

August 29, 2018

Mr. Peter Ouderkirk, P.E.
Environmental Engineer II
Division of Hazardous Waste Remediation
New York State Department of Environmental Conservation
317 Washington Street
Watertown, New York 13601-3787

RE: Revised Work Plan for 2018 Groundwater Sampling of 1,4-Dioxane and Per- and Polyfluoroalkyl Substances (PFAS) at the DuPont Ferdula Landfill, Site No. 622002, Cemetery Road, Frankfort, New York

Dear Mr. Ouderkirk:

On behalf of E.I. du Pont de Nemours and Company (DuPont), Parsons is pleased to provide you with this revised work plan to perform groundwater sampling for 1,4-Dioxane and Per- and Polyfluoroalkyl Substances (PFAS) at selected groundwater monitoring wells at the DuPont Ferdula Landfill located in Frankfort, New York (See Figure 1). The scope of work described in this work plan was developed to satisfy the New York State Department of Environmental Conservation (NYSDEC) letter to DuPont dated May 16th and August 22nd, 2018; in which the NYSDEC requested that a select number of groundwater monitoring wells be sampled for the aforementioned parameters. This revised letter work plan provides the proposed revised scope of work to satisfy the NYSDEC request.

Scope of Work

One groundwater monitoring well (P-11) located upgradient of the landfill cap, one well (P-17) located within the landfill cap, and one well (F-8) located downgradient of the landfill cap will be sampled for 1,4-Dioxane and PFAS. If the upgradient groundwater monitoring well (P-11) does not contain enough water volume in it at the time of field activities for sampling, then alternate upgradient wells P-9 and P-13 will be checked for water volume and the well with sufficient water volume in it will be sampled. Water volume will be determined by measuring the water column in each well with an electronic probe. The locations of the proposed groundwater monitoring wells to be sampled are shown on Figure 2.

In accordance with the Field Sampling and Analysis Plan dated June 2018 (Attachment A) and other associated sampling protocol documents provided in Attachment B (Collection of Groundwater Samples for PFAS From Monitoring Wells Sample Protocol) and Attachment C (United States Corps of Engineers Standard Operating Procedures 047; PFAS Field Sampling) groundwater monitoring wells will be purged and sampled utilizing low-flow sampling techniques with a peristaltic pump, PFAS-free dedicated tubing, and a low flow-through cell. Field parameters will be measured during the sampling



event including pH, temperature, conductivity, turbidity, redox potential, and dissolved oxygen. All results will be recorded in a field form.

Purged groundwater and decontamination water that is generated during field activities will be contained in five-gallon DOT-approved containers and will be disposed of in the onsite leachate collection system, in accordance with the Waste Management Plan dated May 2017 (Attachment D).

Following collection of groundwater samples at each well, the samples will immediately be packed on ice in coolers, secured, and shipped to Eurofins-Lancaster Laboratories Environmental in Lancaster, Pennsylvania for PFAS analysis and to Alpha Analytical (AA) in Westborough, Massachusetts for 1,4-Dioxane analysis (Both laboratories are a New York State Department of Health Environmental Laboratory Approved Program Certified Laboratory) with accompanying chain-of-custody documentation. All samples will be analyzed for 1,4-Dioxane by Environmental Protection Agency (EPA) Method 8270 SIM and PFAS Target List Analyte List as specified in the NYSDEC letter to DuPont dated May 16th, 2018 by Modified EPA Method 537 (Attachment E). Refer to Attachment F for parameter analytical methods, reporting limits, quality control limits, and container requirements.

Data Validation

All samples to be collected by Parsons and analyzed by ELLE will follow procedures contained in the Quality Assurance Project Plan (QAPP) (Attachment G).

In addition to the laboratory's in-house review of the data, an AECOM Project Chemist will review the analytical data prior to its inclusion into a final report. The Project Chemist will conduct a systematic review of the data with respect to the data quality criteria, the laboratory quality assurance plan and quality control programs, and the analytical methods.

The laboratory will send Parsons the required analytical data package deliverables, consisting of CD-ROM and hardcopy versions following completion of the laboratory's validation process. Parsons will perform data validation in accordance with the USEPA Region 2 RCRA and CERCLA Data Validation SOPs for organic data. In addition, Parsons will refer to this QAPP to verify that project quality objectives were met. If problems are identified during data validation, corrective actions will be requested.

Parsons will validate laboratory analytical data 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 sample delivery group (SDG) (or a specific percentage of sample analyses) or analytical method may be performed following an EPA Level IV protocol (full validation), or an EPA 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 data usability summary report (DUSR), as defined by NYSDEC. Level III validation

will be performed on all laboratory data. Ten percent (10%) of the data for each analytical method will undergo a Level IV validation.

A data validation report will be issued and reviewed by the project chemist before finalization. The data validation report will present the results of data validation, including a summary assessment of laboratory data packages, sample preservation and chain-of-custody procedures, and a summary assessment of precision, accuracy, representativeness, completeness, comparability, and sensitivity (PARCC) 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 will be the primary reference for evaluating the data.

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.
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.
No flag	Result accepted without qualification.

After data validation, the data will be evaluated for consistency with site conditions and developed conceptual models. Parsons 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 PARCC criteria and assess issues associated with the overall data and data quality for all validated Level III and Level IV data.

Data Management

All validated analytical data will be loaded into the NYSDEC EQUIS data format and forwarded to the NYSDEC Project Manager (Mr. Peter Ouderkirk), as required by NYSDEC.



Mr. Peter Ouderkirk, P.E.
NYSDEC
August 29, 2018
Page 4

Report Preparation

At the end of all sampling and data validation activities, a letter summary report will be prepared describing field activities and presenting groundwater analytical data results. The letter report will be submitted to the NYSDEC following review from DuPont.

Schedule

Sampling activities will be performed in late summer or early fall of 2018 during bi-yearly site groundwater sampling activities.

On behalf of DuPont, Parsons appreciates the opportunity to present this work plan and we look forward to your favorable review. Should there be any questions regarding this work plan, please contact Edward J. Ashton at 315-552-9673.

Sincerely,
PARSONS

A handwritten signature in black ink that reads "Edward J. Ashton".

