APPENDIX B – QUALITY ASSURANCE PROJECT PLAN

FINAL QUALITY ASSURANCE PROJECT PLAN (QAPP)
TONAWANDA COKE SITE
SITES 109 & 110
3800 RIVER ROAD
TONAWANDA, NEW YORK

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LIST OF ACRONYMS

ACRONYM	Definition
ASTM	American Society for Testing and Materials
CAR	Corrective Action Request
CCS	contract compliance screening
CFR	Code of Federal Regulations
CLP	Contract Laboratory Procedure
COC	contaminant of concern
D	absolute difference
DER	New York State Division of Environmental Remediation
DNAPL	dense non-aqueous phase liquid
DOT	Department of Transportation
DQO	data quality objective
DUSR	Data Usability Summary Report
EDD	electronic data deliverable
EDP	EQuIS Data Processor
EIM	Enterprise Information Management
ELAP	Environmental Laboratory Approved Program
EMIS	Environmental Information Management System
FSP	Field Sampling Plan
GC/MS	gas chromatography/mass spectroscopy
HASP	Health and Safety Plan
HDPE	high-density polyethylene
ICP	inductively coupled plasma
LCS	laboratory control sample
LDPE	low-density polyethylene
LIMS	laboratory information system
LNAPL	light non-aqueous phase liquid
LPM	laboratory project manager
MDL	method detection limit
MS/MSD	Matrix Spike/Matrix Spike Duplicates
NCM	Nonconformance Memo
NIST	National Institute of Standards and Technology
NTU	nephelometric turbidity unit
NYSDEC	New York State Department of Environmental Conservation
NYSDOH	New York State Department of Health
ORP	oxidation-reduction potential
PARCCS	precision, accuracy, representativeness, completeness, comparability, and sensitivity
PCB	polychlorinated biphenyls
PE	performance evaluation
PET	polyethylene terephthalate
PFAS	Per- and Polyfluoroalkyl Substances
PFOA	perflourooctanoic acid
PFOS	perfluorooctanesulfonic acid
PID	photoionization detector
PMP	Project Management Plan
PPE	personal protective equipment
PQL	project quantitation limit
PSHEP	Project Safety, Health, and Environmental Plan
PVC	polyvinyl chloride
QA	Quality Assurance
QC	Quality Control
QAPP	Quality Assurance Project Plan
RPD	relative percent difference
RL	reporting limit
SDG	Sample Delivery Group
SOP	standard operating procedure
SOW	Statement of Work
SVOC	semi-volatile organic compound
TAL	Target Analyte List
TCC	Tonawanda Coke Corporation
TCL	Target Compound List
USCS	Unified Soil Classification System
USEPA	United States Environmental Protection Agency
VOC	volatile organic compound
VTSR	validated line of sample receipt

1.0 PROJECT DESCRIPTION

1.1 Introduction

This Quality Assurance Project Plan (QAPP) has been prepared to support remedial investigation (RI) activities and specifies the quality assurance/quality control (QA/QC) procedures for field and laboratory sampling and measurements for the Tonawanda Coke Site (Site). This RI is being completed by Parsons for Honeywell International, Inc. (Honeywell). The specific objectives of the QAPP are:

- Foster data quality that is sufficient to meet the investigation objectives and to support the decision-making process; and
- Provide a standard for control and review of measurement data to confirm that the data are scientifically sound, representative, comparable, defensible, and of known quality.

This QAPP has been prepared in accordance with United States Environmental Protection Agency (USEPA) guidance (USEPA 2001a, 2002b). Standard field operating procedures including groundwater sampling, surface soil sampling, subsurface soil samples, decontamination activities, monitoring well development, etc., are included in the Generic Field Sampling Plan (FSP) prepared for the Site.

1.2 Remedial Investigation Overview

A metallurgical coke manufacturing and by products plant was operated at the former Tonawanda Coke Facility from 1917 through late 2018. During industrial operations, waste was disposed of on Sites 109 and 110. A Record of Decision was issued to Tonawanda Coke Corporation (TCC) by the New York State Department of Environmental Conservation (NYSDEC) on March 31, 2008, which presented the selected remedy for Sites 109 and Site 110. The remedy was based on active industrial use of the Site and required institutional and engineering controls involving restricting access and filing an environmental easement to control future Site use. The former Tonawanda Coke Facility is now inactive and Sites 109 and 110 are no longer considered to have industrial land use. Due to the change in current land use, potential reuse of the property located at 3875 River Road, and certain other site conditions, Honeywell is required to perform a Focused Remedial Investigation and Feasibility Study (RI/FS) at the Tonawanda Coke Site to evaluate the need for additional remediation of those areas. On February 24, 2020 an Order on Consent was entered into between Honeywell and NYSDEC regarding further investigation to be performed at the Site. Parsons has been retained by Honeywell to implement a RI consisting of test pitting, surface soil sampling, subsurface soil sampling, groundwater monitoring installation, and groundwater sampling.

Volatile Organic Compounds (VOCs), Semi-volatile organic compounds (SVOCs), metals, and cyanide have previously been detected in samples from the Site during historic investigations in exceedance of standards and guidance values. To characterize current site conditions, additional samples will be collected and analyzed. Below is a brief summary of work that will be performed and types of samples that will be collected as part of the RI. A summary of what is to be included in the analytical data package is included in Attachment 1.

Monitoring Well Installation: Up to seven groundwater monitoring wells will be installed at Sites 109 and 110. Wells will be screened in the fill down to the top of the clay layer, with the top of the screen above the water table. Soil samples will be collected from each monitoring well location as described under “Subsurface Soil Samples (borings).”

Groundwater Samples: Groundwater samples will be collected from multiple newly installed monitoring wells as well as one existing well using low-flow methods. Groundwater samples will be analyzed for TCL VOCs (EPA Method SW8260C), TCL SVOCs (EPA Method SW8270D), pesticides/PCBs (EPA Method SW8081B/SW8082A) TAL metals (EPA Method SW6010C/SW7470A), cyanide (EPA Method SW9012). Samples from MW-17-89, MW-3-2020, MW-4-2020, and MW-7-2020 (presumed downgradient wells) will also be analyzed for PFAS (Modified EPA Method 537.1) and 1,4-dioxane (EPA Method SW8270D SIM). PFAS sampling and analysis will follow guidance provided in NYSDEC's "Guidelines for Sampling and Analysis of PFAS." Samples will be submitted on a standard turn-around-time and data will be validated.

Test Pits: A series of test pits will be excavated throughout Sites 109 and 110. Test pits will be excavated to the top of clay layer (2 to 10 feet below ground surface [ft bgs]) and soil and fill materials will be visually assessed. Three soil/fill samples will be collected for chemical analysis at a total of nine test pit locations from the following depth intervals; 0 to 2 inches below ground surface, 2 to 12 inches below ground surface, and underlying fill. Samples will be analyzed for Target Compound List (TCL) VOCs (EPA Method SW8260C), SVOCs (EPA Method SW8270D), pesticides/PCBs (EPA Method SW8081B/SW8082A) Target Analyte List (TAL) metals (EPA Method SW6010C/SW7471B), cyanide (EPA Method SW9012), and per- and polyfluoroalkyl substances (PFAS) (Modified EPA Method 537.1). PFAS sampling and analysis will follow guidance provided in NYSDEC's "Guidelines for Sampling and Analysis of PFAS." Samples will be submitted on a standard turn-around-time and data will be validated.

Soil Borings: Multiple soil borings (all at Site 109) will be completed and three soil samples (0 to 2 and 2 to 12 inches below grade; underlying fill) will be collected from each boring. Soil borings will be installed to the top of the clay layer (approximately 2 to 10 ft bgs). If power lines and underground utilities on Site 110 restrict the installation of test pits at some locations, then up to four additional soil borings may be installed by hand and sampled according to above-referenced sampling intervals. Subsurface soil samples will also be collected from the 0 to 2 and 2 to 12 inch intervals at all seven monitoring well locations. TCL VOCs (EPA Method SW8260C), TCL SVOCs (EPA Method SW8270D), pesticides/PCBs (EPA Method SW8081B/SW8082A), TAL metals (EPA Method SW6010C/SW7471B), cyanide (EPA Method SW9012), and PFAS (Modified EPA Method 537.1). Samples will be submitted on a standard turn-around-time and data will be validated.

Waste Characterization Samples: Waste streams expected to be generated as part of this RI include drilling cuttings, well development water, decon water, purge water from groundwater sampling, personal protective equipment (PPE), and disposable sampling materials/supplies. Upon completion of waste generation, representative samples will be obtained for each waste type (e.g., solids and liquids) and analyzed for the standard suite of characterization parameters as listed in **Table 3.2C.** Samples will be submitted on a standard turn-around-time and data will be not be validated.

1.3 Analytical Restrictions

Polyfluoroalkyl substances (PFAS), can be found in many standard environmental sampling materials, including: Fluoropolymer bailer/tubing, some decontamination solutions, and pump bladders/valves. One specific PFAS compound, perflourooctanoic acid (PFOA), has been broadly utilized in the production of various everyday items such as: waterproof/stain-resistant clothing, non-stick cookware, and many commonly used plastics. The field activities and methods herein have been appropriately modified to prevent cross-contamination during sampling for PFAS and 1,4-dioxane(groundwater sampling only – after monitoring wells are installed).

The sampling team will review the summary of prohibited and acceptable items prior to mobilization to prevent cross contamination and to avoid the introduction of external contaminant sources. **Table 1.1** includes a summary of prohibited and acceptable PFAS and 1,4-dioxane items. A PFAS and 1,4-dioxane sampling checklist

is included as Attachment 2 and should be filled out daily by field personnel. Additionally, field sampling efforts will comply with the NYSDEC Guidelines for Sampling and Analysis of PFAS under NYSDEC's Part 375 Remedial Programs (January 2020). A copy of this plan is included in Attachment 3.

SPECIAL PRECAUTIONS FOR PFAS SAMPLING
Refer to **TABLE 1.1** for special clothing, PPE, supply and equipment requirements for PFAS and 1,4-dioxane sampling.
Bottles for PFAS samples should be stored and shipped to and from laboratory in separate coolers from other bottleware/samples.
DO NOT mix bottleware for PFAS samples with other bottleware to make bottle sets for sample locations.
Change nitrile gloves prior to handling bottles for PFAS analysis and collection of samples for PFAS analysis.
A PFAS and 1,4-dioxane sampling checklist is included as **Attachment 2** and should be filled out daily by field personnel.

TABLE 1.1 PROHIBITED AND ACCEPTABLE ITEMS FOR PFAS AND 1,4-DIOXANE SAMPLING

PROHIBITED	ACCEPTABLE
Field Equipment	
Teflon® containing materials	High Density High density polyethylene (HDPE), stainless steel or polypropylene materials
Low density polyethylene (LDPE) materials	Acetate liners Silicone Tubing
Waterproof field books, waterproof paper and waterproof sample bottle labels	Loose non-waterproof paper and non-waterproof sample labels
Waterproof markers / Sharpies®	Pens
Post-It Notes®	Tape; loose leaf paper
Chemical (blue) ice packs	Wet Ice
Field Clothing and PPE	
New cotton clothing or synthetic water resistant, waterproof, or stain-treated clothing, clothing containing Gore-TexTM	Well-laundered clothing made of natural fibers (preferable cotton)
Clothing laundered using fabric softener	No fabric softener
Boots containing Gore-TexTM or treated with water- resistant sprays	Boots made with polyurethane and PVC
Coated Tyvek®	Laundered cotton clothing
No cosmetics, moisturizers, hand cream, or other related products as part of personal leaning/showering routine on the morning of sampling	Sunscreens - Alba Organics Natural Sunscreen, Yes To Cucumbers, Aubrey Organics, Jason Natural Sun Block, Kiss My Face, and baby sunscreens that are "chemical free", "toxin free", or "natural"

Sunscreens or insecticides except as noted on right	Insect Repellents - Jason Natural Quit Bugging Me, Repel Lemon Eucalyptus Insect repellant, Herbal Armor, California Baby Natural Bug Spray, Baby Ganics Sunscreen and insect repellant - Avon Skin So Soft Bug Guard Plus - SPF 30 Lotion
Sample Containers	
LDPE or glass containers	HDPE or polypropylene
Teflon®-lined caps	Unlined polypropylene caps
Rain Events	
Waterproof or resistant rain gear	Wet weather gear made of polyurethane and PVC only; field tents that are only touched or moved prior to and following sampling activities
Equipment Decontamination	
Decon 90® Water from an on-site well	Alconox® and/or Liquinox®

2.0 PROJECT ORGANIZATION

2.1 Project and Team Organization

The project organization and the function and responsibility of each group affected by the QAPP are presented below. The project organization is designed to promote the exchange of information and for efficient project operation. Key contact information is summarized in the Tonawanda Coke Site Work Plan.

Individual	Organization	Role	Responsibility
Benjamin McPherson	NYSDEC	NYSDEC Project Manager	Regulatory oversight
Ed Glaza	Parsons	Project Manager/Technical Director	Overall project direction
George Moreau	Parsons	RI Task Manager	Overall investigation planning and supervision
Maryanne Kosciewicz	Parsons	Data Validation Manager	Data validation and general QA/QC management
TBD	Parsons	Field Team Lead	Field activity performance and oversight
TBD	Analytical Laboratory (TBD)	Laboratory Project Manager	Point of contact at laboratory
TBD	Analytical Laboratory (TBD)	Laboratory QC Manager	QA/QC management at analytical lab

2.1.1 Analytical Services

Laboratory operations will be conducted under the supervision of a general manager or laboratory director and a quality assurance manager. A project manager and alternate will be assigned. The project manager will be the primary point of contact and will be responsible for coordination and quality of the laboratory activities associated with the environmental media which they are responsible for analyzing for the project. The laboratory's project manager will manage project sample receipt, analysis scheduling, and data reporting. In case of temporary absence, the direct supervisor will assume the responsibilities of the absent employee or delegate the responsibility to qualified personnel. Sample Management Staff is responsible for receiving, logging, and maintaining internal custody of samples during the sample's residence in the laboratory. In addition, the laboratory will ensure that project analytical requirements are met; monitor project analytical compliance and immediately notify Parsons if conflict or discrepancies arise; initiate and implement appropriate corrective actions; ensure adequate quality review of deliverables prior to release; and participate in coordination meetings.

2.2 Special Training/Certification

Management and field personnel must review the requirements of this QAPP to make certain that persons assigned to specific tasks have appropriate credentials and experience. The Field Team Leader will check that all onsite personnel have read and understood the QAPP.

Field personnel will be required to adhere to the PSHEP and scope of work. They must also follow applicable task-specific health and safety plans that project subcontractors develop before they begin investigation activities.

The laboratory will have trained and experienced staff capable of performing the analyses specified in this QAPP. The laboratory will have New York State Department of Health (NYSDOH) Environmental Laboratory Accreditation Program (ELAP) certification for all project analyses they are responsible for conducting. Additionally, the laboratory must be able to demonstrate that they have analyzed performance-evaluation or proficiency-testing samples within 12 months of beginning the analyses.

All personnel independent of the laboratory generating the data who are performing data validation and verification must have experience in data validation, quality assurance oversight, and auditing. The data validator must have a Bachelor's degree in chemistry or natural sciences with a minimum of 20 credit hours in chemistry; one year experience in the implementation and application of analytical laboratory methodologies; and one year experience evaluating data packages of all matrices (e.g., soil, water, air, tissue) for compliance and usability with respect to the USEPA National Functional Guidelines with regional modifications.

3.0 DATA QUALITY OBJECTIVES AND DATA QUALITY CRITERIA

3.1 Introduction

A systematic planning process will develop site-specific data quality objective (DQOs). These DQOs will clarify study objectives, define the appropriate type of data, and specify tolerable levels of potential errors. These parameters, in turn, will be the basis for establishing the quality and quantity of data needed to support the utility of the data. This section was prepared in accordance with USEPA Guidance for the Data Quality Objectives Process (USEPA August 2000). Project DQOs will be developed using the "seven-step" DQO process, consisting of the following steps:

Step 1: State the problem
Step 2: Identify the decision
Step 3: Identify inputs to the decision
Step 4: Define the study boundaries
Step 5: Define the decision rule
Step 6: Specify tolerable limits of decision error
Step 7: Optimize the design

Data quality objectives specify the underlying reason for collecting the data and the data type, quality, quantity, and uses needed to make decision, and they provide the basis for designing data collection activities. DQOs and quality assurance objectives are related data quality planning and evaluation tools for all sampling and analysis tools.

The purpose of this QAPP is to provide a standard for control and review of measurement data to ensure they are scientifically sound, representative, comparable, defensible, and of known quality. The data will be used to evaluate the physical and chemical attributes of samples collected. The project objective for analytical testing is to characterize the physical characteristics and chemical constituents and to provide data to support the decision-making process.

The data produced during sampling activities will be compared with the defined quality assurance (QA) objectives and criteria for precision, accuracy, representativeness, completeness, comparability, and sensitivity (PARCCS) to see that the data reported are representative of actual conditions at the site.

This data assessment activity is an on-going coordinated process with data production and is intended to assure that data produced during the project are acceptable for use in subsequent evaluations. Both statistical and qualitative evaluations will be used to assess the quality of the data. The primary evaluation of the data will be based upon the field quality control samples described in Section 8.1.1 and the laboratory quality control samples described in Section 8.1.2. The "blank" samples (laboratory QC blank samples and field QC blank samples) will be used to evaluate whether or not the laboratory and/or the field team's procedures for handling of samples represent a possible source of sample contamination. Laboratory duplicate sample results will be used to evaluate analytical precision. Field duplicate sample results will be used to evaluate the overall precision of the sampling and analysis process, as well as sample representativeness and site heterogeneity. Laboratory control samples will be used to evaluate the accuracy of analytical results, as will other analysis-specific criteria,

such as surrogate compound recoveries for volatile organic compounds (VOCs), semivolatile organic compounds (SVOCs), 1,4-dioxane, pesticides, polychlorinated biphenyls (PCBs), and PFAS. Matrix spike/matrix spike duplicate (MS/MSD) analysis of project samples will be used to evaluate potential sample matrix effects on the analytical results (both of the sample utilized for MS/MSD and of other samples collected from the site). For all sample results, the impact of sample-specific, analysis-specific, and site-specific factors will be evaluated, and an assessment will be made as to their impact, if any, on the data. Duplicate sample (field and laboratory QC samples) results will be used to evaluate data precision.

3.1.1 Data Use Objectives

Data use objectives define why analyses are being conducted and how ultimately the data will be used to meet the overall project objectives. For the Tonawanda Coke Site 109 and 110 activities, these project objectives are stated in the Tonawanda Coke Site 109 and 110 Scoping Documents.

3.2 Data Quality Objectives (DQOs) (PARCCS Parameters)

3.2.1 Introduction

DQOs are based on the premise that different data uses require different levels of data quality. The term *data quality* refers to a degree of uncertainty with respect to PARCCS data quality indicators. Specific objectives are established to develop sampling protocols and identify applicable documentation, sample handling procedures, and measurement system procedures. These DQOs are established by onsite conditions, objectives of the project, and knowledge of available measurement systems. Overall work assignment DQOs are presented and discussed in detail in this QAPP. A wide range of data quality is achieved through the use of various analytical methods. The following data quality levels are widely accepted as descriptions of the different kinds of data that can be generated for various purposes:

- **Level I, Field screening or analysis using portable instruments (e.g., photoionization detector [PID]):** Results are often not compound-specific, but results are available in real time. Depending on the analysis being performed and the instrumentation used, the results may be considered qualitative, semi-quantitative, or quantitative.
- **Level II, Field analysis using more sophisticated portable analytical instruments (e.g., on-site mobile laboratory):** There is a wide range in the quality of data that can be generated depending on the use of suitable calibration standards, reference materials, and sample preparation equipment. Results are available in real-time or typically within hours of sample collection.
- **Level III, All analyses performed in an off-site analytical laboratory using methods other than USEPA-approved analytical methods:** These data generally do not include the level of formal documentation required under Level IV and are not subject to formal data validation. These data are typically used for engineering studies (e.g., treatability testing), site investigations and remedial design.
- **Level IV, Data generated using USEPA methods and enhanced by a rigorous QA program, supporting documentation, and data validation procedures:** These data are typically used for engineering studies (e.g., treatability testing), risk assessment, site investigations, and remedial design, and may be suitable for litigation/enforcement activities. Results are both qualitative and quantitative.

Project data quality level requirements for sample analyses have been determined to be as follows:

- Level I data quality will be obtained for field screening data collected with portable instruments such as pH meters, temperature probes, and PIDs which will be used for health and safety and field operational

monitoring. In addition, these instruments or field test kits may be used to produce data for determining where to collect a sample to assess impacts and for field screening of samples to be designated for laboratory confirmation analyses.

- A Level II data quality assurance program will be executed by the field team for obtaining data.
- A Level III data quality assurance program will be executed by the laboratory for chemical analyses not required to be Level IV, such as pH.
- A Level IV data quality assurance program will be executed, in general, by the laboratory for chemical analyses necessary to meet the work assignment objectives.

3.2.2 PARCCS Parameters (Data Quality Indicators)

3.2.2.1 Precision

Precision is an expression of the reproducibility of measurements of the same parameter under a given set of conditions. Specifically, it is a quantitative measurement of the variability of a group of measurements compared to their average value (USEPA 1987). Precision is usually stated in terms of standard deviation, but other estimates such as the coefficient of variation (relative standard deviation), absolute difference (D), range (maximum value minus minimum value), relative range, and relative percent difference (RPD) are common.

The objectives for precision for each chemical are based on the capabilities of the approved EPA analytical method with respect to laboratory performance. For this project, field-sampling precision will be determined by analyzing coded (blind) duplicate samples for the same parameters, and then, during data validation, calculating the %RPD for duplicate sample results. Field duplicate precision criteria for the water samples will be 30%RPD and 50%RPD for soil samples. The laboratory will determine analytical precision by calculating the %RPD or %D, as applicable to the analytical method being used, e.g., pH will be evaluated using %D.

The laboratory will determine analytical precision by calculating the RPD for the results of the analysis of the laboratory duplicates and matrix spike duplicates. The formula for calculating %RPD is as follows:

$$\%RPD = \frac{|V1 - V2|}{(V1 + V2)/2} \times 100$$

where:

RPD	=	Relative percent difference
V1, V2	=	Values to be compared
|V1 - V2|	=	Absolute value of the difference between the two values
(V1 + V2)/2	=	Average of the two values

For data evaluation purposes, in instances where both sample concentrations are less than five times (<5x) the RL, duplicate precision will be evaluated using the calculated %D result. In this instance, the applicable precision criterion will be two times the RL (2xRL). If a value is not detected, the %RPD criterion will be considered to be not applicable and the %RPD will not be calculated (i.e., precision will not be quantitatively determined). The data quality objectives for analytical precision, calculated as the RPD between duplicate analyses, are presented in **Tables 3.1A and 3.1B**.

3.2.2.2 Accuracy

Accuracy is a measure of the degree of agreement of a measured value with the true or expected value of the quantity of concern (Taylor 1987) or the difference between a measured value and the true or accepted

reference value. The accuracy of an analytical procedure is best determined by the analysis of a sample containing a known quantity of material and is expressed as the percent of the known quantity that is recovered or measured. The recovery of a given analyte depends on the sample matrix, method of analysis, and the specific compound or element being determined. The concentration of the analyte relative to the detection limit of the analytical method is also a major factor in determining the accuracy of the measurement. Concentrations of analytes that are less than the quantitation limits are less accurate because they are more affected by such factors as instrument "noise." Higher concentrations will not be as affected by instrument noise or other variables and, thus, will be more accurate.

The objectives for accuracy for each chemical are based on the capabilities of the approved USEPA analytical method with respect to laboratory performance. Analytical accuracy is typically assessed by examining the percent recoveries of surrogate compounds that are added to each sample (organic analyses only), the percent recoveries of matrix spike compounds added to selected samples, and the percent recoveries of spike compounds added to laboratory control samples (LCS). An LCS will be analyzed to provide additional information on analytical accuracy. Additionally, initial and continuing calibrations must be performed and accomplished within the established method control limits to define the instrument accuracy before analytical accuracy can be determined for any sample set.

Accuracy is normally measured as the percent recovery (%R) of a known amount of analyte, called a *spike*, added to a sample (matrix spike or laboratory control). The accuracy on a per sample basis will be measured using surrogates for the organics analyses. The %R is calculated as follows:

Matrix Spike Recovery:

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

where:

%R	=	Percent recovery
SSR	=	Spike sample result: concentration of analyte obtained by analyzing the sample with the spike added
SR	=	Sample result: the background value; *i.e.,* the concentration of the analyte obtained by analyzing the sample
SA	=	Spiked analyte: concentration of the analyte spike added to the sample

Surrogate Recovery:

$$\% \text{ Recovery} = \frac{\text{Concentration (or amount) found}}{\text{Concentration (or amount) spiked}} \times 100$$

LCS Recovery:

$$\% \text{ Recovery} = \frac{\text{Concentration (or amount) found}}{\text{Concentration (or amount) spiked}} \times 100$$

The acceptance limits for accuracy for each parameter are presented in **Table 3.1**.

3.2.2.3 Representativeness

Representativeness expresses the degree to which sample data accurately and precisely represent a characteristic of a population, parameter variations at a sampling point or an environmental condition. Representativeness is a qualitative parameter and is most concerned with the proper design of the sampling

program (USEPA 1987). Samples must be representative of the environmental media being sampled. An important factor in the selection of sample locations and sampling procedures will be obtaining representative samples.

Field and laboratory procedures will be performed in such a manner as to ensure, to the degree technically possible, that the data derived represents the in-place quality of the material sampled. Care will be exercised to see that chemical compounds are not introduced to the sample from sample containers, handling, and analysis. Field blanks, equipment rinse blanks, trip blanks, and laboratory method/prep blanks will be analyzed to monitor for potential sample contamination from field and laboratory procedures.

The assessment of representativeness also must consider the degree of heterogeneity in the material from which the samples are collected. Sampling heterogeneity will be evaluated during data validation through the analysis of coded (blind) field duplicate samples. The analytical laboratory will also follow acceptable procedures to assure the samples are adequately homogenized prior to taking aliquots for analysis such that the reported results are representative of the sample received. Chain-of-custody (COC) procedures will be followed to document the possession of sample containers from the time of container preparation through sample collection and receipt back at the laboratory. Field QC samples will be collected and analyzed to provide information to evaluate sample representativeness. Details of field QC sample collection (field blanks, equipment rinse blanks, trip blanks, temperature blanks, field duplicates) and COC procedures are presented in Section 4.2 and Section 8.1.1.

3.2.2.4 Completeness

Completeness is defined as the percentage of measurements that meet the project's data quality objectives (USEPA 1987). Completeness is calculated for each method (or analyte) and sample matrix for an assigned group of samples. Completeness for a data set represents the results usable for data interpretation and decision making. The completeness objective for the analytical and field data is 95%. Completeness is defined as follows for all sample measurements:

$$\%C = \frac{V}{T} \times 100$$

where:

%C = Percent completeness
V = Number of measurements judged valid (not rejected during data validation)
T = Total number of measurements

Completeness, which is expressed as a percentage, is calculated by subtracting the number of rejected and unreported results from the total planned results and dividing by the total number of results. Results rejected because of out-of-control analytical conditions, severe matrix effects, broken or spilled samples, or samples that could not be analyzed for any other reason, negatively affect influence completeness and are subtracted from the total number of results to calculate completeness.

3.2.2.5 Comparability

Comparability expresses the degree of confidence with which one data set can be compared to another (USEPA 1987). The comparability of all data collected for this project will be managed by:

- Using identified standard methods (including laboratory standard operating procedures [SOPs]) for both sampling and analysis phases of this project

- Requiring traceability of all analytical standards and/or source materials to the USEPA or National Institute of Standards and Technology (NIST)
- Requiring that calibrations be verified with an independently prepared standard from a source other than that used for calibration (if applicable)
- Using standard reporting units and reporting formats including the reporting of QC data
- Performing data validation on the analytical results, including the use of data qualifiers in all cases where appropriate
- Evaluating the sample collection information and analytical QC sample results
- Requiring that the significance of all validation qualifiers be assessed any time an analytical result is used for any purpose.

By taking these steps during the investigation, future users of either the data or the conclusions drawn from them will be able to judge the comparability of these data and conclusions.

3.2.2.6 Sensitivity and Quantitation Limits

When selecting an analytical method during the DQO process, the achievable detection limit (DL) and method reporting limit (RL) must be evaluated to verify that the method will meet the project quantitation limits necessary to support project decision making requirements. This process ensures that the analytical method sensitivity has been considered and that the methods used can produce data that satisfy users' needs while making the most effective use of resources. The concentration of any one target compound that can be detected and/or quantified is a measure of sensitivity for that compound. Sensitivity is instrument, compound, method, and matrix specific and achieving the required project quantitation limit (PQL) and/or method detection limit (MDL) objectives depends on instrument sensitivity and potential matrix effects. With regard to instrument sensitivity, it is important to monitor the instrument performance to ensure consistent instrument performance at the low end of the calibration range. Instrument sensitivity will be monitored through the analysis of method/prep blanks, calibration check samples, and low standard evaluations.

Laboratories generally establish limits that are reported with the analytical results; these results may be called reporting limits, detection limits, quantitation limits, or other terms. These laboratory-specific limits, apply undiluted analyses and must be less than or equal to the project RLs. The RL, also known as the PQL, represents the concentration of an analyte that can be routinely measured in the sampled matrix within stated limits and with confidence in both identification and quantitation. Throughout various documents RL and PQL may be interchanged, but they effectively have the same meaning. The RLs are established based on specific knowledge about the analyte, sample matrix, project specific requirements, and regulatory requirements. The RL is typically established by the laboratory at the level of the lowest calibration standard and is generally in the range of two to ten times the MDL.

The MDL is defined as "the minimum measured concentration of a substance that can be reported with 99% confidence that the measured concentration is distinguishable from method blank results" (40 Code of Federal Regulations (CFR) 136 Appendix B). MDLs are experimentally determined and verified for each target analyte of the methods in the sampling program. The laboratory will determine MDLs for each analyte and matrix type prior to analysis of project samples. In addition, when multiple instruments are employed for the analysis of the same method, each individual instrument will maintain a current MDL study. MDLs are statistically calculated in accordance with the Title 40, Code of Federal Regulations Part 136 (40 CFR 136) as promulgated in September 2017. If risk-based project objectives are developed, then where practicable, MDLs must be lower than the risk-based criteria determined for the project.

Laboratory RLs and MDLs for all analyses will meet at a minimum the standards criteria specified in the NYSDEC 6 NYCRR Part 375 Soil Cleanup Objectives for Unrestricted Use and/or the NYSDEC Division of Water Technical

and Operational Guidance Series (TOGS) "Ambient Water Quality Standards and Guidance Values and Groundwater Effluent Limitations."

Analytical results below the MDL will be flagged with a *U* at the RL to indicate the data are non-detect. However, the laboratory will flag analytes detected at a level less than the RL but greater than the MDL (or the laboratory's determined minimum reportable concentration) with a *J* to denote an estimated concentration.

