing the sub-slab vapor concentrations.[10]

In general, results from multiple sub-slab sampling points should NOT be averaged. Results from each sample should be evaluated individually. The information from a sampling network helps the investigator identify "hot spots" of contamination and preferential pathways for vapor movement. Large buildings are often subdivided into smaller spaces when they undergo redevelopment which may change air exchange patterns and may heighten a vapor intrusion problem. However, there are situations, such as in large industrial or commercial buildings, where area-weighted averaging of sub-slab vapor concentrations may be useful. In these cases, the contaminated areas beneath the building should be evaluated separately from the non-contaminated areas in order to evaluate vapor intrusion risk and, where necessary, properly target remedial action and vapor mitigation.

Sub-slab vapor samples can be collected in vacuum gas canisters fitted with a controller to limit vapor flow to no more than 200 ml/min (a 6 L canister will fill in approximately 30 minutes at this flow rate). Vapor samples should be analyzed using Method TO-15 or Method TO-14a for the chemicals of concern identified from soil and groundwater sampling conducted at the site. The use of other sampling equipment or laboratory methods should be discussed with the DNR Project Manager.

Quality control for sub-slab sampling should include a combination of vacuum testing of lines and leak detection tracers to ensure the integrity of the sample. Sample lines extending from the sub-slab probe to the Summa canister should be vacuum tested for tightness prior to sample collection and a leak tracer compound should be released around the sub-slab probe during sample collection. Several leak tracer compounds are available (such as pentane, isopropyl alcohol, helium, and SF6). The Department recommends the use of helium because it allows the detection and correction of leaks prior to sample collection.[11] If a leak tracer other than helium is used, the selection of the leak tracer compound should be coordinated with the analytical laboratory to ensure that its presence in sub-slab vapor samples will not interfere with the analysis of target compounds. If the leak tracer compound is detected at more than 10% leakage rate by volume in the sub-slab sample, then the sample results should be rejected. In this case, resample the sub-slab probes with improved sample collection techniques. (Note: to determine leakage rate, it is necessary to sample the concentration of leak tracer beneath the tracer shroud, which is placed over the sub-slab probe to contain the tracer gas.)

2. *Soil Gas Samples*. Soil gas samples are best used as a survey tool to identify buildings at risk of vapor intrusion where follow-up sub-slab vapor testing will be performed. Sub-slab samples are strongly preferred to other vapor samples in assessing vapor concentrations at specific buildings. In cases where sub-slab sampling is precluded or where contamination

[10] McAlary, T., et.al., High purge volume sampling – a new paradigm for subslab soil gas monitoring, Ground Water Monitoring & Remediation, v. 30, no. 2, Spring 2010, pp. 73 – 85.
[11] See the ReNews Article "Detecting air leaks when collecting sub-slab samples" at http://dnr.wi.gov/org/aw/rr/technical/subslab.pdf for more information.

exists over a wide area, the use of soil gas samples to assess vapor intrusion potential to indoor air should be discussed with the DNR Project Manager. Soil gas samples should be collected considering these guidelines:

- If the vapors originate from contaminants in groundwater (water table 30 feet or less below ground surface), soil gas samples should be collected 1 to 2 feet above the water table and as near the building being assessed as possible. If the water table is greater than 30 feet below ground surface, a soil gas sample should be collected half the distance to the water table.
- Where groundwater conditions permit, soil gas samples should be collected from a depth of at least 5 feet or more below the building foundation. Where no building exists, soil gas samples should be collected at least 5 feet below ground surface.
- Soil gas samples should be collected from zones of more permeable material because vapors can more readily move through transmissive zones to nearby receptors.
- If site conditions preclude the application of the above distances, alternative vapor sampling methods and approaches should be discussed with the DNR Project Manager.

Soil gas samples should be collected on the side of the building nearest the contaminant source. If contaminated groundwater is the source, soil gas samples should be collected on all sides of the building.

Soil gas samples may be collected using vacuum canisters or Tedlar bags, if laboratory analysis of the Tedlar bag occurs within 48 hours. Laboratory analysis should be conducted in the same manner as for sub-slab vapor samples. Soil gas samples should use the quality control procedures (vacuum testing of sample lines and leak tracer testing) described for sub-slab probes above.

3. *Utility Corridors as Preferential Pathways*. If subsurface utility corridors or geologic features provide preferential migration pathways for contaminant vapors, passive or active soil gas surveys may be the best tool for identifying the migration pathways and should be incorporated into the site investigation. Unique sampling schemes may be necessary when dealing with preferential pathways, for example, a combination of indoor air samples and vapor samples from sewer vents or along utility backfill may be needed. Other approaches may help focus locations for vapor migration investigation, such as video logging of storm or sanitary sewers in cases where chemicals may have entered sewer systems and migrated along utility lines.

4. *Indoor and outdoor air sampling*. The goal of indoor air sampling is to determine if there is a complete exposure pathway due to vapor intrusion and to determine whether mitigation or remediation is necessary to address unacceptable risks. Indoor air sampling is also necessary after a mitigation system is installed and operating. An outdoor (ambient) air sample should be collected whenever indoor air samples are collected. The outdoor sample provides information on the air quality surrounding the building. The outdoor sample should be collected using the same procedures as the indoor sample.

   Indoor air samples are often collected after results from sub-slab vapor sampling indicate screening levels are exceeded (see Section VI below). However, indoor air samples may be

collected concurrently with sub-slab vapor samples (but not during installation of sub-slab probes). An investigator cannot usually determine whether a vapor intrusion pathway exists with only indoor air sample results. The indoor air sample should be accompanied by corresponding (although not necessarily concurrent) sub-slab or sump samples. Here are some considerations for determining whether indoor air samples should be collected (these considerations assume that sub-slab vapor concentrations exceed screening levels).

- The presence of building occupants, particularly residents. Indoor air samples should always be collected in buildings where people are currently living or working in order to rule out an unacceptable exposure.
- The concurrent use of the contaminant(s) of concern. Indoor air samples should not be collected in a building space that currently uses the contaminant of concern. For instance, indoor air samples should not be collected for perchloroethylene (PCE) at a dry cleaning facility that uses PCE in the dry cleaning machine or as a spot treatment.
- Abandoned or inactive building. If a building is unoccupied and the heating, ventilation, and air conditioning (HVAC) system is not operational, an indoor air sample is unlikely to be representative of normal building operations and may not be useful in determining the potential for exposure.
- Industrial facilities with a large footprint and various mechanical and/or chemical operations. It may be difficult to collect a representative indoor air sample due to the size and scope of large industrial facilities. The need for indoor air sampling under these conditions should be discussed with the Department PM.

Prior to indoor air sampling, conduct a survey for any items that may contribute VOCs to the indoor air and remove those items from the building at least 24 hours prior to sampling. Indoor air samples should be collected as 24-hour (residential) or 8-hour (commercial/industrial) time-weighted samples using vacuum gas canisters. Indoor air should be sampled on the lowest occupied level of the building and in commonly occupied spaces with the sampling canister placed approximately 3 to 5 feet above the floor and near the center of the room, away from windows. One indoor air sample from each level of a typical residential home should be adequate while multiple samples will likely be necessary from commercial facilities (especially those with individual business spaces) and industrial facilities. Samples should be collected under normal operating conditions of the building (i.e., doors opening/closing, regular HVAC operations, etc.). In the summer months, windows should be closed at least 24 hours prior to sampling and during sampling to minimize contribution from outdoor air.

Laboratory analysis of indoor air samples should focus on the contaminants of concern and should achieve detection limits that are 10 times lower than the targeted indoor air Action Level. Summa canister samples and laboratory method TO-15 should be used for indoor air, although method TO-15 SIM may be necessary to achieve required detection levels for certain contaminants. The use of passive indoor air samplers that allow collection of 7 or 14 day samples with laboratory methods that meet the detection levels for target contaminants are acceptable for assessing indoor air contaminant risk.

If results from indoor air concentrations are believed to be due to “background” or typical indoor air VOC sources rather than vapor intrusion, further evaluation should be conducted

to try and determine the source of indoor air contaminants. Where possible, remove materials contributing the VOCs prior to any subsequent testing.

VI. Assessing the Risk Posed by the Vapor Intrusion Pathway

The major goals of investigating the vapor intrusion pathway are to identify the vapor source and the pathway(s) of vapor movement into buildings (on- or off-site), to determine whether vapor migration is a risk to current or future users of the building and where necessary, to aid in designing and implementing remedial actions to interrupt or eliminate the exposure pathway. This section addresses the Vapor Action Levels (VAL) and vapor risk screening levels (referred to as screening levels throughout) that should be applied when assessing the health threat from vapor intrusion and how to apply these when assessing vapor data. Site investigation reports should clearly state the land use classification (e.g., residential, commercial or large industrial) used to determine VAL and screening levels appropriate to the site.