Edward J. Ashton, P.G.
Project Manager/Principal Geologist

Attachments

cc: Thomas E. Stilley, P.E. – DuPont
Project File: 450862

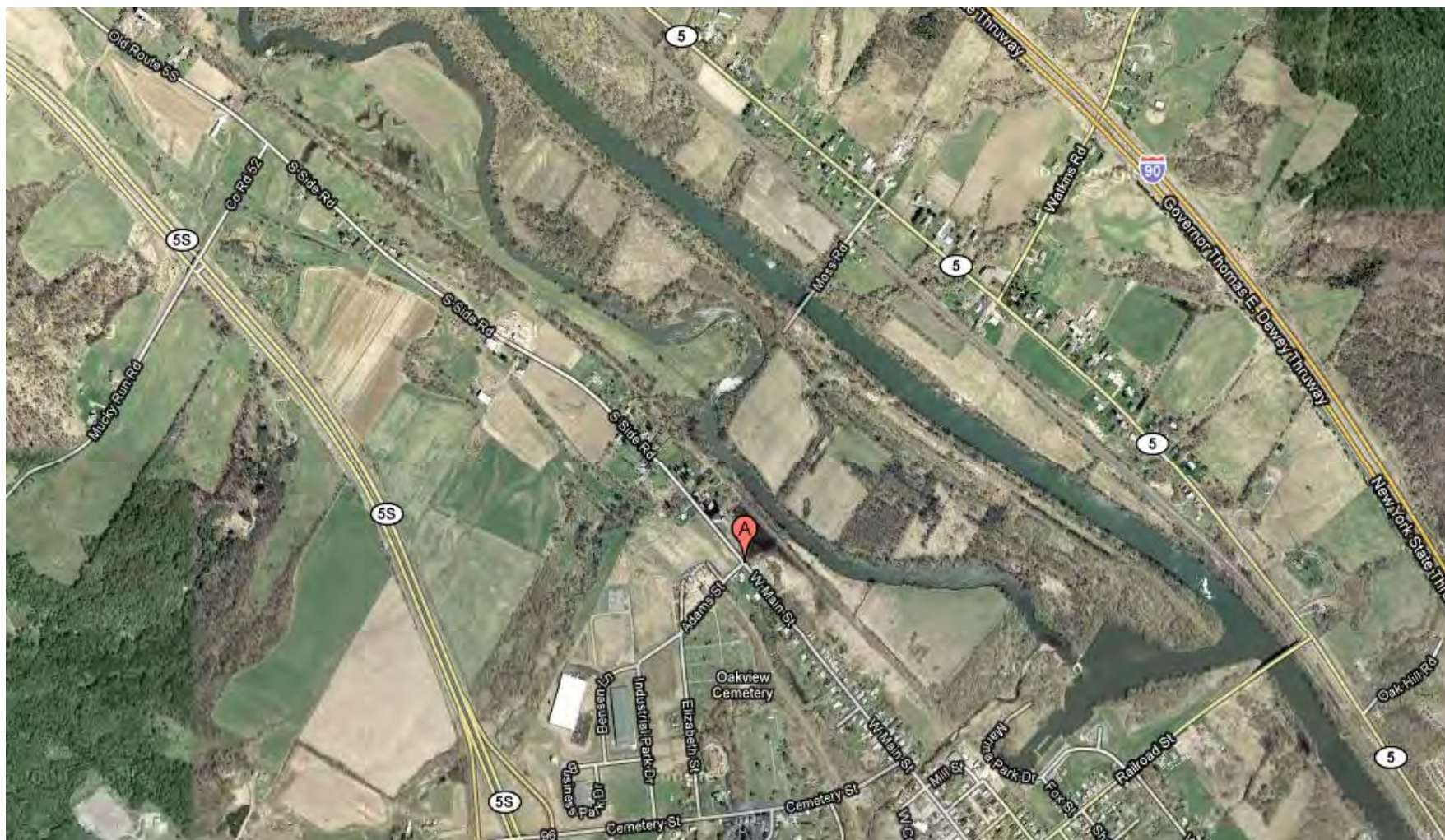
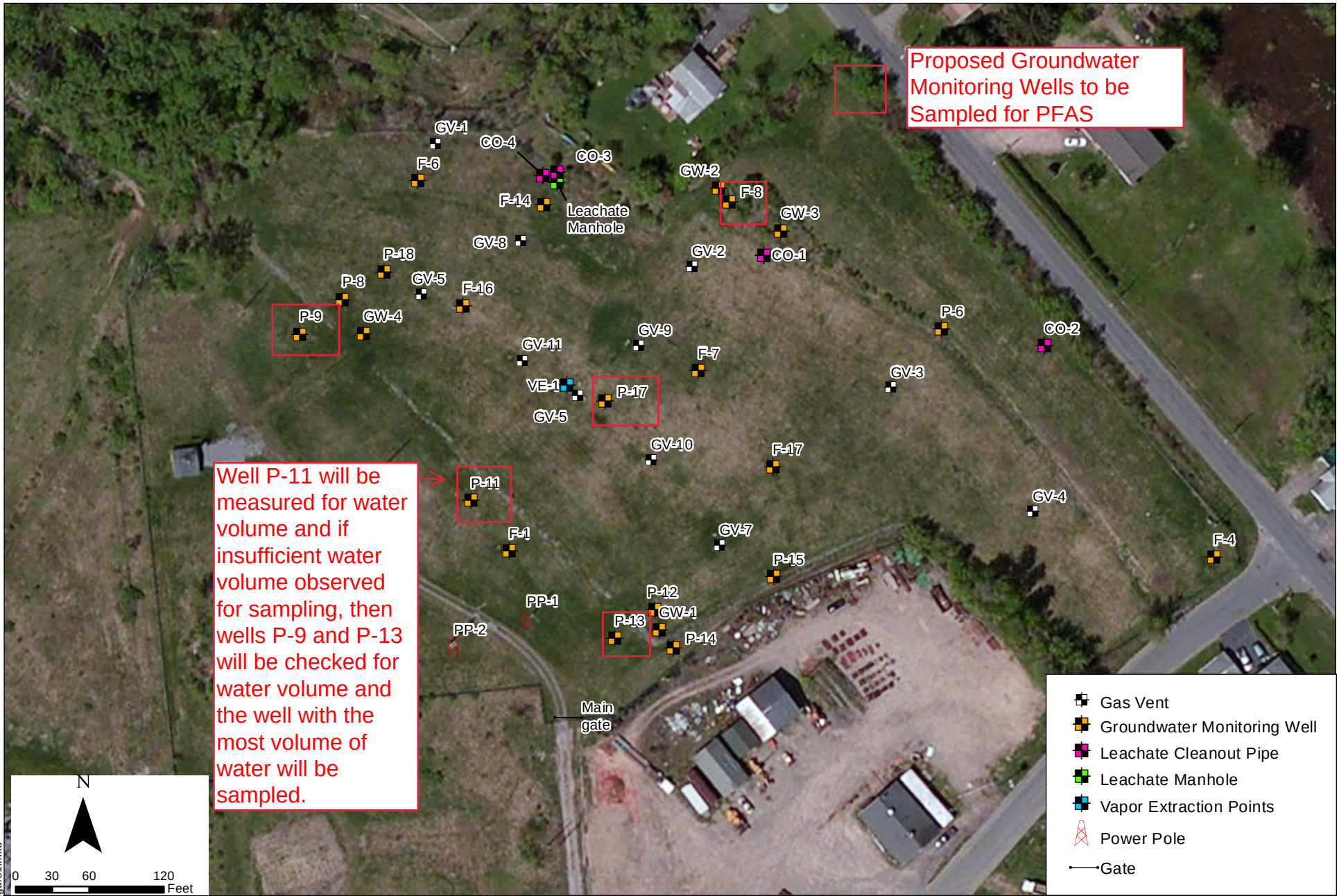


Figure 1
Site Location Map
DuPont Ferdula Landfill
W. Main & Adams Street
Frankfort, NY 13340



ATTACHMENT A

FERDULA SAMPLING AND ANALYSIS PLAN
(JUNE 2018)

FIELD SAMPLING AND ANALYSIS PLAN

Ferdula Landfill Site Frankfort, New York

Submitted to:



DuPont Corporation

Corporate Remediation Group
Barley Mill Plaza
4417 Lancaster Pike
Wilmington, Delaware 19805

Prepared By:

PARSONS

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Phone: (315) 451-9560
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REVIEWED AND APPROVED BY:

Project Manager:

Edward J. Ashten

6-19-18

Date

Technical Manager:

Date

NOVEMBER 2009
(Revised June 2018)

TABLE OF CONTENTS

	<u>Page</u>
LIST OF ACRONYMS	iv
SECTION 1 FIELD SAMPLING PLAN.....	1-1
1.1 INTRODUCTION	1-1
1.2 SITE HISTORY.....	1-1
1.2 SAMPLING OBJECTIVES	1-1
SECTION 2 GENERAL GUIDELINES FOR FIELD WORK.....	2-1
2.1 SURFACE HAZARDS	2-1
2.2 UNDERGROUND UTILITIES.....	2-1
2.3 FIELD LOG BOOKS	2-1
SECTION 3 SAMPLING EQUIPMENT AND PROCEDURES FOR FIELD EQUIPMENT DECONTAMINATION, WASTE MANAGEMENT, AND EQUIPMENT CALIBRATION.....	3-1
3.1 FIELD EQUIPMENT CHECKLIST	3-1
3.2 EQUIPMENT DECONTAMINATION	3-1
3.2.1 SAMPLING EQUIPMENT DECONTAMINATION	3-1
3.3 MANAGEMENT OF INVESTIGATION DERIVED WASTE	3-2
3.3.1 Decontamination Fluids.....	3-2
3.3.2 Development Purge and Pumping Water	3-2
3.3.3 Personal Protective Equipment.....	3-2
3.4 FIELD INSTRUMENT CALIBRATION	3-2
3.5 MAINTENANCE PROCEDURES	3-2
3.5.1 Non-Routine Maintenance Procedures	3-2
3.5.2 Routine Maintenance Procedures and Schedules	3-2
3.5.3 Spare Parts	3-2
3.5.4 Maintenance Records	3-3
SECTION 4 SAMPLING EQUIPMENT AND PROCEDURES FOR FIELD MEASUREMENTS AND MONITORING.....	4-1
4.1 AIR MONITORING.....	4-1
4.2 WATER LEVEL MEASUREMENT	4-1

TABLE OF CONTENTS

(Continued)

	<u>Page</u>
SECTION 5 SAMPLING EQUIPMENT AND PROCEDURES FOR FIELD SAMPLE COLLECTION	5-1
5.1 INTRODUCTION	5-1
5.2 GROUNDWATER SAMPLES	5-1
5.3 AIR SAMPLES	5-1
SECTION 6 SAMPLE HANDLING AND ANALYSIS	6-1
6.1 SAMPLE DESIGNATION	6-1
6.2 SAMPLE CONTAINERIZATION, PRESERVATION AND ANALYSIS	6-1
6.3 CHAIN OF CUSTODY	6-1
6.4 SAMPLE DOCUMENTATION	6-2
6.5 SAMPLE TRACKING	6-2
SECTION 7 SAMPLING QA AUDITS	7-1
7.1 SAMPLING QA AUDITS	7-1
7.2 RECORD MAINTENANCE	7-1

LIST OF TABLES

Table 1.1 Sampling Objectives and Data Uses	1-3
Table 1.2 Summary of Samples and Analyses	1-4

LIST OF FIGURES

Figure 5.1 Groundwater Sampling Record	5-2
Figure 7.1 Corrective Action Request	7-5

TABLE OF CONTENTS (Continued)

Page

LIST OF APPENDICES

Appendix A - ADQM Laboratory Analytical Information Sheets

Appendix B - Air Sampling Procedure Dated July 25, 2005

LIST OF ACRONYMS

ACO	Administration Consent Order
CAR	Corrective Action Request
COC	Chain of Custody
FSAP	Field Sampling and Analysis Plan
HASP	Health and Safety Plan
NYSDEC	New York State Department of Environmental Conservation
PID	Photoionization Detector
PPE	Personal Protective Equipment
QA	Quality Assurance
QAO	Quality Assurance Officer
QA/QC	Quality Assurance/Quality Control
RCRA	Resource Conservation and Recovery Act
RI/FS	Remedial Investigation/Feasibility Study
ROD	Record of Decision
SDG	Sample Delivery Group
SITE	Ferdula Landfill, Frankfort, New York
SGPI	Sporting Goods Properties, Inc.
SVE	Soil Vapor Extraction
SVOCs	Semi-volatile organic compounds
UFPO	Underground Facilities Protective Organization
VOC	Volatile organic compound

SECTION 1

FIELD SAMPLING PLAN

1.1 INTRODUCTION

This Field Sampling and Analysis Plan (FSAP) describes in detail the sampling and data gathering methods and procedures to be used during field sampling activities performed at the DuPont – Ferdula Landfill Site located in Frankfort, New York.

1.2 SITE HISTORY

The Ferdula Landfill Site (Site) is located in the Village of Frankfort, Herkimer County, New York (Figure 1.1), near the intersection of West Main Street and Adams Street. The Site consists of a 1.5-acre landfill situated on an 8-acre lot, previously owned by Mr. Joseph Ferdula, Jr. From 1967 to 1975, a former DuPont subsidiary, Sporting Goods Properties Inc. (SGPI) formerly known as Remington Industries, contracted with Mr. Joseph Ferdula, Sr. to dispose of wastes in the landfill. The wastes consisted of various solvents, industrial wastes, construction debris, and lead shot sand generated from the subsidiary's plant. In 1975, land filling operations ceased and SGPI installed a cap on the landfill in 1980. Subsequently, groundwater and leachate seeps were identified on the northern and western banks of the landfill. Analytical analyses of the seeps revealed the presence of volatile organic compounds (VOCs), semi-volatile organic compounds (SVOCs) and trace metals.

