Date
December 28, 2022

Project No.
1940103307

MULTI-SITE QUALITY ASSURANCE PROJECT PLAN

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DOCUMENT REVISION RECORD

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Revision 0	December 28, 2022	• Original Document

DOCUMENT APPLICABILITY BY FACILITY OWNER

Table A. Document Applicability by Facility Owner

Facility & Owner	Unit ID	Unit Name	40 C.F.R. § 257	35 I.A.C. § 845
Baldwin Power Plant Dynegy Midwest Generation, LLC	601	Bottom Ash Pond	X	X
	605	Fly Ash Pond System	X	X
Coffeen Power Plant Illinois Power Generating Company	101	Ash Pond No. 1	X	X
	102	Ash Pond No. 2	X	X
	103	GMF Gypsum Stack Pond	X	X
	104	GMF Recycle Pond	X	X
	105	Landfill	X	
Duck Creek Power Plant Illinois Power Resources Generating, LLC	201/202	Ash Pond No. 1 Ash Pond No. 2		X
	203	GMF Pond	X	X
	204	Landfill	X	
	205	Bottom Ash Basin	X	X
Edwards Power Plant Illinois Power Resources Generating, LLC	301	Ash Pond	X	X
Hennepin Power Plant Dynegy Midwest Generation, LLC	801	Landfill	X	
	802	Ash Pond No. 2	X	X
	803	East Ash Pond	X	X
	804	Old West Ash Pond	X	X
	802/805	Ash Pond No. 2 Ash Pond No. 4		X
Joppa Power Plant Electric Energy, Inc.	401	East Ash Pond	X	X
	402	Landfill	X	
Kincaid Power Plant Kincaid Generation, LLC	141	Ash Pond	X	X
Miami Fort Power Plant Dynegy Miami Fort, LLC	113	Landfill	X	
	115	Pond System	X	
Newton Power Plant Illinois Power Generating Company	501	Primary Ash Pond	X	X
	502	Landfill 2	X	
Vermilion Power Plant Dynegy Midwest Generation, LLC	910	North Ash Pond		X
	911	Old East Ash Pond		X
	912	New East Ash Pond		X
Zimmer Power Plant Zimmer Power Company, LLC	121	D Basin	X	
	122	Landfill	X	
	124	Gypsum Recycle Pond	X	
	125	Coal Pile Runoff Pond	X	

Notes:

35 I.A.C. = Title 35 of the Illinois Administrative Code

40 C.F.R. = Title 40 of the Code of Federal Regulations

CONTENTS

TABLES (ATTACHED)

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APPENDICES

ACRONYMS AND ABBREVIATIONS

±	plus or minus
≤	less than or equal to
§	section
%	percent
%R	percent recovery
%RSD	percent relative standard deviation
35 I.A.C.	Title 35 of the Illinois Administrative Code
40 C.F.R.	Title 40 of the Code of Federal Regulations
CCR	Coal Combustion Residuals
Consultant PM	Consultant Project Manager
DI	deionized
DQI	Data Quality Indicator
DQO	Data Quality Objective
DO	dissolved oxygen
DVSR	Data Validation Summary Report
EB	equipment blank
EDD	Electronic Data Deliverable
FB	field blank
FD	field duplicate
GMP	Groundwater Monitoring Plan
HASP	Health and Safety Plan
ICP	inductively coupled plasma
ID	Identifier
Lab Manager	Laboratory Manager
Lab PM	Laboratory Project Manager
LCS	laboratory control sample
LCSD	laboratory control sample duplicate
MCL	Maximum Contaminant Level
MDC	minimum detectable concentration
MDL	method detection limit
MS	matrix spike
MS/MSD	Matrix Spike/Matrix Spike Duplicate
MSD	Matrix Spike Duplicate
NELAC	National Environmental Laboratory Accreditation Conference
NPDES	National Pollutant Discharge Elimination System
ORP	oxidation-reduction potential
OSHA	Occupational Safety and Health Administration
Owner PgM	Owner Program Manager
PDF	Portable Data Format
PM	Ramboll Project Manager
PgM	Ramboll Program Manager
POC	point-of-contact
QAPP	Quality Assurance Project Plan
QA	Quality Assurance
QAM	QA Manual

QA/QC	Quality Assurance and Quality Control
QC	Quality Control
Ramboll	Ramboll Americas Engineering Solutions, Inc.
RL	Reporting Limit
RPD	relative percent difference
SAP	Sampling and Analysis Plan
SAR	sampling and analysis request
SDG	Sample Delivery Group
SOP	Standard Operating Procedure
TB	trip blank
TIC	Tentatively Identified Compounds
USEPA	United States Environmental Protection Agency
VOC	volatile organic compound

1. QUALITY ASSURANCE PROJECT PLAN OBJECTIVES

This Quality Assurance Project Plan (QAPP) was prepared to document the quality assurance and quality control (QA/QC) procedures and performance criteria applicable to data collection tasks associated with groundwater, surface water, porewater, and leachate sampling and analysis at the monitored units listed in **Table A**.

The purpose of this QAPP is to (1) describe the QA/QC procedures that the project team will follow during sampling and analysis; and (2) specify methods, performance criteria, and protocols to produce data that are representative of field conditions, meet the data quality objectives (DQOs) established in this document, and are of acceptable quality to meet industry standards.

This QAPP has been prepared in general accordance with the applicable elements of several United States Environmental Protection Agency (USEPA) guidance documents, including Guidance on Systematic Planning Using the Data Quality Objectives Process, EPA QA/G-4 (USEPA, 2006); EPA Requirements for Quality Assurance Project Plans, EPA QA/R-5 (USEPA, 2001); and Guidance for Quality Assurance Project Plans, EPA QA/G-5 (USEPA, 2002).

The overall goal of the QAPP is to outline the procedures, methods, and other specifications a site investigation and monitoring project will use to ensure that the samples are collected and analyzed, the data are stored and managed, and the reporting of data are of high enough quality to meet project needs. Quality Assurance (QA) and Quality Control (QC) are activities undertaken to achieve this goal. QA is generally understood to be more comprehensive than QC. QA can be defined as the integrated system of activities that ensures that a project meets defined standards.

QC is the basic building block of data quality. It starts with establishing limits of acceptable performance and defining activities whose purpose is to control quality at the source by finding problems and defects. At its simplest, QC is inspecting, testing, or checking data to make sure it is correct, valid, or otherwise in accordance with established specifications. The intent is to identify data that is not correct, and either correct or eliminate it, to make sure all data conforms to the specifications, and/or functions as required. QC does not ensure quality; it only finds instances where quality is absent or below established criteria.

QA asserts that data quality can be improved by looking 'further up the line'. It is aimed at preventing nonconforming or invalid data. QA can be defined as the integrated system of activities that ensures that a project meets defined standards. QA still has QC at its core to control data quality, but it goes beyond testing or inspection to also consider related activities or processes (such as training, document control and audits) that may be resulting in systemic and recurring data quality issues. The overall goal of the QA/QC procedures and specifications established in this QAPP is to ensure that comparable and representative data are produced during data collection tasks and that data quality is consistently assessed and documented with respect to its precision, accuracy, sensitivity, and completeness. The specific QAPP objectives are to:

- Provide standardized methods and quality specifications for all anticipated field sampling, analysis, and data review procedures

- Provide guidance and criteria for selected field and analytical procedures
- Establish procedures for reviewing and documenting compliance with field and analytical procedures

This QAPP identifies the planning, implementation, and assessment procedures for the QA/QC program to be followed for groundwater, surface water, porewater, and leachate data collection tasks including the following:

- Collecting aqueous samples
- Conducting field analysis of water quality parameters
- Labeling and shipping samples to laboratories
- Documenting field activities
- Coordinating laboratory services
- Reviewing and validating laboratory data
- Submitting finalized, validated data

The QAPP will be expanded or revised if further sampling work activities or analyses are identified.

2. DATA QUALITY OBJECTIVES

The overall goal of the QA/QC procedures and specifications established in this QAPP is to ensure that comparable and representative data are produced, and that data quality is consistently assessed and documented in order to accomplish the sampling objectives. To achieve this goal, a systematic approach is followed in the planning of this project equivalent to the USEPA Data Quality Objective Process, as described in Guidance on Systematic Planning Using the Data Quality Objectives Process, EPA QA/G-4 (USEPA, 2006).

2.1 DQO Process

The DQO Process is a series of logical steps that guides users to a plan for collecting environmental data. It is used to establish performance and acceptance criteria, which serve as the basis for designing a plan for generating data of sufficient quality and quantity to support the goals of the study. The DQO Process consists of seven iterative steps; the iterative nature of the DQO Process allows one or more of these steps to be revisited as more information on the problem is obtained.

Step 1: State the Problem

The monitored units located at the project facilities are locations of potential releases that could pose unacceptable risk to human health or the environment. The units are subject to one or more of the following regulatory programs:

- 35 I.A.C. § 811, Illinois landfill regulations
- 35 I.A.C. § 845, the Illinois standards for the disposal of coal combustion residuals (CCR) in surface impoundments
- 40 C.F.R. § 257 Subpart D, the federal standards for the disposal of CCR in landfills and surface impoundments
- Closure and post-closure monitoring
- National Pollutant Discharge Elimination System (NPDES) Permits

Step 2: Identify the Goal of the Study

Analytical results will be used to evaluate potential releases of CCR.

Step 3: Identify the Information Inputs

The primary required data type will be the analytical results from the groundwater samples collected from the well networks. Additional aqueous matrices such as surface water, porewater, and leachate may also be collected at the monitored units. The required analytical methods for sampling conducted under 40 C.F.R. § 257 and 35 I.A.C. § 845 are listed in **Table 1**. **Appendix A** lists methods and parameters that are part of compliance monitoring under other regulatory programs, listed in Step 1, at the monitored units.

Step 4: Define the Boundaries of the Study

Sampling will be conducted from established groundwater networks located at each monitored unit. The state and federal regulatory programs and requirements, including required wells,

parameters, and sampling frequency, are listed in the unit-specific Groundwater Monitoring Plan (GMP).

Step 5: Develop the Analytical Approach

The unit-specific GMPs list the requirements and frequency that groundwater samples will be collected. The sampling and analysis program requires that only one sample will be collected per well per sampling event, and analyzed for all parameters specified in the Sampling Analysis Request (SAR), or in lieu of a SAR, the corresponding regulatory program or permit. Data reporting requirements and workflow are provided in the Data Management Plan (DMP) (Ramboll, 2022a).

Step 6: Specify Performance of Acceptance Criteria

Performance and acceptance criteria have been designed to ensure that potential releases from the monitored units can be accurately and precisely identified and delineated. Criteria have been developed for the QA/QC sample types that will be utilized and are listed on **Table 2**. **Table 3** summarizes the sample preservation, containers, and hold time requirements.
Tables 4 through 6 list the quality control requirements and corrective actions required for the sampling analyses.

Step 7: Develop the Detailed Plan for Obtaining Data

Aqueous samples will be collected, analyzed, and evaluated as described in this QAPP.

The QA/QC procedures for this project require that the data meet minimum requirements for precision, accuracy, completeness, representativeness, comparability, and sensitivity. The procedures and minimum requirements are presented in the subsequent sections of this QAPP.

The primary and all other subcontracted laboratories will perform analytical work in accordance with this QAPP, their internal Standard Operating Procedures (SOPs) and QA Manuals (QAMs), which comply with National Environmental Laboratory Accreditation Conference (NELAC) standards and USEPA protocols established in Test Methods for Evaluating Solid Waste, Physical/Chemical Methods, EPA publication SW-846, Third Edition, Final Updates I (1993), II (1995), IIA (1994), IIB (1995), III (1997), IIIA (1999), IIIB (2005), IV (2008), V (2015), VI (2019) and subsequent revisions. The primary laboratory is responsible for providing a copy of this QAPP to any subcontracted laboratories and ensuring that they follow the requirements of the QAPP. The QAMs include names of the responsible oversight individuals, QA/QC manual review and update procedures, organization and responsibilities of various individuals, QA/QC objectives and reports, QA/QC policies and procedures including sampling and receiving policies, equipment calibrations and maintenance information, necessary reagents and standards, extraction and analysis methods, data review and reporting processes, QA/QC procedures, system audits and corrective actions, certifications, recordkeeping and sample retention, sample disposal procedures, recent method detection limit (MDL) studies, and other QA/QC criteria relevant to the specific analytical methods.

The QA/QC Manager or designee will evaluate the field and laboratory data against the requirements of the QAPP. Each analytical laboratory will provide the most current QA/QC information, SOPs, and QAMs that specify laboratory QA/QC samples and acceptance levels for each method. The project specific MDLs and reporting limits (RLs) and QC limits for the

parameters to be tested will be provided by the laboratories at the time of laboratory procurement.

Project laboratories will either use the limits specified in this QAPP or propose equally or more stringent statistically calculated QC limits. Specific QA/QC (Field Duplicates, Equipment Blanks, *etc.*) samples will be analyzed to satisfy the DQOs. The QA/QC samples to be used and the minimum frequency of their analysis are summarized in **Table 2** The data obtained will conform to the QC requirements specified in this QAPP.

2.2 Characteristics of Data Quality

The term "data quality" refers to the level of uncertainty associated with a particular data set. Data quality associated with environmental measurement is a function of the sampling plan rationale and procedures used to collect the samples, as well as of the analytical methods and instrumentation used in making the measurements. Uncertainty cannot be eliminated entirely from environmental data. However, QA programs effective in measuring uncertainty in data are employed to monitor and control deviations from the desired DQOs. Sources of uncertainty that can be traced to the sampling component include poor sampling plan design, incorrect sample handling, faulty sample transportation, and inconsistent use of SOPs. The most common sources of uncertainty that can be traced to the analytical component of the total measurement system are problems associated with calibration and contamination.

The purpose of this QAPP is to ensure that the data collected are of known and documented quality and useful for the purposes for which they are intended. The procedures described are designed to obtain data quality indicators for each field procedure and analytical method. To ensure that quality data continues to be produced, systematic checks must show that test results and field procedures remain reproducible and that the analytical methodology is actually measuring the quantity of parameters in each sample.

All laboratory analytical data will be generated by a NELAC-certified laboratory and validated. This applies to the primary laboratory and any laboratory subcontracted by the primary laboratory. The primary laboratory is responsible for ensuring any subcontracted laboratories are NELAC-certified and/or certified for the applicable subcontracted methods. Laboratories must have an in-place program for data reduction, validation, and reporting as discussed in this QAPP. The reliability and credibility of analytical laboratory results can be corroborated by the inclusion of a program of scheduled replicate analyses, analyses of standard or spiked samples, and analysis of split samples with QA laboratories for some projects. Regularly scheduled analyses of known duplicates, standards, and spiked samples are a routine aspect of data reduction, validation, and reporting procedures.

2.3 Measurement Performance Criteria

Performance and acceptance criteria are often expressed in terms of data quality indicators (DQIs). The principal data quality indicators are sensitivity, accuracy, precision, completeness, representativeness, and comparability. These DQIs are discussed below.

2.3.1 Sensitivity

Sensitivity refers to the amount of analyte necessary to produce a detector response that can be reliably detected (*i.e.,* the MDL) or quantified (*i.e.,* the RL). Where practicable, to reduce the possibility of false negatives, the RL of each contaminant of concern should be lower than its

corresponding screening value. In cases where a screening value is below the RL, the sample-adjusted MDL can be used to evaluate the presence or absence of the analyte from environmental samples. Furthermore, to be considered valid for project use under normal conditions, the concentrations of contaminants of concern in any blank (*e.g.,* equipment blank, field blank, and/or method blank) should not exceed the laboratory RLs, unless a higher number is considered valid to reflect actual field and laboratory conditions. Target parameters reported for all blanks should be below the RL to reduce the possibility of false positives. The specific MDLs, RLs, and screening values for the 35 I.A.C. § 845 and 40 C.F.R. § 257 Subpart D parameters are summarized in **Table 1**. **Appendix A** lists the MDLs, RLs, and screening values for parameters that monitored under other regulatory programs at the monitored units.

In the case of radionuclides, the actual result of the analysis is reported regardless of the minimum detectable concentration (MDC) metric. The MDC is a sample-specific value defined as the lowest level of activity in a sample that is statistically distinguishable from a sample with no activity. For radiochemical analysis the MDC is functionally equivalent to the MDL and no RL is reported.

2.3.2 Accuracy

Accuracy of the data is the measure of the overall agreement of a measured value to the true value. It includes a combination of systematic error (bias) and random error (precision) components of sampling and analytical operations. It reflects the total error associated with a measurement. A measurement is considered accurate when the value reported does not differ from the true value or known concentration of a spike sample or standard beyond an acceptable margin. Field and laboratory activities are subject to accuracy checks.

To estimate the accuracy of the data, a selected sample is spiked with a known amount of a standard and is analyzed; the results of which are used to calculate percent recovery. Accuracy of laboratory analyses will be assessed by comparing results for a surrogate standard, matrix spike (MS) or laboratory control sample (LCS), and initial and continuing calibration of instruments to control limits. Laboratory accuracy is expressed as the percent recovery (%R). If the %R is determined to be outside of acceptance criteria, the data will be flagged for reporting purposes. Accuracy goals vary for analytical data by the type of analysis employed. Laboratory goals are established as part of the laboratory QA/QC program as described in the QA Manual and SOPs.