A. Vapor Action Levels and Vapor Risk Screening Levels

A Vapor Action Level (VAL) is equal to the lesser concentration of the following: a hazard index (HI) of 1.0 or a 1-in-100,000 (1 x 10^{-5}) excess lifetime cancer risk. Contaminant concentrations in the breathing space of buildings should be compared to the contaminant's VAL, taking into consideration exposure conditions (i.e., residential or commercial/industrial building use). Concentrations in indoor air equal to or exceeding the VAL require additional action and are to be addressed as part of the site remediation effort.[12]

1. *Applying Vapor Action Levels*. Vapor Action Levels for indoor air exposures are based, in part, upon standard U.S. EPA risk calculation methods. Tables and equations for indoor air concentrations can be found at http://www.epa.gov/reg3hwmd/risk/human/rb-concentration_table/index.htm.[13]. The tables found at this web site provide screening levels for residential and industrial indoor air exposure scenarios. The screening levels for non-carcinogens correspond to a HI=1.0 while the screening levels for carcinogens correspond to a 1-in-1,000,000 excess lifetime cancer risk. Therefore, the screening values provided for carcinogens should be multiplied by 10 to determine the Wisconsin VAL.

   If multiple contaminants from a vapor intrusion source are present in indoor air, the total risk (the additive risk of each of the contaminants individually) can not exceed a HI of 1.0 or a cumulative risk of 1 additional cancer per 100,000 population (1-in-100,000 excess lifetime cancer risk).

   There are circumstances when immediate action is needed to halt inhalation exposures by occupants when a contaminant level in air reaches or exceeds a certain concentration. For non-carcinogens, this is when the concentration and appropriate exposure factors (dose,

[12] See DNR-DHS memo "Vapor Intrusion Action Levels and Screening Levels", attached.
[13] Soil inhalation pathway values are NOT an acceptable method to estimate screening values for the vapor intrusion pathway.

duration, frequency, etc) indicate the exposure may result in adverse health effects (symptoms or disease). For carcinogens, this is when the concentration and appropriate exposure factors (dose, duration, frequency, etc) estimates the excess lifetime increased cancer risk is at or exceeds 1-in-10,000. The Wisconsin Department of Health Services (DHS) and the local city or county health department should be contacted to assist with assessing such exposures. Under such circumstances DHS and the local health department may declare that the situation constitutes a "human health hazard" (s. 255.59, Wis. Stats.), which requires immediate action to halt such an exposure.

2. *Screening Levels for Residential and Small Commercial Buildings*. To determine screening levels for samples used to estimate indoor air concentrations, such as sub-slab vapor, soil gas or groundwater concentrations, use standard vapor attenuation factors contained in current U.S. EPA guidance. Attenuation factors[14] can be found at http://www.epa.gov/osw/hazard/correctiveaction/eis/vapor.htm. U.S. EPA may adjust these attenuation factors in the future. As of 2010, commonly applied vapor attenuation factors include:
   - 0.1 sub-slab vapor to indoor air
   - 0.1 shallow soil gas[15] to indoor air
   - 0.01 deep soil gas[16] to indoor air
   - 0.001 groundwater to indoor air (where vapor concentrations are calculated from partitioning across the water table using Henry's Law)

3. *Screening Levels for Large Commercial/Industrial Buildings.* U.S. EPA based their vapor attenuation factors primarily on observations at residential homes. Because large commercial/industrial facilities are different from residential homes in several areas that affect vapor intrusion, the vapor attenuation factors may be reduced by a factor of 1/10, if criteria listed below are met. In this case, the applicable attenuation factors at a large commercial/industrial facility may be:
   - 0.01 sub-slab vapor to indoor air
   - 0.01 shallow soil gas[15] to indoor air
   - 0.001 deep soil gas[16] to indoor air
   - 0.0001 groundwater to indoor air

   The following criteria should be documented in order to justify applying a reduced vapor attenuation factor at a large commercial/industrial building.
   - Building size. Commercial/industrial buildings typically have a significantly larger footprint than homes. The interior of the building should be open to air flow rather than subdivided into smaller offices or businesses.
   - Foundation thickness and structural integrity. Commercial/industrial buildings are often slab-on-grade construction with thicker and more intact concrete slabs than residences.
   - Ceiling height. Ceilings are usually considerably higher in commercial/industrial facilities, increasing the air volume compared to residences.

[14] Vapor attenuation factor (α) is defined by: $\alpha = \text{Concentration}_{(\text{indoor air})} \div \text{Concentration}_{(\text{source})}$
[15] Shallow soil gas samples are defined as those collected 5 feet or less below the building foundation.
[16] Deep soil gas samples are defined as those collected more than 5 feet below the building foundation.

- Air exchange rate. Higher ventilation rates in commercial/industrial buildings should result in lower indoor air concentrations, if the rate of vapor intrusion from the subsurface is constant.

B. Applying VAL and Screening Levels to Vapor Intrusion Risk

When assessing risk posed by the vapor intrusion pathway to a specific receptor, the Department prefers sub-slab samples over indoor air samples. Sub-slab vapor is more likely to originate from contaminant sources beneath or outside the building; can reveal the potential for vapor intrusion before contaminants have entered the breathing space; and contaminant concentrations may be less variable with time as compared to indoor air. In most cases, **negative indoor air samples alone are NOT adequate evidence to rule out the vapor intrusion pathway**; however, sub-slab sampling alone or in conjunction with indoor air sampling may be able to rule out the pathway.

After vapor samples are collected and contaminant concentrations are compared to VAL or screening levels, determine whether further action regarding the vapor pathway is necessary based on these decision criteria.

1. *Sub-slab concentration is less than screening levels.* Measured vapor concentrations in the sub-slab that are less than the applicable screening levels (considering the appropriate risk exposure and attenuation factor) indicate there is not a risk to human health due to vapor intrusion. In this scenario, the vapor intrusion pathway will be considered adequately addressed.

2. *Sub-slab concentration is greater than screening levels.* Sub-slab vapor concentrations equal to or greater than a screening level indicate the potential for vapor migration into a building and require further action to assess the vapor intrusion pathway and/or to reduce the on-going migration of contaminants.

3. *Indoor air concentration is equal to or greater than VAL due to migration from subsurface contaminants*. Indoor air equal to or greater than an Action Level requires that exposure of building occupants to the chemical vapors be reduced; that the extent of the vapor migration be determined; and that on-going migration of contaminants be remediated. The Wisconsin Department of Health Services should also be apprised of indoor air concentrations above VAL.

4. *Vapor concentration in other media exceeds the screening levels*. Assessment of soil gas and/or vapor migration of VOCs from the water table surface can be used to screen for the potential of vapor migration at redevelopment sites that currently lack buildings or at sites where vapor intrusion may be occurring over a wide area. Screening levels for vapor migration potential should be calculated as discussed above, considering the appropriate attenuation factors. If the soil gas concentrations exceed the screening levels, appropriate action should be taken, such as installation of a vapor barrier at new buildings or additional vapor assessment at nearby buildings.

5. *Soil gas concentrations in utility corridors/rights-of-way*. Soil gas sample results from utility corridors or in rights-of-way should be treated as deep soil gas samples, using an attenuation factor of 0.01. If contaminant concentrations exceed the screening values then additional investigation of the vapor pathway is warranted. Utility owners should be informed of the vapor concentrations identified in the utility corridor(s).

C. Role of Department of Health Services (DHS) in Evaluating Risk from Vapor Intrusion

Both the Department and DHS have responsibility for ensuring that human health is protected at contaminated sites. There are overlaps in responsibilities between the two agencies regarding indoor air risks at vapor intrusion sites. Department of Health Services focuses on the contaminated sites where a risk to human health is likely to exist and must follow-up on these risks with local health departments.

Consultants and responsible parties can seek help from DHS when investigating the VI pathway. Situations in which DHS staff either must be consulted or can provide additional support include:

- When indoor air concentrations exceed VAL of contaminants in an occupied structure. Remediation staff works in concert with DHS to ensure that the indoor air risk is mitigated and building occupants are protected.
- When help is needed to interpret indoor air results.
- When support is needed to gain access to homes or businesses to collect sub-slab or indoor air samples; to communicate risk from chemical exposures; to explain why samples need to be collected; or to address health concerns or questions.

VII. Responses to Vapor Intrusion that Exceed VAL or Screening Levels

When a vapor sample concentration exceeds a VAL or a vapor risk screening level, one can not automatically conclude that vapor intrusion is occurring. All lines of evidence should be evaluated to determine the likely source of the contamination, pathways for vapor movement and the effect on receptors. This may require revising the site investigation workplan and enlarging the site investigation. If, after assessing the lines of evidence, it is determined that vapor intrusion poses a threat to building occupants action is to be taken to address the source of the hazardous substance discharge in accordance with ss. 292.11(3), Wis. Stats. **In most cases this will require remediating, to the extent practical, the source of the contamination in order to address long-term risk and interrupting the vapor intrusion pathway to address near-term risk and protect receptors.**

A. Remediation and Mitigation

Remediation of the vapor source is the most effective way to confidently eliminate the long-term risks of vapor intrusion from sources such as contaminated soils, groundwater, and/or NAPL. For more information on the remedy selection process see NR 722, Standards for Selecting Remedial Action.

The Department expects that vapor mitigation will be implemented at buildings where sub-slab vapor concentrations exceed screening levels. Several options exist for interrupting the vapor intrusion pathway in order to protect human health[17]. Vapor mitigation technologies for buildings include:

- sealing potential vapor entry points
- sub-slab depressurization
- vapor barrier and passive venting for new construction
- building pressurization/HVAC modification at commercial and industrial facilities

The most common way to interrupt the vapor pathway in existing structures is to install a sub-slab depressurization system (SSDS; often referred to as a "radon system" for its similar use in mitigating radon gas at buildings). Sub-slab depressurization systems actively maintain a negative pressure gradient between the sub-slab and indoor air.