When results are corrected for dry weight, the reporting limits are then elevated accordingly. To compensate for the low solids, modifications are made either to increase the initial volume extracted/digested or to reduce the final volume of extract/digestate.

For samples that do not meet the project-specified RLs or MDLs, (taking into consideration elevated detection limits due to percent solids or percent moisture and aliquots used for the designated analysis), the laboratory must make available compelling documentation (e.g., screening data) and a justifiable explanation for its inability to meet the specified limits using the project protocols. It must also provide an appropriate, justifiable explanation of the issues and resolution in the analytical report/data package (dilution factor, interference, etc.). Excessive, unnecessary dilutions on any sample for a project are unacceptable. The laboratory will analyze all samples initially undiluted, unless for gas chromatography/mass spectroscopy (GC/MS) analyses (i.e., SW8260C and SW8270D), a preliminary gas chromatography (GC)-screen is performed and indicates that GC/MS instrument damage or compromise may occur if the sample is not analyzed initially at dilution. In this instance, the sample will be analyzed at the lowest possible dilution factor. If multiple extractions/ analyses are performed (such as undiluted and diluted analyses), resulting in several data sets for the same sample, the laboratory will report all data and results from each of the multiple analyses in the data package. Quantitation limits for all definitive data quality level laboratory analytical methods, compounds, and matrices are presented in **Tables 3.2A, 3.2B, and 3.2C.**

TABLE 3.1A QUALITY CONTROL LIMITS - GROUNDWATER

Laboratory Accuracy and Precision							
Analytical Parameters	Analytical Method	Matrix Spike (MS) Compounds	MS/MSD (a) % Recovery	MS/MSD RPD (b)	LCS (c) % Recovery	Surrogate Compounds	Surrogate % Recovery
VOCs	SW8260C	All target VOCs	70-130 or lab QC limit	0-20 or lab QC limit	70-130 or lab QC limit	Toluene-d8 4-Bromofluorobenzene 1,2-Dichloroethane-d4 Dibromofluoromethane	Lab QC Limit
SVOCs	SW8270D	All target SVOCs	70-130 or lab QC limit	0-20 or lab QC limit	70-130 or lab QC limit	Nitrobenzene-d5 2-Fluorobiphenyl Terphenyl-d14 Phenol-d5 2-Fluorophenol 2,4,6-Tribromophenol	Lab QC Limit
1,4-dioxane	SW8270D SIM	1,4-dioxane	70-130 or lab QC limit	0-20 or lab QC limit	70-130 or lab QC limit	1,4-dioxane-d8	Lab QC Limit
Pesticides	SW8081B	All target pesticides	70-130 or lab QC limit	0-20 or lab QC limit	70-130 or lab QC limit	Tetrachloro-m-xylene Decachlorobiphenyl	Lab QC Limit
PCBs	SW8082A	All target PCBs	50-150 or lab QC limit	0-20 or lab QC limit	50-150 or lab QC limit	Tetrachloro-m-xylene Decachlorobiphenyl	Lab QC Limit
Metals	SW6010C/ SW7470A	All target metals	75-125 or lab QC limit	0-20 or lab QC limit	85-115 or lab QC limit	NA	NA
Cyanide	SW9012	Cyanide	90-110 or lab QC limit	0-20 or lab QC limit	90-110 or lab QC limit	NA	NA
PFAS	E537.1 modified	All target PFAS	70-130 or lab QC limit	0-20 or lab QC limit	70-130 or lab QC limit	all tracer PFAS (isotope dilution all PFAS)	50-150 or lab QC limit

TABLE 3.1B QUALITY CONTROL LIMITS – SOIL AND WASTE CHARACTERIZATION

Analytical Parameter	Analytical Method	Matrix Spike (MS) Compound	MS/MSD (a) % Recovery	MS/MSD RPD (b)	LCS (c) % Recovery	Surrogate	Surrogate % Recovery
VOCs and TCLP VOCs	SW8260C	All target VOCs	70-130 or lab QC limit	0-30 or lab QC limit	70-130 or lab QC limit	Toluene-d8 Bromofluorobenzene 1,2-Dichloroethane-d4	Lab QC Limit
SVOCs and TCLP SVOCs	SW8270D	All target SVOCs	50-150 or lab QC limit	0-30 or lab QC limit	50-150 or lab QC limit	Nitrobenzene-d5 2-Fluorobiphenyl Terphenyl-d14 Phenol-d5 2-Fluorophenol 2,4,6-Tribromophenol	Lab QC Limit
Pesticides and TCLP Pesticides	SW8081B	All target pesticides	50-150 or lab QC limit	0-30 or lab QC limit	50-150 or lab QC limit	Tetrachloro-m-xylene Decachlorobiphenyl	Lab QC Limit
PCBs	SW8082A	All target PCBs	50-150 or lab QC limit	0-30 or lab QC limit	50-150 or lab QC limit	Tetrachloro-m-xylene Decachlorobiphenyl	Lab QC Limit
TCLP Herbicides	SW8051A	All target herbicides	50-150 or lab QC limit	0-30 or lab QC limit	50-150 Or Lab QC Limit	DCAA	Lab QC Limit
Metals and TCLP Metals	SW6010C/ SW7470A/ SW7471B	All target metals	75-125 or lab QC limit	0-20 or lab QC limit	85-115 Or lab QC limit	NA	NA

TABLE 3.1 QUALITY CONTROL LIMITS – SOIL AND WASTE CHARACTERIZATION (CONT.)

Analytical Parameter	Analytical Method	Matrix Spike (MS) Compound	MS/MSD (a) % Recovery	MS/MSD RPD (b)	LCS (c) % Recovery	Surrogate	Surrogate % Recovery
Cyanide	SW9012	Cyanide	80-120 or lab QC limit	0-20 or lab QC limit	90-110 or lab QC limit	NA	NA
Ignitability, Corrosivity, Reactivity	SW1010B/SW1030 SW9040/SW9045 7.3.3.2/7.3.4.2	NA	NA	0-20 or lab QC limit	80-120 or lab QC limit	NA	NA

(a) Matrix Spike/Matrix Spike Duplicate
(b) Relative Percent Difference
(c) Laboratory Control Sample
NA – Not Applicable
VOC – volatile organic compound
SVOC – semi-volatile organic compound
PCB – polychlorinated biphenyl
TCLP – toxicity characteristic leaching procedure

TABLE 3.2A GROUNDWATER ANALYSIS

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TABLE 3.2A
GROUNDWATER ANALYSIS
TONAWANDA COKE SITE 109 AND 110

CAS NO.	COMPOUND	NYSDEC Class GA Ambient Water Quality Standards/Guidance Criteria[1]	QAPP Quantitation Limit [2]	UNITS
	VOLATILES (SW8260C)			
71-55-6	1,1,1-TRICHLOROETHANE	5	1	µg/l
79-34-5	1,1,2,2-TETRACHLOROETHANE	5	1	µg/l
76-13-1	1,1,2-TRICHLORO-1,2,2-TRIFLUOROETHANE	5	1	µg/l
79-00-5	1,1,2-TRICHLOROETHANE	1	1	µg/l
75-34-3	1,1-DICHLOROETHANE	5	1	µg/l
75-35-4	1,1-DICHLOROETHENE	5	1	µg/l
87-61-6	1,2,3-TRICHLOROBENZENE	5, 5[3]	1	µg/l
120-82-1	1,2,4-TRICHLOROBENZENE	5, 5[3]	1	µg/l
96-12-8	1,2-DIBROMO-3-CHLOROPROPANE	0.04	1	µg/l
106-93-4	1,2-DIBROMOETHANE	5	1	µg/l
95-50-1	1,2-DICHLOROBENZENE	3, 5[4]	1	µg/l
107-06-2	1,2-DICHLOROETHANE	0.6	1	µg/l
78-87-5	1,2-DICHLOROPROPANE	1	1	µg/l
541-73-1	1,3-DICHLOROBENZENE	3, 5[4]	1	µg/l
106-46-7	1,4-DICHLOROBENZENE	3, 5[4]	1	µg/l
591-78-6	2-HEXANONE	50	5	µg/l
67-64-1	ACETONE	50	5	µg/l
71-43-2	BENZENE	1	1	µg/l
74-97-5	BROMOCHLOROMETHANE	5	1	µg/l
75-27-4	BROMODICHLOROMETHANE	50	1	µg/l
75-25-2	BROMOFORM	50	1	µg/l
74-83-9	BROMOMETHANE	5	1	µg/l
75-15-0	CARBON DISULFIDE	60	1	µg/l
56-23-5	CARBON TETRACHLORIDE	5	1	µg/l
108-90-7	CHLOROBENZENE	5	1	µg/l
75-00-3	CHLOROETHANE	5	1	µg/l
67-66-3	CHLOROFORM	7	1	µg/l
74-87-3	CHLOROMETHANE	5	1	µg/l
156-59-2	CIS-1,2-DICHLOROETHYLENE	5	1	µg/l
10061-01-5	CIS-1,3-DICHLOROPROPENE	0.4	1	µg/l
110-82-7	CYCLOHEXANE	NS	1	µg/l
124-48-1	DIBROMOCHLOROMETHANE	50	1	µg/l
75-71-8	DICHLORODIFLUOROMETHANE	5	1	µg/l
100-41-4	ETHYLBENZENE	5	1	µg/l
98-82-8	ISOPROPYLBENZENE (CUMENE)	5	1	µg/l
79-20-9	METHYL ACETATE	NS	5	µg/l
78-93-3	METHYL ETHYL KETONE (2-BUTANONE)	50	5	µg/l
108-10-1	METHYL ISOBUTYL KETONE	NS	5	µg/l
108-87-2	METHYLCYCLOHEXANE	NS	1	µg/l
75-09-2	METHYLENE CHLORIDE	5	1	µg/l
100-42-5	STYRENE	5	1	µg/l
1634-04-4	TERT-BUTYL METHYL ETHER	10	1	µg/l
127-18-4	TETRACHLOROETHYLENE (PCE)	5	1	µg/l
108-88-3	TOLUENE	5	1	µg/l
156-60-5	TRANS-1,2-DICHLOROETHENE	5	1	µg/l
10061-02-6	TRANS-1,3-DICHLOROPROPENE	0.4	1	µg/l
79-01-6	TRICHLOROETHYLENE (TCE)	5	1	µg/l
75-69-4	TRICHLOROFLUOROMETHANE	5	1	µg/l
75-01-4	VINYL CHLORIDE	2	1	µg/l
XYLENES	XYLENES, TOTAL	5	2	µg/l
	1,4-DIOXANE (8270D SIM)			
123-91-1	1,4-DIOXANE	200[5]	0.35	µg/l
	SEMIVOLATILES (SW8270D)			
58-90-2	2,3,4,6-TETRACHLOROPHENOL	1[6]	10	µg/l
95-95-4	2,4,5-TRICHLOROPHENOL	1[6]	10	µg/l

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TABLE 3.2A
GROUNDWATER ANALYSIS
TONAWANDA COKE SITE 109 AND 110

CAS NO.	COMPOUND	NYSDEC Class GA Ambient Water Quality Standards/Guidance Criteria[1]	QAPP Quantitation Limit [2]	UNITS
88-06-2	2,4,6-TRICHLOROPHENOL	1[6]	10	µg/l
120-83-2	2,4-DICHLOROPHENOL	5	10	µg/l
105-67-9	2,4-DIMETHYLPHENOL	50	10	µg/l
51-28-5	2,4-DINITROPHENOL	10	20	µg/l
121-14-2	2,4-DINITROTOLUENE	5	2	µg/l
606-20-2	2,6-DINITROTOLUENE	5	2	µg/l
91-58-7	2-CHLORONAPHTHALENE	10	10	µg/l
95-57-8	2-CHLOROPHENOL	1[6]	10	µg/l
91-57-6	2-METHYLNAPHTHALENE	NS	10	µg/l
95-48-7	2-METHYLPHENOL (O-CRESOL)	1[6]	10	µg/l
88-74-4	2-NITROANILINE	5	10	µg/l
88-75-5	2-NITROPHENOL	1[6]	10	µg/l
91-94-1	3,3'-DICHLOROBENZIDINE	5	10	µg/l
99-09-2	3-NITROANILINE	5	10	µg/l
106-44-5	3&4-METHYLPHENOL (M&P-CRESOL)	1[6]	10	µg/l
534-52-1	4,6-DINITRO-2-METHYLPHENOL	1[6]	20	µg/l
101-55-3	4-BROMOPHENYL PHENYL ETHER	NS	10	µg/l
59-50-7	4-CHLORO-3-METHYLPHENOL	1[6]	10	µg/l
106-47-8	4-CHLOROANILINE	5	10	µg/l
7005-72-3	4-CHLOROPHENYL PHENYL ETHER	NS	10	µg/l
100-01-6	4-NITROANILINE	5	10	µg/l
100-02-7	4-NITROPHENOL	1[6]	20	µg/l
83-32-9	ACENAPHTHENE	20	10	µg/l
208-96-8	ACENAPHTHYLENE	NS	10	µg/l
98-86-2	ACETOPHENONE	NS	10	µg/l
120-12-7	ANTHRACENE	50	10	µg/l
1912-24-9	ATRAZINE	7.5	2	µg/l
100-52-7	BENZALDEHYDE	NS	10	µg/l
56-55-3	BENZO(A)ANTHRACENE	0.002	1	µg/l
50-32-8	BENZO(A)PYRENE	ND	1	µg/l
205-99-2	BENZO(B)FLUORANTHENE	0.002	2	µg/l
191-24-2	BENZO(G,H,I)PERYLENE	NS	10	µg/l
207-08-9	BENZO(K)FLUORANTHENE	0.002	1	µg/l
85-68-7	BENZYL BUTYL PHTHALATE	50	10	µg/l
92-52-4	BIPHENYL (DIPHENYL)	5	10	µg/l
111-91-1	BIS(2-CHLOROETHOXY) METHANE	5	10	µg/l
111-44-4	BIS(2-CHLOROETHYL) ETHER	1	1	µg/l
108-60-1	BIS(2-CHLOROISOPROPYL) ETHER	5	10	µg/l
117-81-7	BIS(2-ETHYLHEXYL) PHTHALATE	5	2	µg/l
105-60-2	CAPROLACTAM	NS	10	µg/l
86-74-8	CARBAZOLE	NS	10	µg/l
218-01-9	CHRYSENE	0.002	2	µg/l
53-70-3	DIBENZ(A,H)ANTHRACENE	NS	1	µg/l
132-64-9	DIBENZOFURAN	NS	10	µg/l
84-66-2	DIETHYL PHTHALATE	50	10	µg/l
131-11-3	DIMETHYL PHTHALATE	50	10	µg/l
84-74-2	DI-N-BUTYL PHTHALATE	50	10	µg/l
117-84-0	DI-N-OCTYLPHTHALATE	50	10	µg/l
206-44-0	FLUORANTHENE	50	10	µg/l
86-73-7	FLUORENE	50	10	µg/l
118-74-1	HEXACHLOROBENZENE	0.04	1	µg/l
87-68-3	HEXACHLOROBUTADIENE	0.5	1	µg/l
77-47-4	HEXACHLOROCYCLOPENTADIENE	5	10	µg/l
67-72-1	HEXACHLOROETHANE	5	2	µg/l
193-39-5	INDENO(1,2,3-C,D)PYRENE	0.002	2	µg/l
78-59-1	ISOPHORONE	50	10	µg/l
91-20-3	NAPHTHALENE	10	10	µg/l
98-95-3	NITROBENZENE	0.4	1	µg/l

Honeywell PARSONS

TABLE 3.2A
GROUNDWATER ANALYSIS
TONAWANDA COKE SITE 109 AND 110

CAS NO.	COMPOUND	NYSDEC Class GA Ambient Water Quality Standards/Guidance Criteria[1]	QAPP Quantitation Limit [2]	UNITS
621-64-7	N-NITROSODI-N-PROPYLAMINE	NS	1	µg/l
86-30-6	N-NITROSODIPHENYLAMINE	50	10	µg/l
87-86-5	PENTACHLOROPHENOL	1[6]	20	µg/l
85-01-8	PHENANTHRENE	50	10	µg/l
108-95-2	PHENOL	1[6]	10	µg/l
129-00-0	PYRENE	50	10	µg/l
	PESTICIDES (SW8081B)			
309-00-2	ALDRIN	ND, 0.001[7]	0.05	µg/l
319-84-6	ALPHA BHC	0.01	0.05	µg/l
959-98-8	ALPHA ENDOSULFAN	NS	0.05	µg/l
5103-71-9	ALPHA-CHLORDANE	0.05	0.05	µg/l
319-85-7	BETA BHC	0.04	0.05	µg/l
33213-65-9	BETA ENDOSULFAN	NS	0.05	µg/l
5103-74-2	BETA-CHLORDANE	0.05	0.05	µg/l
319-86-8	DELTA BHC	0.04	0.05	µg/l
60-57-1	DIELDRIN	0.004, 0.001[7]	0.05	µg/l
1031-07-8	ENDOSULFAN SULFATE	NS	0.05	µg/l
72-20-8	ENDRIN	ND	0.05	µg/l
7421-93-4	ENDRIN ALDEHYDE	5	0.05	µg/l
53494-70-5	ENDRIN KETONE	5	0.05	µg/l
58-89-9	GAMMA BHC (LINDANE)	0.05	0.05	µg/l
76-44-8	HEPTACHLOR	0.04	0.05	µg/l
1024-57-3	HEPTACHLOR EPOXIDE	0.03	0.05	µg/l
72-43-5	METHOXYCHLOR	35	0.5	µg/l
72-54-8	P,P'-DDD	0.3	0.05	µg/l
72-55-9	P,P'-DDE	0.2	0.05	µg/l
50-29-3	P,P'-DDT	0.2	0.05	µg/l
8001-35-2	TOXAPHENE	0.06	1	µg/l
	PCBs (SW8082A)			
12674-11-2	PCB-1016 (Aroclor 1016)	0.09[8]	0.5	µg/l
11104-28-2	PCB-1221 (Aroclor 1221)	0.09[8]	0.5	µg/l
11141-16-5	PCB-1232 (Aroclor 1232)	0.09[8]	0.5	µg/l
53469-21-9	PCB-1242 (Aroclor 1242)	0.09[8]	0.5	µg/l
12672-29-6	PCB-1248 (Aroclor 1248)	0.09[8]	0.5	µg/l
11097-69-1	PCB-1254 (Aroclor 1254)	0.09[8]	0.5	µg/l
11096-82-5	PCB-1260 (Aroclor 1260)	0.09[8]	0.5	µg/l
37324-23-5	PCB-1262 (Aroclor 1262)	0.09[8]	0.5	µg/l
11100-14-4	PCB-1268 (Aroclor 1268)	0.09[8]	0.5	µg/l
	PFAS (Modified E537.1)[9]			
2355-31-9	2-(N-methyl perfluorooctanesulfonamido) acetic acid	100, 500[10]	20	ng/L
27619-97-2	6:2 Fluorotelomer sulfonate	100, 500[10]	20	ng/L
39108-34-4	8:2 Fluorotelomer sulfonate	100, 500[10]	20	ng/L
2991-50-6	N-Ethyl-N-((heptadecafluorooctyl)sulphonyl) glycine	100, 500[10]	20	ng/L
375-73-5	Perfluorobutanesulfonic acid (PFBS)	100, 500[10]	2	ng/L
375-22-4	Perfluorobutanoic Acid	100, 500[10]	2	ng/L
	Perfluorodecane Sulfonic Acid	100, 500[10]	2	ng/L
335-76-2	Perfluorodecanoic acid (PFDA)	100, 500[10]	2	ng/L
307-55-1	Perfluorododecanoic acid (PFDoA)	100, 500[10]	2	ng/L
375-92-8	Perfluoroheptane Sulfonate (PFHPS)	100, 500[10]	2	ng/L
375-85-9	Perfluoroheptanoic acid (PFHpA)	100, 500[10]	2	ng/L
355-46-4	Perfluorohexanesulfonic acid (PFHxS)	100, 500[10]	2	ng/L
307-24-4	Perfluorohexanoic acid (PFHxA)	100, 500[10]	2	ng/L
375-95-1	Perfluorononanoic acid (PFNA)	100, 500[10]	2	ng/L
754-91-6	Perfluorooctane Sulfonamide (FOSA)	100, 500[10]	2	ng/L
1763-23-1	Perfluorooctanesulfonic acid (PFOS)	10, 500[10]	2	ng/L

Honeywell PARSONS

TABLE 3.2A
GROUNDWATER ANALYSIS
TONAWANDA COKE SITE 109 AND 110

CAS NO.	COMPOUND	NYSDEC Class GA Ambient Water Quality Standards/Guidance Criteria[1]	QAPP Quantitation Limit [2]	UNITS
335-67-1	Perfluorooctanoic acid (PFOA)	10, 500[10]	2	ng/L
2706-90-3	Perfluoropentanoic Acid (PFPeA)	100, 500[10]	2	ng/L
376-06-7	Perfluorotetradecanoic acid (PFTA)	100, 500[10]	2	ng/L
72629-94-8	Perfluorotridecanoic Acid (PFTriA)	100, 500[10]	2	ng/L
2058-94-8	Perfluoroundecanoic Acid (PFUnA)	100, 500[10]	2	ng/L
	METALS (SW6010C/SW7470A) and CYANIDE (SW9012)			
7429-90-5	ALUMINUM	NS	200	µg/l
7440-36-0	ANTIMONY	3	20	µg/l
7440-38-2	ARSENIC	25	15	µg/l
7440-39-3	BARIUM	1000	200	µg/l
7440-41-7	BERYLLIUM	3	2	µg/l
7440-43-9	CADMIUM	5	4	µg/l
7440-70-2	CALCIUM	NS	5000	µg/l
7440-47-3	CHROMIUM, TOTAL	50	10	µg/l
7440-48-4	COBALT	NS	50	µg/l
7440-50-8	COPPER	200	25	µg/l
7439-89-6	IRON	300, 500[11]	150	µg/l
7439-92-1	LEAD	25	10	µg/l
7439-95-4	MAGNESIUM	35,000	5000	µg/l
7439-96-5	MANGANESE	300, 500[11]	15	µg/l
7439-97-6	MERCURY	0.7	0.2	µg/l
7440-02-0	NICKEL	100	40	µg/l
7440-09-7	POTASSIUM	NS	5000	µg/l
7782-49-2	SELENIUM	10	20	µg/l
7440-22-4	SILVER	50	10	µg/l
7440-23-5	SODIUM	20,000	5000	µg/l
7440-28-0	THALLIUM	0.5	20	µg/l
7440-62-2	VANADIUM	NS	50	µg/l
7440-66-6	ZINC	2,000	30	µg/l
57-12-5	CYANIDE	200	10	µg/l

NOTES:

(1) Groundwater criteria obtained from the NYSDEC document titled, "Division of Water Technical and Operational Gidance Series (1.1.1), Ambient Water Quality Standards and Guidance Values and Groundwter Effluent Limitations," June 1998; Errata Sheet for

(2) Actual laboratory reporting limit (RL) may vary. Laboratory RL or, at a minimum, the laboratory method detection limit (MDL) will

(3) Applies to the sum of 1,2,3-, 1,2,4-, and 1,3,5-trichlorobenze. For the waters of the Great Lakes System, the Department will

(4) Applies to the sum of 1,2-, 1,3- and 1,4-dichlorobenzene

(5) EPA Lifetime Health Advisory level (0.2 mg/L = 200 µg/L).

(6) Applies to the sum of phenolic compounds

(7) Applies to the sum of Aldrin and Dieldrin

(8) Applies to the sum of these substances

(9) PFAS standards obtained from the NYSDEC document titled "Guidelines for Sampling and Analysis of Per- and Polyfluoroalkyl

(10) Applies to sum of PFAS (including PFOA and PFOS)

(11) Applies to sum of iron and manganese

µg/L Micrograms per liter

ng/L Nanograms per liter

TABLE 3.2B SOIL ANALYSIS

Honeywell

PARSONS

TABLE 3.2B
SOIL ANALYSIS
TONAWANDA COKE SITE 109 AND 110

		6 NYCRR Part 375 Soil Cleanup Objectives for Commercial Use[1]	6 NYCRR Part 375 Soil Cleanup Objectives for Industrial Use[1]	Guidelines for Sampling and Analysis of Per- and Polyfluoroalkyl Substances (PFAS)[2]	QAPP Quantitation Limit [3]	UNITS
VOLATILES (SW8260C)						
71-55-6	1,1,1-TRICHLOROETHANE	500,000	1,000,000	N/A	5	µg/kg
79-34-5	1,1,2,2-TETRACHLOROETHANE	NS	NS	N/A	5	µg/kg
76-13-1	1,1,2-TRICHLORO-1,2,2-TRIFLUOROETHANE	NS	NS	N/A	5	µg/kg
79-00-5	1,1,2-TRICHLOROETHANE	NS	NS	N/A	5	µg/kg
75-34-3	1,1-DICHLOROETHANE	240,000	480,000	N/A	5	µg/kg
75-35-4	1,1-DICHLOROETHENE	500,000	1,000,000	N/A	5	µg/kg
87-61-6	1,2,3-TRICHLOROBENZENE	NS	NS	N/A	5	µg/kg
120-82-1	1,2,4-TRICHLOROBENZENE	NS	NS	N/A	5	µg/kg
96-12-8	1,2-DIBROMO-3-CHLOROPROPANE	NS	NS	N/A	5	µg/kg
106-93-4	1,2-DIBROMOETHANE	NS	NS	N/A	5	µg/kg
95-50-1	1,2-DICHLOROBENZENE	500,000	1,000,000	N/A	5	µg/kg
107-06-2	1,2-DICHLOROETHANE	30,000	60,000	N/A	5	µg/kg
78-87-5	1,2-DICHLOROPROPANE	280,000	560,000	N/A	5	µg/kg
541-73-1	1,3-DICHLOROBENZENE	280,000	560,000	N/A	5	µg/kg
106-46-7	1,4-DICHLOROBENZENE	130,000	250,000	N/A	5	µg/kg
591-78-6	2-HEXANONE	NS	NS	N/A	10	µg/kg
67-64-1	ACETONE	500,000	1,000,000	N/A	10	µg/kg
71-43-2	BENZENE	44,000	89,000	N/A	5	µg/kg
74-97-5	BROMOCHLOROMETHANE	NS	NS	N/A	5	µg/kg
75-27-4	BROMODICHLOROMETHANE	NS	NS	N/A	5	µg/kg
75-25-2	BROMOFORM	NS	NS	N/A	5	µg/kg
74-83-9	BROMOMETHANE	NS	NS	N/A	5	µg/kg
75-15-0	CARBON DISULFIDE	NS	NS	N/A	5	µg/kg
56-23-5	CARBON TETRACHLORIDE	22,000	44,000	N/A	5	µg/kg
108-90-7	CHLOROBENZENE	500,000	1,000,000	N/A	5	µg/kg
75-00-3	CHLOROETHANE	NS	NS	N/A	5	µg/kg
67-66-3	CHLOROFORM	350,000	700,000	N/A	5	µg/kg
74-87-3	CHLOROMETHANE	NS	NS	N/A	5	µg/kg
156-59-2	CIS-1,2-DICHLOROETHYLENE	500,000	1,000,000	N/A	5	µg/kg
10061-01-5	CIS-1,3-DICHLOROPROPENE	NS	NS	N/A	5	µg/kg
110-82-7	CYCLOHEXANE	NS	NS	N/A	5	µg/kg
124-48-1	DIBROMOCHLOROMETHANE	NS	NS	N/A	5	µg/kg
75-71-8	DICHLORODIFLUOROMETHANE	NS	NS	N/A	5	µg/kg
100-41-4	ETHYLBENZENE	390,000	780,000	N/A	5	µg/kg
98-82-8	ISOPROPYLBENZENE (CUMENE)	NS	NS	N/A	5	µg/kg
79-20-9	METHYL ACETATE	NS	NS	N/A	10	µg/kg
78-93-3	METHYL ETHYL KETONE (2-BUTANONE)	500,000	1,000,000	N/A	10	µg/kg
108-10-1	METHYL ISOBUTYL KETONE	500,000	1,000,000	N/A	10	µg/kg
108-87-2	METHYLCYCLOHEXANE	NS	NS	N/A	5	µg/kg
75-09-2	METHYLENE CHLORIDE	500,000	1,000,000	N/A	5	µg/kg
100-42-5	STYRENE	NS	NS	N/A	5	µg/kg
1634-04-4	TERT-BUTYL METHYL ETHER	500,000	1,000,000	N/A	5	µg/kg
127-18-4	TETRACHLOROETHYLENE (PCE)	150,000	300,000	N/A	5	µg/kg
108-88-3	TOLUENE	500,000	1,000,000	N/A	5	µg/kg
156-60-5	TRANS-1,2-DICHLOROETHENE	500,000	1,000,000	N/A	5	µg/kg
10061-02-6	TRANS-1,3-DICHLOROPROPENE	NS	NS	N/A	5	µg/kg
79-01-6	TRICHLOROETHYLENE (TCE)	200,000	400,000	N/A	5	µg/kg
75-69-4	TRICHLOROFLUOROMETHANE	NS	NS	N/A	5	µg/kg
75-01-4	VINYL CHLORIDE	13,000	27,000	N/A	5	µg/kg
XYLENES	XYLENES, TOTAL	500,000	1,000,000	N/A	5	µg/kg
SEMIVOLATILES (SW8270D)						
123-91-1	1,4-DIOXANE	130,000	250,000	N/A	100	µg/kg
58-90-2	2,3,4,6-TETRACHLOROPHENOL	NS	NS	N/A	660	µg/kg
95-95-4	2,4,5-TRICHLOROPHENOL	NS	NS	N/A	660	µg/kg
88-06-2	2,4,6-TRICHLOROPHENOL	NS	NS	N/A	660	µg/kg
120-83-2	2,4-DICHLOROPHENOL	NS	NS	N/A	660	µg/kg
105-67-9	2,4-DIMETHYLPHENOL	NS	NS	N/A	660	µg/kg
51-28-5	2,4-DINITROPHENOL	NS	NS	N/A	660	µg/kg
121-14-2	2,4-DINITROTOLUENE	NS	NS	N/A	330	µg/kg
606-20-2	2,6-DINITROTOLUENE	NS	NS	N/A	330	µg/kg