Accuracy of field measured data will be maintained by keeping the field instruments in proper working condition and calibrating as specified by operation manuals. The specific maintenance and calibration procedures in the operation manuals will be followed. The results of calibrations will be evaluated against the limits established in operation manuals specific to each instrument and recorded in field logbooks. Field accuracy will also be assessed in part through adherence to all sample handling, preservation, and holding time requirements as described in this QAPP.

2.3.3 Precision

Precision of the data is the measure of reproducibility or agreement among repeated measurements of the same sample under identical or substantially similar conditions. It is represented as either a range of values or as a standard deviation about the mean value. Precision goals vary for analytical data by the type of QC samples measured. Both laboratory and

field QC samples are utilized to measure precision. Precision may be expressed as a percentage of the mean of measurements, such as relative range or relative standard deviation.

Analytical precision is a measurement of the variability associated with duplicate or replicate analyses of the same sample in the laboratory. Analytical precision is determined by analysis of laboratory QC samples, such as matrix spike duplicates (MSD) or laboratory control sample duplicates (LCSD), or laboratory sample duplicates. These samples should contain concentrations of an analyte above the RL. The most commonly used estimates of precision are percent relative standard deviation (%RSD) and the relative percent difference (RPD) when only two samples are used. RPDs for laboratory control samples are listed in **Table 1** under LCS/LCSD Control RPD and MS/MSD or Laboratory Duplicate RPD Control Limits. The precision goal for aqueous field sample RPD is ≤30%. Field sample RPDs are listed in **Table 2** under Field Duplicate Samples. Samples outside the limits will be noted and reported with qualifiers.

Total precision is a measurement of the variability associated with the entire sampling and analytical process. It is determined by analysis of field duplicate samples, which measure variability introduced by the laboratory and field operations. Field duplicate samples are analyzed to assess field and analytical precision.

Table 2 sets forth the frequency with which laboratory duplicate samples (*i.e.,* LCSD and MSD) will be analyzed as well as the allowable difference in results for laboratory QA/QC samples. If the precision goals indicated in this QAPP are not met, the data will be qualified for reporting purposes.

2.3.4 Completeness

Completeness is defined as the percentage of measurements judged to be valid based on the number of planned analyses. The completeness goal is to generate a sufficient amount of valid data to meet project needs and is calculated and reported for each method, matrix, and analyte combination. Completeness describes the content of the data set once errors, if any, have been identified and qualified and rejected data have been removed from the data set. Completeness may also be impacted when planned samples are not collected (*e.g.,* well damage makes sample collection impossible) or collected samples are not analyzed (*e.g.,* sample bottle broken in transit). The number of valid results divided by the number of planned results, expressed as a percentage, determines the completeness of the data set. The target completeness objective for this project is 95%. The data set will be considered complete if at least 95% of the data planned for collection is usable without meaningful qualifiers or errors. If the goal is not achieved, the rationale for the incompleteness will be assessed and reported. The data completeness will be evaluated during the data validation review process.

2.3.5 Representativeness

Representativeness is a qualitative term used to express the degree to which data accurately and precisely represent a characteristic of a population. It is mostly concerned with the proper design of the sampling program. Sample collection and handling methods, sample preparation, analytical procedures, holding times, and QA protocols developed for this project, and discussed in the subsequent sections of this document, have been established to ensure that the collected data are representative.

2.3.6 Comparability

Comparability is a qualitative term used to express the confidence with which one data set can be compared to another data set. The objective for the QA/QC program is to produce data with the greatest possible degree of comparability. The number of matrices that are samples and the range of field conditions as encountered are considered in determining comparability. Data comparability will be sustained in this project through the use of defined procedures for sampling and analysis (sample collection and handling, sample preparation, and analytical procedures), reporting in standard units, normalizing results to standard conditions, and using standard and comprehensive reporting formats.

The data set will be considered comparable when USEPA or other standard methods have been used for analyses, the data set is representative, and the field investigation is conducted in accordance with accepted industry standards. Laboratory analyses for aqueous samples will be performed in accordance with prescribed USEPA protocols established in the document Test Methods for Evaluating Solid Waste, SW-846, Third Edition, Final Update VI (USEPA, 2019) and subsequent updates, or other appropriate methods as required.

3. PROJECT ORGANIZATION, ROLES, AND RESPONSIBILITIES

Implementation of the approved QAPP requires the involvement of a wide range of individuals and organizations working together as a team. The project organization, and roles and responsibilities of the individuals involved, are defined in the QAPP to promote a clear understanding of the role that each party plays and to provide the lines of authority and reporting for the project. Personnel assigned to the project will be required to familiarize themselves with pertinent protocols and procedures presented in this QAPP. Key project positions relate to project oversight, project management, sampling and analytical data acquisition management, data validation management, and database management.

A communication strategy has been developed and is described in the DMP (Ramboll, 2022a). The project organization and roles and responsibilities are summarized in the sections below. **Figure 1** presents the Organization Chart.

3.1 Owner

The owner for each facility is listed in **Table A**.

3.1.1 Owner Program Manager

The Owner Program Manager (Owner PgM) contracts the analytical laboratory work performed under this QAPP. Primary external points-of-contact (POCs) are the Ramboll Program Manager (PgM), the Laboratory Manager (Lab Manager) and the Laboratory Project Manager (Lab PM).

3.2 Ramboll

3.2.1 Ramboll Program Manager

The Ramboll PgM is responsible for technical and policy decisions involving the project, including interaction with stakeholders. The Ramboll PgM will make recommendations to the Owner PgM if significant policy changes are warranted. The PgM will have primary responsibility for project QA/QC and will evaluate and, if necessary, implement any corrective actions regarding data quality issues. Primary external POCs are the Owner PgM, the Consultant Project Manager (Consultant PM), Lab Manager and the Lab PM.

3.2.2 Ramboll Quality Assurance/Quality Control Manager

The Ramboll QA/QC Manager will oversee implementation of QA/QC procedures during the field sampling program and is responsible for reviewing the project QA/QC program as it relates to the collection and completeness of data from field and laboratory operations. During the contracting process the QA/QC Manager will ensure that method control limits are sufficient to meet this QAPP and are adequate for the use of the data. After receiving analytical results, the Ramboll QA/QC Manager or designee will evaluate the field and laboratory data against the requirements of the QAPP.

3.2.3 Ramboll Laboratory Liaison

The Ramboll Laboratory Liaison (Lab Liaison) is responsible for communication and coordination with the analytical laboratories. Primary external POC is the Lab PM.

3.2.4 Ramboll Data QC Lead

The Ramboll Data QC Lead is responsible for review of analytical data and tracking data through the data verification/validation and reporting processes. The Ramboll Data QC Lead will work with the Ramboll QA/QC Manager to evaluate the field and laboratory data against the requirements of the QAPP. The Ramboll Data QC Lead, or their designee, performs data validation for all analytical data generated.

3.2.5 Ramboll Plant Coordinators

The Plant Coordinators (PCs) are responsible for implementation and review of overall project quality of the collection, completeness, and presentation of the data. If field conditions require modifications to protocol outlined in the QAPP, or if questions arise, the PCs will be the primary contact for direction of Ramboll field personnel. If the sampling is being performed by the laboratory, the Lab PM will contact the Ramboll Lab Liaison who will work with the Ramboll PCs and communicate with the Lab PM. PCs will also be responsible for overseeing review of the QA/QC programs related to the compilation of data. The PC is responsible for compliance monitoring activities at unit, including preparing sampling and analysis request packages, reviewing analytical results, and determining resample needs.

3.2.6 Ramboll Field Team Lead

The Ramboll Field Team Lead is responsible for overall implementation of the approved GMP or work plan, and Sampling and Analysis Plan (SAP) (Ramboll, 2022b) and is responsible for general oversight of field activities being performed by Ramboll.

3.2.7 Ramboll Database Manager

The Ramboll Database Manager is responsible for working with the Ramboll Data QC Lead to assist with review of analytical data and tracking data through the data validation and reporting processes. The Ramboll Database Manager is responsible for processing and uploading data to the project database, controlling access to the data, performing maintenance and database QC, and preparing the data for electronic submissions.

3.3 Consultants

3.3.1 Consultant Project Manager

Consultant PMs will communicate with the Ramboll PgM, Ramboll PC and the Ramboll Lab Liaison prior to sample collection to ensure the proper procedures have been followed so that the data can be processed without delay. This applies to sampling they are performing or have requested of the laboratory. The Consultant PM is responsible for providing data downloads from transducers, sampling and calibration records and all analytical data to Ramboll. For routine compliance monitoring the PC will provide the Consultant PM an opportunity to review the SAR prior to submittal to the laboratory. Primary external POCs are the Ramboll PgM and the Lab PM, if the laboratory is contracted by the Consultant.

3.4 Analytical Laboratories

3.4.1 Laboratory Manager

The Lab Manager is responsible for the overall execution of the work including laboratory analyses, maintaining appropriate certifications, and ensuring equipment is appropriately

maintained and operated. The Lab Manager will have primary responsibility for project QA/QC and will evaluate and, if necessary, implement any corrective actions regarding data quality issues. Primary external POCs are the Owner PgM and the Ramboll PgM.

3.4.2 Laboratory Project Manager

Each laboratory will assign a PM as the primary point-of-contact for the project. The Lab PM is responsible for ensuring project data meet the QA/QC objectives established herein. The Lab PM is also responsible for the field sampling program, tracking the progress of testing in the laboratory and ensuring the timely delivery of data or other laboratory deliverables to the project team. The Lab PM will work with the Ramboll Data QC Lead to resolve any QA/QC deficiencies and implement any necessary corrective actions. Analytical laboratories may also subcontract analyses to other certified laboratories that can meet the requirements of this QAPP upon written approval of the Ramboll PgM or the Ramboll Data QC Lead. Primary external POCs include the Owner PgM, Ramboll PgM, Ramboll Lab Liaison, and Ramboll Data QC Lead.

3.4.3 Laboratory Quality Assurance/Quality Control Manager

The Laboratory Quality Assurance/Quality Control Manager (Lab QA/QC Manager) serves as the focal point for QA/QC at the laboratory and is responsible for oversight of quality control data. The Lab QA/QC Manager is responsible for ensuring internal laboratory QA/QC procedures are being followed and implementing corrective action after nonconformances are identified.

3.4.4 Laboratory Field Team Lead

The Laboratory Field Team Lead (Lab Field Team Lead) is responsible for overall implementation of the approved GMP or work plan, and SAP (Ramboll, 2022b) and is responsible for general oversight of field activities. The Lab Field Team Lead will communicate with the Lab PM with questions that arise in the field.

3.5 Specific Training Requirements and Certifications

Personnel conducting field activities will be required to have completed Occupational Safety and Health Administration (OSHA) Hazardous Waste Operations and Emergency Response 40-hour training with current refresher training as detailed in 29 C.F.R. § 1910.120 for general site workers. 35 I.A.C. § 845.530(c)(2)(E) requires that all employees, contract workers, and third-party contractors complete an OSHA 10-hour or 30-hour construction safety training. These trainings will be completed as follows:

- All employees, contract workers, and third-party contract employees: OSHA 10-hour or 30-hour construction outreach training.
- Supervisors, superintendents, foreman and safety professionals: OSHA 30-hour construction outreach training.

Staff records documenting compliance with OSHA requirements are kept on file by the company performing the work.

All field staff working at the facility must comply with the appropriate Health and Safety Plan(s) (HASP). The Ramboll PgM will be responsible for ensuring necessary training and certification requirements are met for field operations performed by their personnel and the Lab Manager will be responsible for their personnel.

The primary laboratory and all subcontracted laboratories will maintain current NELAC-certification for aqueous sample analyses. The Lab Manager will be responsible for ensuring certification is maintained for the analytical laboratory.

4. DATA GENERATION AND ACQUISITION

This section discusses: sampling process design; sampling methods; sample handling and custody; and analytical methods.

4.1 Sampling Process Design

This QAPP is intended to cover sampling of groundwater, surface water, porewater, and leachate. Samples will be collected according to applicable USEPA guidelines and following the procedures described in the SAP (Ramboll, 2022b).

4.2 Sampling Methods

Sampling will be conducted in accordance with the procedures described in the SAP (Ramboll, 2022b).

4.3 Sample Handling and Custody Requirements

In general, the subcontracted analytical laboratories will handle samples in a manner to maximize data quality. Samples will be collected, handled, and stored in such a manner that they are representative of their original condition and chemical composition. Identification of samples and maintenance of custody are important elements that must also be utilized to ensure samples characterize site conditions. All samples will be properly identified and maintained under chain-of-custody protocol to protect sample integrity. The following sections discuss the sample handling and custody requirements in detail.

4.3.1 Sample Identification

To maintain consistency, a sample identification convention has been developed and will be followed throughout data collection. The Unique Location identifier (ID) will be entered onto the sample labels, field forms, chain-of-custody forms, logbooks, and other records documenting sampling activities. Field and data forms are included in the SAP (Ramboll, 2022b).

Samples collected in the field will be identified on the chain-of-custody by a unique Program ID that includes: 1) the plant acronym, 2) abbreviation of the regulation or permit, and 3) the Unit ID defined in the site-specific GMP and as described in the DMP (Ramboll, 2022a). An example Unique Location ID is COF_G280.

4.3.2 Sample Labels

Sample labels will be provided with sample containers for laboratory analysis. Each sample collected will be assigned a Unique Sample ID which consists of the Unique Location ID followed by an underscore and the event ID, for example, COF_G280_23Q2. All samples will be labeled in a clear and precise way for proper identification in the field, laboratory, and progress reports.

A sample label will be affixed to all sample containers sent to the analytical laboratory. Field personnel will complete an identification label for each sample with the following information written in waterproof, permanent ink:

- Unique Location ID
- Unique Sample ID

- Date and time (in 24-hour clock format) sample collected
- Filtering performed, if any
- Preservative used, if any
- Name or initials of sampler
- Analyses or analysis code requested

The use of pre-printed sample labels is preferred to reduce sample misidentification problems due to transcription errors. Sample labels must be completed and affixed to the sample container in the field at the time of sample collection.

If errors are made on a sample label, corrections will be made by drawing a single line through the error and recording the correct information. All corrections will be dated and initialed.

4.3.3 Chain-of-Custody Forms and Custody Seals

Completed original chain-of-custody forms will be sent with each sample shipment to document collection and shipment of samples for off-site laboratory analysis with electronic copies to be maintained with project files. The chain-of-custody form will identify the contents of each shipment and maintain the custodial integrity of the samples. A custody seal signed by the sampler will be used to maintain custodial integrity of the samples during shipment to the laboratory. Additional details on chain-of-custody requirements are provided in the SAP (Ramboll, 2022b) and DMP (Ramboll, 2022a).

4.3.4 Containers, Preservation, and Hold Time

Each lot of preservative and sampling containers will be certified as contaminant-free by the provider and/or the laboratory. The laboratories will maintain certification documentation in their files. All preserved samples will be clearly identified on the sample label and chain-of-custody form. If samples requiring preservation are not preserved, field records will clearly specify the reason for the discrepancy.

Aqueous sample containers will be placed in airtight plastic bags, if possible, and refrigerated or placed in a cooler with ice to chill and maintain a sample temperature of ≤ 6 degrees Celsius (°C). Aqueous samples should not be frozen.

Chemical activity continues in the sample until it is either analyzed or preserved. Once the sample has been preserved, the sample may be held for a period of time before analysis. The time from the collection of the sample to the analysis is defined as the holding time.

The analytical methods, type of sample containers to be used for each sample type and analysis, preservation requirements for all samples, and holding times are provided in **Table 3**.

4.4 Analytical Methods

Both field measurement methods and analytical laboratory methods will be utilized to analyze samples during implementation of this QAPP. Analytical methods included are listed on **Table 1** and **Appendix A**. Laboratory SOPs developed and approved by the laboratories performing the analyses are required to be provided for the listed methods.

4.4.1 Field Measurement Methods

Samplers may conduct in-field measurement for depth to water, pH, conductivity, dissolved oxygen (DO), oxygen-reduction potential (ORP), turbidity, and temperature of aqueous samples. An appropriate pH meter and standardization buffers as recommended by the instrument manufacturer will be used. All meter standardizations, QC, and sample results will be recorded on the appropriate field forms. Precision and accuracy goals for field measurements are included in the SAP (Ramboll, 2022b).

4.4.2 Laboratory Analytical Methods

The project will involve the analysis of aqueous samples including groundwater, surface water, porewater, and leachate samples. The primary methods that will be used to analyze samples are summarized in **Table 1**.

Each analytical laboratory used during implementation of this QAPP will be expected to provide a current Statement of Qualifications and laboratory QA/QC documents (including QAM and SOPs) for review by the QA/QC Manager or designee. In addition, analytical laboratories may be requested to provide current MDL studies, proposed RLs and other sources that contain QC procedures, QC acceptance criteria, and corresponding corrective actions for the analytical methods to be used during implementation of the QAPP.

The laboratory will use analytical methods and QA/QC procedures in conformance with approved methods for all samples. Copies of the laboratory QAMs and SOPs for all laboratories will be retained on file with Ramboll. In the event that the listed procedures cannot be performed, the laboratory will notify the facility owner of the conflict. Unless specifically directed otherwise by the Ramboll PgM, or their designee, or Owner PgM, the standard or superseding test methods will govern. No changes in prescribed analytical methods will be made unless approved by Owner PgM.