Sub-slab depressurization systems are not remediation systems and *should not* be considered as a remedial action that adequately addresses the source of the vapor intrusion pathway. **Source control (i.e., remedial or interim actions involving soil or groundwater treatment, excavation or a combination of these) will usually be the best approach to reduce or eliminate the vapor intrusion pathway.** Source control will also reduce the amount of time an SSDS must operate and will help ensure long-term protection of public heath. The goal of source control should be to reduce indoor air and sub-slab concentrations to levels below VAL and screening levels without on-going operation of a SSDS. The reasonable life expectancy of a SSDS fan is 10 to 15 years. Therefore, the goal for the source control remedy should be to reduce vapor concentrations in the subsurface to protective levels well within this period of time.

Passive sub-slab depressurization at a vapor intrusion site is typically acceptable only at new construction where a full vapor barrier is installed beneath the building slab in conjunction with the passive vapor extraction system. Even in these cases, the Department recommends that the passive depressurization system be designed so that it can be attached to a blower if subsequent testing indicates that active depressurization is needed.

B. Verification

A newly installed mitigation system must be tested to verify it is functioning as designed. Verification testing should be performed by the Responsible Party or the building owner. The Department will audit the performance of these systems on a periodic basis[18]. Verification testing should include:

1. *Pressure gradient.* Effective SSDS operation requires that a pressure gradient exist across the foundation slab such that pressure below the slab is lower than indoor air pressure. All SSDS should be instrumented with a pressure gauge or manometer to monitor pressure within the depressurization system. Manometer or pressure gauges should be recorded monthly to ensure the SSDS is operating properly. In addition, at large commercial or

[17] For more information on mitigation technologies, see the ITRC Practical Guide to Vapor Intrusion

[18] The Department may audit the on-going operation and maintenance of vapor mitigation systems both pre- and post-closure.

industrial buildings sub-slab pressure measurements should be confirmed with sub-slab pressure gauges or through smoke testing to ensure that negative pressure exists across the slab throughout the VOC contaminated area.

2. *Indoor air sampling*. Indoor air verification samples should be collected after a mitigation system has been installed and is operating to confirm that an exposure is not occurring. If VAL was exceeded prior to mitigation, indoor air samples will be required after installation of the mitigation system to demonstrate that the exposure no longer exists. The verification samples should confirm that indoor air concentrations are below VAL and that vapor intrusion does not present a health risk. Verification samples should be collected after the system has been operating a minimum of 3 months. If indoor air concentrations are above VAL after operation of the mitigation system, then the source and pathway should be reassessed and additional actions taken to reduce exposure risk.

C. Additional Monitoring

Additional monitoring of sub-slab and/or indoor air may be conducted in response to sample results that exceed screening levels and/or VAL. However, the following apply:

1. *Vapor Action Level exceeded by 10X*. If indoor air concentrations exceed a 1-in-10,000 lifetime cancer risk, immediate action pursuant to ch. NR 708, Wis. Adm. Code, must be taken to immediately stop the exposure, even if additional monitoring occurs. This may include removal of occupants from the building until risk levels decline to less than VAL.

2. *Vapor Action Level exceeded*. Immediate follow-up testing and assessment to interrupt the vapor pathway must occur at any location where contaminants of concern in sub-slab and indoor air exceed both screening and VAL.

3. *Vapor Action Level not exceeded*. Additional sampling of sub-slab and/or indoor air may be conducted to assess the vapor pathway when screening levels are exceeded but contaminants of concern in indoor air are less than VAL. A responsible party may propose an on-going, long-term monitoring program in an effort to rule out the exposure pathway to the indoor air in the future. Any on-going vapor monitoring program should include a sampling frequency and duration that takes into account land use, seasonality, building use, occupant exposure, and changes that may occur in the future to the building itself (such as aging of the building, remodeling that affects the vapor pathway, etc.). However, the cost of this approach could quickly exceed the installation and operation of a mitigation system.

VIII. **Closure at Sites with a Vapor Intrusion Pathway**

Sites with a potential (i.e., sub-slab screening levels exceeded) or complete (i.e., VAL and screening levels exceeded) vapor intrusion pathway can be considered for closure under NR 726 if all of the following circumstances are met:

- All other contaminant migration pathways on- and off-site have been addressed in accordance with NR 726.

- Remediation and mitigation of the vapor intrusion pathway results in contaminant levels less than VAL in indoor air. The Department will expect indoor air verification sampling when mitigation systems are operating.
- The contaminant source from which vapors are migrating has been remediated to the extent practical to reduce future vapor migration and to reduce to the extent practical the length of time a vapor mitigation system must be operated to protect the pathway.
- The property owner(s) and any affected occupant(s) of a building(s) with a vapor intrusion risk have been notified that they are responsible for maintaining the mitigation system as long as necessary to protect the vapor intrusion pathway. The closure letter will require that an operation and maintenance plan be on file with the Department and in the possession of the building occupant. An agreement may be entered into between the property owner and the Responsible Party regarding the responsibility for the future operation and maintenance of the mitigation system.
- The property where the hazardous substance release occurred, as well as the property where vapor intrusion is occurring (if different from the source property) must be entered onto the Remediation & Redevelopment Program's on-line database. Appropriate fees, in accordance with ch. NR 749, Wis. Adm. Code, must be paid to the Department.

In addition, the closure letter will include a requirement that any post-closure change in exposure conditions used to determine VAL be reported to the Department. The closure letter will require that the property owner/developer contact the Department prior to building or property use changes (e.g., from industrial/commercial to residential). The property owner/developer will be required to provide the Department with plans for building use changes and describe how the vapor pathway will be protected. Actions required of the property owner/developer may include reevaluation of the vapor intrusion pathway, additional source control measures and/or installation of more stringent vapor controls to ensure protection of people using the building.

IX. **Examples**

This section provides examples for applying the principals contained in this guidance to sites with vapor intrusion issues. In addition, these examples discuss conditions where additional investigation and remediation maybe necessary and when sites with VI can be considered for closure.

Example No. 1 – CVOC Contaminated Soil beneath a Building

A former dry cleaner operated in a strip mall for 20 years and a new tenant now occupies the space. Soil and groundwater impacts exist beneath several different commercial businesses in the strip mall. Groundwater monitoring indicates the plume meets the criteria for natural attenuation closure and the direct contact pathway due to soil contamination has been addressed. However, given the presence of tetrachloroethylene (PCE) contamination in soil and the water table wells, it was determined that the vapor intrusion pathway needed further evaluation. Sub-slab sampling revealed PCE vapor beneath the building.

- Scenario A – The measured concentrations in sub-slab vapor samples are less than the screening level for the given exposure conditions. The sub-slab vapor does not pose an

exposure risk and because the soil and groundwater pathways have been addressed, the site could be closed under NR 726. Closure conditions will include a requirement to notify the Department if land use changes and the exposure conditions present at the time of closure no longer apply.

- Scenario B – The measured concentrations in sub-slab samples are greater than the PCE screening level for the given exposure conditions. Indoor air samples were collected after receiving the sub-slab sample results and the indoor air levels are less than the applicable VAL. An evaluation of the sampling methodology and frequency confirm that adequate data were provided. While a current human health risk does not exist (based on PCE indoor air concentrations), the potential for a future health risk does exist (based on PCE in sub-slab vapors). Remedial action should be taken to reduce the source of contamination to the extent practical. Given the sub-slab concentrations, a sub-slab depressurization system or other mitigation system should be installed and operated in order to minimize worker and customer exposure to the contaminants in the future.

  Once the source has been remediated to the extent practical and the mitigation system is being operated for the purpose of minimizing exposure of building occupants to unacceptable vapor levels indoors, the requirements of NR 726 have been met and the site could be closed. The continued operation of the sub-slab depressurization system or other mitigation system will be included as a condition of the final closure letter so that the current and future property owners are aware that continuous operation of the system is necessary. The Department's closure letter will specify other conditions of closure. This site would be a candidate for future environmental audits by the Department to ensure the system remains operational.

  As an alternative to installing a mitigation system, a long-term vapor monitoring program could be proposed in order to assess the vapor pathway into the future in accordance with principles discussed earlier in this guidance (see Section VII, part C). As long as sub-slab vapor concentrations remain above screening levels and mitigation has not been implemented, closure is not possible. In accordance with NR 726.05(4), closure may not occur if at any time in the future the remaining level of contamination is likely to pose a threat to public health, safety, welfare or the environment.

- Scenario C – The concentration in sub-slab samples exceeds screening levels and indoor air concentrations exceed the VAL for PCE. This situation represents an unacceptable inhalation exposure and action to reduce or eliminate the exposure to contaminant vapors should be taken as soon as possible. Indoor air sampling will be required by the Department after the mitigation system is operating in order to establish that the mitigation system has reduced the inhalation risk to below VAL. In addition, the RP is expected to implement an appropriate remedial action at the site in order to reduce the mass at the contaminant source and thereby minimize the on-going vapor intrusion.