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TABLE 3.2B
SOIL ANALYSIS
TONAWANDA COKE SITE 109 AND 110

		6 NYCRR Part 375 Soil Cleanup Objectives for Commercial Use[1]	6 NYCRR Part 375 Soil Cleanup Objectives for Industrial Use[1]	Guidelines for Sampling and Analysis of Per- and Polyfluoroalkyl Substances (PFAS)[2]	QAPP Quantitation Limit [3]	UNITS
91-58-7	2-CHLORONAPHTHALENE	NS	NS	N/A	330	µg/kg
95-57-8	2-CHLOROPHENOL	NS	NS	N/A	660	µg/kg
91-57-6	2-METHYLNAPHTHALENE	NS	NS	N/A	330	µg/kg
95-48-7	2-METHYLPHENOL (O-CRESOL)	500,000	1,000,000	N/A	660	µg/kg
88-74-4	2-NITROANILINE	NS	NS	N/A	330	µg/kg
88-75-5	2-NITROPHENOL	NS	NS	N/A	660	µg/kg
91-94-1	3,3'-DICHLOROBENZIDINE	NS	NS	N/A	330	µg/kg
99-09-2	3-NITROANILINE	NS	NS	N/A	330	µg/kg
106-44-5	3&4-METHYLPHENOL (M&P-CRESOL)	500,000	1,000,000	N/A	660	µg/kg
534-52-1	4,6-DINITRO-2-METHYLPHENOL	NS	NS	N/A	660	µg/kg
101-55-3	4-BROMOPHENYL PHENYL ETHER	NS	NS	N/A	330	µg/kg
59-50-7	4-CHLORO-3-METHYLPHENOL	NS	NS	N/A	660	µg/kg
106-47-8	4-CHLOROANILINE	NS	NS	N/A	330	µg/kg
7005-72-3	4-CHLOROPHENYL PHENYL ETHER	NS	NS	N/A	330	µg/kg
100-01-6	4-NITROANILINE	NS	NS	N/A	330	µg/kg
100-02-7	4-NITROPHENOL	NS	NS	N/A	660	µg/kg
83-32-9	ACENAPHTHENE	500,000	1,000,000	N/A	330	µg/kg
208-96-8	ACENAPHTHYLENE	500,000	1,000,000	N/A	330	µg/kg
98-86-2	ACETOPHENONE	NS	NS	N/A	330	µg/kg
120-12-7	ANTHRACENE	500,000	1,000,000	N/A	330	µg/kg
1912-24-9	ATRAZINE	NS	NS	N/A	330	µg/kg
100-52-7	BENZALDEHYDE	NS	NS	N/A	330	µg/kg
56-55-3	BENZO(A)ANTHRACENE	5,600	11,000	N/A	330	µg/kg
50-32-8	BENZO(A)PYRENE	1,000	1,100	N/A	330	µg/kg
205-99-2	BENZO(B)FLUORANTHENE	5,600	11,000	N/A	330	µg/kg
191-24-2	BENZO(G,H,I)PERYLENE	500,000	1,000,000	N/A	330	µg/kg
207-08-9	BENZO(K)FLUORANTHENE	56,000	110,000	N/A	330	µg/kg
85-68-7	BENZYL BUTYL PHTHALATE	NS	NS	N/A	330	µg/kg
92-52-4	BIPHENYL (DIPHENYL)	NS	NS	N/A	330	µg/kg
111-91-1	BIS(2-CHLOROETHOXY) METHANE	NS	NS	N/A	330	µg/kg
111-44-4	BIS(2-CHLOROETHYL) ETHER	NS	NS	N/A	330	µg/kg
108-60-1	BIS(2-CHLOROISOPROPYL) ETHER	NS	NS	N/A	330	µg/kg
117-81-7	BIS(2-ETHYLHEXYL) PHTHALATE	NS	NS	N/A	330	µg/kg
105-60-2	CAPROLACTAM	NS	NS	N/A	330	µg/kg
86-74-8	CARBAZOLE	NS	NS	N/A	330	µg/kg
218-01-9	CHRYSENE	56,000	110,000	N/A	330	µg/kg
53-70-3	DIBENZ(A,H)ANTHRACENE	560	1,100	N/A	330	µg/kg
132-64-9	DIBENZOFURAN	350,000	1,000,000	N/A	330	µg/kg
84-66-2	DIETHYL PHTHALATE	NS	NS	N/A	330	µg/kg
131-11-3	DIMETHYL PHTHALATE	NS	NS	N/A	330	µg/kg
84-74-2	DI-N-BUTYL PHTHALATE	NS	NS	N/A	330	µg/kg
117-84-0	DI-N-OCTYLPHTHALATE	NS	NS	N/A	330	µg/kg
206-44-0	FLUORANTHENE	500,000	1,000,000	N/A	330	µg/kg
86-73-7	FLUORENE	500,000	1,000,000	N/A	330	µg/kg
118-74-1	HEXACHLOROBENZENE	6,000	12,000	N/A	330	µg/kg
87-68-3	HEXACHLOROBUTADIENE	NS	NS	N/A	330	µg/kg
77-47-4	HEXACHLOROCYCLOPENTADIENE	NS	NS	N/A	330	µg/kg
67-72-1	HEXACHLOROETHANE	NS	NS	N/A	330	µg/kg
193-39-5	INDENO(1,2,3-C,D)PYRENE	5.600	11,000	N/A	330	µg/kg
78-59-1	ISOPHORONE	NS	NS	N/A	330	µg/kg
91-20-3	NAPHTHALENE	500,000	1,000,000	N/A	330	µg/kg
98-95-3	NITROBENZENE	NS	NS	N/A	330	µg/kg
621-64-7	N-NITROSODI-N-PROPYLAMINE	NS	NS	N/A	330	µg/kg
86-30-6	N-NITROSODIPHENYLAMINE	NS	NS	N/A	330	µg/kg
87-86-5	PENTACHLOROPHENOL	6,700	55,000	N/A	330	µg/kg
85-01-8	PHENANTHRENE	500,000	1,000,000	N/A	660	µg/kg
108-95-2	PHENOL	500,000	1,000,000	N/A	660	µg/kg
129-00-0	PYRENE	500,000	1,000,000	N/A	330	µg/kg
	PESTICIDES (SW8081B)					
309-00-2	ALDRIN	680	1,400	N/A	0.67	µg/kg
319-84-6	ALPHA BHC	3,400	6,800	N/A	0.67	µg/kg
959-98-8	ALPHA ENDOSULFAN	200,000[4]	920,000[4]	N/A	0.67	µg/kg
5103-71-9	ALPHA-CHLORDANE	24,000	47,000	N/A	0.67	µg/kg

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PARSONS

TABLE 3.2B
SOIL ANALYSIS
TONAWANDA COKE SITE 109 AND 110

		6 NYCRR Part 375 Soil Cleanup Objectives for Commercial Use[1]	6 NYCRR Part 375 Soil Cleanup Objectives for Industrial Use[1]	Guidelines for Sampling and Analysis of Per- and Polyfluoroalkyl Substances (PFAS)[2]	QAPP Quantitation Limit [3]	UNITS
319-85-7	BETA BHC	3,000	14,000	N/A	0.67	µg/kg
33213-65-9	BETA ENDOSULFAN	200,000[4]	920,000[4]	N/A	0.67	µg/kg
5103-74-2	BETA-CHLORDANE	NS	NS	N/A	0.67	µg/kg
319-86-8	DELTA BHC	500,000	1,000,000	N/A	0.67	µg/kg
60-57-1	DIELDRIN	1,400	2,800	N/A	0.67	µg/kg
1031-07-8	ENDOSULFAN SULFATE	200,000[4]	920,000[4]	N/A	0.67	µg/kg
72-20-8	ENDRIN	89,000	410,000	N/A	0.67	µg/kg
7421-93-4	ENDRIN ALDEHYDE	NS	NS	N/A	0.67	µg/kg
53494-70-5	ENDRIN KETONE	NS	NS	N/A	0.67	µg/kg
58-89-9	GAMMA BHC (LINDANE)	9,200	23,000	N/A	0.67	µg/kg
76-44-8	HEPTACHLOR	15,000	29,000	N/A	0.67	µg/kg
1024-57-3	HEPTACHLOR EPOXIDE	NS	NS	N/A	0.67	µg/kg
72-43-5	METHOXYCHLOR	NS	NS	N/A	1.3	µg/kg
72-54-8	P,P'-DDD	92,000	180,000	N/A	0.67	µg/kg
72-55-9	P,P'-DDE	62,000	120,000	N/A	0.67	µg/kg
50-29-3	P,P'-DDT	47,000	94,000	N/A	0.67	µg/kg
8001-35-2	TOXAPHENE	NS	NS	N/A	17	µg/kg
	PCBs (SW8082A)					
12674-11-2	PCB-1016 (Aroclor 1016)	1,000	25,000	N/A	33	µg/kg
11104-28-2	PCB-1221 (Aroclor 1221)	1,000	25,000	N/A	33	µg/kg
11141-16-5	PCB-1232 (Aroclor 1232)	1,000	25,000	N/A	33	µg/kg
53469-21-9	PCB-1242 (Aroclor 1242)	1,000	25,000	N/A	33	µg/kg
12672-29-6	PCB-1248 (Aroclor 1248)	1,000	25,000	N/A	33	µg/kg
11097-69-1	PCB-1254 (Aroclor 1254)	1,000	25,000	N/A	33	µg/kg
11096-82-5	PCB-1260 (Aroclor 1260)	1,000	25,000	N/A	33	µg/kg
37324-23-5	PCB-1262 (Aroclor 1262)	1,000	25,000	N/A	33	µg/kg
11100-14-4	PCB-1268 (Aroclor 1268)	1,000	25,000	N/A	33	µg/kg
	PFAS (Modified E537.1)					
2355-31-9	2-(N-methyl perfluorooctanesulfonamido) acetic acid	N/A	N/A	NS	2	µg/kg
27619-97-2	6:2 Fluorotelomer sulfonate	N/A	N/A	NS	2	µg/kg
39108-34-4	8:2 Fluorotelomer sulfonate	N/A	N/A	NS	2	µg/kg
2991-50-6	N-Ethyl-N-((heptadecafluorooctyl)sulphonyl) glycine	N/A	N/A	NS	2	µg/kg
375-73-5	Perfluorobutanesulfonic acid (PFBS)	N/A	N/A	NS	0.2	µg/kg
375-22-4	Perfluorobutanoic Acid	N/A	N/A	NS	0.2	µg/kg
	Perfluorodecane Sulfonic Acid	N/A	N/A	NS	0.2	µg/kg
335-76-2	Perfluorodecanoic acid (PFDA)	N/A	N/A	NS	0.2	µg/kg
307-55-1	Perfluorododecanoic acid (PFDoA)	N/A	N/A	NS	0.2	µg/kg
375-92-8	Perfluoroheptane Sulfonate (PFHPS)	N/A	N/A	NS	0.2	µg/kg
375-85-9	Perfluoroheptanoic acid (PFHpA)	N/A	N/A	NS	0.2	µg/kg
355-46-4	Perfluorohexanesulfonic acid (PFHxS)	N/A	N/A	NS	0.2	µg/kg
307-24-4	Perfluorohexanoic acid (PFHxA)	N/A	N/A	NS	0.2	µg/kg
375-95-1	Perfluorononanoic acid (PFNA)	N/A	N/A	NS	0.2	µg/kg
754-91-6	Perfluorooctane Sulfonamide (FOSA)	N/A	N/A	NS	0.2	µg/kg
1763-23-1	Perfluorooctanesulfonic acid (PFOS)	N/A	N/A	0.07[5]	0.2	µg/kg
335-67-1	Perfluorooctanoic acid (PFOA)	N/A	N/A	0.07[5]	0.2	µg/kg
2706-90-3	Perfluoropentanoic Acid (PFPeA)	N/A	N/A	NS	0.2	µg/kg
376-06-7	Perfluorotetradecanoic acid (PFTA)	N/A	N/A	NS	0.2	µg/kg
72629-94-8	Perfluorotridecanoic Acid (PFTriA)	N/A	N/A	NS	0.2	µg/kg
2058-94-8	Perfluoroundecanoic Acid (PFUnA)	N/A	N/A	NS	0.2	µg/kg
	METALS (SW6010C/SW7470A) and CYANIDE (SW9012)					
7429-90-5	ALUMINUM	NS	NS	N/A	10	mg/kg
7440-36-0	ANTIMONY	NS	NS	N/A	6	mg/kg
7440-38-2	ARSENIC	16	16	N/A	1	mg/kg
7440-39-3	BARIUM	400	10,000	N/A	2	mg/kg
7440-41-7	BERYLLIUM	590	2,700	N/A	0.5	mg/kg
7440-43-9	CADMIUM	9.3	60	N/A	0.5	mg/kg
7440-70-2	CALCIUM	NS	NS	N/A	100	mg/kg
7440-47-3	CHROMIUM, TOTAL	400[6]	800[6]	N/A	1	mg/kg
7440-48-4	COBALT	NS	NS	N/A	5	mg/kg
7440-50-8	COPPER	270	10,000	N/A	2	mg/kg

Honeywell PARSONS

TABLE 3.2B
SOIL ANALYSIS
TONAWANDA COKE SITE 109 AND 110

		6 NYCRR Part 375 Soil Cleanup Objectives for Commercial Use[1]	6 NYCRR Part 375 Soil Cleanup Objectives for Industrial Use[1]	Guidelines for Sampling and Analysis of Per- and Polyfluoroalkyl Substances (PFAS)[2]	QAPP Quantitation Limit [3]	UNITS
7439-89-6	IRON	NS	NS	N/A	10	mg/kg
7439-92-1	LEAD	1,000	3,900	N/A	5	mg/kg
7439-95-4	MAGNESIUM	NS	NS	N/A	100	mg/kg
7439-96-5	MANGANESE	10,000	10,000	N/A	1	mg/kg
7439-97-6	MERCURY	2.8[7]	5.7[7]	N/A	0.033	mg/kg
7440-02-0	NICKEL	310	10,000	N/A	4	mg/kg
7440-09-7	POTASSIUM	NS	NS	N/A	200	mg/kg
7782-49-2	SELENIUM	1,500	6,800	N/A	1	mg/kg
7440-22-4	SILVER	1,500	6,800	N/A	1	mg/kg
7440-23-5	SODIUM	NS	NS	N/A	100	mg/kg
7440-28-0	THALLIUM	NS	NS	N/A	1	mg/kg
7440-62-2	VANADIUM	NS	NS	N/A	5	mg/kg
7440-66-6	ZINC	10,000	10,000	N/A	6	mg/kg
57-12-5	CYANIDE	27[6]	10,000[6]	N/A	0.5	mg/kg

NOTES:

(1) Soil cleanup objectives from Table 375-6.8(b) in NYSDEC's "6 NYCRR PART 375 Environmental Remediation Programs," December 14, 2006.

(2) PFAS guidelines from NYSDEC's "Guidelines for Sampling and Analysis of Per- and Polyfluoroalkyl Substances (PFAS) Under NYSDEC's Part 365 Remedial Programs," January 2020.

(3) Actual laboratory reporting limit (RL) may vary. Laboratory RL or, at a minimum, the laboratory method detection limit (MDL) will meet the standard criteria.

(4) This SCO is for the sum of endosulfan I, endosulfan II, and endosulfan sulfate

(5) This guideline is for Synthetic Precipitation Leaching Procedure (SPLP) results and is applicable to either individual or combined concentrations of PFOA and PFOS

(6) The SCO for this specific compound (or family of compounds) is considered to be met if the analysis for the total species of this contaminant is below the specific SCO.

(7) This SCO is the lower of the values for mercury (elemental) or mercury (inorganic salts).

µg/kg Micrograms per kilogram

mg/kg Millagrams per kilogram

NS No Standard

N/A Not Applicable

TABLE 3.2C WASTE ANALYSIS

Honeywell

PARSONS

TABLE 3.2C
WASTE
TONAWANDA COKE SITE 109 AND 110

CAS NO.	COMPOUND	TCLP Criteria	QAPP Quantitation Limit (1)	UNITS
	TCLP VOLATILES (SW1311/SW8260C)			
75-35-4	1,1-DICHLOROETHENE	0.7	0.01	mg/L
107-06-2	1,2-DICHLOROETHANE	0.5	0.01	mg/L
106-46-7	1,4-DICHLOROBENZENE	7.5	0.01	mg/L
71-43-2	BENZENE	0.5	0.01	mg/L
56-23-5	CARBON TETRACHLORIDE	0.5	0.01	mg/L
108-90-7	CHLOROBENZENE	100	0.01	mg/L
67-66-3	CHLOROFORM	6	0.01	mg/L
78-93-3	METHYL ETHYL KETONE (2-BUTANONE)	200	0.1	mg/L
127-18-4	TETRACHLOROETHYLENE (PCE)	0.7	0.01	mg/L
79-01-6	TRICHLOROETHYLENE (TCE)	0.5	0.01	mg/L
75-01-4	VINYL CHLORIDE	0.2	0.01	mg/L
	TCLP SEMIVOLATILES (SW1311/SW8270D)			
95-95-4	2,4,5-TRICHLOROPHENOL	400	0.05	mg/L
88-06-2	2,4,6-TRICHLOROPHENOL	2	0.05	mg/L
121-14-2	2,4-DINITROTOLUENE	0.13	0.05	mg/L
95-48-7	2-METHYLPHENOL (O-CRESOL)	200	0.05	mg/L
106-44-5	3&4-METHYLPHENOL (M&P-CRESOL)	200	0.05	mg/L
118-74-1	HEXACHLOROBENZENE	0.13	0.05	mg/L
87-68-3	HEXACHLOROBUTADIENE	0.5	0.05	mg/L
67-72-1	HEXACHLOROETHANE	3	0.05	mg/L
98-95-3	NITROBENZENE	2	0.05	mg/L
87-86-5	PENTACHLOROPHENOL	100	0.1	mg/L
110-86-1	PYRIDINE	5	0.05	mg/L
	TCLP PESTICIDES (SW1311/SW8081B)			
57-74-9	CHLORDANE	0.03	0.01	mg/L
72-20-8	ENDRIN	0.02	0.0005	mg/L
58-89-9	GAMMA BHC (LINDANE)	0.4	0.0005	mg/L
76-44-8	HEPTACHLOR	0.008	0.0005	mg/L
1024-57-3	HEPTACHLOR EPOXIDE	0.008	0.0005	mg/L
72-43-5	METHOXYCHLOR	10	0.0005	mg/L
8001-35-2	TOXAPHENE	0.5	0.02	mg/L
	TCLP Herbicides (SW1311/SW8082A)			
94-75-7	2,4-D (DICHLOROPHENOXYACETIC ACID)	10	0.005	mg/L
93-72-1	SILVEX (2,4,5-TP)	1	0.005	mg/L
	TCLP METALS (SW1311/SW6010C/SW7470A)			
7440-38-2	ARSENIC	5	0.15	mg/L
7440-39-3	BARIUM	100	2.5	mg/L
7440-43-9	CADMIUM	1	0.01	mg/L
7440-47-3	CHROMIUM, TOTAL	5	0.025	mg/L
7439-92-1	LEAD	5	0.10	mg/L
7439-97-6	MERCURY	0.2	0.002	mg/L
7782-49-2	SELENIUM	1	0.10	mg/L
7440-22-4	SILVER	5	0.025	mg/L

NOTES:

(1) Actual laboratory reporting limit (RL) may vary. Laboratory RL or, at a minimum, the laboratory method detection limit (MDL) will meet the standard criteria.

mg/L Millagrams per liter

4.0 DATA ACQUISITION

4.1 Sampling Methods

Any non-disposable sampling equipment used for chemical sampling will be cleaned and decontaminated prior to use to prevent potential cross-contamination between each use. The FSP, best practices, and field decontamination methods will be used to mitigate cross contamination. Additionally, this QAPP describes management, handling, and tracking procedures for investigation-derived waste, including solid and liquid materials, and personal protective equipment.

The special precautions described here will be taken to confirm that each sample collected is representative of the conditions at that location and that the sampling and handling procedures neither alter nor contaminate the sample. If failure in the sampling or measurement system occurs, the procedures specified in Section 10.3 of this QAPP will be followed to identify who is responsible for implementing the appropriate corrective action. This section presents sample container preparation procedures, sample preservation procedures, and sample holding times.

For this program, the laboratory will purchase and distribute certified clean sample containers with chemical preservatives. The sample containers used for chemical analysis must be virgin bottleware, I-Chem™ Series 300 (or equivalent). Vendors are required to provide documentation of analysis for each lot of containers, and the documentation will be kept on file at the laboratory. Alternatively, the laboratory may perform testing to certify that the sample containers are not contaminated. Since the containers supplied by the laboratory will be certified clean, the bottles will not be rinsed in the field prior to use.

Laboratory-supplied sample kits (coolers containing field COC forms, custody seals, sample containers, preservatives, and packing material) will be prepared by the laboratory's Sample Management Staff and shipped to the Field Team Leader. The type of containers, required sample volumes, preservation techniques, and holding times for specific analyses are presented in the **Tables 4.1A, 4.1B, and 4.1C.**

Samples requiring chemical preservation will be collected in sample containers provided by the analytical laboratory that already contain sufficient quantities of the appropriate preservative(s) to ensure that the sample is kept in accordance with the method requirements. The laboratory must provide an adequate amount of pre-preserved bottles with traceable high-purity preservatives, and additional preservative for use if the added amount is not sufficient, based on request by the Field Team Leader and on an as-needed basis if additional bottleware is needed during the field activities. The field team must verify that the preservative has been added appropriately.

TABLE 4.1A WATER SAMPLE CONTAINERIZATION PRESERVATION, AND HOLDING TIMES

WATER SAMPLE CONTAINERIZATION, PRESERVATION, AND HOLDING TIMES

Analysis	Bottle Type	Preservation [a]	Holding Time [b]
VOCs	3-40 mL glass vial w/ Teflon septum	HCl to pH<2 Cool to 4°C	14 days
SVOCs, Pesticides, PCBs	2-1 Liter amber glass containers with Teflon-lined lid	Cool to 4°C	7 days for extraction 40 days for analysis
1,4-dioxane	1000 mL glass w/ Teflon lined cap	Cool to 4°C	7 days for extraction 40 days for analysis
Metals	1000 mL plastic bottle	Nitric Acid to pH<2 Cool to 4°C	6 months 28 days (mercury)
Cyanide	500 mL plastic bottle	NaOH to pH>12 Cool to 4°C	14 days
PFAS	2-250 mL HDPE	Cool to 4°C	14 days for extraction, 28 days for analysis

(a) All samples to be preserved in ice during collection and transport.

(b) Days from sample collection.

mL milliliter

TABLE 4.1B SOIL SAMPLE CONTAINERIZATION PRESERVATION, AND HOLDING TIMES

Analysis	Bottle Type	Preservation [a]	Holding Time [b]
VOCs	Encore or TerraCores	Cool to 4°C	48 hours for extraction 14 days for analysis
SVOCs, Pesticides, PCBs	250 mL wide-mouth glass container	Cool to 4°C	14 days for extraction 40 days for analysis
Metals	250 mL wide-mouth glass container	Cool to 4°C	6 months 28 days (mercury)
Cyanide	250 mL wide-mouth glass container	Cool to 4°C	14 days
PFAS	250 mL wide-mouth glass container	Cool to 4°C	14 days for extraction, 28 days for analysis

(a) All samples to be preserved in ice during collection and transport.

(b) Days from sample collection.

NA = Not applicable.

TABLE 4.1C WASTE SAMPLE CONTAINERIZATION PRESERVATION, AND HOLDING TIMES

Analysis	Bottle Type	Preservation[a]	Holding Time[b]
VOCs	3-40 mL glass vial w/ Teflon septum	Cool to 4±2°C	7 days
TCLP VOCs	Wide-mouth glass container.	Cool to 4±2°C	14 days for TCLP extraction 14 days for analysis
SVOCs, Pesticides, PCBs	Wide-mouth glass container with Teflon-lined lid	Cool to 4±2°C	14 days for extraction 40 days for analysis
TCLP SVOCs TCLP Pesticides TCLP Herbicides	Wide-mouth glass container with Teflon-lined lid	Cool to 4±2°C	14 days for TCLP extraction 7 days for extraction 40 days for analysis
Metals	Wide-mouth glass container.	Cool to 4±2°C	6 months (mercury – 28 days)
TCLP Metals	Wide-mouth glass container.	Cool to 4±2°C	6 months (mercury – 28 days)
Ignitability, Corrosivity, Reactivity	Wide-mouth glass container.	Cool to 4±2°C	7 days (14 days for reactivity)

(a) All samples to be preserved in ice during collection and transport.

(b) Days from sample collection.

4.2 Sample Handling and Custody

This section presents sample handling and custody procedures for both the field and laboratory. Implementation of proper handling and custody procedures for samples generated in the field is the responsibility of field personnel. Both laboratory and field personnel involved in the COC and transfer of samples will be trained as to the purpose and procedures prior to implementation. For transfer of samples within the laboratory, an internal COC will be required.

4.2.1 Sample Handling

Samples to be collected for the work assignment are specified in Schedule I of the Proposal. After the samples are collected, they will be split as necessary among preserved containers appropriate to the parameters to be analyzed. Each container will be provided with a sample label that will be filled out at the time of collection. The sampler will print label information, specified below, on each label either before or immediately after collecting the sample with an indelible writing instrument. The label will be protected from water and solvents with clear label packing tape.

The following information, at a minimum, is required on each sample label (note: the location ID and the sample ID as described in the Data Management section below inherently identify some of this information, see below):

- Client
- Project name
- Sampling location
- Sample number
- Date and time of sample collection
- Parameters to be analyzed
- Preservative(s) added, if any
- Initials of the sampler.

Following sample collection, excess soil, water, etc., will be wiped from the outside of the sample containers with a paper towel and the lids will be checked to verify they are tightly closed. Each glass container will be wrapped with bubble wrap to minimize breakage during transport. Bottles containing soil, sediment, and water samples will be placed in separate Ziploc® bags (one bag) and set on ice (ice bath not necessary). Documentation of equipment and methods used in the field for treating the samples will be maintained in the field logs, and a COC will be initiated to document transfer of the samples from the field team to the laboratory. In preparation for shipment to the analytical laboratory, the shipment cooler will be packaged as follows:

Soil and water samples:

- Fill a dry shipment cooler with inert cushioning to a depth of 1 inch to prevent bottle breakage. A separate shipment cooler will be used for PFAS samples.
- Place the bagged samples and the laboratory-provided temperature blank upright in the sample cooler. The temperature blank should be placed in the center (horizontally and vertically) with the samples surrounding.
- Place additional cushioning material around the sample bottles as necessary.
- Place bags of ice in the remaining void space to keep the samples cooled to 4 degrees Celsius (°C).
- Complete the COC form (see Section 4.2.2). Place the COC form in a polyethylene, sealable bag (such as a 1-gal Ziploc® bag or equivalent) and tape the bag to the interior of the cooler lid. Field personnel retain a copy of the COC form; another copy is transmitted to the data manager (quality assurance officer, QAO) and the Project Manager specified in the PMP.

- Prior to sealing for shipment, the list of samples will be checked against the container contents to verify the presence of each sample listed on the COC record including the temperature blank.
- Affix a custody seal to the cooler.
- Seal the cooler securely with packing tape, taking care not to cover labels if already present.
- Label the cooler appropriately in accordance with the Department of Transportation (DOT) regulations (49 CFR 171 through 179).
- Ship the samples in accordance with the DOT requirements outlined in 49 CFR 171 through 179. Complete the carrier bill of lading and retain a copy on file.
- Samples will be delivered to the laboratory by the most expedient means to meet holding times. Whenever practicable, samples will be shipped on the day of collection for delivery to the laboratory the morning of the day after collection. The laboratory will be required to adhere to holding times for sample analyses. Laboratory performance requirements for analysis turnaround time will be established using the validated time of sample receipt (VTSR) in accordance to NYSDEC requirements. The field team will carefully coordinate sampling activities with the laboratory to see that holding times are met.

The required holding times must be adhered to for the initial sample preparation/analysis. If subsequent reanalysis or re-extraction becomes necessary because of method requirements or additional requirements stated here, the laboratory will make every effort to perform those re-extractions and/or reanalysis within the primary holding times. Any holding time that is exceeded will be reported immediately to the Project Manager and the QAO by the laboratory QA manager.

4.2.2 Field Sample Custody

The primary objective of sample custody procedures is to create an accurate written record that can be used to trace the possession and handling of samples from the moment of their collection through analysis until their final disposition. A sample (or sample container) will be considered under custody if:

- In a person's possession
- Maintained in view after possession is accepted and documented
- Locked and tagged with custody seals placed on the sample cooler so that no one can tamper with it after having been in physical custody
- In a secured area that is restricted to authorized personnel

The sample custody flowchart is shown in **Figure 4.1.**

DATA REQUIRED ON CHAIN-OF-CUSTODY
Project name and client Signatures of samplers Sample number, data and time of collection, and grab or composite sample designation Signatures of individuals involved in sample transfer If applicable, the air bill or other shipping number
ADDITIONAL ITEMS THAT SHOULD BE INCLUDED
Sample matrix Number of sample containers Analyses to be performed Preservative(s) Name of the analytical laboratory to which the samples are sent Method of sample shipment

Project number

A COC record will accompany the samples from the time the samples leave the original sampler's possession through the sample shipments' receipt at the laboratory. Triplicate copies of the COC record must be completed for each sample set collected. See chart for data requirements.

If samples are split and sent to different laboratories, a copy of the COC record is sent with each sample.

The REMARKS space on the COC form is used to indicate if the sample is a MS/MSD, or any other sample information for the laboratory. Since they are not specific to any one-sample point, blanks are indicated on separate rows. Immediately prior to sealing the sample cooler, the sampler will sign the COC form and write the date and time on the first RELINQUISHED BY space. The sampler will also write the method of shipment, the shipping cooler identification number, and the shipper air bill number on the top of the COC form. Mistakes will be crossed out with a single line in ink and initialed by the author.

Sampling personnel will retain one copy of the COC form, and the other two copies are put into a sealable plastic bag and taped inside the lid of the shipping cooler. The cooler lid is closed, custody seals provided by the laboratory are affixed to the latch and across the back and front lids of the cooler, and the person relinquishing the samples signs his or her name across the seal. The seal is taped, and the cooler is wrapped tightly with clear packing tape. Field personnel then relinquish the cooler to personnel responsible for shipment, typically an overnight carrier.

The COC seal must be broken to open the sample cooler. Breakage of the seals before receipt at the laboratory may indicate tampering. If tampering is apparent, the laboratory will contact the Field Team Leader for direction on whether to proceed with the analyses.

Sampling personnel record the information placed on the COC record in the field logs. They also include in the log a detailed description of the exact locations from which the samples were collected, any pertinent conditions under which the samples were obtained, and the lot number of the containers used.

4.2.3 Laboratory Sample Management

The laboratory has a designated Sample Management Staff responsible for receiving samples in the laboratory, opening the coolers, checking the sample integrity and custody seals, logging samples into the laboratory information management system (LIMS), and controlling the handling and storage of samples while in the laboratory. The laboratory is a secure facility and only authorized laboratory personnel are allowed to handle active samples. The laboratory maintains an SOP for sample management.

4.2.4 Sample Receipt and Logging

Upon receipt at the laboratory, sample-receiving personnel inspect the samples for integrity of the custody seal, check the shipment against the COC form, and note any discrepancies. Specifically, the sample-receiving personnel note any damaged or missing sample containers. At this time, the field COC record is completed and signed by the Sample Management Staff.

Using the temperature blank in each cooler, the temperature of each incoming sample cooler is measured and recorded during the sample receipt and log-in procedures before samples are placed in laboratory cold storage. Similarly, the laboratory documents that its cold storage facilities are being maintained through daily (at a minimum) documented temperature measurements using a thermometer.