RLs compiled in **Table 1** are from a review of RLs generally achieved by the laboratories used for implementation of this QAPP. It should be noted that the limits listed in **Table 1** are laboratory dependent using clean matrices and may not always be achievable due to sample matrix effects, necessary dilution of the sample, and/or interferences. RLs should be lower than the regulatory limits specified in 40 C.F.R. § 257 and 35 I.A.C. § 845 in Table 1, and the Screening Levels in Appendix A.

5. DOCUMENTATION, REPORTING, AND DATA MANAGEMENT

This section includes information about the requirements for laboratory data packages including field sampling records, if the laboratory performs the sampling. Requirements for field documentation are described in the SAP (Ramboll, 2022b).

Records that may be generated during field work include field logs and data sheets, photographic logs, sample chain-of-custody records, sample labels, equipment inspection and calibration records, and others as necessary. Units of measure for any field measurements and/or analyses will be clearly identified on the field forms and in notes and logs as necessary. Field and data forms are included in the SAP (Ramboll, 2022b).

Analytical data will contain the necessary sample results and QC data to assure compliance with the DQOs defined for the project. Laboratory data will be provided in Portable Data Format (PDF), and in electronic data deliverable (EDD) format in accordance with this QAPP.

5.1 Field Data

Data that may be collected in the field primarily consist of field-measured water quality parameters including pH, temperature, conductivity, DO, ORP and turbidity, depth to groundwater measurements, and sample depth measurements.

Upon generation all field data will be immediately recorded in site-dedicated field logbooks. Field logbooks may be in paper or electronic (collected using a tablet) format. Calibration results will also be included in field logbooks and/or appropriate field forms. As necessary, field data from logbooks and field forms will be tabulated in spreadsheets to be included in reports. The QA/QC Manager and the PC will review the field data to evaluate the completeness and accuracy of the field records.

5.2 Verification of Electronic Data

Electronic data are generally derived from automated data acquisition systems in an analytical laboratory setting. Analytical instruments are equipped with software that performs various manipulations, identifications, and calculations of data. Software calculations are verified manually during the data validation process. Other data generated by the analytical laboratories may consist of manually recorded results. This data may be documented in a logbook and may subsequently be entered in the form of electronic files. As a part of their periodic reviews of logbooks and deliverables, the analytical laboratories will review transcriptions to ensure accuracy. Any errors encountered will trigger further auditing until no transcription errors are encountered in the audit set, up to and including 100 percent review.

Data can be reported in either hard copy form or electronic form. Screening level data are generally reported in summary form including sample identification information, results for the sample analyses, and a summary of the QC data including calibrations and verifications of precision, accuracy, and representativeness, where appropriate.

If data manipulation or reduction is performed electronically, outside of the raw data produced by purchased instrumentation, the formulae or macros employed for these purposes will be

validated by comparing the results of a sample manual calculation to the result produced electronically. This validation will be documented and maintained in central files.

5.3 Electronic Data Deliverables

In addition to hard copy or PDF data reports provided by the contract laboratory, analytical data will be submitted to the consultant as EDDs. It is the responsibility of the analytical laboratory to ensure that the PDF data and electronic data are identical. The data reported in EDDs and in the hard copy reports must correspond exactly, including significant digits and units. It is preferable that the hard copy and EDD are generated at approximately the same time from the same data source.

The laboratory will provide an EDD per sampling event (the Comprehensive Sampling Event EDD) as discussed in the DMP (Ramboll, 2022a). A 10-business day turnaround time from the time of laboratory receipt will be requested for the laboratory to report the EDD. The EDD must contain the following information at a minimum:

- Unique Location ID
- Unique Sample ID
- Sample Date
- Sample Time
- Laboratory Sample ID
- Analytical Method
- Analyte Name
- CAS#
- STORET
- Dissolved or Total Analysis
- Result
- Detect Flag (y/n)
- Laboratory Qualifier
- Units
- Reporting Limit
- MDL
- Sample Adjusted MDL
- Spike Levels
- %R
- RPD
- Control limits for %R and RPD
- Extraction Method

- Cleanup Method
- Sample Receipt Date
- Extraction Date
- Analysis Date
- Analysis Time
- Dilution Factor
- Result Reportable (y/n)
- Batch Number
- Sample Delivery Group (SDG)

5.4 Analytical Data Packages

The following section discusses general laboratory requirements for preparing data packages. Data packages provided by contract analytical laboratories will be at USEPA Level II or Level IV, depending on the level of data validation required. A 10-business day turnaround time from the time of laboratory receipt will be requested for the laboratory to report the Level II data package and a 15-business day turnaround time for the Level IV data package.

The Level II data package includes the following information:

- Sample and client information
- Sampling time and date
- Sample number
- Analytical method
- Environmental sample results or measurements
- Reporting limits and method detection limits
- Chain-of-custody
- Sample receipt checklist
- Summary of QA/QC results
- Method blank results
- Surrogate recoveries, if applicable
- LCS/LCSD results, recoveries, RPDs and control limits
- MS/MSD results, recoveries, RPDs, and control limits
- Duplicate results RPD
- Spike amount
- Dilution factors
- Initial sample aliquots (weights or volumes) and final sample volumes
- Sample preparation and analytical batch association

- Case narrative

The Level IV data package includes the same information as the Level II data package with the following additional information:

- Instrument summary forms for initial calibration, tunes (mass spectrometry methods only), calibration verification, internal standards, interference check standards (metals only), serial dilutions (metals only), and post digestion spikes (metals only).
- Raw data for all samples including chromatograms and instrument outputs for internal standards (when applicable), tunes, calibrations, QA/QC samples, etc.
- Sample preparation logs, sample run logs or injection logs

The case narrative will be written, and the release of data will be authorized by the laboratory director or their designee. Items to be included in the case narrative are the Unique Location ID with the corresponding laboratory ID, parameters analyzed in each sample and the methodology used (USEPA method numbers or other citation), detailed description of all problems encountered and corrective actions taken, discussion of possible reasons for results exceeding the acceptable laboratory QA/QC results, and observations regarding any occurrences which may affect sample integrity or data quality.

Legible copies of the chain-of-custody forms for each sample will be maintained in the data package. Cooler log-in sheets will be associated with the corresponding chain-of-custody form(s). Any integral laboratory tracking document will also be included. Field sampling records will be provided when the laboratory performs or subcontracts the sampling.

For each environmental sample analysis, this summary shall include Unique Location ID, Unique Sample ID, and corresponding laboratory ID, sample matrix, collection date and time, laboratory receipt date and time, date and time of sample extraction (if applicable), date and time of analysis, identification of the instrument used for analysis, instrument specifications, weight or volume of sample used for analysis and/or extraction, dilution or concentration factor used for the sample extract, method detection limit or sample quantitation limit, definitions of any data qualifiers used, and analytical results.

The following QA/QC results will be presented in summary form. Acceptance limits for all categories of QC criteria will be provided with the data. The summary of QA/QC results for analyses will include, but will not be limited to the following:

- Method Blank Analyses – The concentrations of any parameters found in blanks will be reported, even if the detected amounts are less than the RL. The samples and QA/QC analyses associated with each method blank will be stated.
- Surrogate Standard Recovery (organic analyses only) – The name and concentration of each surrogate compound added will be detailed. The percent recovery of each surrogate compound in the samples, method blanks, MS/MSD, and other QA/QC analyses will be summarized with Unique Location ID such that the information can be linked to sample and QA/QC analyses.
- Matrix Spike and Matrix Spike Duplicate – For MS/MSD analyses the sample results, spiked sample results, percent recovery, and associated recovery and RPD control limits will be detailed. Parent sample results will also be included on the summary form.

- Laboratory Control Sample and Laboratory Control Sample Duplicate – For LCS/LCSD analyses, the spiked sample results, %R, and associated recovery and RPD control limits will be detailed. LCS/LCSD analyses will also include source of the sample(s), true value concentrations, found concentrations, percent recovery for each element analyzed, and the date and time of analysis.
- Laboratory Duplicates – For laboratory duplicate analyses the sample results, RPD between duplicate analyses, and control limits will be reported, as applicable. For laboratory QC check and/or LCS analyses, the %R and acceptable control limits for each analyte will be reported. All batch QC information will be linked to the corresponding sample groups.

All data packages will be reviewed by the individual laboratory QA Manager or designated data review specialists to ensure accurate documentation of any deviations from sample preparation, analysis, and/or QA/QC procedures and descriptions. Any problems identified by the laboratory QA Manager or designated data review specialists will be documented in the narrative of the report.

5.5 Laboratory Record Retention

Raw data will be available for further inspection, if required, and maintained in each laboratory's central job file. Records related to the analytical effort (*i.e.,* cost information, scheduling, custody) are maintained at the laboratories in a secured location. Moreover, analytical laboratories will have the ability to archive data and quality records in a secured area protected from fire and environmental deterioration. Electronic data should be protected against exposure to magnetic or electronic sources.

All records necessary to reproduce the analytical calculations and support the reported results must be maintained for a minimum of five years. Types of records to be maintained for the project include, but are not limited to the following:

- Chain-of-custody forms, including information regarding the sampler's name, date of sampling, type of sampling, sampling location and depth, number and type of sampling containers, signatures of sample custodians with transfer date and times noted, and sample receipt information including temperature and conditions upon arrival at the laboratory
- Cooler receipt form documenting sample conditions upon arrival at the laboratory
- Any discrepancy and/or deficiency report forms due to problems encountered during sampling, transportation, or analysis
- Sample destruction authorization forms containing information on the manner of final disposal of samples upon completion of analysis
- All laboratory notebooks including raw data readings, calibration details, QC checks, etc.
- Hard copies of data system printouts (chromatograms, mass spectra, inductively coupled plasma [ICP] data files, etc.)

- Tabulation of analytical results with supporting QC information Sample preparation documents and records.
- Sampling field records

5.6 Data Management

Data will be generated during sampling and measurement activities, and at the laboratory via analytical testing of samples. The data will be entered into a database system managed by Ramboll. The database will be maintained on a secure, enterprise-level database server that is backed-up regularly. Access to the database will be restricted to authorized users.

EDDs provided by the laboratories should be in the EDD format as defined by the Ramboll. Prior to loading data into the database, EDDs will be reviewed for consistency with the file format and valid values. Data collected in the field will also be entered into the database and integrated with laboratory data.

A detailed description of laboratory data management procedures will be provided in the laboratory QAM.

6. QUALITY CONTROL REQUIREMENTS

There is potential variability in any sample collection, analysis, or measurement activity. QC activities are those technical activities routinely performed, not to eliminate or minimize errors, but to assess and demonstrate reliability and confidence in the measurement data generated. This section identifies QC checks for sample collection, field measurements, and laboratory analyses for sample data collected.

6.1 Field QC Procedures

Field QA/QC samples that will be collected during the proposed investigation include field duplicate samples, field blanks, trip blanks, and equipment blanks. The description and purpose of these samples is discussed in this section. The frequency of analysis of field QA/QC samples is summarized in **Table 2**.

6.1.1 Field Duplicates

The field duplicate (FD) is a replicate sample collected by sequentially alternating filling between the primary sample container and the FD sample container is used to document representativeness and precision. FD samples will be labeled and packaged in the same manner as primary samples but with "-Dup" appended to the Unique Location ID. FDs will be collected at a frequency of one in every 10 primary samples and will be analyzed for the same suite of parameters as the primary sample. The RPD between the field duplicate sample and the primary sample is evaluated to assess the homogeneity of the sample matrix and to assess the reproducibility of laboratory and field sample collection techniques.

6.1.2 Field Blanks

Field blank (FB) samples are used to assess the presence of contaminants arising from field sampling procedures. FB samples are obtained by filling a clean sampling container with analyte-free deionized (DI) water, in the field at a sample location. The sample then is analyzed in the same manner as the primary sample. FB samples will be analyzed for the same suite of parameters as the primary sample to assess potential background contamination, contamination due to bottles and preservatives, or errors in the sampling process. If specified by the PC or Consultant PM, one FB will be collected per sampling event.

6.1.3 Equipment Blanks

Equipment blank (EB) samples are used to assess the effectiveness of decontamination procedures. EB samples are obtained by filling decontaminated sampling equipment with analyte-free DI water, sampling this water, and submitting the sample for analysis. Alternatively, DI water can be poured over or through the decontaminated sampling equipment and then collected and submitted for analysis. EBs will only be collected from samples that come in contact with non-dedicated sampling materials. EBs will be collected at a frequency of one in every 20 samples and will be analyzed for the same suite of parameters as the primary sample to assess the effectiveness of decontamination procedures.

6.1.4 Trip Blanks

Trip blanks (TB) samples are used to assess the potential for cross-contamination of volatile organic compounds (VOCs) between samples during storage and shipment. TB samples are only

necessary when VOCs are being analyzed. A TB sample consists of one or more sample containers that are prepared at the analytical laboratory by filling with reagent-grade DI water. The TB sample is added to the sample cooler or other shipping container as soon as the first primary sample is collected. The TB sample accompanies the primary samples to the laboratory and is analyzed using the same analytical method as the primary samples. TB samples will be prepared and accompany any cooler or shipment that holds VOC samples.

6.2 Laboratory QC Procedures

The laboratory QA/QC program includes performing analytical methods according to prescribed protocols and analyzing laboratory QA/QC samples to measure precision and accuracy of laboratory methods and equipment, instrument calibration and preventive maintenance. Laboratory QA/QC samples and parameters that will be analyzed include method blanks, laboratory control samples, matrix spikes, laboratory duplicates, and surrogates. The acceptable limits of the laboratory QA/QC samples are provided in **Table 1**. The frequency of analysis of laboratory QA/QC samples is summarized in **Table 2**.

6.2.1 Method Blanks

A method blank is a sample of a matrix similar to the batch of associated samples. It is used to assess potential contamination in the laboratory process (*e.g.,* contaminated reagents, improperly cleaned or calibrated equipment). For each analytical method, the laboratory will analyze one method blank sample per 20 primary field samples, or one per preparation batch, whichever is more frequent.

6.2.2 Laboratory Control Samples

A laboratory control sample is a known matrix (*e.g.,* reagent water) that has been spiked with a known concentration of specific target parameters. It is used to demonstrate the accuracy of the analytical process. For each analytical method a laboratory control sample will be analyzed once per 20 primary field samples, or one per laboratory preparation or analytical batch, depending on the analytical method.

6.2.3 Matrix Spikes

Matrix spikes are performed by the analytical laboratory in order to evaluate the efficiency of the sample extraction and analysis procedures. Matrix spike samples are necessary because matrix interference may have a widely varying impact on the accuracy and precision of the extraction or analysis. The matrix spike is prepared by the addition of known quantities of specific target compounds to a sample. The sample then is extracted and analyzed. The results of the analysis are compared with the known additions and a matrix spike recovery is calculated giving an evaluation of the accuracy of the extraction and analysis procedures. Typically, matrix spikes are performed in duplicate in order to evaluate the precision of the procedures as well as the accuracy. Matrix spike %Rs are reviewed to check that they are within acceptable range. For applicable analytical methods matrix spikes and matrix spike duplicates will be analyzed by the laboratory at a frequency of at least 1 per 20 primary field samples, or one per preparation batch, whichever is more frequent.

6.2.4 Laboratory Duplicates

Duplicate samples are used to assess precision in the analytical method. An additional aliquot is extracted from the primary sample and analyzed using the identical procedures as the primary

sample. Then the results are compared to assess the precision. There are three types of duplicates: sample duplicates, laboratory control sample duplicates, and matrix spike duplicates. For applicable analytical methods duplicates will be collected and analyzed at a frequency of at least 1 per 20 primary field samples, or one per preparation batch, whichever is more frequent.

6.2.5 Surrogates

A surrogate is a chemically similar compound spiked into each sample analyzed. Surrogates assess the accuracy of each individual analysis based on the surrogate recoveries. A surrogate (typically more than one) will be analyzed for each primary sample when applicable to the specified method. Surrogate recovery should fall within the limits set by the laboratory in accordance with procedures specified by the method.

6.3 Corrective Actions

Corrective actions may be initiated if precision or accuracy goals are not achieved. The initial step in corrective action will be to instruct the laboratory to examine its procedures to assess whether analytical or computational errors caused the anomalous results. At the same time, sample collection and handling procedures will be reviewed to assess whether they could have contributed to the anomalous results. Based on this evaluation, the Ramboll QC Lead and PC with the Ramboll PgM and Ramboll QA/QC Manager, will assess whether re-analysis or re-sampling is required or whether any protocol should be modified for future sampling events. Any changes in laboratory methods, or quality assurance parameters or limits, require written approval prior to implementation by the laboratory.

7. INSTRUMENT/EQUIPMENT TESTING, INSPECTION, MAINTENANCE, AND CALIBRATION

7.1 Field Instrumentation

Equipment used in the collection of field measurements will be maintained according to the manufacturer's specifications and will be inspected and calibrated prior to use. Field equipment requiring testing, inspection, and maintenance are:

- Water quality meter(s) utilized to measure pH, temperature, conductivity, DO, ORP, and turbidity
- A flow through cell
- Electric water level meter utilized to measure depth to groundwater
- Low flow adjustable sampling pump utilized for collection of groundwater, and
- Dedicated pressure transducers, equipped with data loggers, for measuring and recording atmospheric pressure, water level and temperature.