DuPont performed a Remedial Investigation/Feasibility Study (RI/FS). Following the completion of the RI/FS, Dupont and New York State Department of Environmental Conservation (NYSDEC) executed an Administrative Consent Order (ACO) dated December 1993 to implement remedial action alternatives selected by the Record of Decision (ROD) dated October 1992. The remedial action alternatives were selected to provide protection of human health and environment and included the installation of a cap complying with the Resource Conservation and Recovery Act (RCRA) requirements. Dupont also completed the installation of a Soil Vapor Extraction (SVE) system to remediate the contaminated soils and landfill material present beneath the RCRA cap.

The remedial action elements completed to date provide protection of human health and the environment and have achieved the remedial action objectives established for the site. The upgradient diversion system prevents flow of groundwater through the landfill and the contaminated soil. The RCRA cap over the landfill prevents the infiltration of precipitation resulting in reduced leachate from the landfill. The downgradient leachate collection system prevents any further migration of contaminated groundwater and leachate. The SVE System will remove substantial mass of volatile organics from the landfill.

1.2 SAMPLING OBJECTIVES

The main field sampling activities are to:

- Perform quarterly site inspections to see if any physical problems with drainage ditches, cap system, vegetation cover, security fence, windmill system, and slurry wall and provide a brief summary report to DuPont.

- Perform bi-yearly groundwater sampling from eight piezometers.
- Collect annual leachate discharge sample from a manway located along the northern property boundary and inspect and check flow rate at the same leachate manway location.
- Perform air sampling of vapor extraction points using Draegar tubes to decide which vapor extraction points contain the five highest concentrations and remain open for a period of one year, and which two vapor extraction points get samples using a Summa Canister.
- Perform annual air sampling of the soil vapor extraction system using Summa Canisters collection from influent and collect a duplicate sample from same location. Samples will be collected from Main Extraction Manifold.

Note: Refer to Tables 1.1 and 1.2 for more in depth detail of project objectives

TABLE 1.1
SAMPLING OBJECTIVES AND DATA USES

Sampling/Monitoring Activity	Objective	Intended Data Usage
(insert information as it pertains to individual projects)		
Physical Site Inspection	To make sure that drainage ditches, cap system, vegetation cover, security fence, windmill system, and slurry wall at landfill have no physical problems.	Generate letter report of findings and fix problems if they exist.
Groundwater Sampling Event	Determine groundwater quality.	Generate letter report with analytical results
Air Sampling Event	Determine vapor quality from soil vapor extraction (SVE) system and determine which vapor extraction points at site to keep open during a period of one year and calculate mass-balance removed by SVE system.	Generate letter report with analytical results
Leachate Collection System Event	Determine leachate quality and compare analytical results to discharge permit.	Generate letter report with analytical results

TABLE 1.2
SUMMARY OF SAMPLES AND ANALYSES

Sample Description	Sample Depth	# of Samples	QA/QC Samples	Parameter	Analytical Method
(See attached laboratory analytical information sheets from ADQM in Appendix A)					

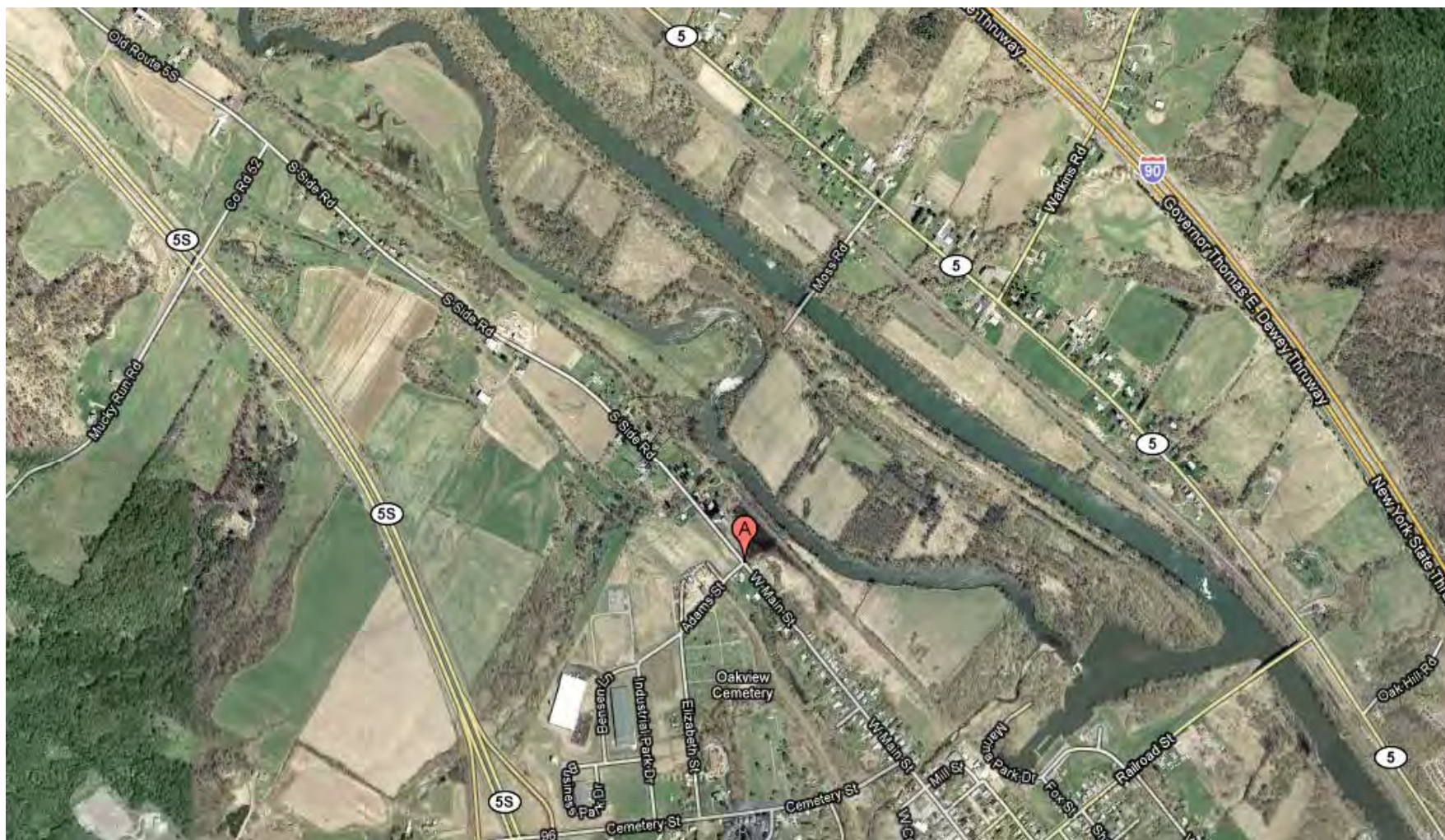


Figure 1.1
Site Location Map
DuPont Ferdula Site
W. Main & Adams Street
Frankfort, NY 13340

SECTION 2

GENERAL GUIDELINES FOR FIELD WORK

2.1 SURFACE HAZARDS

Potential on-site surface hazards, such as sharp objects, overhead power lines, and building hazards, as well as other hazards (i.e., climate, biohazards, etc.) will be identified prior to initiation of field work. Generally, such hazards will be identified during a site reconnaissance visit that proceeds the first day of fieldwork.

2.2 UNDERGROUND UTILITIES

All underground utilities, including electric lines, gas lines, and communication lines, will be identified prior to initiation of drilling and other subsurface work. This will be accomplished by contacting the Underground Facilities Protective Organization (Dig Safely New York): (*811). A UFPO representative will mark all buried utility lines in the work area. New York State law requires that UFPO be notified at least two working days, and not more than ten working days, before subsurface work is conducted. In addition, site representatives will be contacted to identify any other facility utilities, sewer lines, or other obstructions that may pose a risk to health and safety.

2.3 FIELD LOG BOOKS

All field activities will be carefully documented in field log books. Entries will be of sufficient detail that a complete daily record of significant events, observations, and measurements is obtained. The field books will provide a legal record of the activities conducted at the site. Accordingly:

- Field books will be assigned a unique identification number.
- Field books will be bound with consecutively numbered pages.
- Field books will be controlled by the Field Team Leader while fieldwork is in progress.
- Entries will be written with waterproof ink.
- Entries will be signed and dated at the conclusion of each day of fieldwork.
- Erroneous entries made while fieldwork is in progress will be corrected by the person that made the entries. Corrections will be made by drawing a line through the error, entering the correct information, and initialing the correction.
- Corrections made after departing the field will be made by the person who made the original entries. The correction will be made by drawing a line through the error, entering the correct information, and initialing and dating the time of the correction.
- The Parsons Project Manager will control field books when fieldwork is not in progress.

At a minimum, daily field book entries will include the following information:

- Date and page number each page or set of pages;
- Location of field activity;

- Date and time of entry;
- Names and titles of field team members;
- Names and titles of any site visitors and site contacts;
- Weather information: temperature, cloud coverage, wind speed and direction;
- Purpose of field activity; and
- A detailed description of the fieldwork conducted, observations, and any measurements or readings. Where appropriate, a hand-drawn sketch map will also be included that identifies significant landmarks, features, sample locations, and utilities.
- When appropriate boring numbers, well numbers, sample point ID or key activities should be identified on the top of each page to facilitate retrieval of data at a later date.