Upon receipt, Sample Management Staff measure and record on the preservation documentation sheet the pH of acid- or base-preserved aqueous samples. Any problems observed during sample receipt must be communicated to the Field Team Leader and/or the QAO verbally and either by fax transmission or email within

24 hr (preferably 3 hr beginning with the normal business day or immediately following for problems noted during second shifts or weekends) after discovery and before samples are released to the laboratory for analysis. Problems may include but are not limited to broken bottles, errors or ambiguities in paper work, insufficient sample volume or weight, inappropriate pH, and elevated temperature.

When the shipment is inspected and the COC record agree, the sample receiving personnel enter the sample and analysis information into the LIMS and assign each sample a unique laboratory number. This number is affixed to each sample bottle.

4.2.5 Sample Storage Security

While in the laboratory, the samples and aliquots that require cold storage will be stored and will be maintained in a secured refrigerator unless they are being used for preparation and/or analysis. All of the refrigerators in the laboratory used for storage of samples have restricted access and are numbered. In addition, dedicated refrigerators are designated for extracts and analytical standards. The sample storage areas are in the laboratory, and access is limited to laboratory personnel. Specific requirements for sample storage are described below:

- Samples will be removed from the shipping container and stored in their original containers unless damaged.
- Damaged samples will be disposed in an appropriate manner, and the disposal will be documented or repacked as necessary and appropriate.
- Samples and extracts will be stored in a secure area designed to comply with the storage method(s) defined in the contract.
- The storage area will be kept secure at all times. The sample custodian or designated personnel will monitor access to the storage area.
- Standards or reagents will not be stored with samples or sample extracts.

The following SOPs for laboratory sample security will be implemented to confirm that the laboratory satisfies sample COC requirements:

- Samples will be stored in a secure area.
- Access to the laboratory will be through a monitored area. Other outside access doors to the laboratory will be kept locked.
- Visitors must sign a visitor's log and will be escorted while in the laboratory.
- Refrigerators, freezers, and other sample storage areas will be securely maintained.

Storage blanks will be initiated and analyzed on a weekly basis for each cold storage unit used to hold samples submitted for the analysis of VOCs. Field QC samples must be stored in the same cold storage units as the samples that they are associated with (even if the matrices are different). All soil samples must undergo thorough sample homogenization (stirred within the original sample container) using inert utensils and mixing platforms that will not interfere with the target analytes being requested for analysis with the exception of soil samples submitted for the analysis of VOCs. Samples for VOC determinations will be stored in a secure refrigerator separate from other samples, sample extracts, reagents, and standards.

4.2.6 Retention and Disposal of Samples

The laboratory must retain all excess samples within their original sample bottles for a minimum of 30 days in cold storage (below 4°C) following submission of the validated data to NYSDEC. At that time, the laboratory must contact the Field Team Leader for authorization for responsible disposal or further storage instructions. At the point at which the laboratory is provided authorization to dispose of the samples, the laboratory will be responsible, and will assume all liability for proper characterization and disposal of samples and bottleware in accordance with all local, state, and federal regulations.

FIGURE 4.1 SAMPLE CUSTODY FLOW CHART

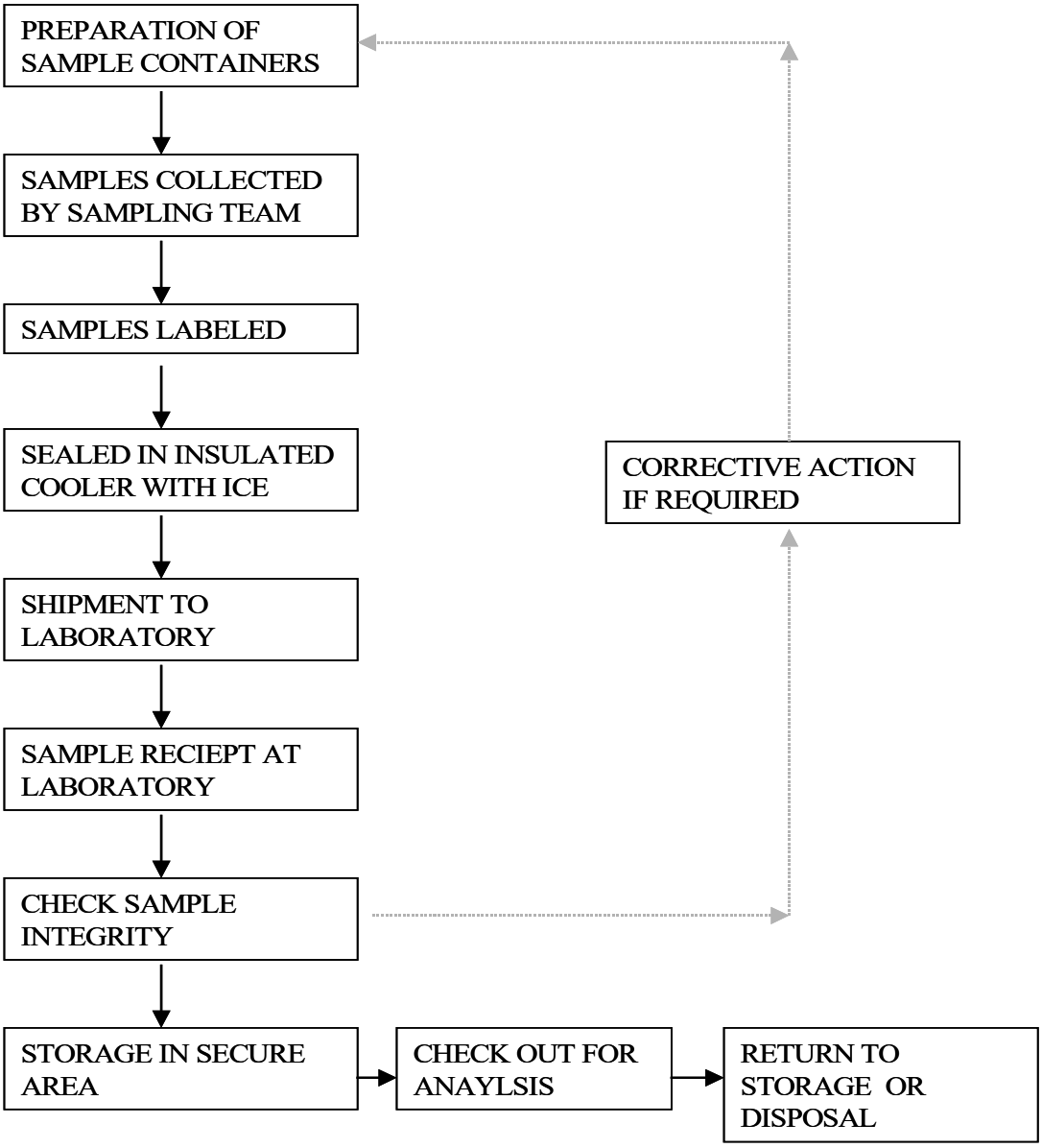
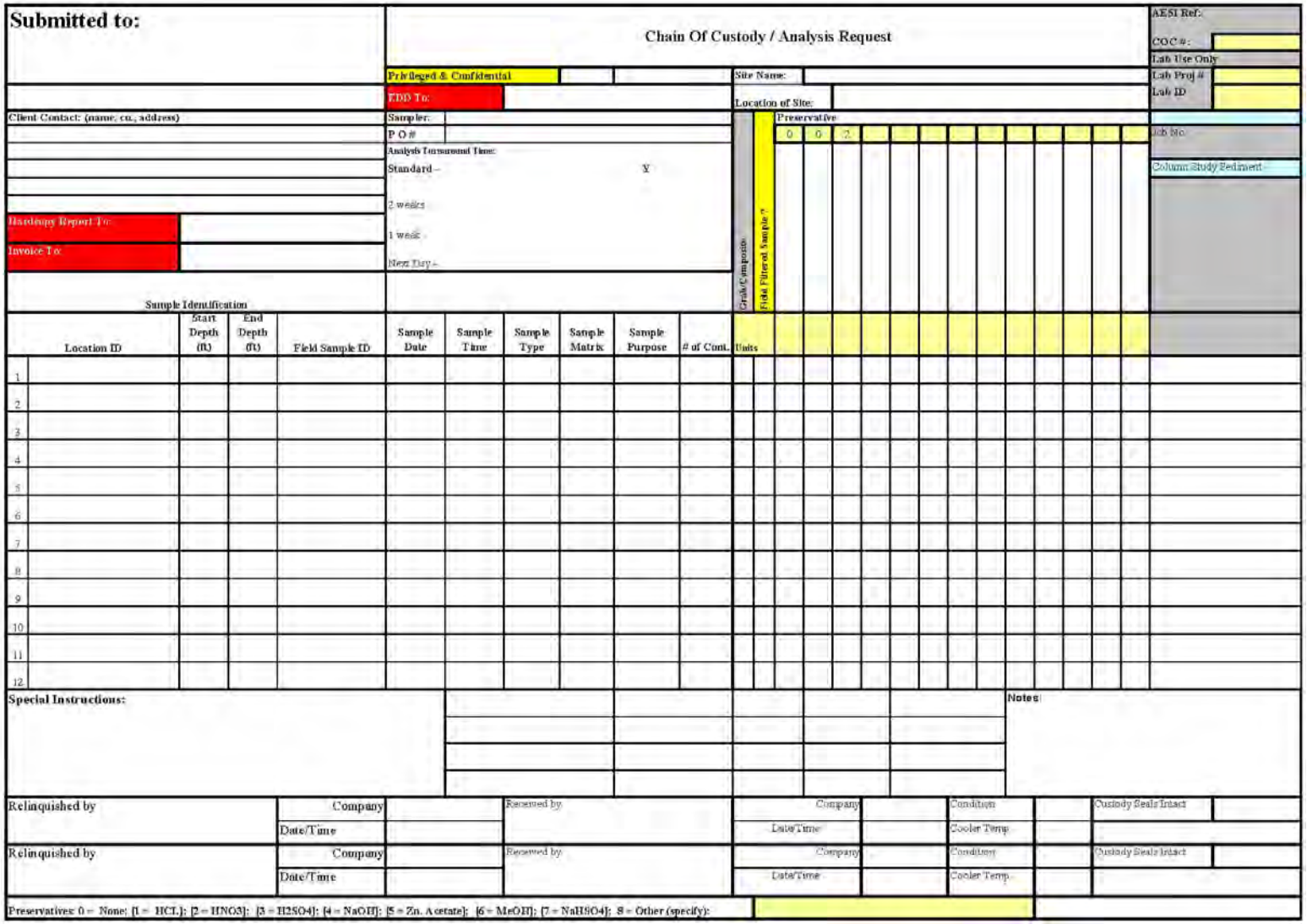


FIGURE 4.2 EXAMPLE OF CHAIN-OF-CUSTODY RECORD



Submitted to:

Chain Of Custody / Analysis Request

AESI Ref:
COC #:
Lab Use Only
Lab Proj #
Lab ID
Job No:
Column Study Sediment

Privileged & Confidential
EDD To:
Sampler:
P O #
Site Name:
Location of Site:
Analysis Turnaround Time:
Standard –
2 weeks
1 week
Next Day –
Hardcopy Report To:
Invoice To:
Client Contact: (name, co., address)
Preservative
Grab/Composite
Field Filtered Sample ?
Units

	Sample Identification: Location ID	Start Depth (ft)	End Depth (ft)	Field Sample ID	Sample Date	Sample Time	Sample Type	Sample Matrix	Sample Purpose	# of Cont.	Preservative: 0	0	2											
1																								
2																								
3																								
4																								
5																								
6																								
7																								
8																								
9																								
10																								
11																								
12																								

Special Instructions:

Notes:

Relinquished by	Company		Received by	Company		Condition		Custody Seals Intact	
	Date/Time			Date/Time		Cooler Temp			
Relinquished by	Company		Received by	Company		Condition		Custody Seals Intact	
	Date/Time			Date/Time		Cooler Temp			

Preservatives: 0 = None; [1 = HCL]; [2 = HNO3]; [3 = H2SO4]; [4 = NaOH]; [5 = Zn. Acetate]; [6 = MeOH]; [7 = NaHSO4]; 8 = Other (specify):

5.0 DATA MANAGEMENT

5.1 Introduction

The electronic data management systems will be implemented to process the information effectively without loss or alteration. As of April 1, 2011, the New York State Division of Environmental Remediation (DER) has implemented an Environmental Information Management System (EIMS). The EIMS uses the database software application EQuIS™ from EarthSoft® Inc. In an effort to improve the management of environmental data and reduce paper quantities, all laboratory analytical data minus instrument raw data must be submitted in the DEC-approved Electronic Data Deliverable (EDD).

Data providers must download and install the EQuIS Data Processor (EDP) to check their properly formatted EDD as well as the NYSDEC DER Format file. The EDP performs a series of formatting checks on the EDD and identifies any errors in the data file prior to submission. All EDDs are to be error free when submitted. It is important that the most recent version of the EDP and NYSDEC format file are employed since the valid values used by EIMS are periodically updated for the EDP.

5.2 Field Data Management

The Field Team Leader will manage data generated in the field. This person or their designee will be responsible for recording and documenting sampling activities in the field logs, on sampling records (as appropriate), and on COC forms (when samples are collected) as described in Section 4.2.2. The records may be photocopied and stored in the project file along with the original.

A sample nomenclature system was developed with the data management team. Each sample name will be unique to include a location ID and field sample ID. The following sample naming conventions will be used for each sampling task:

Groundwater Samples:

Naming Format: Monitoring well ID-Sample Date

Example: MW-5-2020-02052020. Groundwater sample from MW-5-2020.

Soil Samples:

Naming Format: Soil boring/Test pit ID-depth interval-Sample Date

Example: SB-2-2020-4-6-02052020. Soil sample from SB-2-2020, from 4 to 6 feet deep, collected on February 5, 2020

Waste Characterization Samples:

Naming Format: Sample number-waste type-date

Examples: IDW-01-SW-10192020 (SW = solid waste collected on October 19, 2020)

IDW-02-LW-10192020 (LW = liquid waste collected on October 19, 2020)

IDW-03-DW-101920 (DW = debris/mixed waste such as sample tubing, PPE, etc. collected on October 19, 2020)

The Database Manager will add data to EIMS through the input module of the system.

DATA INPUT TO EIMS MAY INCLUDE:
– Sample planning information (e.g., sample depth) – Chain-of-custody data – Sediment coring logs – Geotechnical data – Location and geographic data – Field measurements – Meteorological data – Waste characterization data – Groundwater levels – Radiodating data – Laboratory analytical data

5.3 Laboratory Data Management

Laboratory data management involves several important stages that include data transformation, review, verification, and validation, as well as data storage, retrieval, and security. The laboratory will implement a data management system to manage the data from its generation in the laboratory to its final reporting and storage. The data management system will include, but not be limited to, the use of standard record-keeping practices, standard document control systems, and the electronic data management system.

The laboratory data reduction, verification, validation, and reporting procedures and project data management activities, data/information exchange procedures ensure that complete documentation is maintained, transcription and reporting errors are minimized, and data are properly review.

Specific laboratory data management requirements and procedures are discussed in Sections 6 and 9 of this QAPP.

6.0 DOCUMENTS AND RECORDS

6.1 Introduction

Records will be maintained to document accurately the data generation process during investigation in the field, sample analysis in the lab, and during data validation. Project documentation will be maintained in general accordance with guidelines in the National Enforcement Investigation Center Policies and Procedures (USEPA 1986). A project file will be maintained that will contain appropriate project documentation; see components in chart. Some of this documentation may be retained electronically in lieu of paper copies. **Table 6.1** summarizes the types of project documents and records.

MINIMUM COMPONENTS OF PROJECT FILE
- Project plans and specifications - Field logs and data records - Photographs, maps, and drawings - Sample identification documents - Chain-of-custody records - Data review notes - Report notes and calculations - Progress and technical reports and - Correspondence and other pertinent information - Full analytical data deliverables package provided by the lab, including QC documentation and electronic data deliverable

6.2 Field Records

Field personnel are responsible for documenting sample handling activities, observations, and data in field sampling records including field logs, COC records, photographs, and pre-design investigation records. The Field Team Leader is responsible for maintaining these documents. Each record is described below.

6.2.1 Field Log

A Field Log will be used to document RI activities. The field log will have consecutively numbered pages, and documentation will be recorded using waterproof ink. Incomplete lines, pages, and changes in the log will be lined out with a single line, dated, and initialed. More detailed procedures for documenting investigation activities (such as field sampling records and boring log forms) and type of information to include in the field log may be developed.

MINIMUM REQUIREMENT FOR INFORMATION IN FIELD LOG
- Responsible person's name - Date and time of activity - Equipment and methods used for field preparation of samples - Field measurements of samples (e.g., pH, temperature) - Information coordinating sample handling activities with appropriate field activities and chain-of-custody documentation Daily calibration activities: Calibrator's name Instrument name and model Date and time of calibration Standards used and their source Temperature (if appropriate) Results of calibration Corrective actions taken (if any)

6.2.2 Electronic Field Data Management

The field sampling program will have an electronic data management component. The system will be designed to specify the necessary samples taken at any given location and to provide the ability to be updated and amended in the field. This will provide a management system that efficiently tracks the needs of the sampling scope. As the samples are taken, log entries are put in the database, and sample labels are printed. At any given time a COC record can be printed as well.

6.2.3 Chain-of-Custody Record

The COC record establishes the documentation necessary to trace sample possession from the date and time of sample collection, through sample shipment, to the date and time of arrival at the laboratory designated to perform analysis. The ability to trace the history of a sample is essential to show that the sample collected was, indeed, the sample analyzed and that the sample was not subjected to biasing influences. Evidence of sample traceability and integrity is provided by COC procedures. These procedures are necessary to support the validity of the data and will accompany each shipping container.

A copy of the COC record will be detached and kept with the field log or placed in the project file; the original record will accompany the shipment.

6.3 Laboratory Records

Laboratories providing analytical support for this project must maintain records to ensure that all aspects of the analytical processes are adequately documented to ensure legal defensibility of the data.

When a mistake is made, the wrong entry is crossed out with a single line, initialed, and dated by the person making the entry, and the correct information recorded. Obliteration of an incorrect entry or writing over it is not allowed, nor is the use of correction tape or fluid on any laboratory records.

Overwriting or disposal of any electronic media prior to a 5-yr expiration period is strictly prohibited. All electronic and hardcopy data must be stored in an easily accessible climate-controlled environment. The laboratory will exercise "best practices" in terms of frequent, redundant electronic backup procedures on proper long-term storage media to assure that all electronic data representing sample analyses will be maintained for the 5-year storage period. Electronic data must be stored in a secure, limited-access area with redundant copies stored in fireproof vaults and/or stored off-site of the laboratory facilities.

Sample preparation in the laboratory must be fully documented and include sample preparation conditions (such as digestion temperatures). In addition, documentation must allow complete traceability to all prepared or purchased reagents, acids and solvents, and reference solutions. All spike solutions and calibration standards must be used prior to labeled expiration dates and stored in accordance with manufacturers recommended conditions. Complete and unequivocal documentation must exist to enable traceability of all prepared spike solutions, calibration standards, and prepared reagents back to the reference materials utilized. Organic extracts must be stored in the same type of vials (amber or clear) as the associated standards at the appropriate storage temperatures.

The unit conventions set forth in the figures for reported data will be consistent with standard laboratory procedures. Reporting units used are those commonly used for the analyses performed. Concentrations in soil and rock sediment samples will be expressed in terms of weight per unit dry weight, with moisture content reported for each sample.

Laboratory records used to document analytical activities in the laboratory will include reagent and titrant preparation records, standard preparation logs, sample preparation logs, bench data sheets, instrument run logs, and strip chart recordings/chromatograms/computer output. Additional records will include calibration records, maintenance records, nonconformance memos, and Corrective Action Request (CAR) forms.

LAB RECORDS SHOULD CONVEY:
- What was done - When it was done - Who did it and - What was found

REQUIREMENTS FOR LAB RECORDKEEPING
- Data entries must be made in indelible water-resistant ink - Date of each entry and observer must be clear - Observer uses his or her full name or initials - Initial and signature log is maintained so the recorder of every entry can be identified - Information must be recorded in notebook or on other records when the observations are made - Recording information on loose pieces of paper not allowed

6.3.1 Operational Calibration Records

Operational calibration records will document the calibration of instruments and equipment that are corrected on an operational basis. Such calibration generally consists of determining instrumental response against compounds of known composition and concentration or the preparation of a standard response curve of the

same compound at different concentrations. Records of these calibrations are maintained in the following documents:

- Standard preparation information, to trace the standards to the original source solution of neat compound, is maintained in LIMS or laboratory standard preparation logs.
- Instrument logbook provides an ongoing record of the calibration for a specific instrument. The logbook should be indexed in the laboratory operations records and should be maintained at the instrument by the chemist. The chemist must sign and date all entries, and the QM or his designee must review them.
- For Level IV data packages, copies of the raw calibration data will be kept with the analytical sample data so the results can readily be processed and verified as one complete data package. If samples from several projects are processed together, the calibration data is copied and included with each group of data. The laboratory will maintain all calibration, analysis, and corrective action documentation (both hard copy and electronic data) for a minimum of seven years. The documentation maintained must be sufficient to show all factors used to derive the final (reported) value for each sample. Documentation must include all calculation factors such as dilution factor, sample aliquot size, and dry-weight conversion for solid samples. The individual who performs hand calculations must sign and date them. This documentation must be stored with the raw data. Calculations performed by the data system will be documented and stored as electronic and hard copy data. The instrument printouts will be kept on file, and the electronic data will be stored by the laboratory for a minimum of seven years.

6.3.2 Maintenance Records

Maintenance records will be used to document maintenance activities, service procedures, and schedules. They must be traceable to each analytical instrument, tool, or gauge. The individual responsible for the instrument must review, maintain, and file these records. These records may be audited by the QAO to verify compliance. Logs must be established to record and control maintenance and service procedures and schedules.

6.3.3 Nonconformance Memos

Nonconformance Memos (NCM) may be either a hard copy record or an electronic database record. In either case, review and release of the record must be documented by the initiator, the analytical group leader where appropriate, the laboratory project manager (LPM), and the laboratory QA manager. All internal laboratory nonconformance documentation will be communicated to the Field Team Leader by the laboratory project manager verbally and summarized in the report narrative. The NCM will be used to document equipment that fails calibration and will identify any corrective actions taken.

6.3.4 Corrective Action Request (CAR) Forms

The laboratory must use CAR forms to document any incidents requiring corrective action. The CAR form will be issued to the personnel responsible for the affected item or activity. A copy will also be submitted to the LPM. The individual to whom the CAR is addressed will return the requested response promptly to the QA personnel and will affix his or her signature and date to the corrective action block after stating the cause of the conditions and corrective action to be taken. QA personnel will maintain a log for status of CAR forms to confirm the adequacy of the intended corrective action and to verify its implementation. CARs will be retained in the project record file.

6.3.5 Analytical Data Reports

Analytical data will be reported as an EDD and as an analytical data package. The analytical laboratories are required to submit all data, preliminary and final, in formatted EDDs in accordance with NYSDEC's requirements.

The laboratory must meet 100% compliance with these requirements. The Parsons Database Manager will submit written requests dictating the requirements and appropriate files to be supplied by the laboratory. The specifications of the EDD are presented in Section 5. EDDs are required for this project for all data collected regardless of whether the data will be validated or not.

Analytical data reports will be provided by the laboratory within 28 calendar days following receipt of a complete Sample Delivery Group (SDG) and will include the specifications identified in Attachment 1. An SDG is considered to include all samples received for the same project or site, to a maximum of twenty investigative samples not to exceed 5 consecutive days of sampling. The data package provided by the laboratory will be Level IV data in the NYSDEC ASP Category B format for all data requiring validation, unless an alternative requirement is specified in a laboratory statement of work (SOW) and will contain all information to support the data validation in accordance with the USEPA Region II SOP as described in Section 9. Additionally, the completed copies of the COC records, accompanying each sample from the time of initial bottle preparation to completion of analysis, must be attached to the analytical reports.

6.4 Data Validation and Audit Records

Data validation personnel are responsible for documenting validation procedures and results in the form of a data usability summary report (DUSR). The QAO will be responsible for maintaining this report and the QAO will be responsible for its distribution. Additionally, audit reports will be prepared and distributed by the QAO. A brief description of each record is described below.

6.4.1 Data Usability Summary Records

The DUSR will be prepared as required by NYSDEC DER-10 Technical Guidance for Site Investigation and Remediation, Appendix 2B, May, 2010. The DUSR will summarize the impacts of using data that do not achieve overall data quality objectives or that do not meet PARCC and sensitivity criteria identified in Section 3.2.

6.4.2 Audit Records

Among other QA audit reports, which may be generated during the conduct of activities, a final audit report for this project may be prepared by the QAO. The report will include:

- Periodic assessment of measurement data accuracy, precision, and completeness
- Results of performance audits and/or system audits
- Significant QA problems and recommended solutions for future projects
- Status of solutions to any problems previously identified

TABLE 6.1 SUMMARY OF FIELD, LABORATORY, AND DATA MANAGEMENT RECORDS

REPORT	PERSON RESPONSIBLE FOR		STORAGE
	MAINTENANCE	DISTRIBUTION	
PROJECT FILES AND FIELD SAMPLING RECORDS			
Field Log	Field Team Leader	Project Manager	Job File at Primary Contractor's Location
Photographs	Field Team Leader	Project Manager	Job File at Primary Contractor's Location
Chain-of-Custody	Field Team Leader	Project Manager	Job File at Primary Contractor's Location
Field Sampling Records	Field Team Leader	Project Manager	Job File at Primary Contractor's Location
LABORATORY RECORDS			
Reagent and Titrant Preparation Records	Quality Assurance Manager	Laboratory Project Manager	Job File at Laboratory
Standards Preparation Logs	Quality Assurance Manager	Laboratory Project Manager	Job File at Laboratory
Sample Preparation Logs	Quality Assurance Manager	Laboratory Project Manager	Job File at Laboratory
Bench Data Sheets	Quality Assurance Manager	Laboratory Project Manager	Job File at Laboratory
Instrument Run Logs	Quality Assurance Manager	Laboratory Project Manager	Job File at Laboratory

TABLE 6.1 SUMMARY OF FIELD, LABORATORY, AND DATA MANAGEMENT RECORDS (CONT.)

REPORT	PERSON RESPONSIBLE FOR		STORAGE
	MAINTENANCE	DISTRIBUTION	
Strip Chart Recordings/ Chromatograms/Computer Output	Quality Assurance Manager	Laboratory Project Manager	Job File at Laboratory
Analytical Data Reports	Quality Assurance Manager	Laboratory Project Manager	Job File at Laboratory
Log-in Sheets	Quality Assurance Manager	Laboratory Project Manager	Job File at Laboratory
Maintenance Records	Quality Assurance Manager	Laboratory Project Manager	Instrument Maintenance Logbook at Laboratory
Periodic Calibration Records	Quality Assurance Manager	Laboratory Project Manager	QA Files at Laboratory
Operational Calibration Records	Quality Assurance Manager	Laboratory Project Manager	Job File at Laboratory
Nonconformance Memos	Quality Assurance Manager	Laboratory Project Manager	Maintained in Database File at Laboratory
Corrective Action Request Forms	Quality Assurance Manager	Laboratory Project Manager	Client Correspondence Records at Laboratory
DATA VALIDATION AND AUDIT RECORDS			
Data Validation Reports	Quality Assurance Officer	Quality Assurance Officer	Job File at Primary Contractor's Location
Audit Reports	Quality Assurance Officer	Quality Assurance Officer	Job File at Primary Contractor's Location

7.0 ANALYTICAL PROCEDURES

7.1 Introduction

To meet program specific regulatory requirements for chemicals of concern, all methods will be followed as stated, with some specific requirements noted below. Chemical analyses for inorganics, organics, and wet chemistry parameters will be conducted in accordance with the QAPP, Schedule I of the proposal, laboratory's SOPs (maintained "on-file" at the laboratory), and with referenced analytical methods including USEPA SW846 Test Methods for Evaluating Solid Waste, Physical, and Chemical (USEPA 1997), and Methods for Chemical Analysis of Water and Wastes (USEPA 1983). Where requirements conflict, the technical and QA/QC requirements in this QAPP, or the Work Assignment Scoping Documents take precedence.

7.2 Standard Operating Procedures (SOPs)

SOPs are a written step-by-step description of laboratory operating procedures exclusive of analytical methods. Laboratories providing analytical support for this project will be required to document all procedures in SOPs. The SOPs must address the following areas:

- Storage containers and sample preservatives
- Sample receipt and logging
- Sample custody
- Sample handling procedures
- Sample transportation
- Glassware cleaning
- Laboratory security
- QC procedures and criteria
- Equipment calibration and maintenance
- Documentation
- Safety
- Data handling procedures
- Document control
- Personnel training and documentation
- Sample and extract storage
- Preventing sample contamination
- Traceability of standards
- Data reduction and validation
- Maintaining instrument records and logbooks
- Nonconformance
- Corrective actions
- Records management

8.0 QUALITY CONTROL (QC)

8.1 Introduction

A QC program is a systematic process that controls the validity of analytical results by measuring the accuracy and precision of method and matrix, developing expected control limits, using these to detect anomalous events, and requiring corrective action techniques to prevent or minimize the recurrence of these events. QC measurements for analytical protocols are designed to evaluate laboratory performance, and measurement biases resulting from the sample matrix and field performance.

- **Field performance:** QC samples are used to evaluate the effectiveness of the sampling program to obtain representative samples, eliminating any cross contamination. These samples will include trip blanks, field duplicates and rinse blanks.
- **Sample performance:** Factors associated with sample preparation and analysis influence accuracy and precision. Such factors are monitored by the use of internal QC samples. QC field samples are analyzed to evaluate measurement bias due to the sample matrix based on evaluation of matrix spike (MS) and matrix spike duplicate (MSD) samples. If acceptance criteria are not met, matrix interferences are confirmed either by reanalysis or by inspection of the LCS results to verify that laboratory method performance is in control. Data are reported with appropriate qualifiers or discussion.
- **Laboratory method performance:** All QC criteria for method performance should be met for all target analytes for data to be reported. These criteria generally apply to instrument detector assessment (such as, tunes, inductively coupled plasma (ICP) interference check sample), calibration, method blanks, and LCS. Variances will be documented and noted in the case narrative of the report.

8.1.1 Field Quality Control Samples

QC samples will be collected in the field as part of the sampling program to allow evaluation of data quality. Field QA/QC samples will consist of the collection and analysis of field blanks, equipment rinse blanks, field duplicates, and MS/MSD samples, at a frequency of 1:20 for each sample media. Temperature blanks will accompany each sample shipment container (cooler) shipped to the laboratory for sample analysis (water and soil). An equipment rinse blank will be collected from disposable sampling equipment at a frequency of once per lot. For PFAS sampling, equipment rinse blanks and field blanks will be collected daily. Standard sample identifiers will identify field QA/QC samples and they may provide no indication of their nature as QA/QC samples.