The operating manuals for each piece of field equipment used describe the procedures required for testing, inspecting, and maintaining this equipment. Field SOPs for using the field instrumentation are included in the SAP (Ramboll, 2022b). Testing, inspection, and maintenance of field equipment and documentation of completion of these activities will be the responsibility of field personnel under the direction of the Ramboll or Lab Field Team Lead.

7.2 Laboratory Equipment

An instrument maintenance record is maintained for each instrument in the laboratory. In general, the records contain a schedule of maintenance, as well as a complete history of past maintenance, both routine and non-routine, for that instrument.

Preventive maintenance is performed according to the procedures specified in the manufacturer's instrument manuals, including lubrication, source cleaning, and detector cleaning, and the frequency of such maintenance. Chromatographic carrier gas purification traps, injector liners, and injector septa are cleaned or replaced on a regular basis. Precision and accuracy data are examined for trends and excursion beyond control limits to determine evidence of instrument malfunction. Maintenance will be performed when an instrument begins to degrade as evidenced by the degradation of peak resolution, shift in calibration curves, decrease in sensitivity, or failure to meet one or another of the pre-determined QC criteria.

7.3 Laboratory Calibration Procedures

The laboratory SOPs and QAMs address the calibration and frequency of calibration required for laboratory instruments as well as a description of documentation that will be completed. **Tables 4 through 6** summarize the minimum frequency and scope of laboratory checks and calibrations to be performed for the analyses included in this QAPP. Laboratories may have more stringent requirements as part of their SOPs but must meet these minimum requirements as well as satisfying specific requirements of the standard methods specified for this project.

The Lab Manager will be responsible for ensuring proper calibration and recordkeeping are conducted and will inform the Ramboll Data QC Lead of any issues that may impact analytical results.

7.4 Inspection and Acceptance of Supplies and Consumables

Field and laboratory supplies and consumables that may directly or indirectly affect the quality of results will be inspected. Only supplies and consumables that have been determined to be acceptable will be utilized for the project.

Containers will be provided by the laboratory or their approved supplier for samples to be analyzed by the laboratory. If any container is found to have a defect or damage it will be properly discarded, and replacements will be requested as necessary. Other field supplies and consumables to be used include items such as bailers, bailer cord, calibration standards, disposable bladders for pumping, sample tubing, and distilled water. These supplies will be inspected upon receipt in part to verify they are new and in their original packaging. If any defects are noted or suspected, they will be properly discarded and replaced prior to use.

The supplies and consumables for this project will be handled and stored in a manner that will not compromise sampling results. This will involve keeping items in their original containers until use, sealing containers properly between uses, or storing items in new or dedicated plastic bags.

The Ramboll or Lab Field Team Lead with assistance from field personnel will be responsible for inspecting and accepting field supplies and consumables and providing replacements as necessary. Field personnel will inventory critical supplies on a regular basis and report to the Ramboll or Lab Field Team Lead to ensure that work will not be delayed unnecessarily.

7.5 Laboratory Supplies and Consumables

A detailed description of the laboratory inspection and acceptance policy for supplies and consumables will be provided in the laboratory QA Manual. A list of primary supplies and consumables necessary for each laboratory analysis will be provided in the individual laboratory SOPs.

The laboratory is responsible for ensuring that supplies and consumables are appropriate and adhere to laboratory policy as described in their QAM. Any issues regarding supplies that could have a negative effect on data quality will be communicated to the Lab PM who will inform the Ramboll Data QC Lead in a timely manner.

8. ASSESSMENT AND OVERSIGHT

Assessment and oversight are designed to determine whether the QAPP and SAP are being implemented as approved, to increase confidence in the information obtained, and ultimately, to determine whether the information may be used for its intended purpose(s).

8.1 Assessment and Response Actions

8.1.1 Field Assessments and Response Actions

The Ramboll QA/QC Manager, or other person designated by the Ramboll PgM will perform periodic assessments of compliance with the QAPP and the SAP. When problems or issues are identified, the Lab Manager and Lab PM will be notified of the issue and instructed as to how to proceed going forward. If a subsequent assessment reveals that the problem has not been corrected, a field audit may be conducted. In addition, periodic unannounced audits may be conducted of field operations. Such audits may include evaluation of the following actions: field procedures, sampling activities, field forms and logbooks, chain-of-custody procedures, field measurements, field equipment calibration procedures, and sample packaging and shipment. Additional routine audits may be conducted during the course of collecting data as deemed necessary by the Ramboll QA/QC Manager to verify conformance with corrective actions identified in a previous audit and/or to provide additional qualitative assessment of field procedures. The Lab Manager will be responsible for ensuring corrective actions identified by the audit are completed. Consultants are responsible for conducting field assessments for the task-specific work they are implementing.

8.1.2 Laboratory Assessments and Response Actions

The laboratory will be responsible for its own compliance with the QAPP. If an internal audit identifies a nonconformance that affects analytical results for this project then the Lab PM will notify the Ramboll Data QC Lead, Ramboll PgM, and Ramboll QA/QC Manager in writing describing the nonconformance, the impact to analytical results, and corrective actions implemented to respond to the nonconformance.

During the data validation process, the Ramboll Data QC Manager will review selected elements of the laboratory performance as it relates to the QAPP. If non-compliance issues are identified, the laboratory will be notified as to what issue(s) has been identified and will be required to prepare a written response to the consultant regarding what corrective action will be taken to address the issue. If non-compliance problems persist, audits and/or further performance evaluation may be implemented.

8.2 Descriptions of Audits

Audits may be performed to review and evaluate the adequacy of the QAPP and to ascertain that it is being implemented.

A systems audit includes an evaluation of field and laboratory QA/QC procedures. If the systems audit shows a significant discrepancy from the QAPP or SAP (Ramboll, 2022b), the responsible party will remedy the situation before work continues. Each major system change will require a written summary to document the change made.

A performance audit includes a careful evaluation of field, laboratory, and data documentation and management procedures to determine accuracy. Upon discovery of significant deviation from the QAPP, the nature and extent of the deviation will be recorded. Corrective action will be taken to remedy the deviation as necessary.

The Ramboll QA/QC Manager has the responsibility of performing, or delegating, audits as deemed necessary and upon learning of any nonconformance. The Ramboll PgM has the ultimate responsibility for implementing corrective actions.

8.3 Reports to Management

Upon completion of any audit, the Ramboll QA/QC Manager will document and report the QA/QC results and the identified issues (*i.e.,* laboratory and/or field) to the Ramboll PgM. The Ramboll Data QC Lead and Ramboll PCs will evaluate the impact of the QA/QC issues and determine if the deviations will result in an adverse effect on the project conclusions. If it is determined that corrective actions are necessary, procedures outlined in Section 6.3 Corrective Actions will be implemented.

9. DATA VALIDATION AND USABILITY

9.1 Data Review, Validation, and Verification Requirements

All monitoring data will undergo two levels of review, verification and validation. The laboratories and Ramboll will provide data verification. Data validation will be performed by Ramboll, and/or independent data validation contractors.

9.2 Validation and Verification Methods

9.2.1 Verification of Field Data Procedures

Procedures to verify field data include checking for transcription errors and review of field logbooks at the time of data collection. Field sampling efforts as described in the field logbooks will be reviewed at the conclusion of each sampling event to confirm sampling procedures followed established procedures. If any significant nonconformance issues are noted they will be reported with a description of the potential effect of the nonconformance to the data. This task will be the responsibility of the Ramboll Data QC Lead, Ramboll or Lab Field Team Lead, or their designees.

9.2.2 Laboratory Data Verification Procedures

Initial data reduction, verification, and reporting will be performed by the laboratory and described in the laboratory QAMs and SOPs.

The laboratory will perform in-house analytical data verification under the direction of their QA/QC Manager and the Lab PM. The laboratory will be responsible for assessing data quality and advising of any data rated "preliminary", "unacceptable", or other notations that would caution the data user of possible nonconformance.

The Lab QA/QC Manager will routinely audit or provide a secondary review of reports to assess data quality. This data assessment will be based on the assumption that the sample was properly collected and handled.

The Lab QA/QC Manager will conduct a systematic review of the data for compliance with the established QC criteria based on spike, duplicate and blank results and an evaluation of data precision, accuracy, and completeness will be performed.

After the laboratory has completed its review of the data and released a report to Ramboll and the project team, a second stage of review will be done. This process will be called data verification. Data verification involves the review of contractual obligations between the Owner PgM and the laboratory. This review will be equivalent to the Stage 1 validation as defined by USEPA (USEPA, 2009). The review will include, at a minimum:

- Review of sample handling (chains-of-custody)
- Review of methods performed
- Review of samples analyzed
- Review of reported analyte lists
- Review of reporting limits

In order to ensure that any issues with samples analyzed are remedied as quickly as possible, every effort will be made to verify data within three days of when it is reported.

9.3 Laboratory Data Validation Procedures

Data validation evaluates the analytical quality of a data set and occurs after data verification. Ramboll is responsible for ensuring that the data are validated. Data validation will be performed by staff that have been trained in data validation procedures, and are knowledgeable about the analytical methods and data validation guidelines. Data validation will be consistent with the USEPA National Functional Guidelines for Organic and Inorganic Superfund Methods Data Review (USEPA, 2020a; USEPA, 2020b).

QA/QC criteria checked during the validation process will include items identified in "Guidance for Labelling Externally Validated Laboratory Analytical Data for Superfund Use" (USEPA, 2009). At a minimum, all data generated will be validated as 100% Stage 2A. Data generated during a sampling event that includes samples for 35 I.A.C. § 845 compliance monitoring data will be validated as 90% Stage 2A and 10% Stage 4 which includes Stage 2B. Stage 2A data validation requires a Level II laboratory data deliverable and Stage 4 requires a Level IV laboratory data deliverable. A sample list of validation checks at each stage are outlined below:

Stage 1 data validation checks include:

- Completeness check
- Chain-of-custody review
- Evaluate sample results by comparing sample conditions upon receipt at the laboratory (*e.g.,* preservation checks) and sample characteristics (*e.g.,* percent moisture to the requirements and guidelines present in national or regional data validation documents, analytical methods(s) or contract.

Stage 2A data validation checks include:

- All parameters reviewed for Stage 1
- Review of holding times
- Review of QC summaries, including negative controls (*i.e.,* blanks), positive controls (*i.e.,* LCS), and sample specific controls (*i.e.,* replicates, matrix spikes, surrogates, tracers/yields)
- Frequency of QC samples checked for appropriateness (*e.g.,* one LCS per twenty samples in a preparation batch)

Stage 2B data validation checks include:

- All parameters reviewed for Stage 1 and Stage 2A
- Initial and continuing calibration
- Review of internal standards
- Interference check sample, ICP serial dilution, gas chromatography/mass spectrometry instrument performance check, and RLs
- Project or sampling specific items that have been identified for review
- Overall assessment

Stage 4 data validation checks include:

- All parameters reviewed for Stage 1, Stage 2A, and Stage 2B
- Random recalculation (10-20%) of reported results versus raw data
- Review of Compound Identification, and Tentatively Identified Compounds (TICs), where appropriate
- Random check (10-20%) of integration and mass spectrum matches, where appropriate

9.3.1 Data Validation Qualifiers

During the validation process, final data qualifiers will be applied to the final results using the latest version of the USEPA National Functional Guidelines for Organic and Inorganic Superfund Methods Data Review (USEPA, 2020a; USEPA, 2020b) and professional judgement. The data validation qualifiers indicate known issues, biases, and uncertainties associated with the final results. The USEPA National Functional Guidelines for Organic and Inorganic Superfund Methods Data Review (USEPA, 2020a; USEPA, 2020b) define the following data validation flags which will be assigned, as appropriate, during the data validation process:

U: The analyte was analyzed for but was not detected above the level of the reported sample quantitation limit.

J: The result is an estimated quantity. The associated numerical value is the approximate concentration of the analyte in the sample.

J+: The result is an estimated quantity, but the result may be biased high.

J-: The result is an estimated quantity, but the result may be biased low.

UJ: The analyte was analyzed for but was not detected. The reported quantitation limit is approximate and may be inaccurate or imprecise.

R: The data are unusable. The sample results are rejected due to serious deficiencies in meeting QC criteria. The analyte may or may not be present in the sample.

If multiple flags are required for a result, the most severe flag will be applied to the electronic result. The hierarchy of flags from the most severe to the least severe will be as follows: R, UJ, U, and J.

9.4 Reconciliation with Data Quality Objectives

Analytical results obtained from the project will be reconciled with the requirements specified in this QAPP. Data validation and usability include the final project checks to evaluate if the data obtained conforms to the project's objectives, and to estimate the effect of any deviations. Assessment of data for precision, accuracy, and completeness will be performed according to the following quantitative definitions.

9.4.1 Precision

If calculated from duplicate measurements:

$$RPD = \frac{(C_1 - C_2) \times 100}{(C_1 + C_2)/2}$$

RPD = relative percent difference
C_1 = larger of the two observed values
C_2 = smaller of the two observed values

If calculated from three or more replicates, use percent relative standard deviation (%RSD) rather than RPD:

$$\%RSD = \left(s\sqrt{y}\right) \times 100$$

$\%RSD$ = percent relative standard deviation
s = standard deviation of replicates
$\bar{y}$ = mean of replicate analyses

Standard deviation is defined as follows:

$$s = \sqrt{\sum_{i=1}^{n} \frac{(y_i/\bar{y})^{-2}}{n-1}}$$

s = standard deviation
y_i = measured value of the ith replicate
$\bar{y}$ = mean of replicate analyses
n = number of replicates

9.4.2 Accuracy

For measurements where matrix spikes are used:

$$\%R = \left(\frac{S - U}{C_{sa}}\right) \times 100$$

$\%R$ = percent recovery
S = measured concentration in spike aliquot
U = measured concentration in unspiked aliquot
C_{sa} = actual concentration of spike added

9.4.3 Completeness (Statistical)

Defined as follows for all measurements:

$$\%C = \left(\frac{V}{T}\right) \times 100$$

$\%C$ = percent completeness
V = number of measurements judged valid
T = total number of planned measurements

9.5 Data Submittals

9.5.1 Data Validation Summary Report

After the data validation process is complete, a Data Validation Summary Report (DVSR) will be prepared as a technical memo. The DVSR will summarize the data reviewed, any nonconformances, and validation actions. Data qualifiers and reason codes will be added to the database based on this evaluation. The DVSR will include a table of all qualified data and the reason for qualification.

9.5.2 Electronic Data Deliverable

Quarterly, or upon request, Ramboll will provide a copy of the database to the Owner's PM.

9.6 Reconciliation With Data User Requirements

All laboratory data and validation results will be reviewed to determine if the data meet the DQOs. Project results that do not meet DQOs will be reviewed by the Ramboll Data QC Lead. Raw analytical data, laboratory notebooks, or other laboratory data may be obtained and examined as necessary. Corrective actions will begin with identifying the source of the problem. Potential problem sources may include failure to adhere to method procedures, improper data reduction, equipment malfunctions, or systemic contamination.

The first level of responsibility for identifying problems and initiating corrective action will be with the sampler or field personnel under the supervision of the Ramboll or Lab Field Team Lead, depending on who is performing the work. The second level of responsibility will be with any person reviewing the data including the Ramboll Data QC Lead and the Ramboll PCs.

If critical data are found to not meet QC objectives, the Lab Manager, or their designee, will take appropriate action to obtain acceptable data as determined necessary. This may include re-analyzing existing samples, collecting new investigative samples, or other actions that will result in obtaining acceptable data. The specific course of action will be determined on a case-by-case basis based in part on the effect the nonconformance may have on the sampling objectives.

Data that provide useful information but are not critical for achieving sampling objectives will be appropriately documented if they do not meet QC objectives. However, resampling or re-analysis to address such data will typically not be necessary.

Other corrective actions may include more intensive training, equipment repair followed by a more intensive preventive maintenance program, or removal of the source of systemic problems. Any and all corrective actions will be reviewed by the Ramboll QA/QC Manager and the Ramboll PgM for certainty that resolution was achieved. Once resolved, the corrective action procedure will be fully documented.