Example No. 2 – Redevelopment of a CVOC Contaminated Property

Trichloroethylene (TCE) is present in soil and shallow groundwater at a site that is being evaluated for redevelopment. The development plan[19] calls for a below grade parking lot, office space at grade level, and condominiums on the upper levels of the building. A large portion of the source area was removed and groundwater monitoring shows the plume is receding. The soil direct contact pathway will be addressed with the construction of the building and associated soil placement for landscaping purposes. The building is designed to vent car exhaust from the parking structure to the atmosphere so it doesn't migrate to the existing office space or condos.

- Scenario A – Soil gas and/or groundwater concentrations are less than applicable screening levels, indicating that TCE concentrations are likely to be less than VAL in residential areas. The operation of the parking structure exhaust system will ensure that the vapor intrusion pathway is protected. Because the other pathways of concern have also been addressed, the requirements of NR 726 have been met and the site can be closed.

- Scenario B – Sub-surface vapor testing reveals that concentrations beneath the proposed building may be greater than the TCE screening level for residential dwellings. A vapor barrier and passive venting system beneath the building, in addition to operation of the parking structure venting system is proposed to ensure that no measurable concentrations of TCE can enter the proposed businesses or the condominiums. The parking structure exhaust system will need to be in constant operation in order to prevent dangerous levels of carbon monoxide from accumulating in the building. Because the groundwater and direct contact pathways have already been addressed and significant contaminant source removed, this case could close under NR 726. The closure letter would require the operation and maintenance of the vapor barrier, passive venting and continuous operation of the parking exhaust system.

Example No. 3 – CVOC Groundwater Plume with Off-site Migration

An industry discovers a release from one of their underground TCE tanks. The subsequent investigation determines that a plume of contaminated groundwater extends under an adjacent sub-division. While the homes are on municipal water, the concentrations in groundwater are high enough that the vapor intrusion pathway needs to be evaluated. Initial soil gas sampling reveals relatively high levels of contaminants in the unsaturated zone near several of the homes in question, levels that may result in indoor air concentrations exceeding the VAL for TCE. The homes considered to be most at risk are targeted for follow-up sub-slab and indoor air sampling in order to determine whether a human health risk may exist. The remedy for this site includes soil removal from the source area along with the installation of an active groundwater treatment and soil vapor extraction (SVE) system. The remedy is intended to address control of the groundwater plume and to reduce vapor concentrations in the unsaturated zone.

- Scenario A – As long as the groundwater treatment / SVE system needs to operate to control plume expansion, closure of the site is not possible. If sub-slab screening levels

[19] Developers are urged to install vapor barriers with passive or active venting if volatile chemicals remain in soil or groundwater on property being redeveloped.

are exceeded at any of the nearby homes, indoor air sampling should be conducted. If sub-slab vapor concentrations are exceed but VAL are not exceeded, either an on-going indoor air vapor monitoring program should be established or a vapor mitigation system should be installed in the affected homes in order to address the potential risk to human health. If indoor air concentrations exceed VAL, mitigation of the vapor pathway will be required. Indoor air sampling should also be conducted after the mitigation system has been installed to ensure that an unacceptable risk to human health does not exist. Provisions should be made for on-going operation and maintenance of the mitigation system as well as periodic indoor air monitoring.

- Scenario B – Information is provided to document that operation of the groundwater treatment / SVE system is no longer needed to ensure the plume is stable or receding. The effect of the remedial effort on the vapor pathway is evaluated and sub-slab and indoor air monitoring at homes where the vapor pathway was identified as a concern reveal concentrations below applicable screening and VAL. Remedial efforts have effectively addressed the vapor pathway in this scenario and operation of the vapor mitigation system is no longer necessary. If all other requirements of NR 726 are met, the site qualifies for closure.

- Scenario C – The groundwater plume is determined to be stable or receding and the groundwater treatment / SVE system is shut down. TCE does not exceed the indoor air VAL, but sub-slab vapor sampling reveals that measured concentrations at several homes are greater than the screening level, requiring continued operation of the mitigation system. Operation of the groundwater treatment/SVE system should be continued or other remedial action be considered in order to eliminate to the extent practical the off-site vapor migration pathway to the nearby homes. Closure under NR 726 is not appropriate at this time.

- Scenario D – The groundwater plume is believed to be stable or receding without operation of the groundwater treatment / SVE system, but sub-slab vapor concentrations exceed screening levels for 2 homes that were previously unaffected. In addition to installation and operation of mitigation systems at the homes, additional remedial actions need to be evaluated including continued operation of the groundwater treatment / SVE system or other remedial action. Closure under NR 726 is not appropriate at this time.

<u>Example No. 4 – CVOC Contamination at an Operating Business with Later Redevelopment</u>
An existing dry cleaner recently completed a site investigation to define the degree and extent from a release of PCE at their current place of business. The investigation confirmed relatively high levels of soil contamination with the highest concentrations directly under the building. Due to the presence of low permeability soils (primarily silt and clay) groundwater impacts have been minor and monitoring has determined that the contaminant plume is not expanding. Action to address sub-slab soils may be necessary given the high soil matrix concentrations. After appropriate source control measures have been taken, there is not a direct contact issue at this site due to the presence of the building. The remaining issue is the potential for vapor intrusion into nearby structures and the dry cleaner building if building use changes in the future.

- Scenario A – The dry cleaner plans to continue operation at the site, which includes the use of PCE in the dry cleaning machine, and requests closure. The soil direct contact and groundwater pathways have already been addressed in accordance with NR 726. While it would be difficult to determine what affect vapor intrusion is having on the overall concentrations of PCE in the building because of on-going dry cleaning operations, sub-slab sampling should be conducted to evaluate whether vapor intrusion is a potential pathway of concern. In this case the indoor air quality standards that apply within the building are set by OSHA and are not exceeded.

  If the sub-slab vapor sampling indicates that vapor intrusion could be a potential problem if commercial indoor air exposure criteria were applied rather than OSHA indoor standards, consideration should be given to installing and operating a sub-slab vapor mitigation system to control lateral vapor movement away from the dry cleaner and thereby limit migration into nearby buildings. The current and future building owners would be responsible for on-going maintenance and operation of the mitigation system. If building use changes in the future and dry cleaning no longer occurs in the building, indoor air sampling will be necessary to assess vapor concentrations in the building. If a mitigation system has previously been installed, the indoor air sampling will determine the effectiveness of the mitigation system in controlling vapor intrusion into the building. In addition, the closure letter will require that the Department be notified of the air sampling results and the proposed land use change.

- Scenario B – At some point after the dry cleaner in Scenario A receives case closure, the owner vacates the building and a developer plans to remodel the space and rent it to several individuals interested in opening up a bookstore. Because OSHA rules no longer apply, an evaluation of the vapor pathway, using the appropriate indoor air exposure conditions, needs to be undertaken. If a vapor mitigation system is in operation, indoor air samples should be collected to determine whether there is a risk to human health. If indoor air concentrations are below VAL and the mitigation system is operational, no further action regarding the vapor pathway is needed. If a mitigation system was not previously installed or if VAL is exceeded, assessment of sub-slab and indoor air vapor will be necessary to determine the need for additional actions. If a health risk exists at the site, the Department will reopen the site in accordance with NR 726.09.

- Scenario C – After site closure, the vacated building undergoes redevelopment. A vapor mitigation system was not installed previously. It will be necessary to assess the vapor intrusion pathway, including testing sub-slab vapor and, perhaps, indoor air. If sub-slab vapor concentrations exceed screening levels, a remediation plan should be developed. If the building will be occupied prior to completion of the remedy, a mitigation system should be installed to address the potential human health risk. Verification indoor air samples will be necessary to determine that a human health risk does not exist. In this scenario, the Department would reopen and oversee the case until the contaminant pathway is addressed.

- Scenario D – After closure is issued under Scenario A, a developer purchases the property from the dry cleaner. The preliminary plans include demolition of the building

and construction of a new structure. The closure requires that the new property owner be notified of their responsibility to investigate and clean up subsurface contamination after building removal. In addition, the closure letter requires evaluation of the vapor intrusion pathway, including assessing additional source control actions and mitigation of the vapor pathway that may be necessary for the new building. The Department must be notified if contamination is found during the subsequent investigation. At the time of the future investigation, the new owner should contact the Department regarding the proposed development, protection of the various environmental pathways, and the need for additional source control.

Example No. 5 – Petroleum Release with Free-product and Off-site Migration of Groundwater

An underground tank leaks at a service station releasing gasoline into fractured bedrock. The free product gasoline at the water table is the source of a shallow groundwater plume that extends more than a city block downgradient of the service station. Beside the gas station is a church and half a block from the gas station, the local bank has a basement with two sumps to keep shallow groundwater from entering the building.

- Scenario A. Bank employees begin to complain of symptoms of burning eyes and an unusual odor in the basement. A consultant evaluates the building and determines there is not an explosion hazard. Water samples collected from the sumps are analyzed and show that benzene concentrations exceed 500 ppb. Results of indoor air sampling show benzene concentrations exceed the industrial/commercial VAL. Due to the proximity of the groundwater to the basement foundation, a sub-slab depressurization system cannot be installed. The vapors appear to be emanating from the sumps; therefore the sumps are both sealed and vented to the outdoors. Subsequent indoor air sampling confirms that benzene concentrations have fallen below the appropriate VAL. A maintenance plan should be developed to ensure that the sump seals are periodically inspected and the vapor vents are functional.