A summary of the type and collection frequency of field QC samples to be collected respective to the sampling programs specified in this QAPP, is included in **Table 8.1**. A description of each QC sample is included below.

8.1.1.1 Equipment Rinse Blanks

To assess field sampling and decontamination performance, equipment rinse blanks will be used to evaluate the effectiveness of the decontamination procedures for chemical sampling equipment. Equipment rinse blanks will be collected as part of all chemical sampling programs, except for waste characterization samples. For groundwater sampling, an equipment rinse blank is a sample of deionized water provided by the laboratory that is poured over or through the sampling equipment (e.g., stainless steel spoon, tubing, etc.) into the sample container. An equipment rinse blank will be collected at a frequency of 1:20 samples per type of sample collection activity using non-disposable sampling equipment. An equipment rinse blank will be collected from

disposable sampling equipment at a frequency of once per lot. For PFAS sampling, equipment rinse blanks will be collected daily using laboratory supplied PFAS-free water.

8.1.1.2 Field Duplicates

Coded (blind) field duplicates will be used to assess the precision of field sampling procedures. Precision of a sample is calculated by quantifying the RPD between two sample measurements (Section 3.2.2.1). If the RPD of field duplicate results is greater than the precision criterion, environmental results for the field duplicate pair will be qualified as estimated. The Field Leader responsible for sample collection and processing should be notified to identify the source of variability (if possible), and corrective action should be taken (Section 10.3).

Coded (blind) field duplicates will be collected to evaluate the representativeness and effectiveness of homogenization and proper mixing for soil and aqueous samples and to assess sampling errors for vapor intrusion samples. The field duplicate will be analyzed for all of the parameters for which the associated samples are being analyzed. The samples will be labeled in such a manner that the laboratory will not be able to identify the sample as a duplicate sample. This will eliminate bias that could arise by laboratory personnel.

8.1.1.3 Trip Blanks

During field sampling and sample shipping, contamination may be introduced to the samples that could affect the accuracy of analysis results. Trip blanks will be used during sample shipment to detect cross-contamination. Each cooler of aqueous samples sent to the laboratory for analysis of VOCs will contain one trip blank. Trip blanks are prepared only when VOCs samples are taken and are analyzed for VOCs analytes. The trip blank consists of a VOC sample vial filled in the laboratory with American Society for Testing and Materials (ASTM) Type II reagent grade water, transported to the sampling site, handled like an environmental sample, and returned to the laboratory for analysis. Trip blanks are not opened in the field.

8.1.1.4 Field Blanks

The primary purpose of this type of blank is to provide an additional check on possible sources of contamination. A field blank serves a similar purpose as a trip blank regarding water quality and sample bottle preparation. However, it is primarily used to indicate potential contamination from ambient air as well as from sampling instruments used to collect and transfer samples from point of collection into sample containers. A field blank will be collected daily for PFAS sampling only using laboratory supplied PFAS-free water.

8.1.1.5 Temperature Blank

The temperature blank is used to indicate the temperature of the sample cooler upon receipt at the laboratory. A temperature blank consists of laboratory reagent in a 40-ml glass vial sealed with a Teflon® septum. Any cooler temperature exceeding the allowable 4 ± 2 °C must be noted and the QAO notified prior to sample analyses.

8.1.2 Laboratory Quality Control Samples

QC data from the laboratory are necessary to determine precision and accuracy of the analyses and to demonstrate the absence of interferences and contamination of glassware and reagents. The laboratory will analyze QC samples routinely as part of the laboratory QC procedures. Laboratory QC results will consist of analysis of MS/MSD, LCS, method/preparation blanks, and surrogate spikes. The frequency of the analysis of laboratory QC is summarized in **Table 8.2**. QC samples will be prepared and analyzed utilizing the same preparation and analysis procedures as the field samples. These laboratory QC sample analyses will be run

independently of the field QC samples. Results of these analyses will be reported with the sample data and kept in the project QC data file.

QC samples will be prepared and analyzed utilizing the same preparation and analysis procedures as the field samples. Re-preparation and/or reanalysis of the laboratory QC samples due to a failing recovery and/or precision failure without the re-preparation and reanalysis of the associated samples is prohibited. In all events, QC failures, holding time exceedances, or any other non-standard occurrence must be communicated immediately to the QAO and prior to reporting and then, with approval to report the data, summarized in the case narrative. If the criteria are not met, appropriate corrective action must be taken as specified in Section 9.1 and Section 10.

8.1.2.1 Matrix Spike/Matrix Spike Duplicate/Matrix Duplicates

MS/MSD samples for organics, metals, and general chemistry parameters will be taken at a frequency of one per 20 field samples (per SDG) per matrix per method. A "batch" is considered up to twenty samples from the same matrix, of the same extraction/digestion type, prepared and/or analyzed by a given analyst, within 12-hr, within an extraction/digestion event, whichever is more frequent. These samples are used to assess the effect of the sample matrix on the recovery of target compounds or target analytes by spiking a normal field sample with a known concentration of the analyte of interest. Samples identified as blanks (e.g., trip blank, field blank, equipment rinse blank) will not be used for the MS/MSD preparation or analysis.

Spiked samples will be analyzed, and the percent recovery will be calculated. Results of the analysis will be used to evaluate accuracy and precision of the actual sample matrix. For MS/MSD, the result will be compared and used to evaluate the precision of the actual sample matrix. The percent recovery for each analyte in the MS and MSD should fall within the limits established by laboratory QC protocol.

The original sample, MS, and MSD sample aliquots will be treated exactly the same throughout the sample preparation and analysis and will not be homogenized more than any other project sample (either in the field or at the laboratory). The spike samples will be analyzed for the same parameters as the sample. Field personnel must indicate on the COC form which sample(s) are designated as MS/MSD. If samples are not designated for these QC purposes and/or insufficient sample is available the Project Manager and/or QAO will be notified for resolution.

8.1.2.2 Laboratory Control Samples (LCS)

LCS are designed to check the accuracy of the analytical procedure by measuring a known concentration of an analyte of interest. An LCS will be analyzed for each analytical batch requested for sample preparation and analysis. LCSs must be prepared at a frequency of one per batch for all analytical methods. If high LCS recoveries are observed and the associated samples are reported as "not detected" for the requested target analytes, no action is necessary other than to note the issue in the case narrative of the final analytical report.

8.1.2.3 Method and Preparation Blanks

Laboratory blank samples (also referred to as method or preparation blanks) are designed to detect contamination resulting from the laboratory environment or sample preparation procedure. Method blanks verify that method interferences caused by contaminants in solvents, reagents, glassware, or in other sample processing hardware, are known. Method blanks will be analyzed for each analytical batch using similar preparation techniques (separatory funnel and liquid/liquid extraction) to assess possible contamination and evaluate which corrective measures may be taken, if necessary.

Method blanks associated with field samples must undergo all of the processes performed on investigative samples, including but not limited to pre-filtration and sample cleanups. Where all the field samples in a batch do not require an additional cleanup procedure, an additional blank may be prepared to check the performance of the additional cleanup and will be associated with the field samples getting the specific additional cleanup. Where this is done, both blanks will be reported, and the procedure described in the case narrative. Method blanks must be prepared at a frequency of one per analytical batch.

8.1.2.4 Surrogate Spike Analyses

Surrogate spikes (applicable to organic analysis only) are used to determine the efficiency of analyte recovery in sample preparation and analysis. Calculated percent recovery of the spikes is used to measure the accuracy of the analytical method. A surrogate spike is prepared by adding a known amount of a compound similar in type to the analytes of interest. Surrogate compounds will be added to all samples analyzed by USEPA Methods, including method blanks, MS/MSDs, project environmental samples, and duplicate samples in accordance with the method.

8.2 Instrument/Equipment Testing, Inspection, and Maintenance

8.2.1 Field Equipment

Equipment failure will be minimized by routinely inspecting all field equipment to ensure that it is operational and by performing preventative maintenance procedures. Field sampling equipment will be inspected prior to sample collection activities, and repairs will be made prior to decontamination and reuse of the sampling equipment. PFAS-specific requirements for field sampling equipment are described in the checklists and NYSDEC guidance documents included in Attachments 2 and 3. Equipment, instruments, tools, gauges, and other items requiring preventive maintenance will be serviced in accordance with the manufacturer's specified recommendations and written procedure, based on the manufacturer's instructions or recommendations. Maintenance will be performed in accordance with the schedule specified by the manufacturer to minimize the downtime of the measurement system. Qualified personnel must perform maintenance work.

MINIMUM ROUTINE PREVENTIVE MAINTENANCE
Removal of foreign debris from exposed surfaces
Storage in a cool dry place protected from the elements
Daily inspections
Verification of instrument calibrations (Section 8.3.1)

A list of critical spare parts will be developed prior to the initiation of fieldwork. Field personnel will have ready access to critical spare parts to minimize downtime while fieldwork is in progress. A service contract for rapid instrument repair or backup instruments may be substituted for the spare part inventory.

Non-routine maintenance procedures require field equipment to be inspected prior to initiation of fieldwork to determine whether or not it is operational. If it is not operational, it will be serviced or replaced. Batteries will be fully charged or fresh, as applicable.

8.2.2 Laboratory Instrumentation

Periodic preventive maintenance is required for all sensitive equipment. Instrument manuals will be kept on file for reference if equipment needs repair. The troubleshooting section of factory manuals may be used in assisting personnel in performing maintenance tasks.

Major instruments in the laboratory are covered by annual service contracts with manufacturers or other qualified personnel (internal or external). Under these agreements, trained service personnel make regular preventive maintenance visits. Maintenance is documented and maintained in permanent records by the individual responsible for each instrument.

The laboratory manager is responsible for preparation, documentation, and implementation of the program. The laboratory QA manger reviews implementation to verify compliance during scheduled internal audits.

Written procedures will establish the schedule for servicing critical items to minimize the downtime of the measurement system. The laboratory will adhere to the maintenance schedule and arrange any necessary and prompt service. Qualified personnel will perform required service.

8.3 Instrument/Equipment Calibration and Frequency

Instruments (field and laboratory) used to perform chemical measurements will be properly calibrated prior to use to obtain valid and usable results. The requirement to properly calibrate instruments prior to use applies equally to field instruments as it does to fixed laboratory instruments to generate appropriate data to meet DQOs.

8.3.1 Field Instruments

All field analytical equipment will be calibrated immediately prior to each day's use. The calibration procedures of field instruments (such as PID, pH, temperature), will conform to manufacturer's standard instructions to ensure that the equipment functions within the allowable tolerances established by the manufacturer and required by the project. Personnel performing instrument calibrations must be trained in its proper operation and calibration. Records of all instrument calibration will be maintained by the Field Team Leader in the field log (Section 6.2) and will be subject to audit by the QAO or authorized personnel. The Field Team Leader will maintain copies of all the instrument manuals on the site.

8.3.2 Laboratory Instruments

A formal calibration program will control instruments and equipment used in the laboratory. The program will verify that equipment is of the proper type, range, accuracy, and precision to provide data compatible with specified requirements. Instruments and equipment that measure a quantity or whose performance is expected at a stated level will be subject to calibration. Laboratory personnel or external calibration agencies or equipment manufacturers will calibrate the instruments using reference standards. Upon request, the laboratory will provide all data and information to demonstrate that the analytical system was properly calibrated at the time of analysis including calibration method, frequency, source of standards, concentration of standards, response factors, linear range, check standards, and all control limits. This data will be documented in a calibration record (Section 6.3.1). Calibration records will be prepared and maintained for each piece of equipment subject to calibration.

This section provides an overview of the practices used by the laboratory to implement a calibration program. Detailed calibration procedures, calibration frequencies, and acceptance criteria are specified in the laboratory's

analytical method SOPs. The requirements for the calibration of instruments and equipment depend on the type and expected performance of individual instruments and equipment. Therefore, the laboratory will use the guidelines provided here to develop a calibration program.

Two types of calibration are described in this section: periodic calibration and operational calibration. The results of the calibration activities will be documented in the analytical data package and the calibration records (Section 6.3.1).

- **Periodic calibration:** Performed at prescribed intervals for equipment, such as balances and thermometers. In general, equipment which can be calibrated periodically is a distinct, singular purpose unit and is relatively stable in performance.
- **Operational calibration:** routinely performed as part of an analytical procedure or test method, such as the development of a standard curve for use with an atomic absorption spectrophotometer. Operational calibration is generally performed for instrument systems.

Equipment that cannot be calibrated or becomes inoperable will be removed from service. Such equipment must be repaired and satisfactorily recalibrated before reuse. For equipment that fails calibration, analysis cannot proceed until appropriate corrective action is taken, and the analyst achieves an acceptable calibration. This type of failure will be documented in an NCM (Section 10).

8.3.3 Calibration System

The calibration system includes calibration procedures, equipment identification, calibration frequency, calibration reference standards, calibration failure, and calibration records. These elements are described next.

8.3.3.1 Calibration Procedures

Written procedures will be used by the laboratory for all instruments and equipment subject to calibration. Whenever possible, recognized procedures, such as those published by ASTM or USEPA, will be adopted. If established procedures are not available, a procedure will be developed considering the type of equipment, stability characteristics of the equipment, required accuracy, and the effect of operational error on the quantities measured. Calibration procedure established by the laboratory must, at a minimum, meet the calibration requirements of the method on which the SOP is based.

MINIMUM CALIBRATION PROCEDURES
Equipment to be calibrated
Reference standards used for calibration
Calibration technique and sequential actions
Acceptable performance tolerances
Frequency of calibration
Calibration documentation format

8.3.3.2 Equipment Identification

Equipment that is subject to calibration is identified by a unique number assigned by the laboratory. Calibration records reference the specific instrument identification.

8.3.3.3 Calibration Frequency

Instruments and equipment will be calibrated at prescribed intervals and/or as part of the operational use of the equipment. Calibration frequency will be based on the type of equipment, inherent stability, manufacturer's recommendations, values provided in recognized standards, intended data use, specified analytical methods, effect of error upon the measurement process, and prior experience.

8.3.3.4 Calibration Reference Standards

Two types of reference standards will be used by the laboratory for calibration:

- **Physical standards**, such as weights for calibrating balances and certified thermometers for calibrating working thermometers, refrigerators and ovens, are generally used for periodic calibration. Physical reference standards that have known relationships to nationally recognized standards (such as NIST) or accepted values of natural physical constants will be used whenever possible. If national standards do not exist, the basis for the reference will be documented. Physical reference standards will be used only for calibration and will be stored separately from equipment used in analyses. In general, physical standards will be recalibrated annually by a certified external agency, and documentation will be maintained. Balances will be calibrated against class "S" weights by an outside source annually. Physical standards such as the laboratory's class "S" weights will be recertified annually.
- **Chemical standards,** such as vendor certified stock solutions and neat compounds, will generally be used for operational calibration. The laboratory, to provide traceability for all standards used for calibration and QC samples, will document standard preparation activities.

8.3.4 Operational Calibration

Operational calibration will generally be performed as part of the analytical procedure and will refer to those operations in which instrument response (in its broadest interpretation) is related to analyte concentration. Formulas used for calibration are listed in **Table 8.3**.

8.3.4.1 Preparation of a Calibration Curve

Preparation of a standard calibration curve will be accomplished by analyzing calibration standards that are prepared by adding the analyte(s) of interest to the solvent that is introduced into the instrument. The concentrations of the calibration standards will be chosen to cover the working range of the instrument or method. All sample measurements will be made within this working range. Average response factors will be used or a calibration curve will be prepared by plotting or regressing the instrument responses versus the analyte concentrations. Where appropriate a best-fit curve may be used for nonlinear curves and the concentrations of the analyzed samples will be back-calculated from the calibration curve.

8.3.4.2 Periodic Calibration

Periodic calibrations are performed for equipment (such as balances and thermometers), that is required in the analytical method, but that is not routinely calibrated as part of the analytical procedure. **Table 8.4** lists the periodic calibration requirements used by the laboratories.

8.4 Inspection/Acceptance of Supplies and Consumables

In the laboratory, personnel qualifying reagents and standards must be trained to perform the associated instrumental analysis, including instrument calibration, calculations, and data interpretation. Laboratory personnel must document the purchase, receipt, handling, storage, and tracking of supplies and consumables used during analysis. For example, analytical standards, source materials, and reference materials used for instrumental calibration/tunes/checks must be certified and traceable to the USEPA or NIST through reference numbers documented directly in each analytical sequence. Calibration for all requested analyses must be verified by an independent second source reference. Adhering to these procedures precludes the use of expired supplies and consumables or supplies and consumables that do not meet standard acceptance criteria.

Records must be maintained on reagent and standard preparation in the LIMS reagent system or laboratory standard preparation logs. The records should indicate traceability of the standards to their original source solution or neat compound, the name of the material, concentration, the method and date of preparation, the expiration date, storage conditions, and the preparer's initials. Each prepared reagent or standard should be labeled with a unique identifier that links the solution to the preparation documentation that specifies an expiration and/or re-evaluation date for the solution.

TABLE 8.1 SUMMARY OF FIELD QC SAMPLE TYPES AND COLLECTION FREQUENCY

Field QC Sample Type	Sample Type	Collection Frequency
Equipment Rinse Blank	Water, soil	1:20 samples per type of sample collection activity using non-disposable sampling equipment. Once per lot for disposable sampling equipment. Daily for PFAS sampling.
Field Blank	Water	Daily for PFAS sampling only.
Trip Blank	Water	One per cooler of aqueous VOC samples
Field Duplicates	Water, soil	1:20 Samples
Extra Volume Sample (collected for MS/MSD)	Water, soil	1:20 Samples

Field QA/QC samples will be identified by using standard sample identifiers that will provide no indication of their nature as QA/QC samples.

TABLE 8.2 LABORATORY QUALITY CONTROL SAMPLE FREQUENCY

QC Sample	Frequency
Method/prep Blanks	1 per analytical batch of 1-20 samples, per preparation event
Laboratory Control Sample	1 per analytical batch of 1-20 samples, per preparation event
Surrogates	Spiked into all field and QC samples (Organic Analyses)
Matrix Spike/Matrix Spike Duplicate or Matrix (Laboratory) Duplicate	1 per batch of 1-20 samples

TABLE 8.3 OPERATIONAL CALIBRATION FORMULAS

Application	Formula	Symbols
Linear calibration curves	$C = (R - a_0)/a_1$	C = analytical concentration R = instrument response a_0 = intercept of regression curve (instrument response when concentration is zero) a_1 = slope of regression curve (change in response per change in concentration)
Calibration factors [1]	$CF = A_x / C$	C = concentration (µg/L) CF = calibration factor Ax = peak size of target compound in sample extract
Response factors [2]	$RRF = C_{is} A_x / C_x A_{is}$	C = concentration (µg/L) RF = internal standard response factor Cis = concentration of the internal standard (µg/L) Ax = area of the characteristic ion for the target compound Ais = area of the characteristic ion for the internal standard

1. Used for quantitation by the external standard technique
2. Used for quantitation by the internal standard technique

Note: For organic analysis, the laboratory will make efforts to use the best curve technique for each analyte. This practice is described in detail in the laboratory calibration criteria documents for GC analysis. This may require the use of a quadratic curve for some compounds.

TABLE 8.4 PERIODIC CALIBRATION REQUIREMENTS

Instrument	Calibration Frequency		Corrective Actions
Analytical Balances	Daily: Annually:	Sensitivity (with a Class S-verified weight) Calibrated by outside vendor against certified Class S weights	Adjust sensitivity Service balance
Thermometers	Annually:	Calibrated against certified NIST thermometers	Tag and remove from service
Automatic Pipettors	Quarterly:	Gravimetric check	Service or replacement

9.0 DATA VALIDATION AND USABILITY ELEMENTS

9.1 Data Review, Verification, and Validation

The data collected during this project will undergo a systematic review for compliance with the DQOs and performance objectives as stated in Section 3. In particular, field, laboratory, and data management activities will be reviewed to confirm compliance with the method QC criteria for performance and accuracy and to show that data were collected in a manner that is appropriate for accomplishing the project objectives. These data will be evaluated as to their usability during data verification. In particular, data outside QC criteria, but not rejected, will be reviewed for possible high and low bias. Groundwater, surface water and vapor intrusion sample data will be validated following verification and reduction. Waste characterization samples will not be validated.

Qualified data validation personnel will assess and verify data; they will review the data against QC criteria, DQOs (Sections 3 and 9.2.2), analytical method, and USEPA Region 2 SOPs for data review to identify outliers or errors and to flag suspect values. Field and laboratory activities that should be reviewed include, at a minimum, sample collection, handling, and processing techniques; field documentation records; verification of proper analytical methods; analytical results of QC samples; and calibration records for laboratory instruments and field equipment. A review of such elements is necessary to demonstrate whether the DQOs outlined in 3 were met. Samples that deviate from the experimental design and affect the project objectives must be reported to the QAO and data validation personnel.

Departures from standard procedures (in this QAPP, or the laboratory SOPs, may lead to exclusion of that data from the project database or validation process, based on discussions with and approval of the NYSDEC. However, routine field audits involving thorough reviews of sample collection procedures and sample documentation should preclude such deviations from occurring. Additionally, routine laboratory audits will be used to document proper sample receipt, storage, and analysis; instrument calibration; use of the proper analytical methods; and use of QC samples specified in Section 8 to assist in appropriately qualifying the data.

The laboratory's analytical report for each SDG will be assembled by collecting and incorporating all the data for each analysis associated with the reported samples; the analytical narratives; and other report-related information such as copies of COC forms, communication records, and nonconformance forms. The information included in the analytical data report is summarized in Attachment 1.

Before the laboratory submits data, the laboratory's data review process will include a full first level "technical" review by the laboratory's analyst during sample analysis and data generation. The review must include a check of all QC data for errors in transcription, calculations, and dilution factors and for compliance with QC requirements. Failure to meet method performance QC criteria may result in the reanalysis of the sample or analytical batch. After the initial review is completed, the data will be collected from summary sheets, workbooks, or computer files and assembled into a data package.

The laboratory's first review will be followed by a second-level technical review of the data package. The second level review may be performed by a peer trained in the procedures being reviewed or by the appropriate analytical group supervisor. The reviewer will check the data packages for completeness and compliancy with the project requirements and will certify that the report meets the DQOs for PARCCS specifications. The report narrative will be generated at this stage of the data review. Any problems discovered during the review and the corrective actions necessary to resolve them will be communicated to the responsible individual, who will discuss the findings with the laboratory QA manager for resolution.

The first and second review will be conducted throughout sample analysis and data generation to validate data integrity during collection and reporting of analytical data. Data review checklists will be used to document the performance and review of the QC and analytical data.

Before the laboratory's final release to the client, the data will undergo a final review by the laboratory's QA officer or his/her designee. This third level review is to confirm that the report is complete and meets project requirements for performance and documentation. The laboratory's QA officer must review reports involving non-conforming data issues. A summary of all non-conformances will be included in the case narrative. The report will then be released to the client for data validation, and a copy will be archived by the laboratory for a period of seven years.

The laboratory analytical data will be validated using project-specific data validation procedures to confirm that data meet the applicable data quality objectives. Depending on the type of data and the intended data uses, the data validation process for a given SDG (or a specific percentage of sample analyses) or analytical method may be performed following a Level IV protocol (full validation), or a Level III protocol (sample plus QC summary data only, no raw data review). The project-specific Level III data validation protocol will provide a level of review resulting in the generation of a DUSR, as defined by NYSDEC DER-10 requirements. Level III validation will be performed on all DQO Level III and all DQO Level IV data. Ten percent (10%) of the DQO Level IV Data for each analytical method will undergo a Level IV validation. Certain geotechnical and field screening data may be evaluated in a manner suitable for the intended data uses.

A data validation report will be issued and reviewed by the QAO before finalization. The data validation report will present the results of data validation, including a summary assessment of laboratory data packages, sample preservation and COC procedures, and a summary assessment of PARCCS criteria for each analytical method. The validation criteria are objective and are not sample dependent, except for consideration of sample matrix effects. The criteria specify performance requirements that should be under the control of the field-sampling contractor or analytical laboratory. This QAPP will be the primary reference for evaluating the data.

After data validation, the data will be evaluated for consistency with site conditions and developed conceptual models. Data validation personnel will prepare a project DUSR that summarizes the implications of the use of any data out of criteria. In addition, the data usability report will include the percentage of sample completeness for critical and non-critical samples and a discussion of any issues in representativeness of the data that may develop as a result of validation. The data usability report will address overall data quality and achievement of PARCCS criteria and assess issues associated with the overall data and data quality for all validated Level III and Level IV data.

9.2 Verification and Validation Methods

9.2.1 Laboratory

The laboratory will verify and assess analytical data against the stated requirements on the COC record, the sample handling procedures (Section 4), and the QC parameters. The laboratory data reviewers will also check that transcriptions of raw or final data and calculations were performed correctly and are verified.

Following data verification, analytical data generated by the laboratory will be reduced and managed based on the procedures specified in this QAPP and analytical methodologies. Data reduction includes all processes that change either the values or numbers of data items. The data reduction processes used in the laboratory includes establishment of calibration curves, calculation of sample concentrations from instrument responses, and computation of QC parameters. **Table 9.1** lists the formulas used to calculate sample concentrations.

The reduction of instrument responses to sample concentrations takes different forms for different types of methods. For most analyses, the sample concentrations are calculated from the measured instrument responses using a calibration curve. The sample concentrations can be back-calculated from a regression equation fitted to calibration data. For gravimetric and titrimetric analyses, the calculations are performed according to equations given in the method. For chromatographic analyses, the unknown concentrations are determined using either calibration factors (external standard procedure) or relative response factors (internal standard procedure). GC analyses are generally quantitated using the external standard technique; GC/MS analyses are quantitated using the internal standard technique. These calculations are generally performed by the associated computerized data systems.

Validated analytical data will be loaded into a database and reported in tabular format. Database fields will include the field sample identification, laboratory sample identification, blinded sample number, analytical results, detection limits, and validation qualifiers. The usability of the data will be evaluated by the QAO or designee.

9.2.2 Analytical Data Validation

The data review process is performed in two phases:

1. **Initial phase, contract compliance screening (CCS)**: Review of sample data deliverables for completeness. Completeness is evaluated by ensuring that all required data deliverables are received in a legible format with all required information. The CCS process also includes a review of the COC forms, case narratives, and RLs. Sample resubmission requests, documentation of nonconformances with respect to data deliverable completeness, and corrective actions often are initiated during the CCS review. The results of the CCS process are incorporated into the data validation process.
2. **Second phase, data validation:** A project-specific data validation procedure based on a "Level III" or the "Level IV" validation protocol will be performed on the analytical results from the fixed-base laboratory or laboratories, with the exception of the bench-scale testing data. The Level III validation protocol, which be applied to Level III data packages and Level IV data packages not receiving "full" Level IV validation includes a review of summary information to determine adherence to analytical holding times; results from analysis of field duplicates, method blanks, field blanks, surrogate spikes, MS/MSDs, LCSs, and sample temperatures during shipping and storage. Data qualifiers are applied to analytical results during the data validation process based on adherence to method protocols and laboratory-specific QA/QC limits. The Level IV validation protocol incorporates the Level III validation protocol and adds calculation checks from the raw data of reported and summarized sample data and QC results.

FULL VALIDATION (LEVEL IV)	
Organic Analytical Methods	**Inorganic Constituents, Wet Chemistry Parameters**
Percentage of solids Sample preservation and holding times Instrument tuning Instrument calibrations Blank results System monitoring compounds or surrogate recovery compounds (as applicable) Internal standard recovery results MS and MSD results LCS results Target compound identification Chromatogram quality Duplicate results Compound quantitation and reported RLs System performance and Results verification	Percentage of solids Sample preservation and holding times Calibrations Blank results Interference check samples (inorganics only) LCSs Project Required Reporting Limit (PRRL) standard check samples Duplicates MSs (pre-digestions and post-digestions for inorganics only) ICP serial dilutions and Results verification and reported detection limits

The laboratory will send the required analytical data package deliverables, consisting of hardcopy versions and the EDD, following completion of the laboratory's validation process (Section 9.2.2). Data validation will be performed in accordance with the USEPA Region 2 Data Validation SOPs for organic and inorganic data review (USEPA, 2012, 2015a, 2015b, 2016a, 2016b, 2016c, 2016d, 2016e) and NYSDEC Guidelines for Sampling and Analysis of PFAS under NYSDEC's Part 375 Remedial Programs (NYSDEC 2020). In addition, Parsons will refer to this QAPP and the Work Assignment Scoping Documents to verify that DQOs were met. If problems are identified during data validation, the QAO and the laboratory QA manager will be alerted, and corrective actions will be requested. The LPM and data validation chemists will maintain close contact with the QAO to ensure all nonconformance issues are acted upon prior to data manipulation and assessment routines.

Data validation will be conducted using the USEPA guidelines (USEPA 2017a, 2017b) as supplementary guidelines. Where USEPA guidelines and SW-846 disagree, this QAPP and data validation professional judgment will prevail.

Trained and experienced data validation chemists will perform the data validation work. The QAO will review the data validation report before it is finalized. The data validation report will present the results of data validation, including a summary assessment of laboratory data packages, sample preservation and COC procedures, and a summary assessment of PARCCS criteria for each analytical method. A detailed assessment of each SDG will follow. Based on the results of data validation, the validated analytical results reported will be assigned a usability flag (see chart below).

USABILITY FLAGS FOR VALIDATED RESULTS	
U	Not detected at given value
UJ	Analyte not detected; associated quantitation limit is an approximate (estimated) values.
J	Estimated value
J+	Estimated biased high
J-	Estimated biased low
N	Presumptive evidence at the value given
NJ	Analysis indicates presence of analyte tentatively identified; the associated numerical value is its approximate concentration
R	Result not useable and
No flag	Result accepted without qualification

9.3 Reconciliation With User Requirements

Following data validation by qualified personnel, the data will be evaluated by the QAO and the project manager as to consistency with site conditions and developed conceptual models to determine whether field and analytical data meet the requirements for decision making. Specifically, the results of the measurements will be compared to the DQOs (Section 3).

The DQOs will be considered complete and satisfied if the data are identified as usable and if no major data gaps are identified. For example, the objective for data collected under the characterization program is to further refine the limits of dredging and/or capping. If the collected data sufficiently characterizes these limits in a manner that is acceptable for remedial action, then the DQO is satisfied. In cases where data may be considered not usable (for example, rejected during data validation), resampling may be required at a specific location. If resampling is not possible, the data will be identified and noted in the project database to make data users aware of its limitations.