SECTION 3

SAMPLING EQUIPMENT AND PROCEDURES FOR FIELD EQUIPMENT DECONTAMINATION, WASTE MANAGEMENT, AND EQUIPMENT CALIBRATION

3.1 FIELD EQUIPMENT CHECKLIST

A general list of equipment necessary for field measurement and sample collection includes:

- Appropriate sample containers (see Appendix A);
- Chain-of-Custody seals and record forms;
- Field sample record forms;
- Log book and indelible ink markers;
- Phosphate-free decontamination soaps (such as Alconox), reagent-grade solvents, and deionized water to be used for decontaminating equipment between sampling stations;
- Buckets, plastic wash basins, plastic drop cloths, and scrub brushes to be used for decontaminating equipment;
- Camera and film for use in documenting sampling procedures and sample locations;
- Stakes to identify sampling locations;
- Shipping labels and forms;
- Knife;
- Bubble wrap or other packing/shipping material for sample bottles;
- Strapping tape;
- Clear plastic tape;
- Coolers;
- Duct tape;
- Rope;
- Resealable plastic bags;
- Portable field instruments (photoionization detector (PID), metal detector, combustible gas indicator, conductivity meter, pH/temperature/conductivity meter, dissolved oxygen meter, redox probe, electronic water level indicator, Jerome[®] Mercury Vapor Analyzer, etc.); and
- Health and safety equipment.

3.2 EQUIPMENT DECONTAMINATION

3.2.1 Sampling Equipment Decontamination

Sample equipment decontamination will be conducted in a decon pad when one is readily available; otherwise decontamination will be conducted in buckets on plastic sheeting. Prior to sampling, all bowls, spoons, augers, bailers, and filtering equipment will be washed in potable

water and phosphate-free detergent (e.g. Alconox). The sampling equipment will then be rinsed with potable water followed by a distilled water rinse. Between rinses, equipment will be placed on polyethylene sheets or aluminum foil if necessary. Sample equipment may also be steam cleaned, if appropriate. Sampling equipment will be wrapped in aluminum foil for storage or transportation from the designated decontamination area to the sample locations. Decontaminated equipment will not be placed directly on the ground surface. In order to minimize the time spent in the field and reduce the opportunity for cross contamination, the sampling team will have sufficient clean equipment available to complete a sampling round without excessive delays.

3.3 MANAGEMENT OF INVESTIGATION DERIVED WASTE

3.3.1 Decontamination Fluids

All decontamination fluids will be collected in 5-gallon buckets and poured into the leachate collection system located onsite.

3.3.2 Development Purge and Pumping Water

All development and purge water will be collected and disposed of utilizing the same procedure outlined in Section 3.3.1.

3.3.3 Personal Protective Equipment

All personal protective equipment (PPE) will be placed in trash bags and disposed of as miscellaneous trash.

3.4 FIELD INSTRUMENT CALIBRATION

All field screening and sampling instruments (e.g., temperature-conductivity-pH probes) that require calibration prior to operation will be calibrated daily in accordance with the manufacturer's instructions. All instrument calibrations will be documented in the project field book. Instrument operating manuals will be maintained on-site by the field team.

3.5 MAINTENANCE PROCEDURES

3.5.1 Non-Routine Maintenance Procedures

Field equipment will 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.

3.5.2 Routine Maintenance Procedures and Schedules

Field equipment requiring preventive maintenance will be serviced in accordance with written procedures based on the manufacturer's instructions or recommendations. Maintenance will be performed in accordance with the schedule specified by the manufacturer, in order to minimize the downtime of the measurement system. Maintenance work will be performed by qualified personnel.

3.5.3 Spare Parts

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 in order to minimize downtime while

fieldwork is in progress. In lieu of maintaining an inventory of spare parts, access to critical spare parts may be provided by firms capable of rapid repair or replacement. These firms must be identified prior to initiation of fieldwork.

3.5.4 Maintenance Records

Equipment maintenance logs will be maintained to document maintenance activities and schedules. All maintenance logs will be traceable to a specific piece of equipment. These records may be audited by the QAO to verify compliance.

SECTION 4

SAMPLING EQUIPMENT AND PROCEDURES FOR FIELD MEASUREMENTS AND MONITORING

4.1 AIR MONITORING

Air monitoring will be conducted during all field activities with a Photovac MicroTip HL-2000 (or equivalent) PID equipped with an 11.7 eV lamp. The Photovac MicroTip is capable of ionizing and detecting compounds with an ionization potential of less than 11.7 eV. This accounts for up to 73 percent of the VOCs on the NYSDEC ASP Target Compound List and for most of the VOCs detected onsite. The compounds with ionization potentials above 11.7 eV have correspondingly high allowable limits, for example 100 ppm for 1,1-DCA and 350 ppm for 1,1,1-TCA. The PID will be used to monitor for VOCs in the breathing zone and in boreholes, and to screen samples for analysis.

Method

- The PID will be calibrated at the beginning and end of each day of use with a standard calibration gas of a concentration within the expected range of use. The calibration gas, which is most often used, has an approximate concentration of 100 ppm of isobutylene.
- If abnormal or erratic readings are observed, additional calibration will be required.
- All calibration data will be recorded in field notebooks and on calibration log sheets to be maintained on-site.
- The PID will be used to monitor the breathing zone and the borehole during drilling. Action levels are specified in the Health and Safety Plan (HASP).
- The PID will also be used to screen samples and sample headspace.
- PID readings will be recorded in the field book and on the drilling record during drilling activities.
- A battery check will be completed at the beginning and end of each working day, and the battery will be checked for proper voltage.
- Detailed procedures for operation of the PID are included in the HASP.

4.2 WATER LEVEL MEASUREMENT

The following procedures will be used to measure static groundwater levels in monitoring wells, observation wells and piezometers:

- The cap on the monitoring well will be opened and the breathing zone above the opening of the casing will be screened for organic vapors with a PID.
- The total depth of the well will be measured with a decontaminated tape measure.
- The static water level in each monitoring well, observation well or piezometer will then be measured with a decontaminated electronic water level indicator.
- The water level will be measured to the nearest 0.01 foot from the surveyed well elevation mark on the top of the casing.

- The well depth and water level measurement will be recorded in the field book.

SECTION 5

SAMPLING EQUIPMENT AND PROCEDURES FOR FIELD SAMPLE COLLECTION

5.1 INTRODUCTION

Procedures for obtaining samples of various environmental media are described in this section. Sample handling and procedures are described in Section 6.

5.2 GROUNDWATER SAMPLES

The following procedure will be used to collect groundwater samples from selected wells:

Sampling Method

- The electric water level probe will be decontaminated with a detergent solution, tap water rinse, and distilled water rinse.
- The static water level will be measured to the nearest 0.01 foot from the surveyed well elevation mark on the top of the casing. The measurement will be recorded in the field book.
- The well will be purged by removing a minimum of three well volumes of water. Purging will be conducted with a disposable HDPE bailer, a peristaltic pump with dedicated tubing, or a decontaminated submersible pump depending on the well yield. If a well goes dry before the required volumes are removed, it will be allowed to recover, purged a second time, and sampled when it recovers sufficiently.
- The turbidity of the water will be measured with a portable nephelometer. If the turbidity increases during purging, a different purging technique, such as low flow pumping, will be utilized.
- Samples will be collected with either a dedicated disposable HDPE bailer lowered with a dedicated polypropylene line, a peristaltic pump with dedicated tubing, or a decontaminated submersible pump using low flow sampling techniques. Temperature, pH, and conductivity will be recorded in the field book.
- Well sampling data will be recorded on the Groundwater Sampling Record shown in Figure 5.1.

5.3 AIR SAMPLES

The procedures outlined in the attached document entitled, “Air Sampling Procedure”, dated July 25, 2005 (Refer to Appendix B), will be followed when collecting air samples at the site.

Page 1 of 1

LOW FLOW (MINIMAL DRAWDOWN) SAMPLING RECORD

FIELD MEASUREMENTS

SECTION 6

SAMPLE HANDLING AND ANALYSIS

6.1 SAMPLE DESIGNATION

Each sample will be given a unique alphanumeric identifier in accordance with the classification system established by DuPont and ADQM. Duplicate samples will be assigned identifiers that do not allow the laboratory to distinguish them as duplicates. Each sample container will be labeled prior to packing for shipment. The sample identifier, site name, date and time of sampling, and analytical parameters will be written on the label in waterproof ink and recorded in the field book.

6.2 SAMPLE CONTAINERIZATION, PRESERVATION AND ANALYSIS

Sample containerization, holding time requirements, and preservation requirements are listed in the attached ADQM sample information list. Field handling and storage of samples and sample containers is described in the attached ADQM sample information list. Analytical methods for sample analyses are listed in the attached ADQM sample information list.

6.3 CHAIN OF CUSTODY

A Chain of Custody (COC) record will accompany the sample containers during selection and preparation at the laboratory, during shipment to the field, and during return shipment to the laboratory. The COC will be provided by ADQM and will identify each sample container and the analytical parameters for each, and will list the field personnel that collected the samples, the project name and number, the name of the analytical laboratory that will receive the samples, and the method of sample shipment. If samples are split and sent to different laboratories, a copy of the COC record will be sent with each sample shipment.

Method

- The COC will be completed by field personnel as samples are collected and packed for shipment.
- Erroneous markings will be crossed-out with a single line and initialed by the author.
- The REMARKS space will be used to indicate if the sample is a matrix spike, matrix spike duplicate, or matrix duplicate.
- Trip and field blanks will be listed on separate rows.
- After the samples have been collected and sample information has been listed on the COC form, the method of shipment, the shipping cooler identification number(s), and the shipper air bill number will be entered on the COC.
- Finally, a member of the sampling team will write his/her signature, the date, and time on the first RELINQUISHED BY space. Duplicate copies of each COC must be completed.
- One copy of the COC will be retained by sampling personnel. The other copy and the original will be sealed in a plastic bag and taped inside the lid of the shipping cooler.
- Sample shipments going to chemical analytical laboratories will be refrigerated at 4°C, typically by packing with ice, to preserve the samples during shipment. Samples going to geotechnical labs for geotechnical analyses will not require refrigeration.