  Additional investigation of other buildings overlying the groundwater plume footprint reveals that the buildings are all slab on grade construction and that the presence of oxygenated, unsaturated soil between the plume and the buildings protect the buildings from petroleum vapors emanating off the plume. The remedial action occurring at the gas station will continue until the contaminants no longer pose a threat to human health or the environment.

- Scenario B. The church building abuts the gas station property and is located near the extent of free product but upgradient of the groundwater plume. The consultant assesses the possible vapor pathway to the church by conducting a survey of soil oxygen levels and soil benzene vapors between the church and the free product zone. Soil vapor samples are collected over depth intervals that assess the oxygen and vapor concentrations at least 5 feet below the church foundation and extend to approximately 2 feet below the ground surface. The survey shows that soil oxygen levels exceed 5% and benzene concentrations are near non-detect levels in the soil gas. The vapor pathway is not a risk to the church.

- Scenario C. The same circumstances as Scenario B, but the oxygen levels in the soil are near zero and the benzene levels indicate that vapor intrusion may present a risk to the church. Sub-slab vapor samples should be collected from below the church building. If sub-slab vapors exceed screening levels, mitigation should be implemented. If a SSD system is selected, it must be intrinsically safe to avoid an explosion risk. Closure can not occur at the gas station until the contaminants no longer pose a risk to human health or the environment.

Please contact Terry Evanson at Theresa.Evanson@wisconsin.gov or at 608-266-0941 if you have questions about this guidance.

This document contains information about certain state statutes and administrative rules but does not necessarily include all of the details found in the statutes and rules. Readers should consult the actual language of the statutes and rules to answer specific questions.

The Wisconsin Department of Natural Resources provides equal opportunity in its employment, programs, services, and functions under an Affirmative Action Plan. If you have any questions, please write to Equal Opportunity Office, Department of Interior, Washington, D.C. 20240.

This publication is available in alternative format upon request. Please call 608-267-3543 for more information.

Attachment 1

State of Wisconsin

CORRESPONDENCE/MEMORANDUM

DATE: May 19, 2010

TO: RR Staff Statewide

FROM: Terry Evanson -RR/5

SUBJECT: Vapor Intrusion Action Levels and Screening Levels

The Remediation and Redevelopment (RR) Program works closely with the Division of Public Health (DPH) regard ing vapor intrusion issues. The purpose of this memo is to document two important decisions made by the RR Management Team in cooperation with DPH.

Both agencies have agreed to use an excess life-time increased cancer risk of 1.0×10^{-5} or higher, and for non-carcinogens, a hazard index of 1.0, as a threshold for determining if a vapor action level for indoor air has been reached or exceeded. This risk level is in the middle of the acceptable inhalation risk range utilized by U.S. EPA and is high enough to exceed the background indoor air concentrations for most volatile compounds of concern.

In addition, the agencies have agreed that vapor screening levels (i.e., samples used to estimate indoor air from concentrations of vapors measured in sub-slab, soil gas, etc.) will be determined using the vapor action level divided by the appropriate attenuation factor developed by U.S. EPA. The attenuation factors currently found in EPA's guidance are:

- 0.1 sub-slab to indoor air
- O.O ldeep soil gas to indoor air
- O.OO lgroundwater to indoor air (where vapor concentrations are calculated from partitioning across the water table using Henry's Law)

If U.S. EPA modifies the existing attenuation factors, the RR Program and DPH will adjust the levels accordingly.

The current drafts of the NR 700 rule series have been modified to be consistent with the criteria set out in this memo. Ifanyone has questions or needs further clarification, please do not hesitate to contact me at 608-266-0941.

cc: Hemy Nehls-Lowe -Division of Public Health

APPROVED:

Mark F. Giesfeldt, P.E., D" ector
Bureau for Remediation & Redevelopment

Charles J. Warzecha, Director
Bureau of Environmental & Occupational Health

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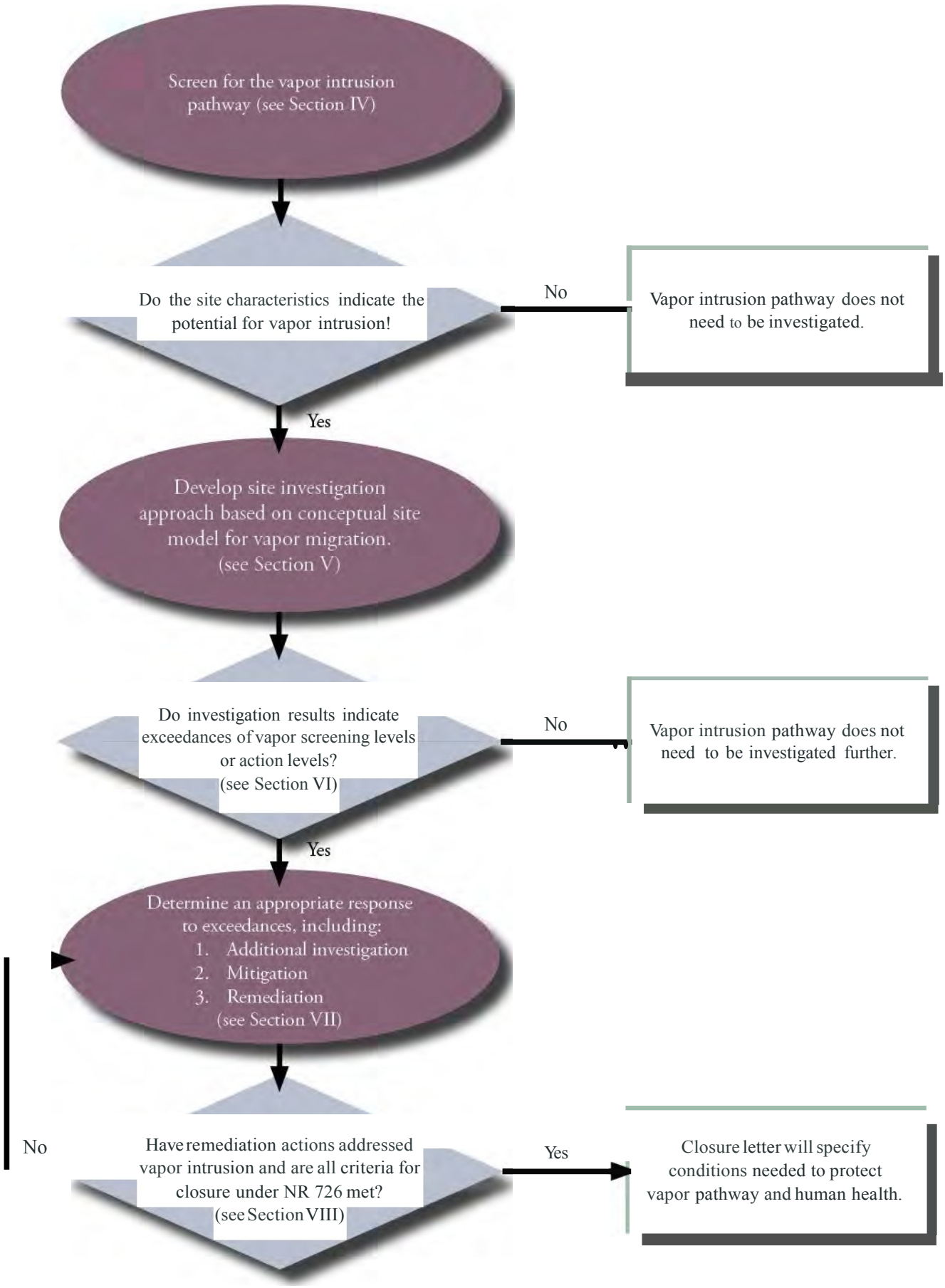
Evaluating the Vapor Intrusion Pathway



Identifier: SOP-12	Revision: 1	Effective Date: 04/23/2015	
Author: Stu Gross			

Standard Operating Procedure

for:

PAINT CHIP SAMPLE COLLECTION

Responsible QA Manager: Richard J. Binder, P.G.	

SOP-12
Paint Chip Sample Collection

Revision Log

Revision No.	***Effective Date***	***Prepared By***	***Description of Revisions***	***Affected Pages***
0	10/31/12	Stu Gross	New Procedure	All
1	04/23/15	Dave Constant	Removed Subcontractor Reference from Section 2	5

SOP-12
Paint Chip Sample Collection

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SOP-12
PAINT CHIP SAMPLE COLLECTION

1.0 PURPOSE

This SOP describes the procedures for collection of paint chip samples for analysis for lead and other hazardous substances to be conducted as part of environmental characterization and/or remediation (ECR) projects performed by Stantec.

2.0 SCOPE

This SOP is a mandatory document and shall be implemented by all Stantec project participants when collecting paint chip samples.

3.0 TRAINING

The Field Leader (FL) is responsible for ensuring that field team members who collect representative paint chip samples for the project are familiar with the objectives of, and properly trained in, the procedures of paint chip sampling.