TABLE 9.1 SAMPLE CONCENTRATION CALCULATION FORMULAS

Application	Formula	Symbols
Linear regression calibration curves	$C = (R - a_0)/a_1$	C = analytical concentration R = instrument response a_0 = intercept of regression curve (instrument response when concentration is zero) a_1 = slope of regression curve (change in response per change in concentration)
Calibration factors [1]	$C = A_x V_f / CF V_i$	C = concentration (µg/L) CF = calibration factor A_x = peak size of target compound in sample extract V_f = final volume of extracted sample (mL) V_i = initial volume of sample extracted (mL)
Response factors [2]	$C = C_{is} A_x V_f / RF A_{is} V_I$	C = concentration (µg/L) RF = internal standard response factor C_{is} = concentration of the internal standard (µg/L) A_x = area of the characteristic ion for the target compound V_f = final volume of extracted sample (mL) A_{is} = area of the characteristic ion for the internal standard V_i = initial volume of sample extracted (mL)
Residues [3]	R = (W – T)/V x 1,000,000	R^6 = residue concentration (mg/L) W = weight of dried residue + container (g) T = tare weight of container (g) V = volume of sample used (mL)
Solid samples [4]	K = C V D / W (%S/100)	K = dry-weight concentration (milligram per kilogram, mg/kg) C = analytical concentration (mg/L) V = final volume (mL) of processed sample solution D = dilution factor W = wet weight (g) of as-received sample taken for analysis %S = percent solids of as-received sample

1. Used for quantitation by the external standard technique
2. Used for quantitation by the internal standard technique
3. Used for total, filterable, nonfilterable, and volatile residues as well as gravimetric oil and grease
4. Used to calculate the dry-weight concentration of a solid sample from the analytical concentration of the processed sample.
5. Conversion factor to convert g/mL to mg/L:

$$\frac{mg}{L} = \frac{g}{mL} \times \frac{10^3 mL}{L} \times \frac{10^3 mg}{g}$$

10.0 ASSESSMENT AND OVERSIGHT

10.1 Assessments and Response Actions

Performance and system audits of both field and laboratory activities may be performed. Any such audits will be performed at a frequency to be determined to ensure that sampling and analysis activities are completed in accordance with the procedures specified in the field sampling plan and the contents of this QAPP itself.

Quality assurance audits will be carried out under the direction of the QAO on field activities, including sampling and field measurements. They will be implemented to verify that established procedures are being followed and to evaluate the capability and performance of project and subcontractor personnel, items, activities, and documentation of the measurement system(s).

The QAO will plan, schedule, and approve system and performance audits based on procedures customized to the project requirements. If required, the QAO may request additional personnel with specific expertise from company and/or project groups to assist in conducting performance audits. Quality auditing personnel will not have responsibility for field or laboratory project work.

10.2 Project-Specific Audits

Project-specific audits include system and performance audits of sampling and analysis procedures, and of associated recordkeeping and data management procedures. Project-specific audits will be performed on a discretionary basis at a frequency determined by the project manager.

10.2.1 System Audits

The QAO may perform system audits. Such audits will encompass a qualitative evaluation of measurement system components to ascertain their appropriate selection and application. In addition, field and laboratory QC procedures and associated documentation may be system-audited including the field log, field sampling records, laboratory analytical records, sample handling, processing, and packaging in compliance with the established procedures, maintenance of QA procedures, and COC procedures. These audits may be carried out during execution of the project to confirm that sampling crews employ consistent procedures. However, if conditions adverse to quality are detected additional audits may occur.

Findings from the audit will be summarized and provided to the PM and/or designated personnel so that necessary corrective action can be monitored from initiation to closure.

10.2.2 Performance Audits

The laboratory may be required to conduct an analysis of performance evaluation (PE) samples or provide proof that PE samples were submitted by an approved USEPA or NYSDEC performance testing provider within the past 12 months. If necessary, proof that applicable PE samples have been analyzed at the laboratory within the past 12 months will be included in the laboratory procurement package.

10.2.3 Formal Audits

Formal audits are any system or performance audit that the QAO documents and implements. These audits encompass documented activities performed by qualified lead auditors to a written procedure or checklist to verify objectively that QA requirements have been developed, documented, and instituted in accordance with contractual and project criteria. At the discretion of the project manager, the QAO or designated personnel may conduct formal audits on project and subcontractor work during the course of the project.

Auditors who have performed the site audit after gathering and evaluating all data will write audit reports. Items, activities, and documents determined by lead auditors to be in noncompliance must be identified at exit interviews conducted with the involved management. Noncompliance will be logged and documented through audit findings. These findings will be attached to and become part of the integral audit report. These audit-finding forms are directed to management to resolve satisfactorily the noncompliance in a specified and timely manner.

The QAO has overall responsibility to see that all corrective actions necessary to resolve audit findings are acted upon promptly and satisfactorily. Audit reports will be submitted to the PM after completion of the audit. Serious deficiencies will be reported to the PM on an expedited basis. Audit checklists, audit reports, audit findings, and acceptable resolutions will be approved by the QAO prior to issue. Verification of acceptable resolutions may be determined by re-audit or documented surveillance of the item or activity. Upon verification acceptance, the QAO will close out the audit report and findings.

10.2.4 Laboratory Audits

Internal laboratory audits will be performed routinely to review and evaluate the adequacy and effectiveness of the laboratory's performance and QA program, to ascertain if the QAPP is being completely and uniformly implemented, to identify nonconformances, and to verify that identified deficiencies are corrected. The laboratory QA manager is responsible for such audits and will perform them according to a schedule planned to coincide with appropriate activities on the project schedule and sampling plans. Such scheduled audits may be supplemented by additional audits for one or more of the following reasons:

- When significant changes are made in the QAPP
- When necessary to verify that corrective action has been taken on a nonconformance reported in a previous audit
- When requested by the laboratory's project manager or QA manager

10.2.4.1 Laboratory Performance Audits

Performance audits are independent sample checks made by a supervisor or auditor to arrive at a quantitative measure of the quality of the data produced by one section or the entire measurement process. Performance audits are conducted by introducing control samples, in addition to those used routinely, into the data production process. These control samples include PE samples of known concentrations. The results of performance audits will be evaluated against acceptance criteria. The results will be summarized and maintained by the laboratory QA manager and distributed to the supervisors who must investigate and respond to any results that are outside control limits.

10.2.4.2 Laboratory Internal Audits

The laboratory QA manager conducts routine internal audits of each laboratory section for completeness, accuracy, and adherence to SOPs. The laboratory audit team will verify that the laboratory's measurement

systems are operated within specified acceptable control criteria and that a system is in place to confirm that out-of-control conditions are efficiently identified and corrected.

10.2.4.3 Laboratory Data Audits

The laboratory will maintain raw instrument data for sample analyses on magnetic tape media or optical media in a secured fireproof safe. During routine audits, the audit team will verify the processing of the raw data file by reviewing randomly selected electronic data files and comparing the results with the hardcopy report. Tapes will be archived for a period of seven years. Tapes will be also available for audit by the QAO upon request.

10.2.4.4 Laboratory Audit Procedures

Prior to an audit, the designated lead auditor will prepare an audit checklist. During an audit and upon its completion, the auditor will discuss the findings with the individuals audited and discuss and agree on corrective actions to be initiated. The auditor will prepare and submit an audit report to the designated responsible individual of the audited group, the PM, and the QAO. Minor administrative findings that can be resolved to the satisfaction of the auditor during an audit need not be cited as items requiring corrective action. Findings that are not resolved during the course of the audit and findings affecting the overall quality of the project will be included in the audit report.

The designated responsible individual of the audited group will prepare and submit to the QAO a reply to the audit. This reply will include, at a minimum, a plan for implementing the corrective action to be taken on nonconformances indicated in the audit report, the date by which such corrective action will be completed, and actions taken to prevent reoccurrence. If the corrective action has been completed, supporting documentation should be attached to the reply. The auditor will ascertain (by re-audit or other means) if appropriate and timely corrective action has been implemented.

Records of audits will be maintained in the project files. Audit files will include, as a minimum, the audit report, the reply to the audit, and any supporting documents. It is the responsibility of the designated responsible individual of the audited group to conform to the established procedures, particularly as to development and implementation of such corrective action.

10.2.4.3 Laboratory Documentation

To confirm that the previously defined scope of the individual audits is accomplished and that the audits follow established procedures, a checklist will be completed during each audit. The checklist will detail the activities to be executed and ensure that the auditing plan is accurate. Audit checklists will be prepared in advance and will be available for review.

AUDIT CHECKLIST (AT MINIMUM)
Date and type of audit
Name and title of auditor
Description of group, task, or facility being audited
Names of lead technical personnel present at audit
Checklist of audit items according to scope of audit
Deficiencies or non-conformances

Following each system, performance, and data audit, the QAO or his designee will prepare a report to document the findings of the specific audit. The report will be submitted to the designated individual of the audited group to ensure that objectives of the QA program are met.

MINIMUM CONTENT OF AUDIT REPORT
Description and date of audit
Name of auditor
Copies of completed, signed, and dated audit form and/or checklist
Summary of findings including any nonconformance or deficiencies
Date of report and appropriate signatures
Description of corrective actions

The QAO will maintain a copy of the signed and dated report for each audit. If necessary, a second copy will be placed in project files.

10.3 Corrective Actions

Corrective action procedures have been established to ensure that conditions adverse to quality, such as malfunctions, deficiencies, deviations, and errors, are promptly investigated, documented, evaluated, and corrected. Corrective action enables significant conditions adverse to quality to be noted promptly at the site, laboratory, or subcontractor location. Additionally, it allows for the cause of the condition to be identified and corrective action to be taken to rectify the problem and to minimize the effect on the data set. Further, corrective action is intended to minimize the possibility of repetition.

Condition identification, cause, reference documents, and corrective action planned to be taken will be documented and reported to the QAO, PM, FTL, and involved subcontractor management, at a minimum. Implementation of corrective action is verified by documented follow-up action. Any project personnel may identify noncompliance issues; however, the designated QA personnel are responsible for documenting, numbering, logging, and verifying the close out action. The designated responsible individual of the audited group will be responsible for ensuring that all recommended corrective actions are implemented, documented, and approved.

Events that trigger corrective actions
When predetermined acceptance standards are not attained
When a deviation from SOP is required or observed
When procedure or data compiled are determined to be deficient
When equipment or instrumentation is found to be faulty
When samples and analytical test results are not clearly traceable
When QA requirements have been violated
When designated approvals have been circumvented
As a result of system and performance audits

As a result of a management assessment
As a result of laboratory/field comparison studies
As required by analytical method

All project personnel have the responsibility, as part of normal work duties, to promptly identify, solicit approved correction, and report conditions adverse to quality. Specifically, the laboratory must designate the assigned individual to act as the primary laboratory contact responsible for timely identification and resolution of any and all issues including contract and administrative issues. Any phone calls initiated by personnel or designated representatives to the laboratory with respect to corrective actions must be returned in a timely manner on a normal business day if the designate individual (or alternate) is not available at the initiation of the phone call.

Project management and related staff, including field investigation teams, remedial design planning personnel, and laboratory groups will monitor on-going work performance as part of daily responsibilities. Work may be audited at the site, the laboratories, or subcontractor locations. Activities or documents ascertained to be noncompliant with QA requirements will be documented. Corrective actions will be mandated through audit finding sheets attached to the audit report. Audit findings are logged, maintained, and controlled by the QAO, PM, or designated personnel.

Personnel assigned to QA functions will have the responsibility to issue and control CAR forms (**Figure 10.1**). The CAR identifies the out-of-compliance condition, reference document(s), and recommended corrective action(s) to be administered.

Similar to the CAR, the laboratory will record and report nonconformances internally using the laboratory's non-conformance documentation tracking system in the form of an NCM. Each NCM is traceable so that it can be cross-referenced with its resolution to the associated project records. The laboratory QA manager summarizes critical nonconformances, such as reissued reports and client complaints, in a monthly report to the laboratory management staff. Management of the NCM is described in Section 6.3. Corrective action procedures applicable to QC requirements that do not meet the criteria of this QAPP are described in the following sections. Consistent, frequent contacts between laboratory personnel, the QAO, or designated personnel are required.

TYPICAL CONTENT OF NCM FORMS
Problem description and root cause
Corrective action
Client notification summary
QA verification
Approval history action

FIGURE 10.1 CORRECTIVE ACTION REQUEST FORM

CORRECTIVE ACTION REQUEST **Number** _____ **Date:**_____
TO: _____ You are hereby requested to take corrective actions indicated below and as otherwise determined by you (a) to resolve the noted conditions and (b) to prevent it from recurring. Your written response is to be returned to the Project quality assurance manager by _____.
Condition:
Reference Documents:
_____ _____ _____ ____ ____ _____ Originator Date Approval Date Approval Date
Response
Cause of Condition:
Corrective Action (A) Resolution: (B) Prevention (B2) Affected Documents Signature_____ Date_____
CA Follow-up Corrective Action verified by:_____ Date _____

11.0 REPORT TO MANAGEMENT

11.1 QA Reports

Management personnel receive QA reports appropriate to their level of responsibility. The PM receives copies of all QA documentation. QC documentation is retained within the department that generated the product or service except where this documentation is a deliverable for a specific contract. QC documentation is also submitted to the project QAO for review and approval. Previous sections detailed the QA activities and the reports, which they generate. Among other QA audit reports that may be generated during the conduct of activities, a final audit report for this project will be prepared by the QAO. The report will include:

- Periodic assessment of measurement data accuracy, precision, and completeness
- Results of performance audits and/or system audits
- Significant QA problems and recommended solutions for future projects
- Status of solutions to any problems previously identified

Additionally, any incidents requiring corrective action will be fully documented.

12.0 REFERENCES

REFERENCES

NYSDEC. 2020. Guidelines for Sampling and Analysis of PFAS. January.

Taylor, J. K., 1987. Quality Assurance of Chemical Measurements. Lewis Publishers, Inc., Chelsea, Michigan.

USEPA, 1983. Methods for Chemical Analysis of Water and Wastes, EPA600/4-79/020, U.S. Environmental Protection Agency, Environmental Monitoring and Support Laboratory, Cincinnati, OH, Rev. March.

USEPA, 1986. NEIC Policies and Procedures. EPA 330/9-78-001-R. United States Environmental Protection Agency, Office of Enforcement and Compliance Monitoring, Washington, D.C. May 1978, revised May 1986.

USEPA, 1987. Data Quality Objectives for Remedial Response Actions Activities: Development Process. EPA/540/G-87/003, OSWER Directive 9355.0-7- U.S. Environmental Protection Agency, Washington, D.C.

USEPA, 1997. USEPA SW846 Test Methods for Evaluating Solid Waste, Physical and Chemical. 3rd edition including updates. U.S. Environmental Protection Agency, Washington, D.C. December.

USEPA, 2000. Guidance for the Data Quality Objective Process. EPA QA/G-4. Office of Environmental Information. August.

USEPA, 2001a. EPA Requirements for Quality Assurance Project Plans. EPA QA/R-5. Office of the Environmental Information. March.

USEPA, 2002b. Guidance for Quality Assurance Project Plans. EPA QA/G-5. U.S. Environmental Protection Agency. December.

USEPA, 2012. Mercury and Cyanide Data Validation, SOP HW-2c, Revision 15. USEPA Region 2. December.

USEPA, 2015a. Pesticide Data Validation, SOP HW-36A, Revision 0. USEPA Region 2. June.

USEPA, 2015b. Polychlorinated Biphenyl (PCB) Aroclor Data Validation, SOP HW-37A, Revision 0. USEPA Region 2. June

USEPA, 2016a. ICP-AES Data Validation, SOP HW-3a, Revision 1. USEPA Region 2. September.

USEPA, 2016b. ICP-MS Data Validation, SOP HW-3b, Revision 1. USEPA Region 2. September.

USEPA, 2016c. Mercury and Cyanide Data Validation, SOP HW-3c, Revision 1. USEPA Region 2. September.

USEPA, 2016d. Semivolatile Data Validation, SOP HW-35a, Revision 1. USEPA Region 2. September.

USEPA, 2016e. Low/Medium Volatile Data Validation, SOP HW-33a, Revision 1. USEPA Region 2. September.

USEPA, 2017a. USEPA National Functional Guidelines for Superfund Organic Methods Data Review, EPA 540-R-2017-002. U.S. Environmental Protection Agency, Washington, D.C. January.

USEPA, 2017b. USEPA National Functional Guidelines for Superfund Inorganic Methods Data Review, EPA 540-R-2017-001. U.S. Environmental Protection Agency, Washington, D.C. January.

ATTACHMENT 1 SUMMARY OF ANALYTICAL DATA PACKAGE (DQO LEVEL IV)

ATTACHMENT 1 SUMMARY OF ANALYTICAL DATA PACKAGE (DQO LEVEL IV)

1.0 Introduction

In order for data to be used for decision-making purposes it is essential that it be of known and documented quality. Verification and validation of data requires that appropriate quality assurance and quality control (QA/QC) procedures be followed, and that adequate documentation be included for all data generated both in the laboratory and in the field.

The QA/QC documentation provided by any laboratory, in conjunction with sample results, allows for evaluation of the following indicators of data quality:

- Integrity and stability of samples;
- Instrument performance during sample analysis;
- Possibility of sample contamination;
- Identification and quantitation of analytes;
- Analytical precision; and
- Analytical accuracy.

General laboratory documentation requirements discussed in this document are formatted into two sections, organic and inorganic analyses. These specifications are intended to establish general, analytical documentation requirements that laboratories should meet when generating data for this project.

2.0 General Documentation Requirements

2.1 Data Package Format

Each data package for Level IV data submitted will consist of five sections:

- Case narrative;
- Chain-of-custody documentation
- Summary of results for environmental samples;
- Summary of QA/QC results; and
- Raw data.

Level II data packages will not contain the raw data.

Data packages will be consistent with, and will supply the data and documentation required for NYSDEC ASP-defined deliverables (i.e. Category B and Category A). Summaries of data and results may be presented in a Contract Laboratory Program (CLP) type format or an equivalent format that supplies the required information as stated below. All laboratory data qualifiers shall be defined in the deliverable.

In cases where the laboratory has varied from established methodologies, they will be required to provide the SOPs for those methods and added as an attachment to the Work Assignment Scoping Documents or as variances to this QAPP. Inclusion of these SOPs will aid in final review of the data by data reviewers and users.

2.2 Case Narrative

The case narrative will be written on laboratory letterhead and the release of data will be authorized by the laboratory manager or their designee. The Case Narrative will consist of the following information:

- Client's sample identification and the corresponding laboratory identification;
- Parameters analyzed for each sample and the methodology used. EPA method numbers should be cited when applicable;
- Whether the holding times were met or exceeded;
- Detailed description of all analytical and/or sample receipt problems encountered;
- Discussion of reasons for any QA/QC sample result exceedances; and
- Observations regarding any occurrences which may adversely impact sample integrity or data quality.

2.3 Chain- of-Custody

Legible copies of all COC forms for each sample shall be submitted in the data package. Copies of any internal laboratory tracking documents should also be included. It is anticipated that COC forms and/or internal laboratory tracking documents will include the following information:

- Date and time of sampling and shipping;
- Sampler and shipper names and signatures;
- Type of sample (grab or composite);
- Analyses requested;
- Project, site, and sampling station names;
- Date and time of sample receipt;
- Laboratory sample receiver name and signature;
- Observed sample condition at time of receipt;
- Sample and/or cooler temperatures at time of receipt;
- Air bill numbers;
- Custody seal; and
- Sample numbers.

3.0 Organic Analyses Documentation Requirements

These requirements are applicable to organic methods (e.g., VOCs, SVOCs, PFAS).

3.1 Summary of Environmental Sample Results

The following information is to be included in the summary of sample results for each environmental sample.

- Client's sample identifications and corresponding laboratory identifications;
- Sample collection dates;
- Dates and times of sample extraction and/or analysis;
- Weights or volumes of sample used for extraction and/or analysis;
- Identification of instruments used for analysis;
- Gas Chromatography (GC) column and detector specifications;
- Dilution or concentration factor for the sample;
- Percent Difference between columns, if applicable;

- Percent Moisture or Percent Solids for soil samples;
- Method Detection Limits (MDLs) or sample Reporting Limits (RLs);
- Analytical results and associated units;
- Discussion of any manual integrations; and
- Definitions for any laboratory data qualifiers used.

3.2 Summary of QA/QC Sample Results (as applicable)

The following QA/QC sample results shall be presented on QC summary forms. They shall also include the date and time of analysis. Additional summary forms may be required for some methods. Therefore, when reporting data, laboratories should defer to specific method requirements.

All summary forms should, at a minimum, include in the header:

- Form Title;
- Project Identifier (e.g., Batch QC ID, Site Name, Case Number, Sample Delivery Group);
- Laboratory Name; and
- Sample Matrix.

3.2.1 Instrument Calibration (for each instrument used)

- GC/MS Tuning. Report mass listings, ion abundance criteria, and percent relative abundances. List the instrument identification (ID) and the date and time of analysis. Ensure that all ion abundances have been appropriately normalized.
- Initial Calibration. Report analyte concentrations of initial calibration standards and the date and time of analysis. List the instrument identification (ID), response factors (RF), relative response factors (RRF), or calibration factors (CF), percent relative standard deviation (%RSD), and retention time (RT) for each analyte. The initial calibration (IC) report must also include a sample identifier (ID), associated injection volume or quantity of sample analyzed, the acceptance criteria, such as minimum RF values, and associated maximum %RSD values.
- Continuing Calibration. Report the concentration of the calibration standard used for the continuing calibration and for the mid-level standard, and the date and time of analysis. List the ID, RF, RRF, CF, percent difference (%D), and RT for each analyte.
- Quantitation Limit or Project Required Reporting Limit (PRRL) Verification (if applicable). Report results for standards that are used to verify instrument sensitivity. Report the source for the verification standards. Report the concentration for the true value, the concentration found, the percent recovery, and control limits for each analyte analyzed. The date and time of analysis must also be reported.

3.2.2 Method Blank Analysis

List environmental samples and QC analyses associated with each method blank. Report concentrations of any analytes found in method blanks above the instrument detection limit.

3.2.3 Surrogate Standard Recovery

Report the name and concentration of each surrogate compound added. List percent recoveries of all surrogates in the samples, method blanks, matrix spike/matrix spike duplicates and other QC analyses. Also include acceptance ranges that the laboratory used for the analysis.

3.2.4 Internal Standard Summary

Report internal standard area counts of the associated calibration standard and retention times, include upper and lower acceptance limits. List internal standard area counts and retention times for all samples, method blanks, matrix spike/matrix spike duplicates and other QC analyses. Include the ID and the date and time of analysis.

3.2.5 Compound Confirmation

Report retention times of each compound on both columns as well as retention time windows of the associated standard. In addition, report determined concentrations from each column and percent differences between results. List the ID and the date and time of analysis. A summary should be generated for each sample, including dilutions and reanalyzes, blanks, MSs, and MSDs.

3.2.6 Peak Resolution Summary

For primary and secondary columns report retention times of any target compounds and/or surrogates that coelute in the standards (i.e. the Performance Evaluation Mixture for Contract Laboratory Program pesticides). Calculate and report the percent resolution between each pair of compounds which coelute. Include the ID, column ID, and the date and time of analysis.

3.2.7 Matrix Spike/Matrix Spike Duplicate (MS/MSD) Analysis

Report the name and concentration of each spiking compound. Samples are to be spiked with specified compounds of potential concern. List sample results, spiked sample results, duplicate spiked sample results, percent recovery (%R) and the relative percent difference (RPD) between the MS and MSD (if applicable). Acceptance criteria that the laboratory used for the analysis must also be presented.

3.2.8 Laboratory Duplicate Analysis

When performed, report the RPD between duplicate analyses, along with the associated acceptance criteria.

3.2.9 Laboratory QC Check Sample Analysis

Also known as the Laboratory Control Sample (LCS) or Matrix Spike Blank (MSB). Report the name and concentration of each spiking compound. List the QC check sample and duplicate (if applicable) results, %R, and RPD, if performed in duplicate. The acceptance criteria that the laboratory used for the analysis must also be presented.

3.2.10 Other QC Criteria

- **Retention time windows determination**. Report the retention time window for each analyte, for both primary and confirmation analyses.
- **Compound identification**. Report retention times and concentrations of each analyte detected in samples.
- **MDL determination**. List most recent method detection limits, with dates determined maintained in laboratory file. MDL summary forms may be submitted at start of project and not included in individual data packages.
- **Additional method suggested QC parameters, if required**.
- **Any Performance Evaluation (PE) samples** (if identified) associated with the environmental samples.

3.3 Raw Data

Legible copies of the raw data shall be organized systematically, each page shall be numbered, and a table of contents must be included with each package. Raw data for compound identification and quantitation must be sufficient to verify each result.

3.3.1 Gas Chromatographic (GC) Analyses

This section shall include legible copies of raw data for the following:

- Environmental samples arranged in sequential order by laboratory sample number, include dilutions and reanalyzes;
- Instrument calibrations; and
- QC analyses (i.e., method blanks, LCS, etc.).

Raw data for both primary and confirmation analyses are to be included. Raw data for each analysis shall include the following:

- Appropriately scaled chromatograms (label all analyte peaks, internal standards and surrogate standards with chemical names). All chromatograms shall be scaled such that individual peaks can be readily resolved from any neighboring peaks;
- Appropriately scaled before and after manual integrations;
- Area print-outs or quantitation reports;
- Instrument analysis logs for each instrument used;
- Sample extraction and cleanup logs;
- Standards preparation logs and manufacturer certificates of analyses for standards, if applicable, sufficient to document traceability of all standards (including surrogates, internal standards, and spike solutions) maintained in "job file" in laboratory, unless otherwise requested;
- Percent Moisture or Percent Solids for soil samples; and
- GC/MS confirmation, as applicable.

Note: Additional raw data may be required for some methods. Therefore, when reporting data, laboratories should defer to specific method requirements.

3.3.2 Gas Chromatographic / Mass Spectrometric (GC/MS) Analyses

This section shall include legible copies of raw data for the following:

- Environmental samples arranged in sequential order by laboratory sample number, include dilutions and reanalyzes;
- Mass spectrometer tuning and mass calibration (BFB, DFTPP);
- Initial and continuing instrument calibrations; and
- QC analyses (i.e., method blanks, LCS, etc.).

Raw data for each analysis shall include the following:

- Appropriately scaled chromatograms (label all analyte peaks, internal standards and surrogate standards with chemical names). All chromatograms shall be scaled such that individual peaks can be readily resolved from any neighboring peaks;
- Appropriately scaled before and after manual integrations;
- Ion scans and enhanced spectra of target analytes and tentatively identified compounds (TICs), with the associated best-match spectra;
- Area print-outs and quantitation reports;

- Instrument analysis logs for each instrument used;
- Sample extraction and cleanup logs;
- Standards preparation logs and manufacturer certificates of analyses for standards, if applicable, sufficient to document traceability of all standards (including surrogates, internal standards, and spike solutions) maintained in "job file" in laboratory, unless otherwise requested; and
- Moisture Content (Percent Moisture) for sediment samples.

Note: Additional raw data may be required for some methods. Therefore, when reporting data, laboratories should defer to specific method requirements.

4.0 Inorganic Analyses Documentation Requirements

4.1 Summary of Environmental Sample Results

The following information is to be included in the summary of sample results for each environmental sample:

- Client's sample identifications and corresponding laboratory identifications;
- Sample collection dates;
- Dates and times of sample digestion and/or analysis;
- Weights or volumes of sample used for digestion and/or analysis;
- Identification of instruments and analytical techniques used for analysis;
- Instrument specifications;
- Dilution or concentration factor for the sample;
- Percent Moisture or Percent Solids for soil samples;
- Detection Limits: MDLs, RLs;
- Analytical results and associated units; and
- Definitions for any laboratory data qualifiers used.

4.2 Summary of QA/QC Results

The following QA/QC sample results shall be presented on QC summary forms. They shall also include the date and time of analysis. Additional summary forms may be required for some methods. Therefore, when reporting data, laboratories should defer to specific method requirements.

All summary forms shall, at a minimum, include in the header:

- Form Title;
- Project Identifier (e.g., Batch QC ID, Site Name, Case Number, Sample Delivery Group);
- Laboratory Name; and
- Sample Matrix.

4.2.1 Instrument Calibration Verification (if applicable)

The order for reporting of calibration verifications for each analyte must follow the chronological order in which the standards were analyzed.

- **Initial Calibration Verification.** Report the source for the calibration verification standards. Report the concentration for the true value, the concentration found, the percent recovery, and control limits for each element analyzed. The date and time of analysis must also be reported.

- **Continuing Calibration Verification**. Report the source for calibration verification standards. Report the concentration for the true value, the concentration found, the percent recovery, and control limits for each element analyzed. The date and time of analysis must also be reported.
- **Quantitation Limit** or PRRL Verification (if applicable). Report results for standards that are used to verify instrument sensitivity. Report the source for the verification standards. Report the concentration for the true value, the concentration found, the percent recovery, and control limits for each element analyzed. The date and time of analysis must also be reported.

4.2.2 Blank Analysis

Report analyte concentrations above the instrument detection limits found in the initial calibration blanks (ICBs), continuing calibration blanks (CCBs), and in method/ preparation blanks. The date and time of analysis must also be reported. The order for reporting ICB and CCB results for each analyte must follow the chronological order in which the blanks were analyzed.

4.2.3 Matrix Spike (MS) Analysis

Report concentrations of the unspiked sample result, the spiked sample result and the concentration of the spiking solution added to the pre-digestion spike for each analyte. Calculate and report the %R and list control limits. If performed in duplicate, provide the %R for the MSD and the RPD.

4.2.4 Post Digestion Spike Analysis (if applicable)

In addition to matrix spikes, post-digestion spikes are often required by the method. Report concentrations of the unspiked sample results, spiked sample results, and the concentration of the spiking solution added. Calculate and report the %R and list control limits.

4.2.5 Laboratory Duplicate Analysis

Report concentrations of original and duplicate sample results. Calculate and report the RPD and list control limits.

4.2.6 Laboratory Control Sample

Identify the source for the LCS. Report the found concentration of the laboratory control sample and the true concentration for all analytes. Calculate and report the %R and list control limits.

4.2.7 Other QC Criteria (if applicable)

- **Method of Standard Additions (MSA)**. This summary must be included if MSA analyses are performed. Report absorbance values with corresponding concentration values. Report the final analyte concentration and list the associated correlation coefficient and control limits.
- **ICP-AES Serial Dilution**. Report initial and serial dilution results, associated %D, and control limits.
- **ICP-AES Linear Dynamic Ranges.** For each instrument and wavelength used, report the date on which linear ranges were established, the integration time, and the upper limit concentration.
- **MDL Determination**. List most recent method detection limits as determined using the September 2017 promulgation of the 40CFR136, with dates determined maintained in laboratory file. MDL summary forms may be submitted at start of project and not included in individual data packages.
- **Any Performance Evaluation (PE) Samples** (if identified) associated with the environmental samples.

4.3 Raw Data

Legible copies of the raw data shall be organized systematically, each page shall be numbered, and a table of contents must be included with each package. Data should be organized sequentially by method and analysis date. Raw data for compound identification and quantitation must be sufficient to verify each result.