- After the shipping cooler is closed, custody seals provided by the laboratory will be affixed to the latch and across the front and back of the cooler lid, and signed by the person relinquishing the samples to the shipper.
- The seal will be covered with clear tape, and the cooler lid will be secured by wrapping with packing tape.
- Then the cooler will be relinquished to the shipper, typically an overnight carrier.
- The COC seal must be broken to open the container. Breakage of the seals before receipt at the laboratory may indicate tampering. If tampering is apparent, the laboratory will contact the Parsons Project Manager, and the samples will not be analyzed.
- The chemical analytical samples must be delivered to the laboratory within 48 hours of collection.

6.4 SAMPLE DOCUMENTATION

The field team leader will retain a copy of the COC, and, in addition, the field team leader will ensure that the following information about each sample is recorded in the field book:

- Sample identifier;
- Identification of sampled media (e.g., soil, sediment, groundwater);
- Sample location with respect to known reference point;
- Physical description of sample location;
- Field measurements, (e.g., pH, temperature, conductivity, and water levels);
- Date and time of collection;
- Sample collection method;
- Volume of groundwater purged before sampling;
- Number of sample containers;
- Analytical parameters;
- Preservatives used; and
- Shipping information:
 - Dates and method of sample shipments,
 - Chain-of-Custody Record numbers,
 - FedEx Air Bill numbers, and
 - Sample recipient (e.g., laboratory name).

6.5 SAMPLE TRACKING

ADQM, DuPont's laboratory agency, will use a tracking system to monitor sampling schedules, and the progress of laboratory analytical work and reporting, and to assist in performing contract compliance screening and data validation. Parsons will not perform such service on project. The system tracks the information for each sample: sample identifier, sample medium, sampling date, analytical parameters, sample delivery group (SDG) designations for samples, and laboratory report due date.

SECTION 7

SAMPLING QA AUDITS

7.1 SAMPLING QA AUDITS

Sampling quality assurance (QA) audits may be conducted to verify that fieldwork is conducted in accordance with the procedures specified in this document. The QA audits will be performed by the approved quality assurance officer (QAO) or a qualified designee under the direction of the QAO. The designee will not have responsibility for the project work associated with the audit.

Sampling QA audits will include, but will not be limited by, review of the following items:

- Decontamination procedures;
- Sampling procedures;
- Sampling container cleanliness, size, and material;
- Sample identification (labels and COC);
- Sample handling, preservation, and shipping;
- Sample tracking;
- Maintenance and calibration of sampling equipment; and
- Corrective action.

An audit report must be submitted to the Parsons Project Manager within 15 days of completion of the audit. Serious deficiencies will be reported to the Project Manager within 24 hours. This may be accomplished by issuing a Corrective Action Request (CAR) (Figure 7.1). The CAR identifies the out-of-compliance condition, reference documents, and recommended corrective action. The CAR will be issued to the individual(s) responsible for the noncompliance and to the Project Manager. The individual to whom the CAR is addressed will respond by writing a brief description of the cause and corrective action required in the appropriate area on the CAR, sign and date the response, and return the CAR to the QAO.

The Project Manager will be responsible for ensuring that all required corrective actions identified during an audit are acted upon promptly and satisfactorily. The QAO or a qualified designee will verify and document that satisfactory corrective action has been taken. All audit checklists, audit reports, audit findings, and acceptable resolutions will be approved by the QAO. Then the QAO will close the audit. The QAO will maintain a status log for CARs, and the CARs will be retained in the project file.

7.2 RECORD MAINTENANCE

A project file will be established to retain the documents and records generated during the project. Field records will be stored in the project file when not in use. At the conclusion of the work assignment, the project file will be archived.

Field records that must be retained in the project files include:

- Field books,

- Chain-of-Custody forms,
- Site photographs, and
- QA audit reports.

Equipment calibration and maintenance records will be retained by a designated Parsons equipment manager for at least as long as the project files are retained.

Figure 7.1

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 _____.

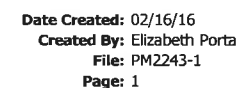
Condition:**Reference Documents:**_____
Originator_____
Date_____
Approval_____
Date_____
Approval_____
Date**Response****Cause of Condition:****Corrective Action****(A) Resolution:****(B) Prevention****(B2) Affected Documents****Signature** _____ **Date** _____**CA Followup****Corrective Action verified by:** _____ **Date** _____

APPENDIX A

ADQM Laboratory Analytical Information Sheets

Alpha Analytical information for 1,4-dioxane.

- Sample container= 2 amber glass 500 ml, < 6 degrees C, no chemical preservatives
- Analytical Method= SW 846- 8280D SIM
- Holding time 7 days from collection to extraction; 40 days to analysis.
- Note that the reporting limits shown on the attachment are in **ng/l**.



DuPont

1,4 Dioxane via EPA 8270D-SIM (WATER)

Holding Time: 7 days

Container/Sample Preservation: 2 - Amber 500ml unpreserved

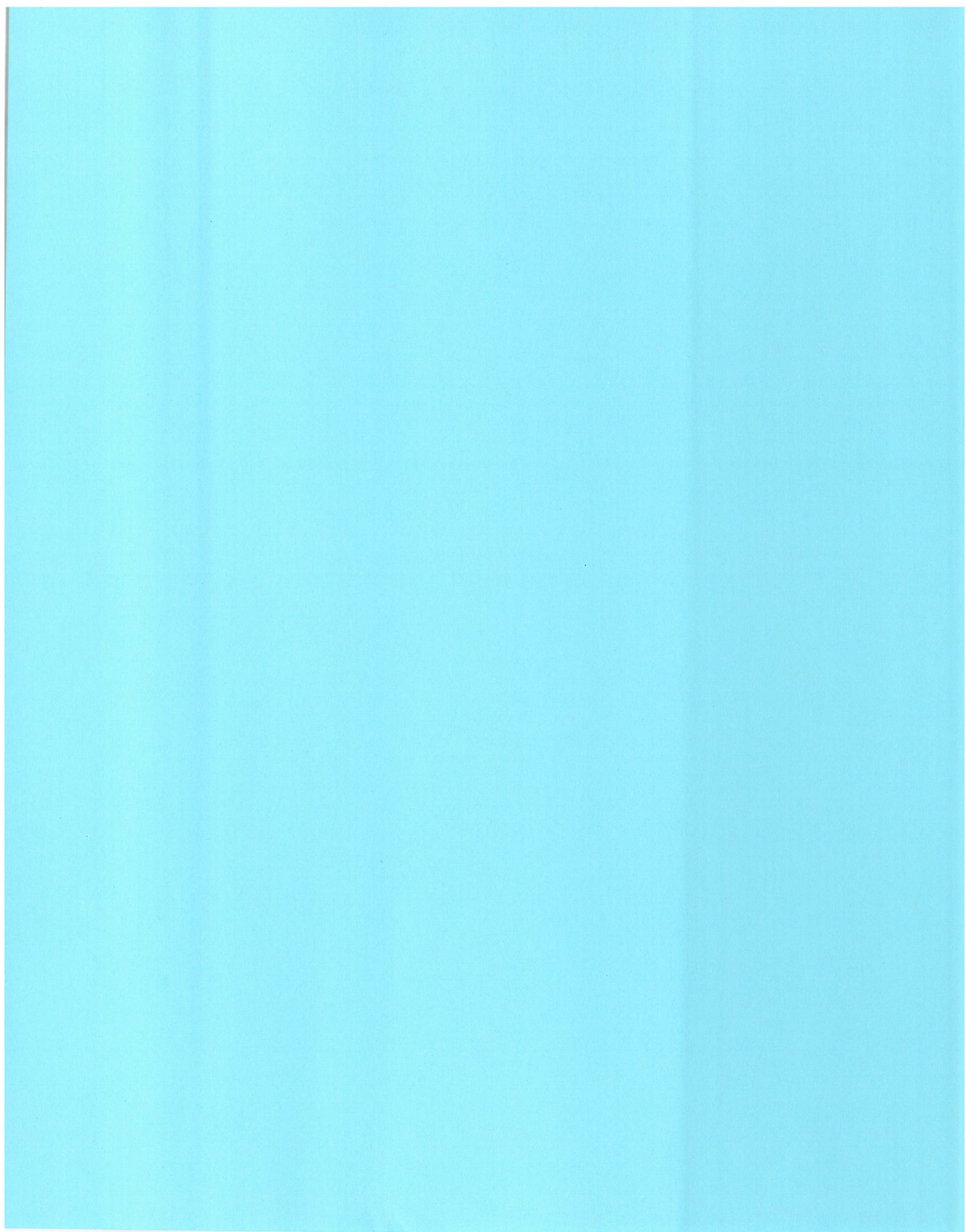
Please Note that the information provided in this table is subject to change at anytime at the discretion of Alpha Analytical, Inc.