10. REFERENCES

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TABLES

TABLE 1. GROUNDWATER ANALYTICAL METHODS AND ANALYTICAL PERFORMANCE CRITERIA FOR 40 C.F.R. § 257 AND 35 I.A.C. § 845 SAMPLING QUALITY ASSURANCE PROJECT PLAN
VISTRA CORP

Constituent	Unit	Analytical Methods [1]	40 C.F.R. § 257 MCL [2] or HBL	35 I.A.C. § 845 Groundwater Protection Standard	Target RL [4]	Target MDL [4]	LCS/LCSD Recovery Control Limits	LCS/LCSD Control RPD	MS/MSD Recovery Control Limits	MS/MSD or Lab Duplicate RPD Control Limits
Metals										
Antimony	µg/L	6020	6	6	1	0.25	80-120	20	75-125	20
Arsenic	µg/L	6020	10	10	1	0.25	80-120	20	75-125	20
Barium	µg/L	6020	2,000	2,000	1	0.4	80-120	20	75-125	20
Beryllium	µg/L	6020	4	4	1	0.5	80-120	20	75-125	20
Boron	µg/L	6020	NS	2,000	25	10	80-120	20	75-125	20
Cadmium	µg/L	6020	5	5	1	0.25	80-120	20	75-125	20
Calcium	µg/L	6020	NS	NS	125	100	80-120	20	75-125	20
Chromium	µg/L	6020	100	100	1	0.3	80-120	20	75-125	20
Cobalt	µg/L	6020	6	6	1	0.25	80-120	20	75-125	20
Lead	µg/L	6020	15	7.5	1	0.25	80-120	20	75-125	20
Lithium	µg/L	EPA 200.7	40	40	1	0.5	80-120	20	75-125	20
Magnesium	µg/L	6020	NS	NS	NS	NS	80-120	20	75-125	20
Mercury	µg/L	7470A or 6020	2	2	0.2	0.051	80-120	20	75-125	20
Molybdenum	µg/L	6020	100	100	1	0.25	80-120	20	75-125	20
Potassium	µg/L	6020	NS	NS	NS	NS	80-120	20	75-125	20
Selenium	µg/L	6020	50	50	1	0.9	80-120	20	75-125	20
Sodium	µg/L	6020	NS	NS	NS	NS	80-120	20	75-125	20
Thallium	µg/L	6020	2	2	1	0.25	80-120	20	75-125	20
Inorganics										
Alkalinity, bicarbonate	mg/L	SM 2320 B	NS	NS	NS	NS	80-120	20	--	20
Alkalinity, carbonate	mg/L	SM 2320 B	NS	NS	NS	NS	80-120	20	--	20
Chloride	mg/L	9056A, 9251 or EPA 300	250 [3]	200	5	1	80-120	20	80-120	20
Fluoride	mg/L	9056A, 9251 or EPA 300	4	4	0.1	0.05	80-120	20	80-120	20
Sulfate	mg/L	9056A, 9251 or EPA 300	250 [3]	400	10	5	80-120	20	80-120	20
Total Dissolved Solids	mg/L	SM 2540 C	500 [3]	1,200	20	10	90-110	10	90-110	10
Other										
Combined Radium 226/228	pCi/L	9315 and 9320; or EPA 903 and 904	5	5	-- [5]	-- [6]	70-130	30	60-140	40

Notes:
EPA = United States Environmental Protection Agency
HBL = Health-based level
MDL = Method detection limit as established by the laboratory
LCS/LCSD = Laboratory Control Sample/Laboratory Control Sample Duplicate
MS/MSD = Matrix Spike/Matrix Spike Duplicate
µg/L = micrograms per liter
mg/L = milligrams per liter
NS = No standard
pCi/L = picoCuries per liter
RL = Reporting limit as established by the laboratory
RPD = Relative Percent Difference
SM = Standard Method

1. Analytical method numbers are from SW-846 unless otherwise indicated. Analytical methods may be updated with more recent versions as appropriate.
2. USEPA MCL = United States Environmental Protection Agency Maximum Contaminant Level.
3. USEPA SMCL = United States Environmental Protection Agency Secondary Maximum Contaminant Level.
4. Reporting limits and method detection limits will vary depending on the laboratory performing the work.
5. All radium results will be reported (values may be positive or negative) and will include uncertainty and the calculated minimum detectable concentration (MDC).
6. Laboratories calculate a minimum detectable concentration (MDC) based on the sample.

TABLE 2. SUMMARY OF QA/QC SAMPLES
QUALITY ASSURANCE PROJECT PLAN
VISTRA CORP

Quality Control Sample Type	Frequency of Analysis	Measurement Performance Criteria
Contamination Control Samples		
Laboratory Method Blank	One per each analytical method. One in every batch of samples (not to exceed 20 samples).	No target analyte concentrations ≥ RL
Trip Blank	One per cooler/shipment if VOCs are tested; analyze for VOCs only.	No target analyte concentrations ≥ RL
Equipment Blank	One per each analytical method. One per every 20 field samples collected. Equipment blanks will not be collected when dedicated single-use equipment is used for sample collection.	No target analyte concentrations ≥ RL
Field Blank	One per each analytical method. One per every 20 field samples collected.	No target analyte concentrations ≥ RL
Accuracy Control Samples		
Laboratory Control Samples	One per each analytical method. One in every preparation batch (not to exceed 20 samples).	Laboratory's statistically devrived control limits
Surrogate Spiked Samples	For methods that use surrogate(s), the surrogate(s) will be spiked and analyzed in all samples and in all batch quality control samples.	Laboratory's statistically devrived control limits
Matrix Spike Samples	Analyzed in each batch, where applicable to the method (not to exceed 20 samples).	Laboratory's statistically devrived control limits
Precision Control Samples		
Field Duplicate Sample	One per each analytical method. One per every 10 field samples collected.	RPD ≤ 30% when analyte is detected in both sample and field duplicate above the RL. For sample results that are less than or equal to five times the RL, the criterion of plus or minus two times the RL will be applied to evaluate field duplicates.
Laboratory Control Sample Duplicates	One per each analytical method. One in every preparation batch (not to exceed 20 samples).	Laboratory's statistically devrived control limits
Laboratory Duplicate Sample	One per each analytical method. One in every preparation batch (not to exceed 20 samples).	Laboratory's statistically devrived control limits

TABLE 2. SUMMARY OF QA/QC SAMPLES
QUALITY ASSURANCE PROJECT PLAN
VISTRA CORP

Quality Control Sample Type	Frequency of Analysis	Measurement Performance Criteria
Matrix Spike Duplicate Samples	Analyzed in each batch, where applicable to the method (not to exceed 20 samples).	Laboratory's statistically devrived control limits

Notes:
QA/QC = quality assurance/quality control
RL = Reporting limit
RPD = Relative percent difference

TABLE 3. SAMPLE PRESERVATION, CONTAINERS, AND HOLDING TIMES
QUALITY ASSURANCE PROJECT PLAN
VISTRA CORP

MATRIX	ANALYTES	ANALYTICAL METHOD	PRESERVATION	CONTAINER [1, 2]	TAT	HOLD TIME [3]	
						Prior to Extraction	After Extraction
Water	VOCs	8260B, 8011	HCl to pH <2; no headspace; cool to ≤6 °C	3 x 40 mL glass VOA vials	10d	14d	
Water	SVCOs	8270C	Cool to ≤6 °C	2 x 1 L amber glass	10d	7d	40d
Water	Phenols	9066 or 420.4 Rev1	H_2SO_4; Cool to ≤6 °C	2 x 500 mL amber glass		28d	
Water	Ammonia as Nitrogen, dissolved	350.1 REV2 or M4500-NH3 G	H_2SO_4 to pH <2; ≤6 °C	500 mL HDPE	10d	28d	
Water	Nitrate nitrogen, dissolved	300.0 or E353.2	Cool to ≤6 °C	500 mL HDPE	10d	48h	
Water	Nitrate nitrogen, total	300.0, 353.2, or SM 4500-NO3 F	Cool to ≤6 °C	500 mL HDPE	10d	48h	
Water	Nitrite + Nitrate	E353.2	Cool to ≤6 °C	500 mL HDPE	10d	28d	
Water	Nitrite nitrogen, dissolved	M4500-NO2 B	Cool to ≤6 °C	500 mL HDPE	10d	28d	
Water	Nitrite nitrogen, total	M4500-NO2 B	Cool to ≤6 °C	500 mL HDPE	10d	28d	
Water	Nitrogen, Ammonia	350.1 or SM 4500-NH3 G	H_2SO_4 to pH <2; ≤6 °C	500 mL HDPE	10d	28d	
Water	Nitrogen, kjeldahl, total	350.1 or SM 4500-NH3 G	H_2SO_4 to pH <2; ≤6 °C	500 mL HDPE	10d	28d	
Water	Nitrogen, total	351.2/353.2	Cool to ≤6 °C	500 mL HDPE	10d	28d	
Water	Phosphorus, dissolved	6020A	HNO_3 to pH <2	500 mL HDPE	10d	180d	
Water	Phosphorus, total	6020A or 6010B or SM 4500P F 1999	HNO_3 to pH <2	500 mL HDPE	10d	180d	
Water	Sulfide, dissolved	SM 4500 S2 F 2000	$2NZn(C_2H_3O_2)_2$ and NaOH to pH >9; cool to ≤6°C	500 mL HDPE	10d	7d	
Water	Sulfide, Reactive	SM 4500 S2 F 2000	$2NZn(C_2H_3O_2)_2$ and NaOH to pH >9; cool to ≤6°C	500 mL HDPE	10d	7d	
Water	Sulfide, total	M4500-S D or SM 4500 S2 F 2000	$2NZn(C_2H_3O_2)_2$ and NaOH to pH >9; cool to ≤6°C	500 mL HDPE	10d	7d	
Water	Sulfur, total	6010B	HNO_3 to pH <2	500 mL HDPE	10d	180d	
Water	Herbicides	8151A, 515.3 REV1, or 8321B	Cool to ≤6 °C	2 x 1 L amber glass	10d	7d	40d
Water	Organochlorine Pesticides	8081A, 8081B	Cool to ≤6 °C	2 x 1 L amber glass	10d	7d	40d
Water	PCBs	8082A	Cool to ≤6 °C	2 x 1 L amber glass	10d	7d	40d
Water	Metals	6020, Li - EPA 200.7	HNO_3 to pH <2	500 mL HDPE	10d	180d	
Water	Mercury	7470A or 6020	HNO_3 to pH <2	500 mL HDPE	10d	28d	
Water	Alkalinity and Carbonate	SM 2320 B	Cool to ≤6 °C	500 mL HDPE	10d	14d	
Water	Chloride, Fluoride, Sulfate	9056A, 9251 or EPA 300	Cool to ≤6 °C	500 mL HDPE	10d	28d	
Water	Total Dissolved Solids (TDS)	SM 2540 C	Cool to ≤6 °C	1 L HDPE	10d	7d	
Water	Radium 226	9315 or EPA 903	None	2 x 1 L HDPE	22d	180d	
Water	Radium 228	9320 or EPA 904	None	2 x 1 L HDPE	22d	180d	
Water	Bacteria (Fecal Coliform)	SM 9222B or D	$Na_2S_20_3$; Cool to ≤6 °C	120 mL HDPE	10d	24hr	
Water	Biochemical Oxygen Demand (5 day - 20 deg C)	SM 5210B 2001	Cool to ≤6 °C	1 L HDPE	10d	48hr	
Water	Carbon, dissolved organic	SM 5310C 2000	HCl to pH <2; cool to ≤6 °C	2 x 1 L amber glass	10d	28d	
Water	Carbon, total organic	9060 or M5310C or SM 5310C 2000	HCl to pH <2; cool to ≤6 °C	2 x 1 L amber glass	10d	28d	
Water	Chemical Oxygen Demand	SM 5220 D 1997	H_2SO_4 to pH <2; ≤6 °C	250 mL glass	10d	28d	
Water	Cyanide, dissolved	9012A (TCN) Aqueou	NaOH to pH >10; ≤6 °C	250 mL HDPE	10d	14d	
Water	Cyanide, Reactive	9012A REV1 7.3.3	NaOH to pH >10; ≤6 °C	250 mL HDPE	10d	14d	

TABLE 3. SAMPLE PRESERVATION, CONTAINERS, AND HOLDING TIMES
QUALITY ASSURANCE PROJECT PLAN
VISTRA CORP

MATRIX	ANALYTES	ANALYTICAL METHOD	PRESERVATION	CONTAINER [1, 2]	TAT	HOLD TIME [3]	
						Prior to Extraction	After Extraction
Water	Cyanide, total	335.4 REV1 or 9012A or ASTM D7511-09e2	NaOH to pH >10; ≤6 ˚C	250 mL HDPE	10d	14d	
Water	Flashpoint, Pensky-Martens Closed Cup	1020B	Cool to ≤6 °C	250 mL HDPE	10d	14d	
Water	Fraction of Oragnic Carbon (FOC)	ASTM-D2974 (FOC & OM)	HCl to pH <2; cool to ≤6 ˚C	2 x 1 L amber glass	10d	28d	
Water	Oil & grease (soxhlet ext)	1664A	H_2SO_4 to pH <2; ≤6 ˚C	2 x 1 L amber glass	10d	28d	
Water	Perchlorate	E314	Cool to ≤6 °C	250 mL HDPE	10d	28d	
Water	Temperature (Celsius)	Field or M2550B					
Water	Temperature (Fahrenheit)	Field or M2550B					
Water	Total Suspended Solids	SM 2540 D 1997	Cool to ≤6 °C	1 L HDPE	10d	7d	

Notes:
ASTM = American Society for Testing and Materials
d = day(s)
h = hours
HCL = Hydrochloric Acid
HDPE = high-density polyethylene
HNO_3 = Nitric Acid
H_2SO_4 = Sulfuric Acid
L = liter
mL = milliliters
NaOH = Sodium Hydroxide
SM = Standard Method
TAT = Turnaround Time
y = year
1. Additional volume will be collected for MS/MSD samples.
2. Laboratory may provide alternate containers as long as the containers meet the requirements of the method and allow the collection of sufficient volume to perform the analysis.
3. Holding time begins from date of sample collection.

TABLE 4. QUALITY CONTROL REQUIREMENTS AND CORRECTIVE ACTIONS - METALS 6020/200.7 AND MERCURY 7470A
QUALITY ASSURANCE PROJECT PLAN
VISTRA CORP

DATA QUALITY INDICATOR (WHERE APPLICABLE TO SPECIFIC METHOD)	FREQUENCY	CONTROL LIMITS	CORRECTIVE ACTION
Holding Times	Samples must be digested and analyzed within holding time.	Metals: 180 days from collection to analysis for aqueous and solid samples. Mercury: 28 days from collection to analysis.	1. If holding times are exceeded for initial or any re-analyses required due to QC excursions, notify QAO since re-sampling may be required. 2. Document corrective action in the case narrative.
ICP/MS tuning, Mass Calibration and Resolution Checks	Analyze tune solution at least 4 times after the instrument has equilibrated prior to sample analysis. Evaluate mass calibration and resolution checks in the mass regions of interest. Solution contains elements representing all of the mass regions of interest (such as Li, Co, In, Tl) to verify resolution and mass calibration within criteria.	1. Verify instrument stability by an analysis of the tuning solution for at least four integrations with relative standard deviations of <5% for the analytes contained in the tuning solution. 2. If mass calibration is >0.1amu from the true value, mass calibration must be adjusted to correct values. 3. Resolution must be less than 0.9 atomic mass units (amu) of full width at 10% of peak height. 4. Provide documentation of mass calibration and resolution evaluations in the data package.	1. Identify and correct problem, and retune instrument - samples cannot be analyzed until tune criteria is met.
ICP/MS Initial and Continuing Calibration Verification (ICV, CCV)	Calibration includes a calibration blank and a single high standard or multi-point standards (three non-zero standards that effectively bracket the desired sample concentration range). Calibration standard solutions must contain appropriate internal standard for each target element. For ICP/MS, prior to preparing standards, each stock solution must be analyzed separately to determine any interferences. The initial calibration verification (ICV) must be prepared in the same matrix as the calibration standards but as an independent standard (second-source calibration verification [SCV]) near the midpoint and at the low concentration of the linear range at a concentration other than the calibration standards. Verify calibration with ICV, ICB immediately after calibration. Verify with CCV, CCB at frequency of every 10 samples and at the end of the sequence.	ICV, CCV must be 90% to 110% of expected value for ICP/MS. If the ICP/MS is re-sloped or recalibrated after the ICV is analyzed, a new CCV, CCB must be analyzed prior to sample analysis. Provide documentation of calibration standard monitoring and evaluation.	1. Reanalyze. 2. If criteria are still not met, terminate analysis, identify and correct problem, recalibrate, and contact QAO. 3. Document corrective action in case narrative - samples cannot be analyzed until calibration control limit criteria have been met.
Lower Limit of Quantitation Check (LLQC)	For ICP, LLQC is a standard at the RL concentration analyzed quarterly for all elements at the RL level.	The percent recovery of the LLQC must meet the laboratory established control limits.	1. The LLQC shall be re-analyzed immediately for those analytes; if the results of the re-analysis for those analytes fall within the control limits, no further corrective action is required. 2. If the results of the re-analysis for those analytes do not fall within the control limits, the analysis shall be terminated, the problem corrected, the instrument recalibrated, the LLQC analyzed, and the samples associated with the LLQC re-analyzed. 3. Document any observation or corrective action in the case narrative.
Internal Standard	Monitored for all samples, blanks, standards, and QC samples analyzed.	Internal standard counts should be within 30% of Internal standard counts of the calibration standard for all samples and standards.	1. If internal standard area is not within 30%, review the internal areas of the closest calibration blanks for compliance. If the calibration blanks meet criteria; dilute the sample five fold and reanalyze. 2. If the internal standard area of the calibration blank is also outside of 30%, stop sample analysis and recalibrate.