4.3.1 Atomic Absorption (AA) and Atomic Emission (AE) Spectrometric Analyses

This section shall include legible copies of raw data for the following:

- Environmental sample results, include dilutions and reanalyzes;
- Instrument calibrations; and
- QC analyses (i.e., method blanks, LCS, etc.).
- Measurement print-outs for all instruments used or copies of logbook pages for analyses that do not provide instrument print-outs;
- Absorbance units, emission intensities, or other measurements for all analyses;
- Sample preparation and digestion logs that include reagents used, standards referenced to standards preparation logs, volumes of reagents, digestion times, etc.;
- Instrument analysis logs for each instrument used or summary of sample analyses;
- Standards preparation logs and manufacturer certificates of analyses for standards, if applicable, sufficient to document traceability of all standards (including spike solutions) maintained in "job file" in laboratory, unless otherwise requested;
- Wavelengths used for the analyses; and
- Percent Moisture or Percent Solids for soil samples.

Note: Additional raw data may be required for some methods. Therefore, when reporting data, laboratories should defer to specific method requirements.

4.3.2 Titrimetric and Colorimetric Analyses

This section shall include legible copies of raw data for the following:

- Environmental sample results, include dilutions and reanalyzes;
- Calibrations; and
- QC analyses (i.e., method blanks, LCS, etc.).

Raw data for each analysis shall include the following:

- Copies of logbook pages for analyses that do not provide instrument print-outs and calculations used to derive reported sample concentrations;
- Titrant volumes, titration end-points, absorbance units, or other measurements for all analyses;
- Sample preparation and digestion logs that include reagents used, standards referenced to standards preparation logs, volumes of reagents, digestion times, sample volumes, solution normalities, etc.;
- Standards preparation logs and manufacturer certificates of analyses for standards, if applicable, sufficient to document traceability of all standards (including spike solutions) maintained in "job file" in laboratory, unless otherwise requested; and
- Wavelengths used for the analyses.

Note: Additional raw data may be required for some methods. Therefore, when reporting data, laboratories should defer to specific method requirements.

4.3.3 Gravimetric Analyses

This section shall include legible copies of raw data for the following:

- Environmental sample results, include dilutions and reanalyzes;
- Calibrations; and
- QC analyses (i.e., method blanks, LCS, etc.).

Raw data for each analysis shall include the following:

- Copies of logbook pages for analyses that do not provide instrument print-outs and calculations used to derive reported sample concentrations;
- Weights, sample volumes, or other measurements for all analyses;
- Sample preparation and digestion logs that include reagents used, standards referenced to standards preparation logs, volumes of reagents, drying times, drying temperatures, etc.; and
- Standards preparation logs and manufacturer certificates of analyses for standards, if applicable, sufficient to document traceability of all standards maintained in "job file" in laboratory, unless otherwise requested.

Note: Additional raw data may be required for some methods. Therefore, when reporting data, laboratories should defer to specific method requirements.

SUMMARY OF REQUIRED LABORATORY DELIVERABLES FOR LEVEL IV DQO DATA PACKAGE (REQUIREMENTS WILL VARY BY METHOD)

Method Requirements	Laboratory Deliverables
Requirements for all methods:	
Parsons project identification number	Case narrative
Discussion of unusual circumstances or problems	Case narrative
Analytical method description and reference citation	Case narrative
Field sample identification	Signed chain-of-custody forms and sample results form
Laboratory assigned sample number	Signed chain-of-custody forms and sample results form
Sample matrix description	Signed chain-of-custody forms and sample results form
Date of sample collection	Signed chain-of-custody forms and sample results form
Date of sample receipt at laboratory	Signed chain-of-custody forms
Analytical method description and reference citation	Signed chain-of-custody forms and case narrative
Sample analysis results	USEPA Contract Laboratory Program (CLP) form or equivalent sample analysis results summary form (e.g., ASP Form I-VOA)
Dates of sample preparation and analysis (including first run and any subsequent runs)	Specific deliverable depends on type of analysis
Laboratory analytical QC batch info and sample analysis associations	Specific deliverable depends on type of analysis
Instrument analysis sequence log	Specific deliverable depends on type of analysis
Analytical holding times compliance	USEPA CLP form or equivalent holding time summary form
Method detection limit (MDL) determination	USEPA CLP form or equivalent MDL summary form
Method reporting limits (RLs) achieved	Specific deliverable depends on type of analysis (see below)
Dilution or concentration factors	Specific deliverable depends on type of analysis
Discussion of unusual circumstances or problems	Case narrative
Laboratory Control Sample (LCS) results	USEPA CLP form or equivalent LCS results summary form
“Raw” analytical data sufficient to recreate and check analysis results for all calibrations, QC sample results, and sample results	Sequentially numbered pages with tabulated index
Matrix spike / matrix spike duplicate	USEPA CLP form or equivalent MS/MSD summary form (e.g., NYSDEC ASP Form III-SV
Method blank analysis	USEPA CLP form or equivalent method blank summary form (e.g., NYSDEC ASP Form IV-SV)
GC/MS instrument performance check. Tuning and mass calibration (abundance) using 4-bromofluorobenzene (BFB) for method SW8260C and decafluoro-triphenyphosphene (DFTPP) for method SW8270CD	USEPA CLP form or equivalent instrument tuning/performance check summary form

Method Requirements	Laboratory Deliverables
Internal Standard Area Counts and Retention Time, as applicable	USEPA CLP form or equivalent internal standard summary form (e.g., NYSDEC ASP Form VIII-SV)
GC/MS initial calibration data	USEPA CLP form or equivalent initial calibration summary form (e.g., NYSDEC ASP Form VI-SV)
GC/MS continuing calibration data.	USEPA CLP form or equivalent continuing calibration summary form (e.g., NYSDEC ASP Form VII-SV)
GC/MS calibration verification (initial and continuing)/2nd source calibration verification (ICV/CCV)	USEPA CLP form or equivalent calibration verification summary form
GC continuing calibration data for volatile and semivolatile analyses. If calibration factors are used, calibration factors and their percent differences from the initial calibration must be reported. Retention time windows and analyte retention times must be included in this form	USEPA CLP form or equivalent calibration verification summary form
GC/MS internal standard area and retention time summary data	USEPA CLP form or equivalent internal standard summary form
GC second column confirmation, as applicable. To be done for all compounds that are detected above method detection limits	Chromatograms of all confirmations of all samples and the standard laboratory form for all positive results
Surrogate Compound percent recovery summary	USEPA form or equipment percent recovery summary form (e.g., NYSDEC ASP Form II-SV)
"Raw" analytical data sufficient to recreate and check analysis results for all calibrations, QC sample results, and sample results	Sequentially numbered pages with tabulated index
Requirements for inorganic analytical methods:	
Initial and Continuing Calibration Verification	USEPA CLP form or equivalent calibration verification summary form(s) (e.g., NYSDEC ASP Form II-IN)
ICP Interference Check Sample (ICS), as applicable	USEPA CLP form or equivalent ICS standard summary form (e.g., NYSDEC ASP Form IV-IN)
ICP Interelement Correction Factors, as applicable	USEPA CLP form or equivalent internal standard summary form (e.g., NYSDEC ASP Form XII-IN
Instrument Detection Limit (IDL) or MDL determination	USEPA CLP form or equivalent IDL or MDL summary form(s)
Post-digestion spike, as applicable	USEPA CLP form or equivalent post-digestion spike summary form(s) (e.g., NYSDEC ASP Form V-IN)
ICP linear range	USEPA CLP form or equivalent linear range summary form(s) (e.g., NYSDEC ASP Form XII-IN)
ICP serial dilution, as applicable	USEPA CLP form or equivalent serial dilution summary form(s) (e.g., NYSDEC ASP Form IX-IN)
Method of standard addition (MSA), as applicable	USEPA CLP form or equivalent MSA summary form(s)
Laboratory duplicate results, as applicable	USEPA CLP form or equivalent duplicate analysis summary form(s) (e.g., NYSDEC ASP Form VI-IN)
Requirements for other methods:	
Preparation and analysis logs	No format
Sample results	No format
MS/MSD results	No format

Method Requirements	Laboratory Deliverables
Lab duplicate sample results	No format
Laboratory control sample	Control limits
Method blank results	No format
Initial calibration results	No format
Continuing calibration check (calibration verification)	No format. Report percent relative standard deviation or percent difference from initial calibration

ATTACHMENT 2 PFAS SAMPLING CHECKLIST

PARSONS

Site Name: _____
Weather (temp/precip): _____

Task: _____
Date: _____

Field Clothing and PPE:

☐ Ansell TNT® Powder-Free Nitrile Gloves ONLY
☐ No clothing or boots containing Gore-Tex™
☐ No clothing or boots treated with water-resistant spray
☐ Safety boots made from polyurethane and PVC or leather boots covered with overboots
☐ No materials containing Tyvek®
☐ Field crew has not used fabric softener on clothing
☐ Field crew has not used cosmetics, moisturizers, hand cream, or other related products this morning
☐ Field crew has not applied unauthorized sunscreen or insect repellant
☐ Samplers don fresh nitrile gloves for each sample collected

Field Equipment:

☐ No Teflon® or LDPE containing materials other than QED brand LDPE
☐ All sample materials made from stainless steel, HDPE, acetate, silicon, or polypropylene or QED brand LDPE
☐ No waterproof field books, waterproof paper or waterproof bottle labels, waterproof markers/Sharpies®
☐ No plastic clipboards, binders, or spiral hard cover notebooks
☐ No Post-It Notes®
☐ Coolers filled with regular ice only; no chemical (blue) ice packs in possession

Sample Containers:

☐ Containers for PFAS shipped in separate cooler
☐ Sample containers made of HDPE or polypropylene
☐ Caps are unlined and made of HDPE or polypropylene

Wet Weather (as applicable):

☐ Wet weather gear made of polyurethane and PVC only

Equipment Decontamination:

☐ PFAS-free water on-site for decontamination of sample equipment; no other water sources to be used
☐ Alconox® or 7th Generation Free & Clear Dish Soap to be used as decontamination cleaning agents

Food Considerations:

☐ No food or drink on-site with exception of bottled water and/or hydration drinks (i.e., Gatorade® and Powerade®) that is available for consumption only in the staging area

Vehicle Considerations:

☐ Avoid utilizing areas inside vehicle as sample staging areas

Sampling Equipment and Supply Summary (include brand names and serial numbers where available):

Decontamination fluid source(s): _____

Soap and other fluids used: _____

Gloves:_____ Rope: _____

Sampling Equipment: _____

Deviation Summary:

If possible, materials identified as potentially containing PFAS should be relocation to a separate area of the site as far away as possible from the sampling location(s) and containerized if practicable. Notes should include method of response including type of materials on site and how they were moved and containerized.

Deviations include: _____

_____

_____

_____

Field Team Leader Name: _____

Field Team Leader Signature: _____

Field Team Member Name	Field Team Member Signature

ATTACHMENT 3 NYSDEC GUIDELINES FOR SAMPLING AND ANALYSIS OF PFAS

NEW YORK STATE OF OPPORTUNITY. Department of Environmental Conservation

GUIDELINES FOR SAMPLING AND ANALYSIS OF PFAS

Under NYSDEC's Part 375 Remedial Programs

January 2020

www.dec.ny.gov

Contents

ERRATA SHEET for

Guidelines for Sampling and Analysis of PFAS Under NYSDEC's Part 375 Program
Issued January 17, 2020

Citation and Page Number	Current Text	Corrected Text	Date

Guidelines for Sampling and Analysis of Per- and Polyfluoroalkyl Substances (PFAS) Under NYSDEC's Part 375 Remedial Programs

Objective

New York State Department of Environmental Conservation's Division of Environmental Remediation (DER) performs or oversees sampling of environmental media and subsequent analysis of PFAS as part of remedial programs implemented under 6 NYCRR Part 375. To ensure consistency in sampling, analysis and reporting of PFAS, DER has developed this document to summarize procedures and update previous DER technical guidance pertaining to PFAS.

Applicability

Sampling for PFAS has already been initiated at numerous sites under DER-approved work plans, in accordance with specified procedures. All future work plans should include PFAS sampling and analysis procedures that conform to the guidelines provided herein.

As part of a site investigation or remedial action compliance program, whenever samples of potentially affected media are collected and analyzed for the standard Target Analyte List/Target Compound List (TAL/TCL), PFAS analysis should also be performed. Potentially affected media can include soil, groundwater, surface water, and sediment. Based upon the potential for biota to be affected, biota sampling and analysis for PFAS may also be warranted as determined pursuant to a Fish and Wildlife Impact Analysis. Soil vapor sampling for PFAS is not required.

Field Sampling Procedures

DER-10 specifies technical guidance applicable to DER's remedial programs. Given the prevalence and use of PFAS, DER has developed "best management practices" specific to sampling for PFAS. As specified in DER-10 Chapter 2, quality assurance procedures are to be submitted with investigation work plans. Typically, these procedures are incorporated into a work plan, or submitted as a stand-alone document (e.g., a Quality Assurance Project Plan). Quality assurance guidelines for PFAS are listed in Appendix A - Quality Assurance Project Plan (QAPP) Guidelines for PFAS.

Field sampling for PFAS performed under DER remedial programs should follow the appropriate procedures outlined for soils, sediments or other solids (Appendix B), non-potable groundwater (Appendix C), surface water (Appendix D), public or private water supply wells (Appendix E), and fish tissue (Appendix F).

QA/QC samples (e.g. duplicates, MS/MSD) should be collected as specified in DER-10, Section 2.3(c). For sampling equipment coming in contact with aqueous samples only, rinsate or equipment blanks should be collected. Equipment blanks should be collected at a minimum frequency of one per day or one per twenty samples, whichever is more frequent.

Data Assessment and Application to Site Cleanup

Until such time as Ambient Water Quality Standards (AWQS) and Soil Cleanup Objectives (SCOs) for PFAS are published, the extent of contaminated media potentially subject to remediation should be determined on a case-by-case basis using the procedures discussed below and the criteria in DER-10.

Water Sample Results

PFAS should be further assessed and considered as a potential contaminant of concern in groundwater or surface water if PFOA or PFOS is detected in any water sample at or above 10 ng/L (ppt). In addition, further assessment of water may be warranted if either of the following screening levels are met:

a. any other individual PFAS (not PFOA or PFOS) is detected in water at or above 100 ng/L; or
b. total concentration of PFAS (including PFOA and PFOS) is detected in water at or above 500 ng/L

If PFAS are identified as a contaminant of concern for a site, they should be assessed as part of the remedy selection process in accordance with Part 375 and DER-10.

Soil Sample Results

The extent of soil contamination for purposes of delineation and remedy selection should be determined by having certain soil samples tested by Synthetic Precipitation Leaching Procedure (SPLP) and the leachate analyzed for PFAS. Soil exhibiting SPLP results above 70 ppt for either PFOA or PFOS (individually or combined) are to be evaluated during the cleanup phase.

Sites in the site management phase should evaluate for PFAS to determine if modification to any components of the SMP is necessary (e.g., monitoring for PFAS, upgrading treatment facilities, or performing an RSO).

Testing for Imported Soil

Soil imported to a site for use in a soil cap, soil cover, or as backfill is to be tested for PFAS in general conformance with DER-10, Section 5.4(e) for the *PFAS Analyte List* (Appendix F) using the analytical procedures discussed below and the criteria in DER-10 associated with SVOCs.

If PFOA or PFOS is detected in any sample at or above 1 µg/kg, then soil should be tested by SPLP and the leachate analyzed for PFAS. If the SPLP results exceed 10 ppt for either PFOA or PFOS (individually) then the source of backfill should be rejected, unless a site-specific exemption is provided by DER. SPLP leachate criteria is based on the Maximum Contaminant Levels proposed for drinking water by New York State's Department of Health, this value may be updated based on future Federal or State promulgated regulatory standards. Remedial parties have the option of analyzing samples concurrently for both PFAS in soil and in the SPLP leachate to minimize project delays. Category B deliverables should be submitted for backfill samples, though a DUSR is not required.

Analysis and Reporting

As of January 2020, the United States Environmental Protection Agency (EPA) does not have a validated method for analysis of PFAS for media commonly analyzed under DER remedial programs (non-potable waters, solids). DER has developed the following guidelines to ensure consistency in analysis and reporting of PFAS.

The investigation work plan should describe analysis and reporting procedures, including laboratory analytical procedures for the methods discussed below. As specified in DER-10 Section 2.2, laboratories should provide a full Category B deliverable. In addition, a Data Usability Summary Report (DUSR) should be prepared by an independent, third party data validator. Electronic data submissions should meet the requirements provided at: https://www.dec.ny.gov/chemical/62440.html.

DER has developed a *PFAS Analyte List* (Appendix F) for remedial programs to understand the nature of contamination at sites. It is expected that reported results for PFAS will include, at a minimum, all the compounds listed. If lab and/or matrix specific issues are encountered for any analytes, the DER project manager, in consultation with the DER chemist, will make case-by-case decisions as to whether certain analytes may be temporarily or permanently discontinued from analysis at each site. As with other contaminants that are analyzed for at a site, the *PFAS Analyte List* may be refined for future sampling events based on investigative findings.

Routine Analysis

Currently, New York State Department of Health's Environmental Laboratory Approval Program (ELAP) does not offer certification for PFAS in matrices other than finished drinking water. However, laboratories analyzing environmental samples for PFAS (e.g., soil, sediments, and groundwater) under DER's Part 375 remedial programs need to hold ELAP certification for PFOA and PFOS in drinking water by EPA Method 537.1 or ISO 25101. Laboratories should adhere to the guidelines and criteria set forth in the DER's laboratory guidelines for PFAS in non-potable water and solids (Appendix H - Laboratory Guidelines for Analysis of PFAS in Non-Potable Water and Solids). Data review guidelines were developed by DER to ensure data comparability and usability (Appendix H - Data Review Guidelines for Analysis of PFAS in Non-Potable Water and Solids).

LC-MS/MS analysis for PFAS using methodologies based on EPA Method 537.1 is the procedure to use for environmental samples. Isotope dilution techniques should be utilized for the analysis of PFAS in all media. Reporting limits for PFOA and PFOS in aqueous samples should not exceed 2 ng/L. Reporting limits for PFOA and PFOS in solid samples should not exceed 0.5 µg/kg. Reporting limits for all other PFAS in aqueous and solid media should be as close to these limits as possible. If laboratories indicate that they are not able to achieve these reporting limits for the entire *PFAS Analyte List*, site-specific decisions regarding acceptance of elevated reporting limits for specific PFAS can be made by the DER project manager in consultation with the DER chemist.

Additional Analysis

Additional laboratory methods for analysis of PFAS may be warranted at a site, such as the Synthetic Precipitation Leaching Procedure (SPLP) and Total Oxidizable Precursor Assay (TOP Assay). Commercially methods are also available for biota and air samples.

SPLP is a technique used to determine the mobility of chemicals in liquids, soils and wastes, and may be useful in determining the need for addressing PFAS-containing material as part of the remedy. SPLP by EPA Method 1312 should be used unless otherwise specified by the DER project manager in consultation with the DER chemist.

Impacted materials can be made up of PFAS that are not analyzable by routine analytical methodology. A TOP Assay can be utilized to conceptualize the amount and type of oxidizable PFAS which could be liberated in the environment, which approximates the maximum concentration of perfluoroalkyl substances that could be generated if all polyfluoroalkyl substances were oxidized. For example, some polyfluoroalkyl substances may degrade or transform to form perfluoroalkyl substances (such as PFOA or PFOS), resulting in an increase in perfluoroalkyl substance concentrations as contaminated groundwater moves away from a source. The TOP Assay converts, through oxidation, polyfluoroalkyl substances (precursors) into perfluoroalkyl substances that can be detected by routine analytical methodology.

Please note that TOP Assay analysis of highly-contaminated samples, such as those from an AFFF (aqueous film-forming foam) site, can result in incomplete oxidation of the samples and an underestimation of the total perfluoroalkyl substances.

Commercial laboratories have adopted methods which allow for the quantification of targeted PFAS in air and biota. The EPA's Office of Research and Development (ORD) is currently developing methods which allow for air emissions characterization of PFAS, including both targeted and non-targeted analysis of PFAS. Consult with the DER project manager and the DER chemist for assistance on analyzing biota/tissue and air samples.

Appendix A - Quality Assurance Project Plan (QAPP) Guidelines for PFAS

The following guidelines (general and PFAS-specific) can be used to assist with the development of a QAPP for projects within DER involving sampling and analysis of PFAS.

General Guidelines in Accordance with DER-10

- Document/work plan section title – Quality Assurance Project Plan
- Summarize project scope, goals, and objectives
- Provide project organization including names and resumes of the project manager, Quality Assurance Officer (QAO), field staff, and Data Validator
    - The QAO should not have another position on the project, such as project or task manager, that involves project productivity or profitability as a job performance criterion
- List the ELAP-approved lab(s) to be used for analysis of samples
- Include a site map showing sample locations
- Provide detailed sampling procedures for each matrix
- Include Data Quality Usability Objectives
- List equipment decontamination procedures
- Include an "Analytical Methods/Quality Assurance Summary Table" specifying:
    - Matrix type
    - Number or frequency of samples to be collected per matrix
    - Number of field and trip blanks per matrix
    - Analytical parameters to be measured per matrix
    - Analytical methods to be used per matrix with minimum reporting limits
    - Number and type of matrix spike and matrix spike duplicate samples to be collected
    - Number and type of duplicate samples to be collected
    - Sample preservation to be used per analytical method and sample matrix
    - Sample container volume and type to be used per analytical method and sample matrix
    - Sample holding time to be used per analytical method and sample matrix
- Specify Category B laboratory data deliverables and preparation of a DUSR

Specific Guidelines for PFAS

- Include in the text that sampling for PFAS will take place
- Include in the text that PFAS will be analyzed by LC-MS/MS for PFAS using methodologies based on EPA Method 537.1
- Include the list of PFAS compounds to be analyzed (*PFAS Analyte List*)
- Include the laboratory SOP for PFAS analysis
- List the minimum method-achievable Reporting Limits for PFAS
    - Reporting Limits should be less than or equal to:
        - Aqueous – 2 ng/L (ppt)
        - Solids – 0.5 µg/kg (ppb)
- Include the laboratory Method Detection Limits for the PFAS compounds to be analyzed
- Laboratory should have ELAP certification for PFOA and PFOS in drinking water by EPA Method 537.1, EPA Method 533, or ISO 25101
- Include detailed sampling procedures
    - Precautions to be taken
    - Pump and equipment types
    - Decontamination procedures
    - Approved materials only to be used
- Specify that regular ice only will be used for sample shipment
- Specify that equipment blanks should be collected at a minimum frequency of 1 per day per matrix

Appendix B - Sampling Protocols for PFAS in Soils, Sediments and Solids

General

The objective of this protocol is to give general guidelines for the collection of soil, sediment and other solid samples for PFAS analysis. The sampling procedure used should be consistent with Sampling Guidelines and Protocols – Technological Background and Quality Control/Quality Assurance for NYS DEC Spill Response Program – March 1991 (http://www.dec.ny.gov/docs/remediation_hudson_pdf/sgpsect5.pdf), with the following limitations.

Laboratory Analysis and Containers

Samples collected using this protocol are intended to be analyzed for PFAS using methodologies based on EPA Method 537.1.

The preferred material for containers is high density polyethylene (HDPE). Pre-cleaned sample containers, coolers, sample labels, and a chain of custody form will be provided by the laboratory.

Equipment

Acceptable materials for sampling include: stainless steel, HDPE, PVC, silicone, acetate, and polypropylene. Additional materials may be acceptable if pre-approved by New York State Department of Environmental Conservation's Division of Environmental Remediation.

No sampling equipment components or sample containers should come in to contact with aluminum foil, low density polyethylene, glass, or polytetrafluoroethylene (PTFE, Teflon™) materials including sample bottle cap liners with a PTFE layer.

A list of acceptable equipment is provided below, but other equipment may be considered appropriate based on sampling conditions.

- stainless steel spoon
- stainless steel bowl
- steel hand auger or shovel without any coatings

Equipment Decontamination

Standard two step decontamination using detergent (Alconox is acceptable) and clean, PFAS-free water will be performed for sampling equipment. All sources of water used for equipment decontamination should be verified in advance to be PFAS-free through laboratory analysis or certification. Previous results of "non-detect" for PFAS from the UCMR3 water supply testing program are acceptable as verification.

Sampling Techniques

Sampling is often conducted in areas where a vegetative turf has been established. In these cases, a pre-cleaned trowel or shovel should be used to carefully remove the turf so that it may be replaced at the conclusion of sampling. Surface soil samples (e.g. 0 to 6 inches below surface) should then be collected using a pre-cleaned, stainless steel spoon. Shallow subsurface soil samples (e.g. 6 to ~36 inches below surface) may be collected by digging a hole using a pre-cleaned hand auger or shovel. When the desired subsurface depth is reached, a pre-cleaned hand auger or spoon shall be used to obtain the sample.

When the sample is obtained, it should be deposited into a stainless steel bowl for mixing prior to filling the sample containers. The soil should be placed directly into the bowl and mixed thoroughly by rolling the material into the middle until the material is homogenized. At this point the material within the bowl can be placed into the laboratory provided container.

Sample Identification and Logging

A label shall be attached to each sample container with a unique identification. Each sample shall be included on the chain of custody (COC).

Quality Assurance/Quality Control

- Immediately place samples in a cooler maintained at 4 ± 2º Celsius using ice
- Collect one field duplicate for every sample batch, minimum 1 duplicate per 20 samples. The duplicate shall consist of an additional sample at a given location
- Collect one matrix spike / matrix spike duplicate (MS/MSD) for every sample batch, minimum 1 MS/MSD per 20 samples. The MS/MSD shall consist of an additional two samples at a given location and identified on the COC
- Request appropriate data deliverable (Category B) and an electronic data deliverable

Documentation

A soil log or sample log shall document the location of the sample/borehole, depth of the sample, sampling equipment, duplicate sample, visual description of the material, and any other observations or notes determined to be appropriate. Additionally, care should be performed to limit contact with PFAS containing materials (e.g. waterproof field books, food packaging) during the sampling process.

Personal Protection Equipment (PPE)

For most sampling Level D PPE is anticipated to be appropriate. The sampler should wear nitrile gloves while conducting field work and handling sample containers.

Field staff shall consider the clothing to be worn during sampling activities. Clothing that contains PTFE material (including GORE-TEX®) or that have been waterproofed with PFAS materials should be avoided. All clothing worn by sampling personnel should have been laundered multiple times.

Appropriate rain gear (PVC, polyurethane, or rubber rain gear are acceptable), bug spray, and sunscreen should be used that does not contain PFAS. Well washed cotton coveralls may be used as an alternative to bug spray and/or sunscreen.

PPE that contains PFAS is acceptable when site conditions warrant additional protection for the samplers and no other materials can be used to be protective. Documentation of such use should be provided in the field notes.

Appendix C - Sampling Protocols for PFAS in Monitoring Wells

General

The objective of this protocol is to give general guidelines for the collection of groundwater samples for PFAS analysis. The sampling procedure used should be consistent with Sampling Guidelines and Protocols – Technological Background and Quality Control/Quality Assurance for NYS DEC Spill Response Program – March 1991 (http://www.dec.ny.gov/docs/remediation_hudson_pdf/sgpsect5.pdf), with the following limitations.

Laboratory Analysis and Container

Samples collected using this protocol are intended to be analyzed for PFAS using methodologies based on EPA Method 537.1.

The preferred material for containers is high density polyethylene (HDPE). Pre-cleaned sample containers, coolers, sample labels, and a chain of custody form will be provided by the laboratory.

Equipment

Acceptable materials for sampling include: stainless steel, HDPE, PVC, silicone, acetate, and polypropylene. Additional materials may be acceptable if pre-approved by New York State Department of Environmental Conservation's Division of Environmental Remediation.

No sampling equipment components or sample containers should come in contact with aluminum foil, low density polyethylene, glass, or polytetrafluoroethylene (PTFE, Teflon™) materials including plumbers tape and sample bottle cap liners with a PTFE layer.

A list of acceptable equipment is provided below, but other equipment may be considered appropriate based on sampling conditions.

- stainless steel inertia pump with HDPE tubing
- peristaltic pump equipped with HDPE tubing and silicone tubing
- stainless steel bailer with stainless steel ball
- bladder pump (identified as PFAS-free) with HDPE tubing

Equipment Decontamination

Standard two step decontamination using detergent (Alconox is acceptable) and clean, PFAS-free water will be performed for sampling equipment. All sources of water used for equipment decontamination should be verified in advance to be PFAS-free through laboratory analysis or certification.

Sampling Techniques

Monitoring wells should be purged in accordance with the sampling procedure (standard/volume purge or low flow purge) identified in the site work plan, which will determine the appropriate time to collect the sample. If sampling using standard purge techniques, additional purging may be needed to reduce turbidity levels, so samples contain a limited amount of sediment within the sample containers. Sample containers that contain sediment may cause issues at the laboratory, which may result in elevated reporting limits and other issues during the sample preparation that can compromise data usability. Sampling personnel should don new nitrile gloves prior to sample collection due to the potential to contact PFAS containing items (not related to the sampling equipment) during the purging activities.

Sample Identification and Logging

A label shall be attached to each sample container with a unique identification. Each sample shall be included on the chain of custody (COC).

Quality Assurance/Quality Control

- Immediately place samples in a cooler maintained at 4 ± 2º Celsius using ice
- Collect one field duplicate for every sample batch, minimum 1 duplicate per 20 samples. The duplicate shall consist of an additional sample at a given location
- Collect one matrix spike / matrix spike duplicate (MS/MSD) for every sample batch, minimum 1 MS/MSD per 20 samples. The MS/MSD shall consist of an additional two samples at a given location and identified on the COC
- Collect one equipment blank every day that sampling is conducted and minimum 1 equipment blank per 20 samples. The equipment blank shall test the new and decontaminated sampling equipment utilized to obtain a sample for residual PFAS contamination. This sample is obtained by using laboratory provided PFAS-free water and passing the water over or through the sampling device and into laboratory provided sample containers
- Additional equipment blank samples may be collected to assess other equipment that is utilized at the monitoring well
- Request appropriate data deliverable (Category B) and an electronic data deliverable

Documentation

A purge log shall document the location of the sample, sampling equipment, groundwater parameters, duplicate sample, visual description of the material, and any other observations or notes determined to be appropriate. Additionally, care should be performed to limit contact with PFAS containing materials (e.g. waterproof field books, food packaging) during the sampling process.

Personal Protection Equipment (PPE)

For most sampling Level D PPE is anticipated to be appropriate. The sampler should wear nitrile gloves while conducting field work and handling sample containers.

Field staff shall consider the clothing to be worn during sampling activities. Clothing that contains PTFE material (including GORE-TEX®) or that have been waterproofed with PFAS materials should be avoided. All clothing worn by sampling personnel should have been laundered multiple times.

Appropriate rain gear (PVC, polyurethane, or rubber rain gear are acceptable), bug spray, and sunscreen should be used that does not contain PFAS. Well washed cotton coveralls may be used as an alternative to bug spray and/or sunscreen.

PPE that contains PFAS is acceptable when site conditions warrant additional protection for the samplers and no other materials can be used to be protective. Documentation of such use should be provided in the field notes.