8 Walkup Drive, Westborough, MA 01581 • 508-898-9220 • www.alphalab.com

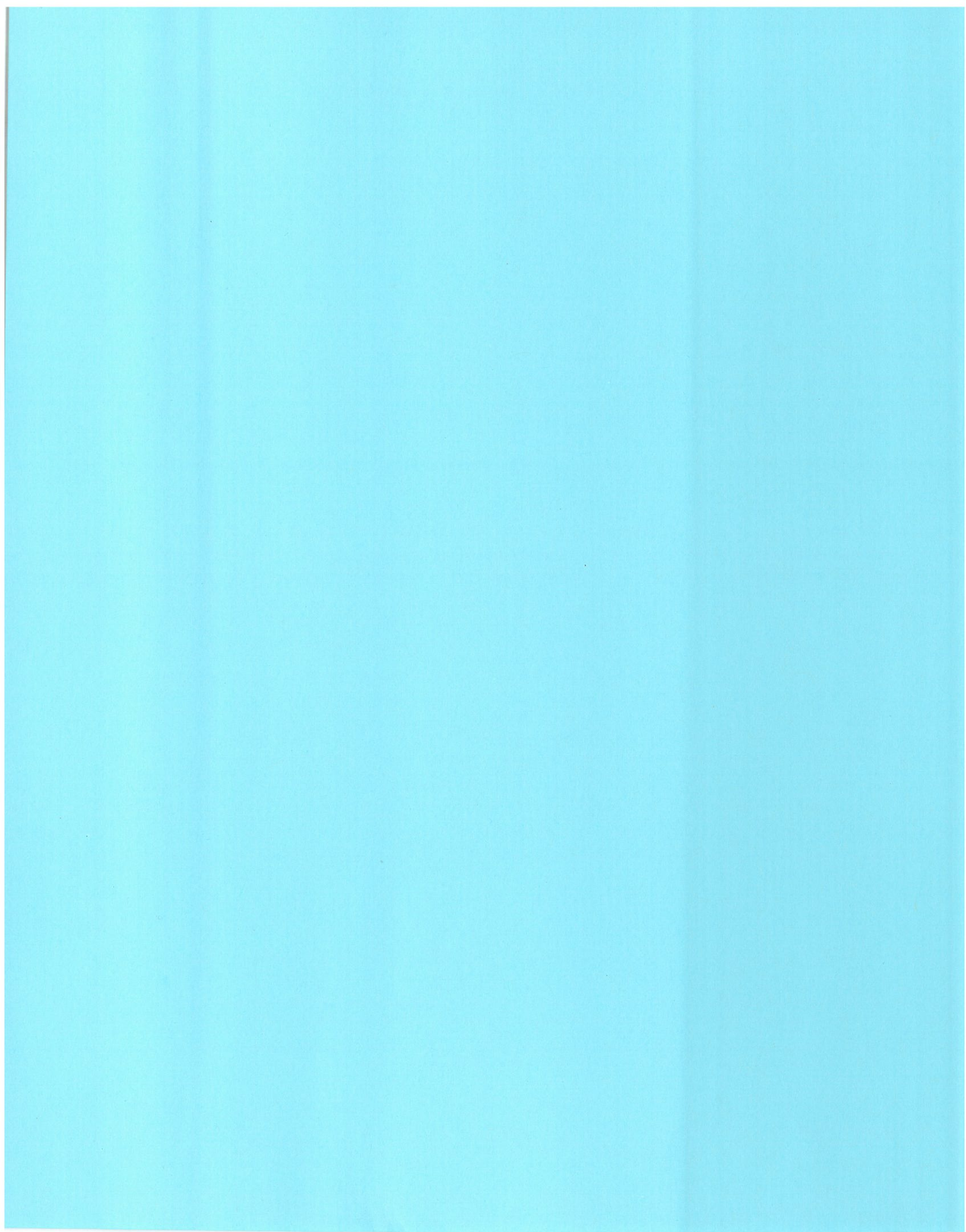
Mansfield, MA • Mahwah, NJ • Albany, NY • Buffalo, NY





<u>Compound</u>	<u>CAS Number</u>	<u>MDL</u>	<u>LOQ</u>	<u>Units</u>	<u>Bottle Volume</u>	<u>Bottle Container</u>	<u>Bottle Count</u>	<u>Preservative</u>
6:2 fluorotelomersulfonate	27619-97-2	1	2	ng/l	250 ml	round plastic	1	None
8:2 fluorotelomersulfonate	39108-34-4	2	6	ng/l	250 ml	round plastic	1	None
NEtFOSAA	2991-50-6	1	3	ng/l	250 ml	round plastic	1	None
NMeFOSAA	2355-31-9	1	3	ng/l	250 ml	round plastic	1	None
Perfluoro-Octanesulfonic Acid	1763-23-1	0.4	2	ng/l	250 ml	round plastic	1	None
Perfluorobutanesulfonic Acid	375-73-5	0.3	1	ng/l	250 ml	round plastic	1	None
Perfluorobutanoic acid	375-22-4	2	6	ng/l	250 ml	round plastic	1	None
Perfluorodecanesulfonate	335-77-3	0.6	2	ng/l	250 ml	round plastic	1	None
Perfluorodecanoic acid	335-76-2	1	2	ng/l	250 ml	round plastic	1	None
Perfluorododecanoic acid	307-55-1	0.3	1	ng/l	250 ml	round plastic	1	None
Perfluoroheptanesulfonate	375-92-8	0.4	2	ng/l	250 ml	round plastic	1	None
Perfluoroheptanoic acid	375-85-9	0.3	1	ng/l	250 ml	round plastic	1	None
Perfluorohexanesulfonic Acid	355-46-4	0.4	2	ng/l	250 ml	round plastic	1	None
Perfluorohexanoic acid	307-24-4	0.4	2	ng/l	250 ml	round plastic	1	None
Perfluorononanoic acid	375-95-1	0.4	2	ng/l	250 ml	round plastic	1	None
Perfluorooctanesulfonamide	754-91-6	1	3	ng/l	250 ml	round plastic	1	None
Perfluorooctanoic acid	335-67-1	0.3	1	ng/l	250 ml	round plastic	1	None
Perfluoropentanoic acid	2706-90-3	2	6	ng/l	250 ml	round plastic	1	None
Perfluorotetradecanoic acid	376-06-7	0.3	1	ng/l	250 ml	round plastic	1	None
Perfluorotridecanoic acid	72629-94-8	0.3	1	ng/l	250 ml	round plastic	1	None
Perfluoroundecanoic acid	2058-94-8	0.4	2	ng/l	250 ml	round plastic	1	None

Reporting limits and statistical QC windows are evaluated periodically and are subject to change.



WCD Analytical Bottle Sheet

Project Location: **(FER) Ferdula, NY**

GW SAMPLING ANNUAL 2016

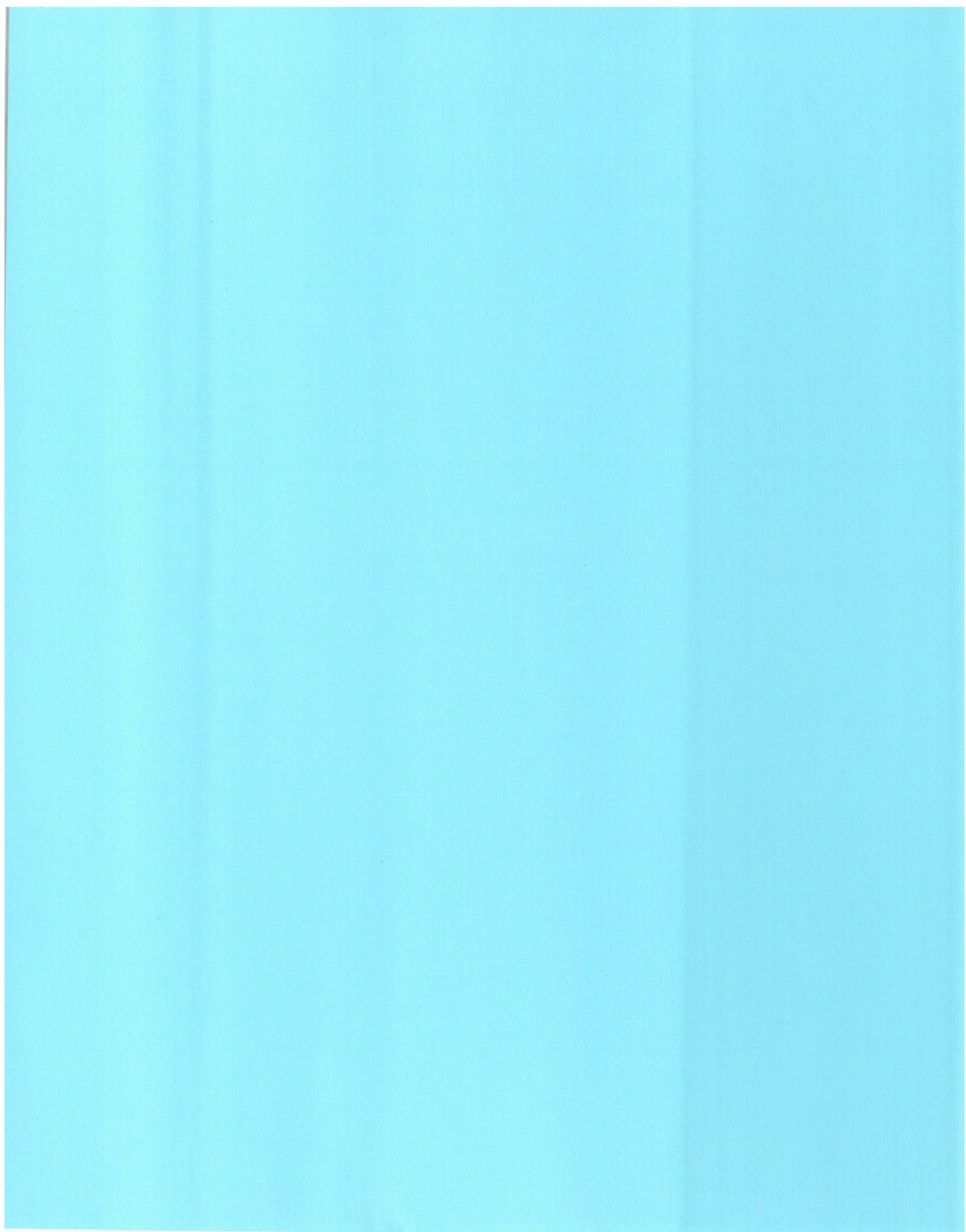
Sample I.D.	Type	Analyses Required	
		VOCS (SEE ATTACHED LIST)	
		8260B	
GW2016-F-6	G	X	
GW2016-F-6-D	G	X	
GW2016-F-7	G	X	
GW2016-F-14	G	X	
GW2016-F-16	G	X	
GW2016-F-17	G	X	
GW2016-P-17	G	X	
GW2016-P-18	G	X	
GW2016-F-8	G	X	
GW2016-_____	G	X	spare set
GW2016-EB-DATE	K	X	
GW2016-EB-DATE	K	X	
GW2016-TB-DATE	K	X	
GW2016-TB-DATE	K	X	