4.0 DEFINITIONS

Site-Specific Health and Safety Plan (SSHASP) - A health and safety plan that is specific to a site or related field activity that has been approved by the health and safety representative. This document contains information specific to the project including scope of work, relevant history, descriptions of hazards by activity associated with the project site(s), and techniques for exposure mitigation (e.g., personal protective equipment [PPE]) and hazard mitigation.

5.0 BACKGROUND AND PRECAUTIONS

5.1 This SOP shall be used in conjunction with an approved SSHASP. Also, consult the SSHASP for information on and use of all PPE.

5.2 All waste generated from sampling operations should be handled in accordance with SOP-10, Management of Investigative Wastes.

5.3 This SOP shall not be used in environments potentially contaminated with flammable or explosive components.

6.0 RESPONSIBLE PERSONNEL

The following personnel are responsible for activities identified in this procedure.

6.1 Author

6.2 Stantec project personnel

6.3 Field Leader (FL)

6.4 QA/QC Officer

7.0 EQUIPMENT

Recommended sampling tools and materials to perform paint chip sampling are listed below.

a. Sharp stainless steel paint scraper.

b. Disposable wipes for cleaning paint scraper.

c. Non-sterilized non-powdered disposable gloves.

d. Hard-shelled containers (such as non-sterilized 50-ml polypropylene centrifuge tubes) that can be rinsed quantitatively for paint chip samples if results are to be reported in mg/cm². Ziploc™ baggies can be used only if results are to be reported in µg/g or percent by weight.

e. Collection device (clean creased piece of paper or cleanable tray).

f. Field sampling and laboratory submittal forms.

g. Tape measure or ruler (if results are reported in mg/cm²).

h. Ladder.

i. Plastic trash bags.

j. Flashlight.

k. Adhesive tape.

l. Heat Gun or other heat source operating below 1100°F to soften the paint before removal.

8.1 PROCEDURE

Notes:

- *It is each person's responsibility to ensure that they trained to and utilize the current version of this procedure. The author may be contacted if text is unclear. The QA/QC Officer may be contacted if the author cannot be located.*

- *Deviations from this SOP shall be recorded in the field notebook*

- *Paint chip sampling is a destructive method that may release a small quantity of lead dust. Although paint chip samples are to be collected from inconspicuous areas, for sampling conducted in structures that are occupied, the occupant must always be notified that paint chip sampling may be necessary.*

- *The procedure described below was developed by Stantec from the paint chip collection protocol in Appendix 13.2 of the U.S. Department of Housing and Urban Development Guidelines for the Evaluation and Control of Lead-Based Paint Hazards in Housing.*

8.1 Field Preparation

Gather and decontaminate the appropriate supplies and equipment in accordance with SOP-08, Equipment Decontamination.

8.2. Containment

Note: Containment procedures should be utilized for sampling conducted in occupied buildings or buildings that will potentially be occupied in the future. Less rigorous containment procedures are acceptable on derelict buildings and/or unoccupied structures scheduled for demolition.

8.2.1. Method One: Plastic Sheeting Underneath Sampling Area

A clean sheet of plastic measuring 4-feet by 4-feet should be placed under the area to be sampled to capture any paint chips that are not captured by the collection device or creased piece of paper. Any visible paint chips falling to the plastic should be included in the sample. Dispose of the plastic after each sample is collected by placing the sheeting in a trash bag. Do not throw away the plastic at the sample site. Wet wipes may be used to clean the area.

8.2.2. Method Two: "Glovebag" Approach

If further containment is deemed necessary, a "glovebag" approach may be used. A durable sheet of plastic is loosely taped to the surface to be sampled, with a paint scraper, collection device, and shipment container housed inside the plastic. There should be enough "play" in the plastic to permit a scraping motion without dislodging the tape holding the plastic to the surface. Large plastic baggies can be used in lieu of the sheet of plastic if paint chips are to be shipped to the lab in plastic baggies. Properly conducted, this method completely seals the surface during the actual scraping operation. A 4-foot by 4-foot sheet of plastic is still required under the

glove bag to capture any debris that falls to the ground during the glove bag removal. The tape should be slowly removed from the surface to avoid lifting any additional paint off of the surface.

8.3. Paint Sample Collection

The paint chip sample need not be more than 2-4 square inches in size (consult with the laboratory for the optional size). Persons collecting paint chips should wear new disposable gloves for each sample.

The most common paint sampling method is to scrape paint directly off the substrate. The goal is to remove all layers of paint equally, but none of the substrate. A heat gun should be used to soften the paint before removal to reduce the chances of including substrate with the sample and to help prevent sample loss. Including substrate in the sample will dilute the lead content if results are reported in µg/g or weight percent. Hold the heat gun no closer than six inches from the surface. Do not scorch the paint. Discontinue heating as soon as softening or blistering is observed.

Use a razor-sharp scraper to remove paint from the substrate. Paint samples collected in this fashion are usually reported in µg/g or % lead only. The sample may be placed in a baggie for shipment to the laboratory.

If the area sampled is measured exactly, and all the paint within that area can be removed and collected, it is possible to also report the results in mg/cm². All of the sample must be placed in a hard-shelled container for shipment to the laboratory. The hard-shelled container is used since the laboratory will analyze the entire sample submitted. The exact dimensions of the area sampled must be recorded on the field sampling form. For mg/cm², including a small amount of substrate in the sample is permitted.

If permitted by the property owner, clearly mark the sample location with a permanent marker or other means so that it can be relocated if necessary for resampling or additional sampling. The mark should include the sample location identification number. If marking of the surface is not permitted by the property owner, measure and/or otherwise document the location of the sample. If possible, document the sample location with photographs.

8.4. Composite Paint Chip Sample Collection

Paint chip samples may be composited by collecting individual subsamples from different surfaces. If results are reported in mg/cm², each subsample should be exactly the same size in surface area. If results are reported in weight percent or µg/g, each subsample should have about the same weight (weighing is done in a laboratory). The result is then compared to the standard for lead-based paint divided by the number of sub-samples (the composite standard). If the result is above this number, one or more of the samples may be above the standard. Each sub-sample should be reanalyzed individually in this case. If the result is below this number, none of the sub-samples can contain lead above the standard. No more than 5 subsamples should be included in the same sample container or Ziploc™ baggie. If both single-surface and composite samples are collected side-by-side, the individual samples can be submitted for analysis without returning to the structure if the composite result is above the composite standard. If the laboratory does not analyze the entire composite sample, it must use a validated homogenizing technique to ensure that all sub-samples are completely mixed together.

8.5. Cleanup and Repair

Note: The following cleanup and repair procedures should be utilized for samples collected from occupied buildings, or buildings that are vacant but which are suitable for future occupancy without rehabilitation. Cleanup and repair is generally not necessary on derelict buildings or unoccupied structures scheduled for demolition.

a. All settled dust generated must be cleaned up using wet wipes.

b. The surface can be resealed with new paint if necessary. If desired, apply spackling and/or new paint to repair the area where paint was removed.

c. Personnel conducting paint sampling should avoid hand-to-mouth contact (specifically, smoking, eating, drinking, and applying cosmetics) and should wash their hands with running water immediately after sampling. The inspector should ask to use the resident's bathroom for this purpose. Wet wipes may be used if no running water is available or if the bathroom is not available.

d. Handle sampling wastes, excess sample materials, disposable items, and decontamination fluids according to SOP-10.

e. Upon completion of sampling, clean and decontaminate any sampling equipment utilized, and return the equipment and supplies to their proper storage locations.

8.6. Laboratory Submittal

The samples should be submitted to a laboratory recognized by the EPA National Lead Laboratory Accreditation Program. Appropriate sample submittal forms should be used.

The field sample number should appear on the field sampling form, the laboratory submittal form, and the container label. The name of the laboratory, the date the samples were sent to the laboratory, and all personnel handling the sample from the time of collection to the time of arrival at the laboratory should be recorded on a chain of custody form, if appropriate.

9.1 REFERENCES

Project personnel using this procedure should become familiar with the contents of the following documents to properly implement this SOP.

- U.S. Department of Housing and Urban Development, Guidelines for the Evaluation and Control of Lead-Based Paint Hazards in Housing, Appendix 13.2
- SOP - 8, Equipment Decontamination
- SOP - 10, Management of Investigative Wastes

10.0 RECORDS

The FL is responsible for data entry and submitting the following records to central filing.

10.1 Completed field notebook.

Identifier: SOP-13	Revision: 2	Effective Date: 4/23/2015	
Author: Lynelle Caine			

Standard Operating Procedure

for:

PORTABLE ENERGY DISPERSIVE X-RAY FLUORESCENCE ANALYSIS OF ENVIRONMENTAL SAMPLES

Responsible QA Manager: Richard J. Binder, P.G.	