TABLE 4. QUALITY CONTROL REQUIREMENTS AND CORRECTIVE ACTIONS - METALS 6020/200.7 AND MERCURY 7470A
QUALITY ASSURANCE PROJECT PLAN
VISTRA CORP

DATA QUALITY INDICATOR (WHERE APPLICABLE TO SPECIFIC METHOD)	FREQUENCY	CONTROL LIMITS	CORRECTIVE ACTION
Internal Standard for ICP/MS	Appropriate internal standard as listed in Method 6020 is required for each analyte. The internal standard should be no more than 50 amu from the target element. Recommended internal standards include 6Li, 45 Sc, 89Y, 103 Rh, 115In, 159Tb, 169Ho, 209Bi.	Intensity of all internal standards must be monitored for every analysis. The intensity of any internal standard must be >70% or <130% of the intensity of the internal standard in the initial calibration standard or blank. Document internal standard intensity and the evaluation for each analysis performed and include in the data package. The intensity of the internal standard of the CCB and CCV must agree within ±20% of the intensity of the internal standard in the ICV or calibration blank.	1. If sample analysis fails, dilute the sample fivefold (1+4), adjust internal standard and reanalyze. 2. Repeat until internal standard intensify meets criteria. 3. If the CCB or CCV intensity fails, terminate analysis, identify and correct problem, recalibrate, verify calibration and reanalyze samples, document in the case narrative, and contact QAO.
Contract Required Detection Limit (CRDL) Standard for ICP, ICPMS and AA.	1. For ICP, the CRDL is the RL concentration at the beginning and end of each run for all elements at the RL level. 2. The CRDL shall be run for every wavelength used for analysis.	The percent recovery of the CRDL must meet the control limits of 70-130%.	1. The CRDL shall be re-analyzed immediately for those analytes; if the results of the re-analysis for those analytes fall within the control limits, no further corrective action is required. 2. If the results of the re-analysis for those analytes do not fall within the control limits, narrate the failure in the case narrative. 3. Document any corrective action in case narrative.
Initial and Continuing Calibration Blank (ICB/CCB) (Iron, manganese, calcium)	After ICV, CCV, at beginning and end of run and at a rate of 10%.	The absolute value of the ICB and CCB must not exceed the RL.	1. Identify and correct problem. 2. If criteria are still not met, recalibrate and reanalyze affected samples. 3. Document corrective action in the case narrative - samples should not be analyzed until blank control limit criteria have been met.
Preparation Blank (PB) Analysis	1 per batch of samples digested, or 1 in 20, whichever is greater. PB shall be carried through the complete procedure and contain the same acid concentration in the final solution as the sample solution used for analysis.	The absolute value of the method blank must not exceed the RL.	1. Reanalyze blank. 2. If limits are still exceeded, clean instrument and recalibrate analytical system and re-preparation and reanalyze affected samples if detected. 3. Document corrective action in the case narrative - samples cannot be analyzed until blank criteria are met.
Field Blank Analysis	Collected one per 10 samples or once per sampling event.	Less than RL.	1. Investigate problem. 2. Document in the case narrative.
Rinse Blank	Rinse blank must be analyzed following every sample and standard to flush the instrument.	Not applicable.	Not applicable.
Laboratory Control Sample (LCS)	Every 20 samples or each digestion batch. Prepared independently from calibration standards. LCS must contain all target analytes.	Recovery within laboratory control limits. The lowest acceptable control limits for recovery will be 10%.	1. Reanalyze LCS and examine results of other QC analyses. 2. If recovery is still outside limits, and other QC criteria are met, report both runs. 3. If other QC criteria have not been met, stop analysis, locate and correct problem, recalibrate instrument and reanalyze samples since last satisfactory LCS. 4. Document corrective action in the case narrative.
Serial Dilution Analysis for ICP (Metals)	Required once per analytical batch when analyte concentration is >50 times the instrument IDL or MDL. Samples from the investigation must be used for Serial dilution analysis.	An analysis of a 1:5 dilution of the sample should provide a result with 90% to 110% of the original determination (for concentrations 50x the MDL.	1. Report results 2. Document corrective action in the case narrative.

TABLE 4. QUALITY CONTROL REQUIREMENTS AND CORRECTIVE ACTIONS - METALS 6020/200.7 AND MERCURY 7470A
QUALITY ASSURANCE PROJECT PLAN
VISTRA CORP

DATA QUALITY INDICATOR (WHERE APPLICABLE TO SPECIFIC METHOD)	FREQUENCY	CONTROL LIMITS	CORRECTIVE ACTION
Serial Dilution Analysis for ICP/MS	Required when analyte concentration is >100 times the reagent blank and is within the linear range of the ICP/MS. Performed for every 20 samples for each matrix or per batch.	An analysis of a 1:4 dilution of the sample should provide a result with 90% to 110% of the original determination.	1. Qualify data. 2. Document corrective action in the case narrative.
Interference Check Sample Analysis for ICP (Metals)	Beginning of each analytical for ICP. Solution A consists of the interferents, and Solution AB consists of the analytes mixed with the interferents.	Results for the ICS Solution AB (ICSAB) during the analytical runs shall fall within the control limit of ±2 times the RL of the true value or ±20% of the true value, whichever is greater, for the analytes included in the ICSAB.	1. Reanalyze. 2. If limits are still exceeded, adjust instrument. 3. Restart analytical run and reanalyze samples analyzed since last satisfactory ICS. 4. Document corrective action in the case narrative.
Interference Check Sample Analysis for ICP/MS	Beginning of each analytical run or once during every 12 hours, whichever is more frequent for ICP/MS. For measurement of elemental, molecular-ion isobaric interference corrections. ICSA/ICSAB contains known concentration of interfering elements that will demonstrate the magnitude of the molecular-ion isobaric interferences to verify that the interferences are corrected by the data system within the control limits.	Percent recovery of all elements must be within current laboratory control limits. Document the ICSA/ICSAB evaluations and include in the data package.	1. Reanalyze. 2. If limits are still exceeded, adjust interference corrections for instrument, contact QAO, samples cannot be analyzed until ICSA/ICSAB control limit criteria have been met. 3. Restart analytical run and reanalyze samples analyzed since last satisfactory ICS. 4. Document corrective action in the case narrative.
Matrix Spike Analysis	Collected one per 20 samples or one per matrix (for less than 20 samples). Samples from the investigation must be used for MS/MSD analysis.	Recovery within laboratory control limits or 75-125%, or in-house laboratory limits. Recovery does not apply if sample concentration > 4 X spike concentration. Spike must contain all analytes. The lowest acceptable laboratory control limits for recovery will be 10%.	1. Analyze post-digestion/post-distillation spike. 2. Document corrective action in the case narrative.
Post-Digestion Spike	Spike must contain all target elements. Performed every 20 samples as necessary.	Recovery within 75-125% of true value.	1. Dilute sample and reanalyze. 2. If recovery is outside limits, document in the case narrative. 3. Standard additions may be used to compensate for matrix effects.
Internal standard (Metals)	May be used for each sample instead of post-digestion spike.	Internal Standard counts must be within 30% of Internal Standard counts of ICB for ICP-MS.	Reanalyze.
Laboratory Duplicate or Matrix Spike Duplicate Analysis	Field collected - Samples from the investigation must be used for Laboratory Duplicate and MSD analysis.	Laboratory control limit or 20% for RPD shall be used for original and duplicate sample values greater than or equal to five times the RL. A control limit of the RL value shall be used if either the sample or duplicate value is less than five times the CRQL.	1. Investigate problem and reanalyze. 2. Document corrective action in the case narrative.
Field Duplicate Analysis	Field collected - The field duplicate identification will not be provided to the laboratory.	Validation criteria: 30% RPD for waters. For sample results that are less than or equal to five times the RL, the criterion of plus or minus two times the RL will be applied to evaluate field duplicates.	No corrective action required of the laboratory since the laboratory will not know the identity of the field duplicate samples. If these criteria are not met, sample results will be evaluated on a case-by-case basis.
Laboratory Control Limits	Generated with results for an analyte from a minimum of 20 sample analyses. The average of the sample results and the standard deviation are calculated. The internal warning limits are established at 2 times the standard deviation and the control limits are established at 3 times the standard deviation. The control limits are updated annually.	Not applicable.	Not applicable.

TABLE 4. QUALITY CONTROL REQUIREMENTS AND CORRECTIVE ACTIONS - METALS 6020/200.7 AND MERCURY 7470A
QUALITY ASSURANCE PROJECT PLAN
VISTRA CORP

DATA QUALITY INDICATOR (WHERE APPLICABLE TO SPECIFIC METHOD)	FREQUENCY	CONTROL LIMITS	CORRECTIVE ACTION
System Operation for ICP/MS	Use an average of 3 integrations for both the calibration and sample analysis. All masses which could affect data quality will be monitored to determine the potential effect from the matrix. Isotopes listed in the method should be used.	Not applicable.	Not applicable.
Interference Monitoring for ICP/MS	The analyst is required to monitor potential sources of interferences by measuring the elements of interest or a molecular species that may indicate the presence of an interferent and by taking appropriate action to ensure data of known quality. Interferences must be corrected by using correction equations based on observed isotopic signals and by monitoring the intensity of the internal standards. The rinse period between samples must be long enough to eliminate significant memory interferences. 5. Extensive QC for interference corrections must be performed. Samples exhibiting isobaric elemental interferences (isotopes of different elements with similar mass to charge ratio or very high ion currents at adjacent masses) require resolution improvement, matrix separation, or alternate isotopes.	Not applicable.	Not applicable.
Analyte Quantitation	Concentrations for ICP/MS analysis are reported based on dry weight of the sample. Calculations for the ICP/MS should include appropriate interference corrections, internal standard normalization, and summation of signals at 206, 207, and 208 mass to charge for lead. All QC criteria must be met when applying correction equations. If interference is detected, elements impacted are flagged to indicate percentage interference correction applied to the data or an uncorrected interference because of the equation used for quantitation.	Not applicable.	Not applicable.
Dilutions for ICP/MS	Analyze samples at a 1:5 dilution. Dilute and reanalyze samples with concentrations that are still greater than the linear range of the instrument. The laboratory will note in the data package which analytical runs were used to report the sample results.	Not applicable.	Not applicable.
MDL Determination	Before any field samples are analyzed, the MDLs shall be determined for non-prepared analyses, each digestion procedure and instrument used, prior to the start of analyses. MDL studies are conducted or verified at least annually.	Not applicable.	Not Applicable.
Linear Range Analysis for ICP	Every 6 months must be routinely monitored by analysis of high concentration standard.	Results for high point standard must be within 10% of true value.	Not applicable.

TABLE 4. QUALITY CONTROL REQUIREMENTS AND CORRECTIVE ACTIONS - METALS 6020/200.7 AND MERCURY 7470A
QUALITY ASSURANCE PROJECT PLAN
VISTRA CORP

DATA QUALITY INDICATOR (WHERE APPLICABLE TO SPECIFIC METHOD)	FREQUENCY	CONTROL LIMITS	CORRECTIVE ACTION
Interelement Correction For ICP	Within 6 months of the start of analysis and annually. Correction factors for Al, Ca, Fe, and Mg must be reported and for others if they are applied.	Not applicable.	Not applicable.
Sample Batching	The laboratory will batch project samples together along with QC samples specified from the project. Non-project information will not be included in the data packages.	Not applicable.	Not applicable.
Dilutions	1. When target analyte concentration exceed linear dynamic range of the instrument. 2. When matrix interference demonstrated by lab and documented in the case narrative. 3. Laboratory will note in the data deliverables which analytical runs were reported.	Not applicable.	Not applicable.
Deliverables	1. Full CLP-like deliverables must be provided to document each audit item for easy reference and inspection. 2. An example calculation will be provided for each analysis, for each type of matrix in the data package using samples from the project. 3. Any laboratory abbreviations or notations presented in the raw data or summary information will be explained or referenced in the case narrative. 4. Final spiking concentrations will be presented in summary form. 5. Standard tracing information will be provided. 6. Cooler temperatures will be provided in the data packages. 7. Run logs will be provided in the data packages.	Not applicable.	Provide missing or additional deliverables for validation purposes.
Method and QAPP Requirements	The laboratory will perform the method as presented in this QAPP and will adhere to the QAPP requirements presented herein. Otherwise the laboratory will specifically note any procedures that differ from the method or the QAPP in the data package case narrative.	Not applicable.	Not applicable.

TABLE 5. QUALITY CONTROL REQUIREMENTS AND CORRECTIVE ACTIONS - ALKALINITY, ANIONS, TOTAL DISSOLVED SOLIDS
QUALITY ASSURANCE PROJECT PLAN
VISTRA CORP

DATA QUALITY INDICATOR (WHERE APPLICABLE TO SPECIFIC METHOD)	FREQUENCY	CONTROL LIMITS	CORRECTIVE ACTION
Holding Times	Samples must be analyzed within holding time.	Alkalinity: Analyze within 14 days from collection. Chloride, Fluoride, and Sulfate: Analyze within 28 days from collection. Total Dissolved Solids: Analyze within 7 days from collection.	1. If holding times are exceeded for initial or any re-analyses required due to QC excursions, notify the Quality Assurance Officer (QAO) since re-sampling may be required. 2. Document corrective action in the case narrative.
Initial Calibration	Prior to sample analysis.	Anions: 1. Five concentrations for each target analyte bracketing expected concentration range for all target compounds. One standard must be at the RL concentration. 2. Do not force the calibration line through zero. 3. Linear calibration using response factor with RSD less than or equal to 10% or use linear regression. If RSD <10% the average calibration factor (external calibration) is used for quantitation. 4. For compounds with RSD greater than 10% use linear calibration that does not pass through the origin with least squares regression (r for un-weighted least squares regression, Coefficient of Determination or r2 must be greater than 0.990) or non-linear calibration using no more than third order with seven standards, (COD or r2 must be greater than 0.990). Alkalinity: 2.Alkalinity - Slope between 92 and 102. Each reading ± 0.05 S.U. of pH standard; same applies to Standard Reference Materials (SRMs).	1. Reanalyze. 2. If criteria are still not met, identify and correct problem, recalibrate. 3. Document corrective action in the case narrative - samples cannot be analyzed until calibration criteria have been met.
Initial and Continuing Calibration Verification (ICV, CCV)	ICV analyzed following initial calibration and CCV after every 10 samples and at the end of the sequence.	ICV/CCV: Recovery of 90% to 110% of true value.	1. Reanalyze. 2. If criteria are still not met, identify and correct problem, recalibrate. 3. Document corrective action in the case narrative - samples cannot be analyzed until calibration criteria have been met.
Initial and Continuing Calibration Blank (ICB/CCB)	After ICV, CCV, at beginning and end of run and at a rate of 10% or every 2 hours during run.	The absolute value of the ICB and CCB must not exceed the RL.	1. Identify and correct problem. 2. If criteria are still not met, recalibrate and reanalyze affected samples. 3. Document corrective action in the case narrative - samples cannot be analyzed until blank control limit criteria have been met.
Retention Time Windows	Retention time windows (absolute retention time) must be established.	Compounds must be within established retention time windows for the associated calibration standards. Retention time windows must be provided for each calibration verification.	1. Reanalyze. 2. If criteria are still not met, identify and correct problem, recalibrate; reanalyze samples back to last compliant calibration standard. 3. Document corrective action in the case narrative.
Preparation Blank Analysis	1 per batch of samples digested, or 1 in 20, whichever is greater. PB shall be carried through the complete procedure and contain the same reagent concentration in the final solution as the sample solution used for analysis.	1. The absolute value of the method blank must not exceed the RL.	1. Reanalyze blank. 2. If limits are still exceeded, clean instrument and recalibrate analytical system and re-preparation and reanalyze affected samples if detected. 3. Document corrective action in the case narrative - samples cannot be analyzed until blank criteria are met.

TABLE 5. QUALITY CONTROL REQUIREMENTS AND CORRECTIVE ACTIONS - ALKALINITY, ANIONS, TOTAL DISSOLVED SOLIDS
QUALITY ASSURANCE PROJECT PLAN
VISTRA CORP

DATA QUALITY INDICATOR (WHERE APPLICABLE TO SPECIFIC METHOD)	FREQUENCY	CONTROL LIMITS	CORRECTIVE ACTION
Laboratory Control Sample Analysis	Every 20 samples or each preparation batch. Prepared independently from calibration standards.	Recovery within laboratory control limits. The lowest acceptable control limits for recovery will be 10%.	1. Reanalyze LCS and examine results of other QC analyses. 2. If recovery is still outside limits, and other QC criteria are met, report both runs. 3. If other QC criteria have not been met, stop analysis, locate and correct problem, recalibrate instrument and reanalyze samples since last satisfactory LCS. 4. Document corrective action in the case narrative.
Matrix Spike Analysis	Collected per project requirements. Spike must contain all analytes. Samples from the investigation must be used for MS/MSD analysis. If samples were not designated as MS/MSD samples, contact QAO upon receipt of samples at the laboratory.	Recovery within laboratory control limits or 75-125%. Recovery does not apply if sample concentration > 4 X spike concentration. The lowest acceptable laboratory control limits for recovery will be 10%.	1. Document corrective action in the case narrative.
Laboratory Duplicate or Matrix Spike Duplicate Analysis	Collected per project requirements. Samples from the investigation must be used for Laboratory Duplicate and MSD analysis.	Laboratory control limit or 20% for RPD shall be used for original and duplicate sample values greater than or equal to five times the RL. A control limit of the RL value shall be used if either the sample or duplicate value is less than five times the RL.	1. Investigate problem and reanalyze. 2. Document corrective action in the case narrative.
Field / Equipment Blank Analysis	Collected per project requirements.	Less than RL.	1. Investigate problem. 2. Document in the case narrative.
Field Duplicate Analysis	Collected per project requirements. The field duplicate identification will not be provided to the laboratory.	30% RPD for waters. For sample results that are less than or equal to five times the RL, the criterion of plus or minus two times the RL will be applied to evaluate field duplicates.	No corrective action required of the laboratory since the laboratory will not know the identity of the field duplicate samples. If these criteria are not met, sample results will be evaluated on a case-by-case basis.
Dilutions	1. When target analyte concentration exceed upper limit of calibration curve. 2. When matrix interference demonstrated by lab and documented in the case narrative. 3. Laboratory will note in the data deliverables which analytical runs were reported.	Not applicable.	Not applicable.
Sample Batching	The laboratory will batch project samples together along with QC samples specified from the project. Non-project information will not be included in the data packages.	Not applicable.	Not applicable.
Deliverables	1. Full CLP deliverables must be provided to document each audit item for easy reference and inspection. 2. An example calculation will be provided for each analysis, for each type of matrix in the data package. 3. Any laboratory abbreviations or notations presented in the raw data or summary information will be explained or referenced in the case narrative. 4. Final spiking concentrations will be presented in summary form. 5. Standard tracing information will be provided upon request. 6. Cooler temperatures will be provided in the data packages. 7. Run logs will be provided in the data packages.	Not applicable.	Provide missing or additional deliverables for validation purposes.