Field duplicate and MS/MSD

ANALYTICAL LISTS
GW SAMPLING ANNUAL 2016

TCL VOCs (8260)

Chloromethane	trans-1,3-Dichloropropene
Bromomethane	Trichloroethene
Vinyl Chloride	Dibromochloromethane
Chloroethane	1,1,2-Trichloroethane
Methylene Chloride	Benzene
Acetone	cis-1,3-Dichloropropene
Carbon Disulfide	Bromoform
1,1-Dichloroethene	4-Methyl-2-pentanone
1,1-Dichloroethane	2-Hexanone
Chloroform	Tetrachloroethene
1,2-Dichloroethane	Toluene
2-Butanone	Chlorobenzene
1,1,1-Trichloroethane	Ethylbenzene
Carbon Tetrachloride	Styrene
Bromodichloromethane	Xylene (Total)
1,1,2,2-Tetrachloroethane	trans-1,2-Dichloroethene
1,2-Dichloropropane	cis-1,2-Dichloroethene



WCD Project Initiation Sheet Form A

Page 1 of 2

Project Title: TO-14 SAMPLING	Projected Sampling: _____	Deliverables: Standard Lab Report
Quote Date: _____	Sample Arrival Date: _____	Data Valid.: no _____ ☐ PQL ☒ MDL/Qual
Rev. Date/Rev. #: _____	Prelim. Results Due: _____	Data Completed: _____
Chemours Location/Site: (FER) Ferdula, NY	Prelim. to Customer: _____	Data Received: _____
PM/Phone No.: Ed Ashton (Parsons) 315-552-9673	Final Report Due: LAB:21 day	WCD Rpts To: _____
LSC/Requester: _____	Final Report Mailed: _____	_____
Lab Rpts. To: ADQM Services	_____	_____

Lab	# Samples	Final No.	Type	Method	Services/Analyses Requested	\$ Per	Total	Inv. \$	
LANCAS	4		AIR	TO-14	TO-14A Volatiles- Ferdula list- see 2014 lot 1500167				
LANCAS	5*		AIR	TO-14	Pre-cleaned Summa Canisters- 6 Liter size				
LANCAS	5*		AIR	TO-14	Regulator rental				
					Regulators and canisters are to be set for 8 hour sampling period				
					Subtotal		\$ -		
					Total Project Estimate:		\$ -		

☐ CED ☐ Non-CED ☐ TIC ☐ Field Data ☐ Download

Safety Concerns: _____

Work Orders: **Results to be reported in both PPB**

and mg/cubic meter

Air volumes to be provided by field team

***includes 1 spare regulator and canister**

MDL Reporting

☒

Bottles Del. Date: **by 9/9/16**

Shipping Address: **Edward Ashton**

Parsons

301 Plainfield Road Suite 350

Syracuse, NY 13212

PHONE 315-451-9560

Site Contact: **Edward Ashton**

Phone No.: **315-679-1170 CELL**

LSC Signature: _____

Bump/Credit: _____

Final Amount: _____

(Initial/Date)

Job/Charge #: _____

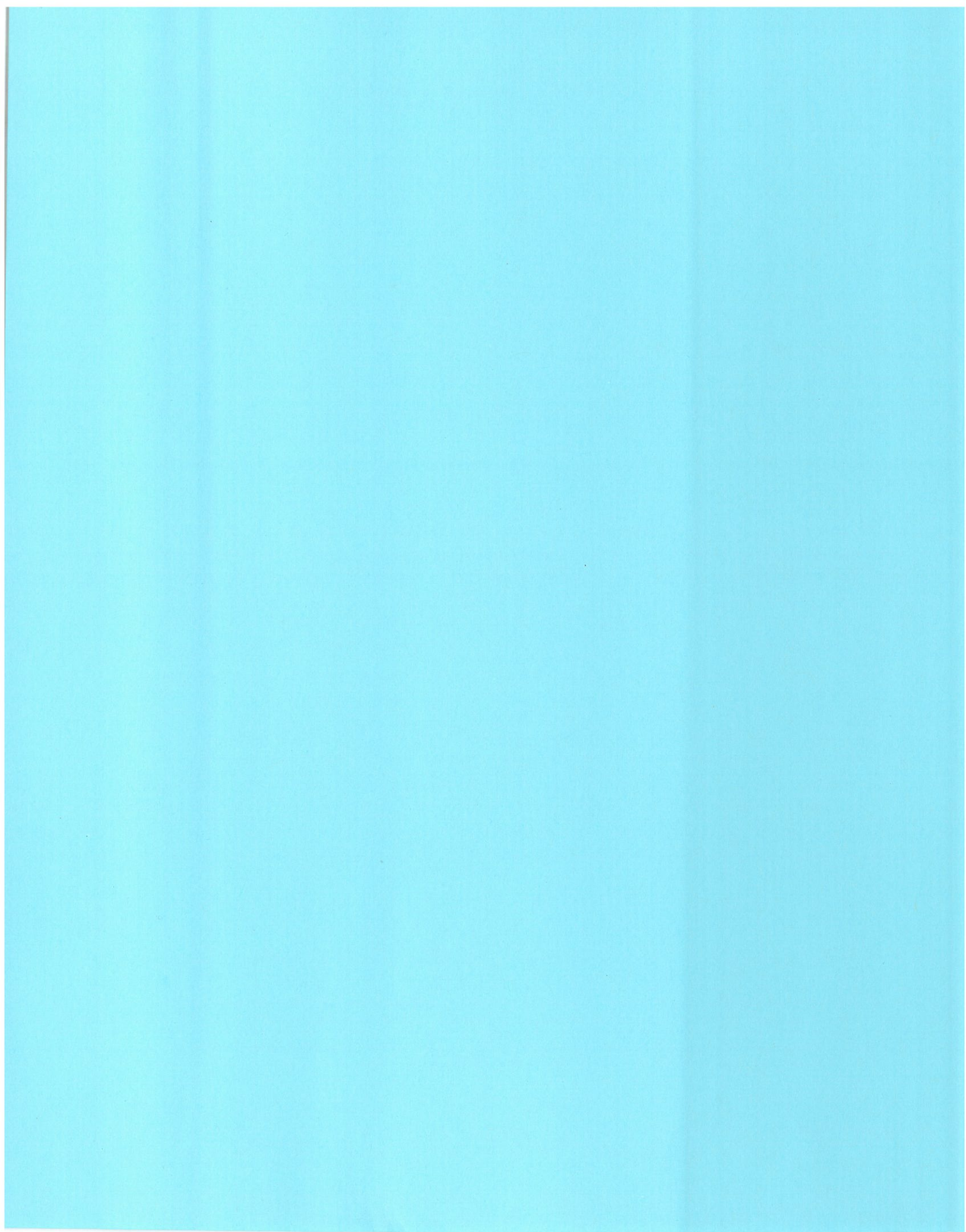
PO/INT#: _____

WCD Analytical Bottle Sheet

Project Location: **(FER) Ferdula, NY**

Project Name: **TO-14 SAMPLING**

Sample I.D.	Type	Analyses Required					
		VOA					
		TO-14					
AA2016-SVE-INFL-1	A	X					
AA2016-SVE-INFL-2	A	X					
AA2016-SVE-GV-___	A	X					
AA2016-SVE-GV-___	A	X					
AIR VOLUMES TO BE PROVIDED BY FIELD TEAM							
1 spare canister and regulator needed							



WCD Analytical Bottle Sheet

Chemours Project Location: **(FER) Ferdula, NY**

Project Name: Leachate Sampling

Sample I.D.	Type	Analyses Required													
		TSS	VOCS (SEE LIST)	SEMIVOAS	BOD	TOTAL PHENOLS	TOTAL CYANIDE	AMENABLE CYANIDE	SULFIDE	TOTAL ICP METALS (SEE LIST BELOW)	Total Ni, Pb, As (ICP/MS)	LL MERCURY (TOTAL)	METALS DIGESTION	OIL & GREASE	PH
		SM2540D	8260C	8270D	SM5210B	9066	9012A	9012A	9030A	6010C	6020A	1631	3010A	1664A	EPA150.1
EF2017_LEACHATE	L	X	X	X	X	X	X	X	X	X	X	X	X	X	X
EF2017- LEACHATE-D	L	X	X	X	X	X	X	X	X	X	X	X	X	X	X
EF2017-TB	K		X												

field duplicate

NOTE: An "X" in any of the above columns indicates that the corresponding sample requires this analysis.

Please include 2 sets of sample containers for matrix/spike/spike dup

TOTAL ICP METALS =Ba, Cd, Cr, Cu, Fe, Ag, Zn

TOTAL ICP/MS METALS= As, Pb, Ni

VOLATILES LIST
LEACHATE SAMPLING 2017

TCL VOCs (8260)

Chloromethane	trans-1,3-Dichloropropene
Bromomethane	Trichloroethene
Vinyl Chloride	Dibromochloromethane
Chloroethane	1,1,2-Trichloroethane
Methylene Chloride	Benzene
Acetone	cis-1,3-Dichloropropene
Carbon Disulfide	Bromoform
1,1-Dichloroethene	4-Methyl-2-pentanone
1,1-Dichloroethane	2-Hexanone
Chloroform	Tetrachloroethene
1,2-Dichloroethane	Toluene
2-Butanone	Chlorobenzene
1,1,1-Trichloroethane	Ethylbenzene
Carbon Tetrachloride	Styrene
Bromodichloromethane	Xylene (Total)
1,1,2,2-Tetrachloroethane	trans-1,2-Dichloroethene
1,2-Dichloropropane	cis-1,2-Dichloroethene

APPENDIX B
Air Sampling Procedure Dated July 25, 2005

Air Sampling Procedure

Date: 7/25/2005
To: Project File
Cc: [Click here and type names]
From: Kevin H. Suter
RE: Ferdula Landfill Air Sampling

Introduction

A windmill powered Soil Vapor Extraction (SVE) System is part of the final remedy to treat impacted soils at the Ferdula Landfill Site. The SVE system extracts soil vapors from the impacted landfill material, treats the vapors with vapor carbon and discharges the treated soil gas to the atmosphere at the top of the windmill tower.