Appendix D - Sampling Protocols for PFAS in Surface Water

General

The objective of this protocol is to give general guidelines for the collection of surface water samples for PFAS analysis. The sampling procedure used should be consistent with Sampling Guidelines and Protocols – Technological Background and Quality Control/Quality Assurance for NYS DEC Spill Response Program – March 1991 (http://www.dec.ny.gov/docs/remediation_hudson_pdf/sgpsect5.pdf), with the following limitations.

Laboratory Analysis and Container

Samples collected using this protocol are intended to be analyzed for PFAS using methodologies based on EPA Method 537.1.

The preferred material for containers is high density polyethylene (HDPE). Pre-cleaned sample containers, coolers, sample labels, and a chain of custody form will be provided by the laboratory.

Equipment

Acceptable materials for sampling include: stainless steel, HDPE, PVC, silicone, acetate, and polypropylene. Additional materials may be acceptable if pre-approved by New York State Department of Environmental Conservation's Division of Environmental Remediation.

No sampling equipment components or sample containers should come in contact with aluminum foil, low density polyethylene, glass, or polytetrafluoroethylene (PTFE, Teflon™) materials including sample bottle cap liners with a PTFE layer.

A list of acceptable equipment is provided below, but other equipment may be considered appropriate based on sampling conditions.

- stainless steel cup

Equipment Decontamination

Standard two step decontamination using detergent (Alconox is acceptable) and clean, PFAS-free water will be performed for sampling equipment. All sources of water used for equipment decontamination should be verified in advance to be PFAS-free through laboratory analysis or certification.

Sampling Techniques

Where conditions permit, (e.g. creek or pond) sampling devices (e.g. stainless steel cup) should be rinsed with site medium to be sampled prior to collection of the sample. At this point the sample can be collected and poured into the sample container.

If site conditions permit, samples can be collected directly into the laboratory container.

Sample Identification and Logging

A label shall be attached to each sample container with a unique identification. Each sample shall be included on the chain of custody (COC).

Quality Assurance/Quality Control

- Immediately place samples in a cooler maintained at 4 ± 2º Celsius using ice
- Collect one field duplicate for every sample batch, minimum 1 duplicate per 20 samples. The duplicate shall consist of an additional sample at a given location
- Collect one matrix spike / matrix spike duplicate (MS/MSD) for every sample batch, minimum 1 MS/MSD per 20 samples. The MS/MSD shall consist of an additional two samples at a given location and identified on the COC
- Collect one equipment blank every day that sampling is conducted and minimum 1 equipment blank per 20 samples. The equipment blank shall test the new and decontaminated sampling equipment utilized to obtain a sample for residual PFAS contamination. This sample is obtained by using laboratory provided PFAS-free water and passing the water over or through the sampling device and into laboratory provided sample containers
- Request appropriate data deliverable (Category B) and an electronic data deliverable

Documentation

A sample log shall document the location of the sample, sampling equipment, duplicate sample, visual description of the material, and any other observations or notes determined to be appropriate. Additionally, care should be performed to limit contact with PFAS containing materials (e.g. waterproof field books, food packaging) during the sampling process.

Personal Protection Equipment (PPE)

For most sampling Level D PPE is anticipated to be appropriate. The sampler should wear nitrile gloves while conducting field work and handling sample containers.

Field staff shall consider the clothing to be worn during sampling activities. Clothing that contains PTFE material (including GORE-TEX®) or that have been waterproofed with PFAS materials should be avoided. All clothing worn by sampling personnel should have been laundered multiple times.

Appropriate rain gear (PVC, polyurethane, or rubber rain gear are acceptable), bug spray, and sunscreen should be used that does not contain PFAS. Well washed cotton coveralls may be used as an alternative to bug spray and/or sunscreen.

PPE that contains PFAS is acceptable when site conditions warrant additional protection for the samplers and no other materials can be used to be protective. Documentation of such use should be provided in the field notes.

Appendix E - Sampling Protocols for PFAS in Private Water Supply Wells

General

The objective of this protocol is to give general guidelines for the collection of water samples from private water supply wells (with a functioning pump) for PFAS analysis. The sampling procedure used should be consistent with Sampling Guidelines and Protocols – Technological Background and Quality Control/Quality Assurance for NYS DEC Spill Response Program – March 1991 (http://www.dec.ny.gov/docs/remediation_hudson_pdf/sgpsect5.pdf), with the following limitations.

Laboratory Analysis and Container

Drinking water samples collected using this protocol are intended to be analyzed for PFAS by ISO Method 25101. The preferred material for containers is high density polyethylene (HDPE). Pre-cleaned sample containers, coolers, sample labels, and a chain of custody form will be provided by the laboratory.

Equipment

Acceptable materials for sampling include: stainless steel, HDPE, PVC, silicone, acetate, and polypropylene. Additional materials may be acceptable if pre-approved by New York State Department of Environmental Conservation's Division of Environmental Remediation.

No sampling equipment components or sample containers should come in contact with aluminum foil, low density polyethylene, glass, or polytetrafluoroethylene (PTFE, Teflon™) materials (e.g. plumbers tape), including sample bottle cap liners with a PTFE layer.

Equipment Decontamination

Standard two step decontamination using detergent (Alconox is acceptable) and clean, PFAS-free water will be performed for sampling equipment. All sources of water used for equipment decontamination should be verified in advance to be PFAS-free through laboratory analysis or certification.

Sampling Techniques

Locate and assess the pressure tank and determine if any filter units are present within the building. Establish the sample location as close to the well pump as possible, which is typically the spigot at the pressure tank. Ensure sampling equipment is kept clean during sampling as access to the pressure tank spigot, which is likely located close to the ground, may be obstructed and may hinder sample collection.

Prior to sampling, a faucet downstream of the pressure tank (e.g., wash room sink) should be run until the well pump comes on and a decrease in water temperature is noted which indicates that the water is coming from the well. If the homeowner is amenable, staff should run the water longer to purge the well (15+ minutes) to provide a sample representative of the water in the formation rather than standing water in the well and piping system including the pressure tank. At this point a new pair of nitrile gloves should be donned and the sample can be collected from the sample point at the pressure tank.

Sample Identification and Logging

A label shall be attached to each sample container with a unique identification. Each sample shall be included on the chain of custody (COC).

Quality Assurance/Quality Control

- Immediately place samples in a cooler maintained at 4 ± 2º Celsius using ice
- Collect one field duplicate for every sample batch, minimum 1 duplicate per 20 samples. The duplicate shall consist of an additional sample at a given location
- Collect one matrix spike / matrix spike duplicate (MS/MSD) for every sample batch, minimum 1 MS/MSD per 20 samples. The MS/MSD shall consist of an additional two samples at a given location and identified on the COC
- If equipment was used, collect one equipment blank every day that sampling is conducted and minimum 1 equipment blank per 20 samples. The equipment blank shall test the new and decontaminated sampling equipment utilized to obtain a sample for residual PFAS contamination. This sample is obtained by using laboratory provided PFAS-free water and passing the water over or through the sampling device and into laboratory provided sample containers
- Request appropriate data deliverable (Category B) and an electronic data deliverable

Documentation

A sample log shall document the location of the private well, sample point location, owner contact information, sampling equipment, purge duration, duplicate sample, visual description of the material, and any other observations or notes determined to be appropriate and available (e.g. well construction, pump type and location, yield, installation date). Additionally, care should be performed to limit contact with PFAS containing materials (e.g. waterproof field books, food packaging) during the sampling process.

Personal Protection Equipment (PPE)

For most sampling Level D PPE is anticipated to be appropriate. The sampler should wear nitrile gloves while conducting field work and handling sample containers.

Field staff shall consider the clothing to be worn during sampling activities. Clothing that contains PTFE material (including GORE-TEX®) or that have been waterproofed with PFAS materials should be avoided. All clothing worn by sampling personnel should have been laundered multiple times.

Appendix F - Sampling Protocols for PFAS in Fish

This appendix contains a copy of the latest guidelines developed by the Division of Fish and Wildlife (DFW) entitled “General Fish Handling Procedures for Contaminant Analysis” (Ver. 8).

Procedure Name: General Fish Handling Procedures for Contaminant Analysis

Number: FW-005

Purpose: This procedure describes data collection, fish processing and delivery of fish collected for contaminant monitoring. It contains the chain of custody and collection record forms that should be used for the collections.

Organization: Environmental Monitoring Section
Bureau of Ecosystem Health
Division of Fish and Wildlife (DFW)
New York State Department of Environmental Conservation (NYSDEC)
625 Broadway
Albany, New York 12233-4756

Version: 8

Previous Version Date: 21 March 2018

Summary of Changes to this Version: Updated bureau name to Bureau of Ecosystem Health. Added direction to list the names of all field crew on the collection record. Minor formatting changes on chain of custody and collection records.

Originator or Revised by: Wayne Richter, Jesse Becker

Date: 26 April 2019

Quality Assurance Officer and Approval Date: Jesse Becker, 26 April 2019

NEW YORK STATE
DEPARTMENT OF ENVIRONMENTAL CONSERVATION

GENERAL FISH HANDLING PROCEDURES FOR CONTAMINANT ANALYSES

A. Original copies of all continuity of evidence (i.e., Chain of Custody) and collection record forms must accompany delivery of fish to the lab. A copy shall be directed to the Project Leader or as appropriate, Wayne Richter. All necessary forms will be supplied by the Bureau of Ecosystem Health. Because some samples may be used in legal cases, it is critical that each section is filled out completely. Each Chain of Custody form has three main sections:

   1. The top box is to be filled out **and signed** by the person responsible for the fish collection (e.g., crew leader, field biologist, researcher). This person is responsible for delivery of the samples to DEC facilities or personnel (e.g., regional office or biologist).

   2. The second section is to be filled out **and signed** by the person responsible for the collections while being stored at DEC, before delivery to the analytical lab. This may be the same person as in (1), but it is still required that they complete the section. Also important is the **range of identification numbers** (i.e., tag numbers) included in the sample batch.

   3. Finally, the bottom box is to record any transfers between DEC personnel and facilities. Each subsequent transfer should be **identified, signed, and dated**, until laboratory personnel take possession of the fish.

B. The following data are required on each **Fish Collection Record** form:

   1. Project and Site Name.

   2. DEC Region.

   3. All personnel (and affiliation) involved in the collection.

   4. Method of collection (gill net, hook and line, etc.)

   5. Preservation Method.

C. The following data are to be taken on each fish collected and recorded on the **Fish Collection Record** form:

   1. Tag number - Each specimen is to be individually jaw tagged at time of collection with a unique number. Make sure the tag is turned out so that the number can be read without opening the bag. Use tags in sequential order. For small fish or composite samples place the tag inside the bag with the samples. The Bureau of Ecosystem Health can supply the tags.

   2. Species identification (please be explicit enough to enable assigning genus and species). Group fish by species when processing.

   3. Date collected.

   4. Sample location (waterway and nearest prominent identifiable landmark).

   5. Total length (nearest mm or smallest sub-unit on measuring instrument) and weight (nearest g or

smallest sub-unit of weight on weighing instrument). Take all measures as soon as possible with calibrated, protected instruments (e.g. from wind and upsets) and prior to freezing.

6. Sex - fish may be cut enough to allow sexing or other internal investigation, but do not eviscerate. Make any incision on the right side of the belly flap or exactly down the midline so that a left-side fillet can be removed.

D. General data collection recommendations:

1. It is helpful to use an ID or tag number that will be unique. It is best to use metal striped bass or other uniquely numbered metal tags. If uniquely numbered tags are unavailable, values based on the region, water body and year are likely to be unique: for example, R7CAY11001 for Region 7, Cayuga Lake, 2011, fish 1. If the fish are just numbered 1 through 20, we have to give them new numbers for our database, making it more difficult to trace your fish to their analytical results and creating an additional possibility for errors.

2. Process and record fish of the same species sequentially. Recording mistakes are less likely when all fish from a species are processed together. Starting with the bigger fish species helps avoid missing an individual.

3. If using Bureau of Ecosystem Health supplied tags or other numbered tags, use tags in sequence so that fish are recorded with sequential Tag Numbers. This makes data entry and login at the lab and use of the data in the future easier and reduces keypunch errors.

4. Record length and weight as soon as possible after collection and before freezing. Other data are recorded in the field upon collection. An age determination of each fish is optional, but if done, it is recorded in the appropriate "Age" column.

5. For composite samples of small fish, record the number of fish in the composite in the Remarks column. Record the length and weight of each individual in a composite. All fish in a composite sample should be of the same species and members of a composite should be visually matched for size.

6. Please submit photocopies of topographic maps or good quality navigation charts indicating sampling locations. GPS coordinates can be entered in the Location column of the collection record form in addition to or instead for providing a map. These records are of immense help to us (and hopefully you) in providing documented location records which are not dependent on memory and/or the same collection crew. In addition, they may be helpful for contaminant source trackdown and remediation/control efforts of the Department.

7. When recording data on fish measurements, it will help to ensure correct data recording for the data recorder to call back the numbers to the person making the measurements.

E. Each fish is to be placed in its own individual plastic bag. For small fish to be analyzed as a composite, put all of the fish for one composite in the same bag but use a separate bag for each composite. It is important to individually bag the fish to avoid difficulties or cross contamination when processing the fish for chemical analysis. Be sure to include the fish's tag number inside the bag, preferably attached to the fish with the tag number turned out so it can be read. Tie or otherwise secure the bag closed. **The Bureau of Ecosystem Health will supply the bags.** If necessary, food grade bags may be procured from a suitable vendor (e.g., grocery store). It is preferable to redundantly label each bag with a manila tag tied between the knot and the body of the bag. This tag should be labeled with the project name, collection location, tag number, collection date, and fish species. If scales are collected, the scale envelope should be labeled with

the same information.

F. Groups of fish, by species, are to be placed in one large plastic bag per sampling location. **The Bureau of Ecosystem Health will supply the larger bags.** Tie or otherwise secure the bag closed. Label the site bag with a manila tag tied between the knot and the body of the bag. The tag should contain: project, collection location, collection date, species and **tag number ranges**. Having this information on the manila tag enables lab staff to know what is in the bag without opening it.

G. Do not eviscerate, fillet or otherwise dissect the fish unless specifically asked to. If evisceration or dissection is specified, the fish must be cut along the exact midline or on the right side so that the left side fillet can be removed intact at the laboratory. If filleting is specified, the procedure for taking a standard fillet (SOP PREPLAB 4) must be followed, including removing scales.

H. Special procedures for PFAS: Unlike legacy contaminants such as PCBs, which are rarely found in day to day life, PFAS are widely used and frequently encountered. Practices that avoid sample contamination are therefore necessary. While no standard practices have been established for fish, procedures for water quality sampling can provide guidance. The following practices should be used for collections when fish are to be analyzed for PFAS:

No materials containing Teflon.
No Post-it notes.
No ice packs; only water ice or dry ice.
Any gloves worn must be powder free nitrile.
No Gore-Tex or similar materials (Gore-Tex is a PFC with PFOA used in its manufacture).
No stain repellent or waterproof treated clothing; these are likely to contain PFCs.
Avoid plastic materials, other than HDPE, including clipboards and waterproof notebooks.
Wash hands after handling any food containers or packages as these may contain PFCs.
Keep pre-wrapped food containers and wrappers isolated from fish handling.
Wear clothing washed at least six times since purchase.
Wear clothing washed without fabric softener.
Staff should avoid cosmetics, moisturizers, hand creams and similar products on the day of sampling as many of these products contain PFCs (Fujii et al. 2013). Sunscreen or insect repellent should not contain ingredients with “fluor” in their name. Apply any sunscreen or insect repellent well downwind from all materials. Hands must be washed after touching any of these products.

I. All fish must be kept at a temperature <45° F (<8° C) immediately following data processing. As soon as possible, freeze at -20° C ± 5° C. Due to occasional freezer failures, daily freezer temperature logs are required. The freezer should be locked or otherwise secured to maintain chain of custody.

J. In most cases, samples should be delivered to the Analytical Services Unit at the Hale Creek field station. Coordinate delivery with field station staff and send copies of the collection records, continuity of evidence forms and freezer temperature logs to the field station. For samples to be analyzed elsewhere, non-routine collections or other questions, contact Wayne Richter, Bureau of Ecosystem Health, NYSDEC, 625 Broadway, Albany, New York 12233-4756, 518-402-8974, or the project leader about sample transfer. Samples will then be directed to the analytical facility and personnel noted on specific project descriptions.

K. A recommended equipment list is at the end of this document.

NEW YORK STATE DEPARTMENT OF ENVIRONMENTAL CONSERVATION
DIVISION OF FISH AND WILDLIFE
FISH COLLECTION RECORD

Project and Site Name _____ DEC Region _____

Collections made by (include all crew) _____

Sampling Method: □Electrofishing □Gill netting □Trap netting □Trawling □Seining □Angling □Other _____

Preservation Method: □Freezing □Other _____ Notes (SWFDB survey number): _____

FOR LAB USE ONLY- LAB ENTRY NO.	COLLECTION OR TAG NO.	SPECIES	DATE TAKEN	LOCATION	AGE	SEX &/OR REPROD. CONDIT	LENGTH ( )	WEIGHT ( )	REMARKS

richter: revised 2011, 5/7/15, 10/4/16, 3/20/17; becker: 3/23/17, 4/26/19

NEW YORK STATE DEPARTMENT OF ENVIRONMENTAL CONSERVATION
CHAIN OF CUSTODY

I, _____, of _____ collected the
(Print Name) (Print Business Address)

following on _____, 20____ from _____
(Date) (Water Body)

in the vicinity of _____
(Landmark, Village, Road, etc.)

Town of _____, in _____ County.

Item(s) _____

_____

Said sample(s) were in my possession and handled according to standard procedures provided to me prior to collection. The sample(s) were placed in the custody of a representative of the New York State Department of Environmental Conservation on _____, 20_____.

_____ _____
Signature Date

I, _____, received the above mentioned sample(s) on the date specified and assigned identification number(s) _____ to the sample(s). I have recorded pertinent data for the sample(s) on the attached collection records. The sample(s) remained in my custody until subsequently transferred, prepared or shipped at times and on dates as attested to below.

_____ _____
Signature Date

SECOND RECIPIENT (Print Name)	TIME & DATE	PURPOSE OF TRANSFER
SIGNATURE	UNIT	
THIRD RECIPIENT (Print Name)	TIME & DATE	PURPOSE OF TRANSFER
SIGNATURE	UNIT	
FOURTH RECIPIENT (Print Name)	TIME & DATE	PURPOSE OF TRANSFER
SIGNATURE	UNIT	
RECEIVED IN LABORATORY BY (Print Name)	TIME & DATE	REMARKS
SIGNATURE	UNIT	
LOGGED IN BY (Print Name)	TIME & DATE	ACCESSION NUMBERS
SIGNATURE	UNIT	

richter: revised 21 April 2014; becker: 23 March 2017, 26 April, 2019

NOTICE OF WARRANTY

By signature to the chain of custody (reverse), the signatory warrants that the information provided is truthful and accurate to the best of his/her ability. The signatory affirms that he/she is willing to testify to those facts provided and the circumstances surrounding the same. Nothing in this warranty or chain of custody negates responsibility nor liability of the signatories for the truthfulness and accuracy of the statements provided.

HANDLING INSTRUCTIONS

On day of collection, collector(s) name(s), address(es), date, geographic location of capture (attach a copy of topographic map or navigation chart), species, number kept of each species, and description of capture vicinity (proper noun, if possible) along with name of Town and County must be indicated on reverse.

Retain organisms in manila tagged plastic bags to avoid mixing capture locations. Note appropriate information on each bag tag.

Keep samples as cool as possible. Put on ice if fish cannot be frozen within 12 hours. If fish are held more than 24 hours without freezing, they will not be retained or analyzed.

Initial recipient (either DEC or designated agent) of samples from collector(s) is responsible for obtaining and recording information on the collection record forms which will accompany the chain of custody. This person will seal the container using packing tape and writing his signature, the time and the date across the tape onto the container with indelible marker. Any time a seal is broken, for whatever purpose, the incident must be recorded on the Chain of Custody (reason, time, and date) in the purpose of transfer block. Container then is resealed using new tape and rewriting signature, with time and date.

EQUIPMENT LIST

Scale or balance of appropriate capacity for the fish to be collected.

Fish measuring board.

Plastic bags of an appropriate size for the fish to be collected and for site bags.

Individually numbered metal tags for fish.

Manila tags to label bags.

Small envelops, approximately 2” x 3.5”, if fish scales are to be collected.

Knife for removing scales.

Chain of custody and fish collection forms.

Clipboard.

Pens or markers.

Paper towels.

Dish soap and brush.

Bucket.

Cooler.

Ice.

Duct tape.

Appendix G – PFAS Analyte List

Group	Chemical Name	Abbreviation	CAS Number
Perfluoroalkyl sulfonates	Perfluorobutanesulfonic acid	PFBS	375-73-5
	Perfluorohexanesulfonic acid	PFHxS	355-46-4
	Perfluoroheptanesulfonic acid	PFHpS	375-92-8
	Perfluorooctanesulfonic acid	PFOS	1763-23-1
	Perfluorodecanesulfonic acid	PFDS	335-77-3
Perfluoroalkyl carboxylates	Perfluorobutanoic acid	PFBA	375-22-4
	Perfluoropentanoic acid	PFPeA	2706-90-3
	Perfluorohexanoic acid	PFHxA	307-24-4
	Perfluoroheptanoic acid	PFHpA	375-85-9
	Perfluorooctanoic acid	PFOA	335-67-1
	Perfluorononanoic acid	PFNA	375-95-1
	Perfluorodecanoic acid	PFDA	335-76-2
	Perfluoroundecanoic acid	PFUA/PFUdA	2058-94-8
	Perfluorododecanoic acid	PFDoA	307-55-1
	Perfluorotridecanoic acid	PFTriA/PFTrDA	72629-94-8
	Perfluorotetradecanoic acid	PFTA/PFTeDA	376-06-7
Fluorinated Telomer Sulfonates	6:2 Fluorotelomer sulfonate	6:2 FTS	27619-97-2
	8:2 Fluorotelomer sulfonate	8:2 FTS	39108-34-4
Perfluorooctane-sulfonamides	Perfluroroctanesulfonamide	FOSA	754-91-6
Perfluorooctane-sulfonamidoacetic acids	N-methyl perfluorooctanesulfonamidoacetic acid	N-MeFOSAA	2355-31-9
	N-ethyl perfluorooctanesulfonamidoacetic acid	N-EtFOSAA	2991-50-6

Appendix H - Laboratory Guidelines for Analysis of PFAS in Non-Potable Water and Solids

General

New York State Department of Environmental Conservation's Division of Environmental Remediation (DER) developed the following guidelines for laboratories analyzing environmental samples for PFAS under DER programs. If laboratories cannot adhere to the following guidelines, they should contact DER's Quality Assurance Officer, Dana Maikels, at dana.maikels@dec.ny.gov prior to analysis of samples.

Isotope Dilution

Isotope dilution techniques should be utilized for the analysis of PFAS in all media.

Extraction

For water samples, the entire sample bottle should be extracted, and the sample bottle rinsed with appropriate solvent to remove any residual PFAS.

For samples with high particulates, the samples should be handled in one of the following ways:

1. Spike the entire sample bottle with isotope dilution analytes (IDAs) prior to any sample manipulation. The sample can be passed through the SPE and if it clogs, record the volume that passed through.
2. If the sample contains too much sediment to attempt passing it through the SPE cartridge, the sample should be spiked with isotope dilution analytes, centrifuged and decanted.
3. If higher reporting limits are acceptable for the project, the sample can be diluted by taking a representative aliquot of the sample. If isotope dilution analytes will be diluted out of the sample, they can be added after the dilution. The sample should be homogenized prior to taking an aliquot.

If alternate sample extraction procedures are used, please contact the DER remedial program chemist prior to employing. Any deviations in sample preparation procedures should be clearly noted in the case narrative.

Signal to Noise Ratio

For all target analyte ions used for quantification, signal to noise ratio should be 3:1 or greater.

Blanks

There should be no detections in the method blanks above the reporting limits.

Ion Transitions

The ion transitions listed below should be used for the following PFAS:

PFOA	413 > 369
PFOS	499 > 80
PFHxS	399 > 80
PFBS	299 > 80
6:2 FTS	427 > 407
8:2 FTS	527 > 507
N-EtFOSAA	584 > 419
N-MeFOSAA	570 > 419

Branched and Linear Isomers

Standards containing both branched and linear isomers should be used when standards are commercially available. Currently, quantitative standards are available for PFHxS, PFOS, NMeFOSAA, and NEtFOSAA. As more standards become available, they should be incorporated in to the method. All isomer peaks present in the standard should be integrated and the areas summed. Samples should be integrated in the same manner as the standards.

Since a quantitative standard does not exist for branched isomers of PFOA, the instrument should be calibrated using just the linear isomer and a technical (qualitative) PFOA standard should be used to identify the retention time of the branched PFOA isomers in the sample. The total response of PFOA branched and linear isomers should be integrated in the samples and quantitated using the calibration curve of the linear standard.

Secondary Ion Transition Monitoring

Quantifier and qualifier ions should be monitored for all target analytes (PFBA and PFPeA are exceptions). The ratio of quantifier ion response to qualifier ion response should be calculated for each target analyte and the ratio compared to standards. Lab derived criteria should be used to determine if the ratios are acceptable.

Reporting

Detections below the reporting limit should be reported and qualified with a J qualifier.

The acid form of PFAS analytes should be reported. If the salt form of the PFAS was used as a stock standard, the measured mass should be corrected to report the acid form of the analyte.

Appendix H - Data Review Guidelines for Analysis of PFAS in Non-Potable Water and Solids

General

These guidelines are intended to be used for the validation of PFAS analytical results for projects within the Division of Environmental Remediation (DER) as well as aid in the preparation of a data usability summary report. Data reviewers should understand the methodology and techniques utilized in the analysis. Consultation with the end user of the data may be necessary to assist in determining data usability based on the data quality objectives in the Quality Assurance Project Plan. A familiarity with the laboratory's Standard Operating Procedure may also be needed to fully evaluate the data. If you have any questions, please contact DER's Quality Assurance Officer, Dana Maikels, at dana.maikels@dec.ny.gov.

Preservation and Holding Time

Samples should be preserved with ice to a temperature of less than 6°C upon arrival at the lab. The holding time is 14 days to extraction for aqueous and solid samples. The time from extraction to analysis for aqueous samples is 28 days and 40 days for solids.

Temperature greatly exceeds 6ºC upon arrival at the lab*	Use professional judgement to qualify detects and non-detects as estimated or rejected
Holding time exceeding 28 days to extraction	Use professional judgement to qualify detects and non-detects as estimated or rejected if holding time is grossly exceeded

*Samples that are delivered to the lab immediately after sampling may not meet the thermal preservation guidelines. Samples are considered acceptable if they arrive on ice or an attempt to chill the samples is observed.

Initial Calibration

The initial calibration should contain a minimum of five standards for linear fit and six standards for a quadratic fit. The relative standard deviation (RSD) for a quadratic fit calibration should be less than 20%. Linear fit calibration curves should have an R^2 value greater than 0.990.

The low-level calibration standard should be within 50% - 150% of the true value, and the mid-level calibration standard within 70% - 130% of the true value.

%RSD >20%	J flag detects and UJ non detects
R^2 >0.990	J flag detects and UJ non detects
Low-level calibration check <50% or >150%	J flag detects and UJ non detects
Mid-level calibration check <70% or >130%	J flag detects and UJ non detects

Initial Calibration Verification

An initial calibration verification (ICV) standard should be from a second source (if available). The ICV should be at the same concentration as the mid-level standard of the calibration curve.

ICV recovery <70% or >130%	J flag detects and non-detects

Continuing Calibration Verification

Continuing calibration verification (CCV) checks should be analyzed at a frequency of one per ten field samples. If CCV recovery is very low, where detection of the analyte could be in question, ensure a low level CCV was analyzed and use to determine data quality.

CCV recovery <70 or >130%	J flag results

Blanks

There should be no detections in the method blanks above the reporting limits. Equipment blanks, field blanks, rinse blanks etc. should be evaluated in the same manner as method blanks. Use the most contaminated blank to evaluate the sample results.

Blank Result	Sample Result	Qualification
Any detection	<Reporting limit	Qualify as ND at reporting limit
Any detection	>Reporting Limit and >10x the blank result	No qualification
>Reporting limit	>Reporting limit and <10x blank result	J+ biased high

Field Duplicates

A blind field duplicate should be collected at rate of one per twenty samples. The relative percent difference (RPD) should be less than 30% for analyte concentrations greater than two times the reporting limit. Use the higher result for final reporting.

RPD >30%	Apply J qualifier to parent sample

Lab Control Spike

Lab control spikes should be analyzed with each extraction batch or one for every twenty samples. In the absence of lab derived criteria, use 70% - 130% recovery criteria to evaluate the data.

Recovery <70% or >130% (lab derived criteria can also be used)	Apply J qualifier to detects and UJ qualifier to non detects

Matrix Spike/Matrix Spike Duplicate

One matrix spike and matrix spike duplicate should be collected at a rate of one per twenty samples. Use professional judgement to reject results based on out of control MS/MSD recoveries.

Recovery <70% or >130% (lab derived criteria can also be used)	Apply J qualifier to detects and UJ qualifier to non detects of parent sample only
RPD >30%	Apply J qualifier to detects and UJ qualifier to non detects of parent sample only

Extracted Internal Standards (Isotope Dilution Analytes)

Problematic analytes (e.g. PFBA, PFPeA, fluorotelomer sulfonates) can have wider recoveries without qualification. Qualify corresponding native compounds with a J flag if outside of the range.

Recovery <50% or >150%	Apply J qualifier
Recovery <25% or >150% for poor responding analytes	Apply J qualifier
Isotope Dilution Analyte (IDA) Recovery <10%	Reject results

Secondary Ion Transition Monitoring

Quantifier and qualifier ions should be monitored for all target analytes (PFBA and PFPeA are exceptions). The ratio of quantifier ion response to qualifier ion response should be calculated from the standards for each target analyte. Lab derived criteria should be used to determine if the ratios are acceptable. If the ratios fall outside of the laboratory criteria, qualify results as an estimated maximum concentration.

Signal to Noise Ratio

The signal to noise ratio for the quantifier ion should be at least 3:1. If the ratio is less than 3:1, the peak is discernable from the baseline noise and symmetrical, the result can be reported. If the peak appears to be baseline noise and/or the shape is irregular, qualify the result as tentatively identified.

Branched and Linear Isomers

Observed branched isomers in the sample that do not have a qualitative or quantitative standard should be noted and the analyte should be qualified as biased low in the final data review summary report. Note: The branched isomer peak should also be present in the secondary ion transition.

Reporting Limits

If project-specific reporting limits were not met, please indicate that in the report along with the reason (e.g. over dilution, dilution for non-target analytes, high sediment in aqueous samples).

Peak Integrations

Target analyte peaks should be integrated properly and consistently when compared to standards. Ensure branched isomer peaks are included for PFAS where standards are available. Inconsistencies should be brought to the attention of the laboratory or identified in the data review summary report.