SOP-13
Portable Energy Dispersive X-Ray Fluorescence
Analysis of Environmental Samples

Revision Log

Revision No.	***Effective Date***	***Prepared By***	***Description of Revisions***	***Affected Pages***
0	01/12/2014	Lynelle Caine	New Procedure	All
1	1/14/13	Lynelle Caine	Address EPA Comments	
2	4/23/15	Dave Constant	Removed Subcontractor Reference from Section 2	5

SOP-13
Portable Energy Dispersive X-Ray Fluorescence
Analysis of Environmental Samples

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SOP-13
Portable Energy Dispersive X-Ray Fluorescence
Analysis of Environmental Samples

LIST OF ACRONYMS AND ABBREVIATIONS

CFR	Code of Federal Regulations
DOT	Department of Transportation
ED-XRF	energy dispersive x-ray fluorescence spectrometry
ECR	Environmental characterization and/or remediation
F	Fahrenheit
FL	Field leader
MDL	minimum detection level
NIST	National Institute of Standards and Technology
PPE	personal protective equipment
PL	project leader
QAPP	Quality assurance project plan
QA/QC	Quality assurance/quality control
SOP	standard operating procedure
SRM	standard reference material
SSHASP	site-specific health and safety plan

SOP-13
Portable Energy Dispersive X-Ray Fluorescence Analysis of Environmental Samples

1.0 PURPOSE

This standard operating procedure (SOP) describes the general process for operating and using portable energy dispersive x-ray fluorescence (ED-XRF) spectrometers to measure heavy metals in solid media as part of environmental characterization and/or remediation (ECR) projects performed by Stantec. The data that are generated allow for rapid evaluation of the extent of contamination. Samples are generally analyzed for elements of atomic number 11 (sodium) through 92 (uranium), with proper x-ray source selection and instrument calibration. Environmental applications include measuring heavy metal concentrations in in solid, liquid, thin film, and powder samples.

2.0 SCOPE

2.1 All project participants shall implement this mandatory SOP.

3.0 TRAINING

3.1 Project participants shall train to and use the current version of this SOP; contact the author if the SOP text is unclear.

3.2 The responsible project team leader (PL) shall monitor the proper implementation of this procedure and ensure that the appropriate personnel complete all applicable training assignments.

4.0 DEFINITIONS

4.1 Site-specific health and safety plan (SSHASP) - Health and safety plan that is specific to a site or field activity that has been approved by the health and safety representative. This document contains information specific to the project including scope of work, relevant history, descriptions of hazards by activity associated with the project site(s), and techniques for exposure mitigation (e.g., personal protective equipment [PPE]) and hazard mitigation.

4.2 ED-X-ray fluorescence spectroscopy - A nondestructive qualitative and semi-quantitative analytical technique used to measure the concentrations of heavy metals in solid, liquid, thin film, and powder samples.

5.0 RESPONSIBLE PERSONNEL

The following personnel are responsible for activities identified in this procedure:

- Data Steward
- Field Leader
- Field Member
- Project Leader
- Quality Assurance/Quality Control (QA/QC) Officer
- Project participants

6.0 BACKGROUND AND PRECAUTIONS

6.1 Project participants shall use this SOP in conjunction with an approved SSHASP.

6.2 Background

6.2.1 Portable XRF instruments are available from a variety of manufacturers. Newer portable ED-XRF spectrometers contain a compact X-ray tube. Older ED-XRF spectrometers contain a sealed radioactive source such as: iron (55Fe), cadmium (109Cd), and americium (241Am) for identification and quantization of numerous elements. Some ED-XRF instruments are often equipped with a high-resolution HgI2 detector connected to a sealed electronic module.

6.2.2 Portable XRF units may contain a multi-channel analyzer for spectral analysis. Generally, they provide internal nonvolatile memory for storage of results, which are shown on the instrument's display panel. A USB port allows users to download data and spectra to a peripheral device such as a Windows-compatible personal computer.

6.2.3 Most portable XRF units are powered by a 115-/220-V wall outlet or an eight-hour, rechargeable battery. Devices operate in temperatures ranging from 32°F to 120°F.

6.2.4 Unit batteries should be replaced periodically, per the manufacturer's instructions.

6.3 Precautions

6.3.1 Instrument integrity - Immediately notify the instrument manufacturer of any condition or concern relative to the probe's structural integrity, source shielding, source switching condition, or operability. If the ED-XRF contains a radioactive X-ray source, immediately notify the appropriate State agency or the United States Nuclear Regulatory Commission office of any damage to the radioactive source or of any loss or theft of the device.

6.3.2 Labels and certifications - Do not alter or remove the labels or instructions on the probe(s). If the ED-XRF contains a radioactive X-ray source, leak test the source(s) in

the probe every six months, and ensure that the leak-test certificates accompany the instrument at all times.

6.3.3 Handling - Do not drop or expose portable XRF instruments to conditions that produce excessive shock or vibration. Do not store the instrument at an ambient temperature below -4°F or above 110°F.

6.3.4 Transport - Properly package the XRF instrument during transport. The suitcase that accompanies the unit is acceptable. If the ED-XRF contains a radioactive X-ray source, the Department of Transportation (DOT) requires that the following statement accompany the unit during transportation: "This package conforms to the conditions and limitations specified in 49 CFR 173.422 for acceptable radioactive material, instruments, and articles, UN 2910."

7.0 EQUIPMENT

XRF instruments often come with a variety of peripheral equipment. If deviations are made, documentation must be made in the field notebook.

8.0 PROCEDURE

The operator shall perform the following procedure, noting any deviations from this SOP in the field note book.

8.1 Perform initial setup per manufacturer instructions.

Note: Measuring times depend upon the elements of interest as well as the desired detection limits. Minimum measuring time for each source should be 20 seconds. Although counting statistics improve as measurement time increases, the practical limit for typical applications can be 600 to 800 seconds.

8.2 Use Probe

If the XRF unit comes with a probe, the following is a general guide for use.

8.2.1 Make sure the probe is always in contact with the surface of the analyzed material and that the material completely covers the probe opening (aperture) when the sources are exposed.

8.2.2 Use the probe's laboratory, safety-shield assembly when the probe is inverted for measuring samples contained in cups.

8.2.3 During operation, keep the probe at least three feet from computer monitors or any other source of radio frequency that could affect measurement results.

8.3 Perform Pre-Operational Checks

8.3.1 Analyze the following preoperational-check samples prior to sample analysis:

- Energy calibration check

- Resolution check
- Blank sample check
- Target metals response check

Note: Refer to the user manual for detailed procedures on pre-operational checks.

8.3.2 Once at the beginning of each day, perform element x-ray response and spectrum resolution check using the appropriate blank, recording results in the field notebook.

8.3.3 If intensities are outside the specified range, refer to manufacturer's instructions and perform an energy calibration.

8.3.4 If the Kev value noted in the spectra of the energy calibration check is out of range, refer to manufacturer's instructions and perform an energy calibration.

8.3.5 Perform analytical background check with the Teflon™ blank at least once a day, recording results in the field notebook.

8.3.6 If the element concentrations of the elements of concern are greater than five times the standard deviation, refer to the "Standard Operating Check" and possibly perform the Acquire Background procedure.

8.3.7 Analyze two standard-reference materials (SRMs) based on your target matrix and anticipated heavy metal concentrations or performance-evaluation samples with metal concentrations; bracket the known or suspected metal concentrations of the measured samples. The sampling time that is used to check the paint film SRM will be the same sampling time used for the in-situ measurements of paint. The National Institute of Standards and Technology (NIST) standard for use in measuring lead paint with ED-XRF is provided in Attachment B.

Note: If using the instrument for quantitative work, perform this check at least once a day and record results in the field notebook to note significant trends in the analytical measurement.

8.3.8 Determine the precision by making multiple analyses of either an NIST SRM similar to the matrix you will be working with at similar heavy metal concentrations (see Attachment B or a thoroughly pre-characterized sample for an evaluation of the precision of the elements of interest. The sampling time that is used to check the paint film SRM will be the same sampling time used for the in-situ measurements of paint.

Note: If using the instrument for quantitative work, perform this at least once a day or once every 20 samples. Conduct this measurement under the same conditions as those used for sample measurements. Record results in the field notebook. The precision objective should be a 20% relative-standard deviation.

8.4 Handle and Present Samples

The following procedures are recommended for handling and preparing the samples.

8.4.1 Lead-in-Paint Application

8.4.1.1 A NIST paint film standard shall be used to check the instrument daily and prior to analysis for lead-in-paint.

8.4.1.2 Check that the area selected for analysis is smooth, representative, and free of surface dirt.

8.4.1.3 Hold the XRF probe firmly on the surface.

8.5 When using the instrument for specimen applications (e.g., on paint chips or nonbacked films), use the probe's safety cover.

8.6 Perform Data Quality Assurance/Quality Control

Run a certified-reference sample periodically. This provides valuable accuracy and precision data. Running a certified-reference sample also alerts the operator that either the probe window is contaminated or the instrument is not operating properly.

8.7 Record and Document Results

8.7.1 Store results (and spectra) automatically; refer to the manufacturer's operating manual.

8.7.2 Download results to a personal computer at the end of each day; refer to the manufacturer's training and application manuals.

8.7.3 Transfer results to a spreadsheet.

8.7.4 If qualitative data (i.e., used only for general surveys or to bias sampling), handle data informally and record in the field notebook.

8.7.5 Report results for a blank and a check standard.

9.1 RECORDS

The field team leader shall maintain the Completed daily activity log or instrument log book, which should include the following pieces of information:

- Record that the leak test has been performed
- Element X-ray response check
- Analytical background check
- Standards check
- Energy calibration
- Performance evaluation
- Sample preparation
- Measurement time for each radioactive source
- Sample results
- Precision results

10.1 REFERENCES

To properly implement this SOP, Stanteco project participants should become familiar with the contents of the following documents:

- SOP-07, Chain of Custody, Sample Control and Field Documentation Procedures
- EPA (U.S. Environmental Protection Agency), “Spectrace™ 9000 Field Portable X-Ray Fluorescence Operating Procedure” (SOP 1713) (EPA Environmental Response Team, Response Engineering and Analytical Contract Standard Operating Procedures, Washington, DC, December 21, 1992).