TABLE 5. QUALITY CONTROL REQUIREMENTS AND CORRECTIVE ACTIONS - ALKALINITY, ANIONS, TOTAL DISSOLVED SOLIDS
QUALITY ASSURANCE PROJECT PLAN
VISTRA CORP

DATA QUALITY INDICATOR (WHERE APPLICABLE TO SPECIFIC METHOD)	FREQUENCY	CONTROL LIMITS	CORRECTIVE ACTION
Method and QAPP Requirements	The laboratory will perform the method as presented in this QAPP and will adhere to the QAPP requirements presented herein. Otherwise the laboratory will specifically note any procedures that differ from the method or the QAPP in the data package case narrative.	Not applicable.	Not applicable.

TABLE 6. QUALITY CONTROL REQUIREMENTS AND CORRECTIVE ACTIONS - RADIUM 226 AND 228
QUALITY ASSURANCE PROJECT PLAN
VISTRA CORP

DATA QUALITY INDICATOR (WHERE APPLICABLE TO SPECIFIC METHOD)	FREQUENCY	CONTROL LIMITS	CORRECTIVE ACTION
Holding Times	Samples must be prepared and analyzed within holding time.	180 days from collection	1. If holding times are exceeded for initial or any re-analyses required due to QC excursions, notify the QAO since re-sampling may be required. 2. Document corrective action in the case narrative.
Calibration	Each detector must be calibrated annually or unacceptable change is detected. Standards must be valid.	The detector resolution must not exceed 10% of the manufacturer's specifications.	1. Repeat calibration until criteria are met. 2. Document corrective actions in the case narrative.
Detector Backgrounds	At a minimum, the Lucas Cells are counted on the day of use and for the same duration as the samples.	Background for each detector will not contain any target analytes above the required detection limit (RDL).	1. Repeat background until criteria are met. 2. Document corrective actions in the case narrative.
Background Check	Background is checked every day of use.	Results must be within ± 3 standard deviations of the decay corrected value for each isotope in the source.	1. Repeat until criteria are met. 2. Document corrective actions in the case narrative.
Preparation Blank Analysis	One blank with each sample batch. Counted for the same count duration as the samples. MDC calculated based on greatest sample volume or weight of the sample batch.	The MDC must meet the RDL. Activity must be less than or equal to the RDL.	1. Reanalyze blank. 2. If limits are still exceeded, clean instrument and recalibrate analytical system and re-preparation and reanalyze affected samples if detected. 3. Document corrective action in the case narrative.
Field / Equipment Blank Analysis	Collected one per sampling equipment and after every 20 samples.	Less than RDL.	1. Investigate problem. 2. Document in the case narrative.
Laboratory Control Sample Analysis	Every 20 samples or each digestion batch. The LCS used must be the same matrix and geometry and at an appropriate activity of the samples in the analytical batch. The LCS must be counted for the same duration and the spectra processed in the same manner (instrument calibration parameters, algorithms) as the samples in the analytical batch.	Recovery within laboratory control limits.	1. Reanalyze LCS. 2. Stop analysis, locate and correct problem, recalibrate instrument and reanalyze samples since last satisfactory LCS. 3. Document corrective action in the case narrative.
Laboratory Duplicate	One for each analytical batch of 20 samples or less. The duplicate must be counted for the same duration as the sample.	RPD < laboratory control limit.	1. Reanalyze duplicate. 2. Document corrective action in the case narrative.
Field Duplicate Analysis	Collected 1 per matrix; every 20 samples of similar matrix	30% RPD for waters.	No corrective action required of the laboratory since the laboratory will not know the identity of the field duplicate samples. If these criteria are not met, sample results will be evaluated on a case-by-case basis.

TABLE 6. QUALITY CONTROL REQUIREMENTS AND CORRECTIVE ACTIONS - RADIUM 226 AND 228
QUALITY ASSURANCE PROJECT PLAN
VISTRA CORP

DATA QUALITY INDICATOR (WHERE APPLICABLE TO SPECIFIC METHOD)	FREQUENCY	CONTROL LIMITS	CORRECTIVE ACTION
Sample re-analysis	Re-analysis should be performed for the sample batch for the following: 1. Sample detection limit target not met. 2. Inadequate aliquot size 3. Inadequate count duration 4. Low detector efficiencies 5. High detector backgrounds 6. LCS ± the error is outside of the known value ± the error of the measurement 7. Preparation blank activity greater than target analyte RDL	Not applicable	Not applicable
Laboratory control limits	1. Generated with results from a minimum of 20 analyses. The average of the sample results and the standard deviation are calculated. The internal warning limits are established at 2 times the standard deviation and the control limits are established at 3 times the standard deviation. The control limits are updated annually.	Not applicable	Not applicable
Minimum Detectable Concentration (MDC)	MDC will be provided for each sample and QC sample analyzed.	Not applicable	Not applicable
Case narrative	The case narrative must address the following (where applicable): 1. Data interpretation used to report results or resolution of interference issues. 2. Sample preparation description. 3. Modifications of methods used.	Not applicable	Not applicable
Sample Batching	The laboratory will batch project samples together along with QC samples specified from the project. Non-project information will not be included in the data packages.	Not applicable	Not applicable
Deliverables	1. CLP-like deliverables must be provided to document each audit item for easy reference and inspection. 2. Analytical sequence logs, including geometry used for each analysis, for calibration, sample and QC samples will be provided in the data packages. 3. Preparation logs will be included for each sample and QC sample will be provided in the data package. 4. The certificates of calibrations for each standard used in the analysis will be provided in the data package. 5. Any laboratory abbreviations or notations presented in the raw data or summary information will be explained or referenced in the case narrative. 6. Final spiking concentrations will be presented in summary form. 7. Standard tracing information will be provided. 8. Cooler temperatures will be provided in the data packages.	Not applicable	Provide missing or additional deliverables for validation purposes.
Method and QAPP Requirements	The laboratory will perform the method as presented in this QAPP and will adhere to the QAPP requirements presented herein. Otherwise the laboratory will specifically note any procedures that differ from the method or the QAPP in the data package case narrative.	Not applicable.	Not applicable.

FIGURES

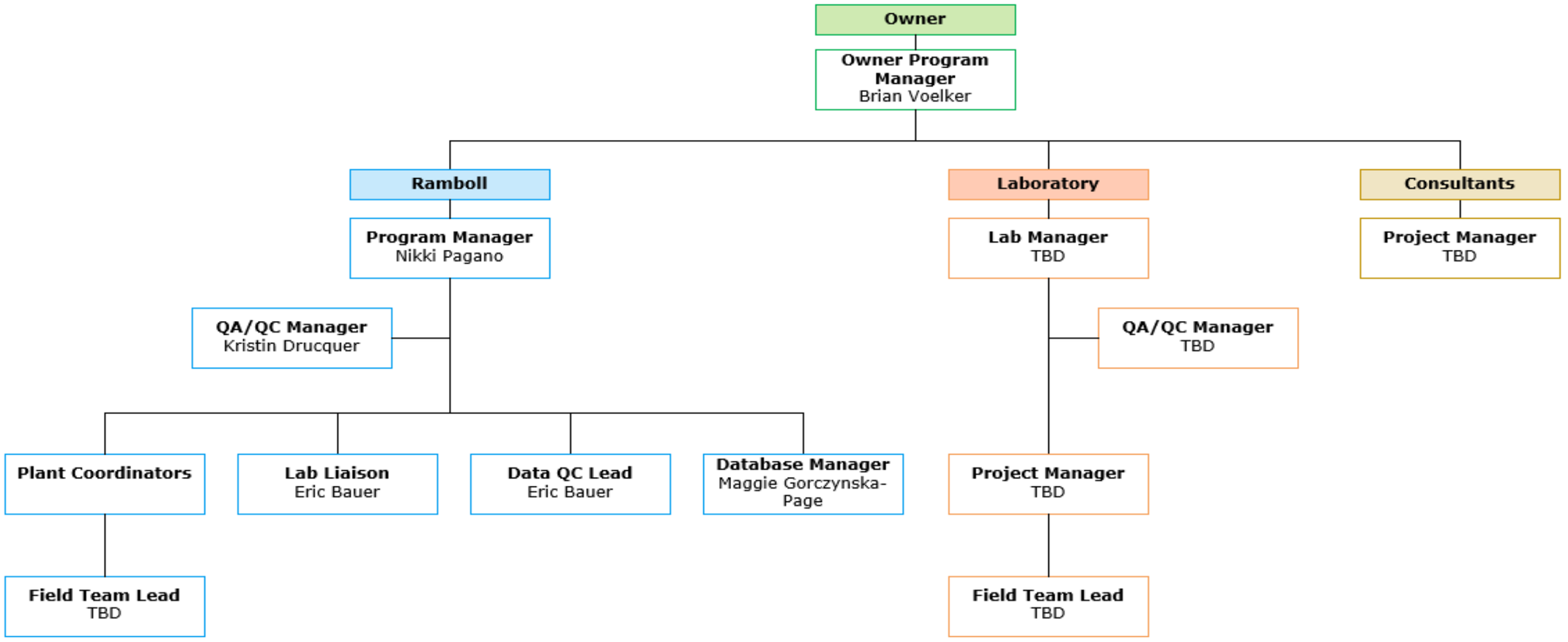

FIGURE 1. ORGANIZATION FLOW CHART

APPENDICES

APPENDIX A
GROUNDWATER ANALYTICAL METHODS AND ANALYTICAL PERFORMANCE CRITERIA FOR COMPLIANCE SAMPLING

APPENDIX A. GROUNDWATER ANALYTICAL METHODS AND ANALYTICAL PERFORMANCE CRITERIA FOR COMPLIANCE SAMPLING
QUALITY ASSURANCE PROJECT PLAN
VISTRA CORP

Constituent	Unit	Analytical Methods [1]	Screening Level	Source [2,3]	RL [4]	MDL [4]	LCS Recovery Control Limits [5]	LCS/LCSD Control RPD [5]	MS/MSD Recovery Control Limits [5]	MS/MSD or Lab Duplicate RPD Control Limits [5]
VOCs										
1,1,1,2-Tetrachloroethane	µg/L	8260B					80-120	20	70-130	30
1,1,1-Trichloroethane	µg/L	8260B	200	MCL			80-120	20	70-130	30
1,1,2,2-Tetrachloroethane	µg/L	8260B					80-120	20	70-130	30
1,1,2-Trichloroethane	µg/L	8260B	5	MCL			80-120	20	70-130	30
1,1-Dichloroethane	µg/L	8260B	7	MCL			80-120	20	70-130	30
1,1-Dichloroethene	µg/L	8260B					80-120	20	70-130	30
1,1-Dichloropropene	µg/L	8260B					80-120	20	70-130	30
1,2,3-Trichlorobenzene	µg/L	8260B					80-120	20	70-130	30
1,2,3-Trichloropropane	µg/L	8260B					80-120	20	70-130	30
1,2,4-Trichlorobenzene	µg/L	8260B	70	MCL			80-120	20	70-130	30
1,2,4-Trimethylbenzene	µg/L	8260B					80-120	20	70-130	30
1,2-Dibromo-3-chloropropane	µg/L	8260B or 8011	.2	MCL			80-120	20	70-130	30
1,2-Dibromoethane (Ethylene dibromide)	µg/L	8260B or 8011	0.05	MCL			80-120	20	70-130	30
1,2-Dichlorobenzene	µg/L	8260B	600	MCL			80-120	20	70-130	30
1,2-Dichloroethane	µg/L	8260B	5	MCL			80-120	20	70-130	30
1,2-Dichloroethene (Dichloroacetylene)	µg/L	8260B					80-120	20	70-130	30
1,2-Dichloropropane	µg/L	8260B	5	MCL			80-120	20	70-130	30
1,3,5-Trimethylbenzene	µg/L	8260B					80-120	20	70-130	30
1,3-Dichlorobenzene	µg/L	8260B					80-120	20	70-130	30
1,3-Dichloropropane	µg/L	8260B					80-120	20	70-130	30
1,3-Dichloropropene	µg/L	8260B					80-120	20	70-130	30
1,4-Dichloro-2-Butene, trans-	µg/L	8260B					80-120	20	70-130	30
1,4-Dichloro-2-butenem, trans-	µg/L	8260B					80-120	20	70-130	30
1,4-Dichlorobenzene	µg/L	8260B	75	MCL			80-120	20	70-130	30
1-Butanol	µg/L	8260B					80-120	20	70-130	30
1-Propanol	µg/L	8260B					80-120	20	70-130	30
2,2-Dichloropropane	µg/L	8260B					80-120	20	70-130	30
2-Chloroethyl vinyl ether	µg/L	8260B					80-120	20	70-130	30
2-Propanol (Isopropanol)	µg/L	8260B					80-120	20	70-130	30
2-Hexanone	µg/L	8260B					80-120	20	70-130	30
4-Methyl-2-pentanone	µg/L	8260B					80-120	20	70-130	30
Acetone	µg/L	8260B					80-120	20	70-130	30
Acrylonitrile	µg/L	8260B					80-120	20	70-130	30
Benzene	µg/L	8260B	5	MCL			80-120	20	70-130	30
bis (chloromethyl) ether	µg/L	8260B					80-120	20	70-130	30
Bromobenzene	µg/L	8260B					80-120	20	70-130	30
Bromodichloromethane	µg/L	8260B					80-120	20	70-130	30
Bromoform	µg/L	8260B					80-120	20	70-130	30
Butylbenzene, n-	µg/L	8260B					80-120	20	70-130	30
Butylbenzene, sec-	µg/L	8260B					80-120	20	70-130	30
Butylbenzene, tert-	µg/L	8260B					80-120	20	70-130	30

APPENDIX A. GROUNDWATER ANALYTICAL METHODS AND ANALYTICAL PERFORMANCE CRITERIA FOR COMPLIANCE SAMPLING
QUALITY ASSURANCE PROJECT PLAN
VISTRA CORP