11.0 ATTACHMENTS

Attachment A: Elements Excited by Radioactive Sources and Lower Limits of Detection for These Elements (2 pages)

Attachment B: NIST SRM 2573 for Lead Paint Film

SOP-13

Attachment A: Elements Excited by Radioactive Sources and Lower Limits of Detection for These Elements

For soil samples application using source-measuring times of 60 seconds and 200 seconds, the following are typical element minimum detection levels (MDLs):

Source	Element	60 second	200 second
		MDL (mg/kg)	MDL (mg/kg)
$_{55}Fe$	Potassium (K)	325	140
	Calcium (Ca)	150	75
	Titanium (Ti)	110	65
	Chromium (Cr Low)	180	117
$_{109}Cd$	Chromium (Cr High)	525	345
	Manganese (Mn)	410	320
	Iron (Fe)	225	155
	Cobalt (Co)	205	138
	Nickel (Ni)	125	95
	Copper (Cu)	90	55
	Zinc (Zn)	70	50
	Mercury (Hg)	60	50
	Arsenic (As)	50	35
	Selenium (Se)	35	25
	Lead (Pb)	30	20
	Rubidium (Rb)	10	10
	Strontium (Sr)	10	5
	Zirconium (Zr)	10	3
	Molybdenum (Mo)	10	4
$_{241}Am$	Cadmium (Cd)	180	90
	Tin (Sn)	100	50
	Antimony (Sb)	65	35
	Barium (Ba)	20	10
	Uranium (U)	100	60
	Thorium (Th)	100	60
	Silver (Ag)	100	60

For thin-sample application using a source measuring time of 200 seconds for the ^{55}Fe and ^{109}Cd sources, and 800 seconds for the ^{241}Am source, the following are typical element MDLs:

Source	Element	200 second $_{55}Fe$ $_{109}Cd$ 800 second for $_{241}Am$
		MDL (g/cm2)
$_{55}Fe$	Potassium (K)	0.40
	Calcium (Ca)	0.20
	Titanium (Ti)	0.15
	Chromium (Cr Low)	0.40
$_{109}Cd$	Chromium (Cr High)	0.90
	Manganese (Mn)	0.65
	Iron (Fe)	0.65
	Cobalt (Co)	0.50
	Nickel (Ni)	0.30
	Copper (Cu)	0.65
	Zinc (Zn)	0.40
	Mercury (Hg)	0.45
	Arsenic (As)	0.40
	Selenium (Se)	0.15
	Lead (Pb)	0.50
	Rubidium (Rb)	0.10
	Strontium (Sr)	0.10
	Zirconium (Zr)	0.15
	Molybdenum (MO)	0.10
$_{241}Am$	Cadmium (Cd)	2.5
	Tin (Sn)	2.5
	Antimony (Sb)	1.5
	Barium (Ba)	0.70

SOP-13 – Attachment B

National Institute of Standards & Technology

Certificate of Analysis

Standard Reference Material→ 2573

Lead Paint Film
For Portable X-Ray Fluorescence Analyzers – Nominal 1.0 mg/cm^2
(Color Code: Red)

This Standard Reference Material (SRM) is intended for checking the calibration of portable, hand-held, x-ray fluorescence analyzers when testing for lead in paint coatings on interior and exterior building surfaces. A unit of SRM 2573 consists of a white polyester sheet, approximately 7.6 cm wide, 10.2 cm long, and 0.2 mm thick, coated with a single, red-colored paint layer, approximately 0.04 mm thick. A blank, SRM 2570, is also provided. The blank is coated with a lead-free, lacquer layer on a white polyester sheet of the same thickness as the lead paint samples. All sheets are over-coated with a clear, thin, plastic laminate to protect the surface from abrasion. SRM 2573 and SRM 2570 are two of a set of six paint films (SRM 2570 to SRM 2575) available as SRM 2579a.

The certified values for lead for this SRM and the blank, SRM 2570, are reported in Table 1 in units of mg/cm^2. These values are based on measurements by isotope dilution inductively-coupled plasma mass spectrometry.

Table 1. Certified Lead Values

Level	Color Code	Lead Concentration, in mg/cm^2
SRM 2570	White (Blank)	<0.001
SRM 2573	Red	1.040 ± 0.064

The uncertainty of each certified value is expressed as an expanded uncertainty, U, at the 95 % level of confidence and is calculated according to the method described in the ISO Guide [1,2]. Because of variability in the paint film between different sheets of each SRM, the uncertainties are 95 % prediction intervals. The expanded uncertainty is calculated as $U = ku_c$, where u_c is intended to represent, at the level of one standard deviation, the combined uncertainty due to material variability and measurement uncertainty. The coverage factor, k, is determined from the Student's t-distribution corresponding to the calculated effective degrees of freedom and 95 % level of confidence.

Expiration of Certification: The certification of SRM 2573 is valid, within the measurement uncertainties specified, until **01 July 2020**, provided the SRM is handled and stored in accordance with the instructions given in this certificate (see "Instructions for Use"). The certification is nullified if the SRM is damaged, contaminated, or otherwise modified.

Maintenance of SRM Certification: NIST will monitor this SRM over the period of its certification. If substantive technical changes occur that affect the certification before the expiration of this certificate, NIST will notify the purchaser. Registration (see attached sheet) will facilitate notification.

The overall direction and coordination of the analytical measurements leading to certification were performed by G.C. Turk and J.D. Fassett of the NIST Analytical Chemistry Division. Analytical measurements were performed by K.E. Murphy, J.R. Sieber, A.F. Marlow, L.J. Wood, P.R. Seo, and M. Lankosz of the NIST Analytical Chemistry Division. The SRM was fabricated under the direction of J.R. Sieber of the NIST Analytical Chemistry Division.

Stephen A. Wise, Chief
Analytical Chemistry Division

Robert L. Watters, Jr., Chief
Measurement Services Division

Gaithersburg, MD 20899
Certificate Issue Date: 24 March 2009
See Certificate Revision History on Last Page

Statistical consultation for this SRM was provided by E.S. Lagergren and N.F. Zhang of the NIST Statistical Engineering Division.

Support aspects involved in the issuance of this SRM were coordinated through the NIST Measurement Services Division.

NOTICE AND WARNING TO USERS

NOTE: This SRM contains lead, as a lead chromate pigment, which is toxic and a suspected carcinogen to the lung and kidney. The SRM must be handled with care and disposed of according to the U.S. Environmental Protection Agency (EPA) practices and procedures.

INSTRUCTIONS FOR USE

The SRM sheet must first be removed from the plastic sleeve in which it is stored and then positioned so that the side labeled with the NIST logo and SRM number faces the x-ray source. For best results, the size of the x-ray beam from the field unit should irradiate an area of the SRM that is at least 2.5 cm in diameter and is centered on the sheet. Care must be exercised not to compromise the protective plastic laminate which prevents scratching or chipping of the painted surface and the potential release of dust containing lead. Upon completion of the measurement, the SRM must be re-stored in the plastic sleeve provided. It is also recommended that this SRM be stored indoors at ambient room temperature and away from direct sunlight when not in use.

Stability: This SRM is considered to be stable during the period of certification. NIST will monitor the SRM and will report any significant changes in certification to the purchaser. Return of the attached registration card will facilitate notification.

PREPARATION

SRM Preparation: The paint-coated, polyester sheets were prepared by an automated coating process at a commercial facility under contract to NIST. Known concentrations of a lead chromate pigment were dispersed in a commercial paint vehicle to prepare the lead paints. A lead-free, organic tint was added to each paint mixture to give the desired color. A thin, protective overlay of plastic laminate was applied to each paint film. The attenuation of lead L_3-$M_{4,5}$ ($L\alpha_{1,2}$) X-rays due to the protective overlay does not exceed 2 % relative, while that of K-$L_{2,3}$ ($K\alpha_{1,2}$) x-rays commonly used for field measurement is negligible.

REFERENCES

[1] ISO; *Guide to the Expression of Uncertainty in Measurement*; ISBN 92-67-10188-9, 1st ed., International Organization for Standardization: Geneva, Switzerland (1993); see also Taylor, B.N.; Kuyatt, C.E.; *Guidelines for Evaluating and Expressing the Uncertainty of NIST Measurement Results*; NIST Technical Note 1297, U.S. Government Printing Office: Washington, DC (1994); available at http://physics.nist.gov/Pubs/.

[2] Hahn, G.J.; Meeker, W.Q.; *Statistical Intervals: A Guide for Practitioners*; John Wiley & Sons, Inc., New York, NY (1991).

Certificate Revision History: 24 March 2009 (Extension of certification period); 29 November 1999 (Original certificate date).

Users of this SRM should ensure that the certificate in their possession is current. This can be accomplished by contacting the SRM Program at: telephone (301) 975-2200; fax (301) 926-4751; e-mail srminfo@nist.gov; or via the Internet at http://www.nist.gov/srm.