Constituent	Unit	Analytical Methods [1]	Screening Level	Source [2,3]	RL [4]	MDL [4]	LCS Recovery Control Limits [5]	LCS/LCSD Control RPD [5]	MS/MSD Recovery Control Limits [5]	MS/MSD or Lab Duplicate RPD Control Limits [5]
Carbon Disulfide	µg/L	8260B					80-120	20	70-130	30
Carbon Tetrachloride	µg/L	8260B	5	MCL			80-120	20	70-130	30
Chlorobenzene	µg/L	8260B	100	MCL			80-120	20	70-130	30
Chlorobromomethane (Bromochloromethane)	µg/L	8260B					80-120	20	70-130	30
Chlorodibromomethane (Dibromochloromethane)	µg/L	8260B					80-120	20	70-130	30
Chloroethane	µg/L	8260B					80-120	20	70-130	30
Chloroform	µg/L	8260B					80-120	20	70-130	30
Chlorotoluene, o- (2-Chlorotoluene)	µg/L	8260B					80-120	20	70-130	30
Chlorotoluene, p- (4-Chlorotoluene)	µg/L	8260B					80-120	20	70-130	30
cis 1,2-Dichloroethene	µg/L	8260B	70	MCL			80-120	20	70-130	30
cis 1,3-Dichloropropene	µg/L	8260B					80-120	20	70-130	30
Dichlorodifluoromethane	µg/L	8260B					80-120	20	70-130	30
Ethyl acetate	µg/L	8260B					80-120	20	70-130	30
Ethylbenzene, total	µg/L	8260B	700	MCL			80-120	20	70-130	30
Hexachlorobutadiene	µg/L	8260B					80-120	20	70-130	30
Iodomethane	µg/L	8260B					80-120	20	70-130	30
Isopropylbenzene	µg/L	8260B					80-120	20	70-130	30
Isopropyltoluene, p-	µg/L	8260B					80-120	20	70-130	30
Methyl Bromide (Bromomethane)	µg/L	8260B					80-120	20	70-130	30
Methyl Chloride (Chloromethane)	µg/L	8260B					80-120	20	70-130	30
Methyl Ethyl Ketone (MEK) (2-Butanone)	µg/L	8260B					80-120	20	70-130	30
Methylene Bromide (Dibromomethane)	µg/L	8260B					80-120	20	70-130	30
Methylene Chloride (Dichloromethane)	µg/L	8260B	5	MCL			80-120	20	70-130	30
Naphthalene	µg/L	8260B					80-120	20	70-130	30
Propylbenzene, n-	µg/L	8260B					80-120	20	70-130	30
Styrene	µg/L	8260B	100	MCL			80-120	20	70-130	30
Tetrachloroethene	µg/L	8260B	5	MCL			80-120	20	70-130	30
Tetrahydrofuran	µg/L	8260B					80-120	20	70-130	30
Toluene	µg/L	8260B	1000	MCL			80-120	20	70-130	30
trans 1,2-Dichloroethene	µg/L	8260B	100	MCL			80-120	20	70-130	30
trans-1,3-Dichloropropylene	µg/L	8260B					80-120	20	70-130	30
Trichloroethene	µg/L	8260B	5	MCL			80-120	20	70-130	30
Trichlorofluoromethane	µg/L	8260B					80-120	20	70-130	30
Vinyl Acetate	µg/L	8260B					80-120	20	70-130	30
Vinyl Chloride	µg/L	8260B	2	MCL			80-120	20	70-130	30
Xylene, m- & p-	µg/L	8260B					80-120	20	70-130	30
Xylene, o-	µg/L	8260B					80-120	20	70-130	30
Xylene, total	µg/L	8260B	10,000	MCL			80-120	20	70-130	30
SVOC										
2,4,5-Trichlorophenol	µg/L	8270C					80-120	20	70-130	30
2,4,6-Trichlorophenol	µg/L	8270C					80-120	20	70-130	30
2,4-Dichlorophenol	µg/L	8270C					80-120	20	70-130	30

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Constituent	Unit	Analytical Methods [1]	Screening Level	Source [2,3]	RL [4]	MDL [4]	LCS Recovery Control Limits [5]	LCS/LCSD Control RPD [5]	MS/MSD Recovery Control Limits [5]	MS/MSD or Lab Duplicate RPD Control Limits [5]
2,4-Dimethylphenol	µg/L	8270C					80-120	20	70-130	30
2,4-Dinitrophenol	µg/L	8270C					80-120	20	70-130	30
2,4-Dinitrotoluene	µg/L	8270C					80-120	20	70-130	30
2,6-Dinitrotoluene	µg/L	8270C					80-120	20	70-130	30
2-Chloronaphthalene	µg/L	8270C					80-120	20	70-130	30
2-Chlorophenol	µg/L	8270C					80-120	20	70-130	30
2-Methylphenol, total	µg/L	8270C					80-120	20	70-130	30
2-Nitrophenol	µg/L	8270C					80-120	20	70-130	30
3,3-Dichlorobenzidine	µg/L	8270C					80-120	20	70-130	30
4,6-Dinitro-ortho-cresol (DNOC)	µg/L	8270C					80-120	20	70-130	30
4-Bromophenyl phenyl ether	µg/L	8270C					80-120	20	70-130	30
4-Chlorophenyl phenyl ether	µg/L	8270C					80-120	20	70-130	30
4-Methylphenol, total	µg/L	8270C					80-120	20	70-130	30
4-Nitrophenol	µg/L	8270C					80-120	20	70-130	30
Acenaphthene	µg/L	8270C					80-120	20	70-130	30
Alachlor	µg/L	8270C	2	MCL			80-120	20	70-130	30
Aldicarb	µg/L	8270C					80-120	20	70-130	30
Aldrin	µg/L	8270C					80-120	20	70-130	30
Alpha-BHC	µg/L	8270C					80-120	20	70-130	30
Anthracene	µg/L	8270C					80-120	20	70-130	30
Atrazine	µg/L	8270C	3	MCL			80-120	20	70-130	30
Benzo(a)anthracene	µg/L	8270C					80-120	20	70-130	30
Benzo(a)pyrene	µg/L	8270C	0.2	MCL			80-120	20	70-130	30
Benzo(b)fluoranthene	µg/L	8270C					80-120	20	70-130	30
Benzo(g,h,i)perylene	µg/L	8270C					80-120	20	70-130	30
Benzo(k)fluoranthene	µg/L	8270C					80-120	20	70-130	30
Beta-BHC	µg/L	8270C					80-120	20	70-130	30
bis (2-chloroethoxy) methane	µg/L	8270C					80-120	20	70-130	30
bis (2-chloroethyl) ether	µg/L	8270C					80-120	20	70-130	30
bis (2-ethylhexyl) phthalate	µg/L	8270C	400	MCL			80-120	20	70-130	30
Bis(2-chloroisopropyl)ether	µg/L	8270C					80-120	20	70-130	30
Butyl benzyl phthalate, n-	µg/L	8270C					80-120	20	70-130	30
Carbofuran	µg/L	8270C	40	MCL			80-120	20	70-130	30
Chrysene	µg/L	8270C					80-120	20	70-130	30
Cresol, m-	µg/L	8270C					80-120	20	70-130	30
Cresol, m, p-	µg/L	8270C					80-120	20	70-130	30
Cresol, Total	µg/L	8270C					80-120	20	70-130	30
Delta-BHC	µg/L	8270C					80-120	20	70-130	30
Dibenzo(a,h)anthracene	µg/L	8270C					80-120	20	70-130	30
Dieldrin	µg/L	8270C					80-120	20	70-130	30
Diethyl phthalate	µg/L	8270C					80-120	20	70-130	30
Dimethyl phthalate	µg/L	8270C					80-120	20	70-130	30

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Constituent	Unit	Analytical Methods [1]	Screening Level	Source [2,3]	RL [4]	MDL [4]	LCS Recovery Control Limits [5]	LCS/LCSD Control RPD [5]	MS/MSD Recovery Control Limits [5]	MS/MSD or Lab Duplicate RPD Control Limits [5]
di-n-butyl phthalate	µg/L	8270C					80-120	20	70-130	30
di-n-octyl phthalate	µg/L	8270C					80-120	20	70-130	30
Endosulfan sulfate	µg/L	8270C					80-120	20	70-130	30
Endosulfan, alpha	µg/L	8270C					80-120	20	70-130	30
Endosulfan, beta	µg/L	8270C					80-120	20	70-130	30
Endrin aldehyde	µg/L	8270C					80-120	20	70-130	30
Fluoranthene	µg/L	8270C					80-120	20	70-130	30
Fluorene	µg/L	8270C					80-120	20	70-130	30
Hexachlorobenzene	µg/L	8270C	1	MCL			80-120	20	70-130	30
Hexachlorobutadiene	µg/L	8270C					80-120	20	70-130	30
Hexachlorocyclopentadiene	µg/L	8270C	50	MCL			80-120	20	70-130	30
Hexachloroethane	µg/L	8270C					80-120	20	70-130	30
Indeno(1,2,3-cd)pyrene	µg/L	8270C					80-120	20	70-130	30
Naphthalene, total	µg/L	8270C					80-120	20	70-130	30
Nitrobenzene	µg/L	8270C					80-120	20	70-130	30
Nitrosodimethylamine, n-	µg/L	8270C					80-120	20	70-130	30
Nitrosodiphenylamine, n-	µg/L	8270C					80-120	20	70-130	30
Nitrosodipropylamine, n-	µg/L	8270C					80-120	20	70-130	30
Phenanthrene	µg/L	8270C					80-120	20	70-130	30
Pyrene	µg/L	8270C					80-120	20	70-130	30
Pyridine	µg/L	8270C					80-120	20	70-130	30
Simazine	µg/L	8270C	4	MCL			80-120	20	70-130	30
Tetrachlorodibenzo-p-dioxins (TCDD)	µg/L	8270C	0.0004	MCL			80-120	20	70-130	30
Phenols, dissolved	µg/L	9066					80-120	20	70-130	30
Phenols, total	µg/L	9066 or 420.4 Rev1					80-120	20	70-130	30
Inorganics										
Ammonia as Nitrogen, dissolved	mg/L	350.1 REV2 or M4500-NH3 G or Soluble Nutrients					90-110	10	90-110	10
Nitrate nitrogen, dissolved	mg/L	300.0 REV 2.1 or E353.2 or Soluble Anions	10	MCL			80-120	20	80-120	20
Nitrate nitrogen, total	mg/L	300.0 REV 2.1 or E353.2 or Soluble Anions or M4500-NO3 F	10	MCL			80-120	20	80-120	20
Nitrite + Nitrate	mg/L	E353.2					90-110	10	90-110	10
Nitrite nitrogen, dissolved	mg/L	M4500-NO2 B	1	MCL			90-110	10	90-110	10
Nitrite nitrogen, total	mg/L	M4500-NO2 B	1	MCL			90-110	10	90-110	10
Nitrogen, Ammonia	mg/L	350.1 REV2 or M4500-NH3 G or Soluble Nutrients					90-110	10	90-110	10
Nitrogen, kjeldahl, total	mg/L	E351.2 (T) or OIA/PAI-DK03 & EPA 3					90-110	10	90-110	10
Nitrogen, total	mg/L	351.2R2.0/353.2R					90-110	10	90-110	10
Phosphorus, dissolved	mg/L	6020A					80-120	20	75-125	20
Phosphorus, total	mg/L	6020A or 6010B or SM 4500P F 1999					80-120	20	75-125	20
Sulfide, dissolved	mg/L	SM 4500 S2 F 2000					90-110	10	90-110	10
Sulfide, Reactive	mg/L	SM 4500 S2 F 2000					90-110	10	90-110	10
Sulfide, total	mg/L	M4500-S D or SM 4500 S2 F 2000					90-110	10	90-110	10
Sulfur, total	mg/L	6010B					80-120	20	75-125	20
Herbicides										

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2,4,5-Trichlorophenoxyacetic acid	µg/L	515.3 REV1	70	MCL			80-120	20	70-130	30
2,4-Dichlorophenoxyacetic acid (2,4-D)	µg/L	515.3 REV1 or 8321B					80-120	20	70-130	30
Dalapon	µg/L	515.3 REV1	200	MCL			80-120	20	70-130	30
Dicamba (Banvel)	µg/L	515.3 REV1					80-120	20	70-130	30
Dinoseb (DNBP)	µg/L	515.3 REV1	7	MCL			80-120	20	70-130	30
Endothall	µg/L	548.1 REV1	100	MCL			80-120	20	70-130	30
MCPP	µg/L	8151A					80-120	20	70-130	30
Picloram	µg/L	515.3 REV1	500	MCL			80-120	20	70-130	30
Silvex	µg/L	515.3 REV1 or 8321B	50	MCL			80-120	20	70-130	30
Pesticides										
4,4-DDD	µg/L	8081B or 8270C					80-120	20	70-130	30
4,4-DDE	µg/L	8081B or 8270C					80-120	20	70-130	30
Chlordane (tech mix & metabs), whole water	µg/L	8081B or 8270C	2	MCL			80-120	20	70-130	30
DDT	µg/L	8081B or 8270C					80-120	20	70-130	30
Endrin in whole water sample	µg/L	8081B or 8270C	2	MCL			80-120	20	70-130	30
Heptachlor epoxide	µg/L	8081B or 8270C	0.2	MCL			80-120	20	70-130	30
Heptachlor in whole water sample	µg/L	8081B or 8270C	0.4	MCL			80-120	20	70-130	30
Lindane in whole water sample	µg/L	8081B or 8270C	0.2	MCL			80-120	20	70-130	30
Methoxychlor in whole water sample	µg/L	8081B or 8270C	40	MCL			80-120	20	70-130	30
Parathion in whole water sample	µg/L	8270C					80-120	20	70-130	30
Pentachlorophenol	µg/L	8270C or 515.3 REV1	1	MCL			80-120	20	70-130	30
Toxaphene in whole water sample	µg/L	8081B or 8270C	3	MCL			80-120	20	70-130	30
PCBs										
PCBs, total	µg/L	8082A	0.5	MCL			80-120	20	70-130	30
Metals										
Aluminum, dissolved	mg/L	6020A or 6010B					80-120	20	75-125	20
Aluminum, total	mg/L	6020A					80-120	20	75-125	20
Antimony, total	mg/l	6020A	0.006	845			80-120	20	75-125	20
Arsenate(+5)	µg/L	1632					80-120	20	75-125	20
Arsenate(+5), dissolved	µg/L	1632					80-120	20	75-125	20
Arsenite(+3)	µg/L	1632					80-120	20	75-125	20
Arsenite(+3), dissolved	µg/L	1632					80-120	20	75-125	20
Copper, dissolved	mg/L	6020A or 6010B	1.3	MCL			80-120	20	75-125	20
Ferric Iron	µg/L	SM3500-Fe D or MetalOxidesCalc					80-120	20	75-125	20
Ferric Iron, dissolved	µg/L	MetalOxidesCalc					80-120	20	75-125	20
Ferrous Iron	µg/L	SM 3500-Fe D MOD					80-120	20	75-125	20
Ferrous Iron, dissolved	µg/L	SM 3500-Fe D MOD					80-120	20	75-125	20
Iron, dissolved	mg/L	6010B or 6020A or 6020B or 200.8					80-120	20	75-125	20
Iron, total	mg/L	6010B or 6020A or 6020B or 200.8					80-120	20	75-125	20
Inorganic Arsenic	µg/L	1632	10	845			80-120	20	75-125	20
Inorganic Arsenic, dissolved	µg/L	1632	10	845			80-120	20	75-125	20
Manganese as MnO	mg/L	MetalOxidesCalc					80-120	20	75-125	20

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Manganese as MnO2	mg/L	MetalOxidesCalc					80-120	20	75-125	20
Manganese, dissolved	mg/L	6010B or 6020A or 200.8					80-120	20	75-125	20
Manganese, total	mg/L	6010B or 6020A or 6020B or 200.8					80-120	20	75-125	20
Nickel, dissolved	mg/L	6010B or 6020A					80-120	20	75-125	20
Nickel, total	mg/L	6020A					80-120	20	75-125	20
Silver, dissolved	mg/L	6010B or 6020A					80-120	20	75-125	20
Silver, total	mg/L	6020A					80-120	20	75-125	20
Strontium, total	mg/L	6020					80-120	20	75-125	20
Tin, total	mg/L	6010B					80-120	20	75-125	20
Vanadium, dissolved	mg/L	6010B or 6020A					80-120	20	75-125	20
Vanadium, total	mg/L	6020A					80-120	20	75-125	20
Zinc, dissolved	mg/L	6010B or 6020A					80-120	20	75-125	20
Zinc, total	mg/L	6020A					80-120	20	75-125	20
Copper, total	mg/L	6020A	1.3	MCL			80-120	20	75-125	20
Others										
Bacteria (Fecal Coliform)	col./100 ml	SM 9222B or D					80-120	20	--	--
Biochemical Oxygen Demand (5 day - 20 deg C)	mg/L	SM 5210B 2001					80-120	20	--	--
Carbon, dissolved organic	mg/L	SM 5310C 2000					80-120	20	80-120	20
Carbon, total organic	mg/L	9060 or M5310C or SM 5310C 2000					80-120	20	80-120	20
Chemical Oxygen Demand	mg/L	SM 5220 D 1997					80-120	20	80-120	20
Cyanide, dissolved	mg/L	9012A (TCN) Aqueous	0.2	MCL			80-120	20	80-120	20
Cyanide, Reactive	mg/L	9012A REV1 7.3.3	0.2	MCL			80-120	20	80-120	20
Cyanide, total	mg/L	335.4 REV1 or 9012A or ASTM D7511-09e2	0.2	MCL			80-120	20	80-120	20
Flashpoint, Pensky-Martens Closed Cup	degrees F	1020B					80-120	20	--	--
Fraction of Organic Carbon (FOC)	pc	D2974 (FOC & OM)					80-120	20	--	20
Oil & grease (soxhlet ext)	mg/L	1664A					80-120	20	70-130	30
Perchlorate	mg/L	E314					80-120	20	70-130	30
Temperature (Celsius)	degrees C	Field or M2550B					--	--	--	--
Temperature (Fahrenheit)	degrees F	Field or M2550B					--	--	--	--
Total Suspended Solids	mg/L	SM 2540 D 1997					80-120	20	--	20

Notes:
col./100 ml = coliform per 100 milliliters
degrees C = degrees Celsius
degrees F = degrees Fahrenheit
µg/L = micrograms per liter
mg/L = milligrams per liter
PCBs = Polychlorinated biphenyls
SVOCs = Semivolatile organic compounds
VOCs = Volatile organic compounds
1. Analytical method numbers are from SW-846 unless otherwise indicated. Analytical methods may be updated with more recent versions as appropriate.
2. USEPA MCL = United States Environmental Protection Agency Maximum Contaminant Level.
3. USEPA SMCL = United States Environmental Protection Agency Secondary Maximum Contaminant Level.
4. RLs and MDLs will vary depending on the laboratory performing the work. RLs and MDLs will be provided by laboratory if/when additional parameters are needed.
5. LCS/LCSD and MS/MSD control limits are laboratory specific; control limits will be updated during laboratory procurement.