Air sampling is performed on an annual basis to evaluate the effectiveness of the SVE system and to estimate the mass removal of contaminants from the soil. The air sampling consists of direct readings with Draegar tubes and the collection of analytical data through Summa canisters.

System Description

Figure 1 shows a diagram of the SVE system at the Ferdula Site. A small building is located at the windmill. This building houses the data collection system, vacuum cylinders and vapor carbon canisters. As shown on Figure 1, a extraction header leads from the building to the landfill and is connected to seven extraction points (GV-5 through GV-11). The extraction points are essentially monitoring wells screened above the water table. Soil vapor is removed from the extraction points and is treated through 2-55 gallon vapor carbon units prior to discharge to the atmosphere.

The extraction points have sampling points and valves boxes located adjacent to each point (Figure 2). The valve boxes are used to direct flow to the extraction points.

Direct (Draegar Tube) Sampling

Draegar tube sampling is performed to get a direct reading of the quality of the soil gas at each of the extraction points. Draegar tubes are used to evaluate contaminant concentrations in the field. Based on direct readings with Draegar tubes, extraction points are opened or closed to remove impacted soil gas from the extraction point. Extraction points with the highest Draegar tube readings will be selected to have the system extract from. Currently, the system is extracting from 5 of the seven points.

Draegar tube readings will be performed for vinyl chloride, toluene and TCE. The Draegar tube sampling is performed in the following manner while the windmill is operating:

1. **Open ball valves at all extraction points.** The ball valve at the extraction point should initially be opened to allow air to be extracted from the extraction point. Therefore, prior to performing any Draegar tube sampling, the sampler should open all of the sample boxes (Figure 2) and open the valves, to allow air to be extracted from the extraction points. Opening the valves to extracted air will purged air from the extraction points similar to groundwater sampling to obtain representative soil gas samples.

Typical extraction point ball valve and quick connect sample location



2. **Collect Draegar tube samples.** Starting with the extraction points that have been opened since the last sampling event, collect Draegar tube samples following the manufacturer's instruction for each of the main constituents of concern from each of the extraction points. Note draeger tubes have different number of pumps based on the analyte and the concentration range. Draegar tube collection will start by closing the ball valve. The glass tips will be broken using the Draegar pump. A piece of tygon tubing connected to a sample barb will be inserted into the sample port. The draegar hand pump will then be connected to the Draegar tube in the direction of flow. The draegar pump is fully compressed to extract soil gas from the sample port through the Draegar tube. The number of strokes to be pumped through the Draegar tube is based on the contaminant and the concentration range. Concentration estimates are determined based on color change in the Draegar tube using the scale on the tube to evaluate the readings. All field results, time and date should be recorded in a field book.

3. **Open the ball valve for the five highest readings.** Based on the draeger tube sampling results the ball valves should be open so the SVE system is removing impacted soil gas from the five extraction points with the highest readings. This data should be reviewed with Kevin Suter to evaluate the points to be opened.
4. **Leave sample point GV-8 cracked opened at a minimum.** Regardless of the Draeger tube sample results, extraction point GV-8 should always be left cracked open at a minimum. GV-8 is the lowest point in the system, therefore, condensate that develops in the extractions lines will travel to GV-8. If the extraction point is left partially open, the condensate will build up and drain back into the soil. If this extraction point is closed the lines could freeze during cold weather.

Summa Canister Sampling

Summa canisters are used to collect actual soil gas samples from the landfill. The summa canisters are then sent to the laboratory for TO-14 volatile organic analysis. This data is then used to evaluate the actual contaminant concentration in the soil gas and to estimate the mass of contaminants that have been treated.

Four summa canisters are collected from the system:

- **Influent Sample** – An influent sample is collected from the main extraction manifold prior to the air passing through the carbon canisters. A sample port is located in the windmill shed prior to the piping entering the two carbon drums.

Picture Showing influent sample location



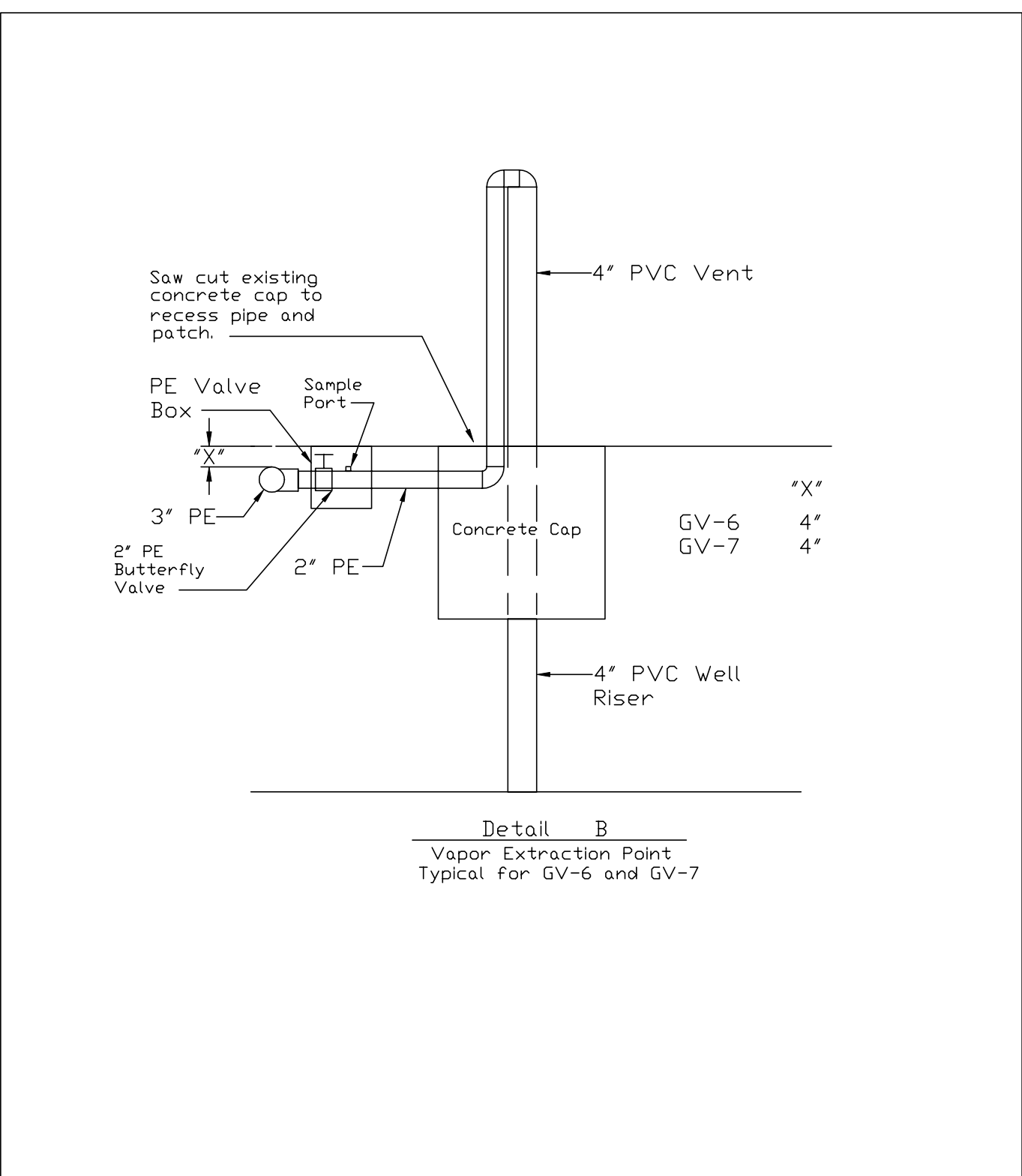
- **Duplicate Influent Sample**
- **GV-10** – Extraction point GV-10 has routinely been the extraction point with the highest draegar tube sample results. Therefore, this location is selected to collect a summa canister sample to evaluate the worst case location within the landfill.
- **GV-9** – Like GV-10 a summa canister is collected from the second highest extraction point (based on draegar tube readings). If GV-9 and GV-10 do not show the highest draegar tube readings, the summa canister samples should be collected from the locations the exhibit the highest sample results.

Summa canister samples are collected from clean summa canisters that have been placed under a vacuum and attached to a regulator that meters the amount of air collected. The summa canisters for this site should be set to collect a sample for 8-hours. The following steps are used to collect a sample using a summa canister:

1. **Record the starting vacuum for all summa canisters.** Write down the canister number, sample location, and use the on-site vacuum gauge and open end wrench to connect the vacuum gauge to the canister. Open the canister valve and write down the starting vacuum for the sample.
2. **Close the sample valve and remove vacuum gauge.**
3. **Attach regulator to the summa canister.** Record the regulator with the corresponding summa canister and sample location
4. **Connect the tygon tubing to the regulator and insert sample barb into quick connect sample port.**
5. **Open the summa canister valve and record the sample start time.**
6. After 8 hours of sample collection, **close the sample valve remove the sample from the sample location. Remove the regulator and determine the final summa canister vacuum with the vacuum gauge.**
7. **Replace all metal nuts, place sample ID on summa canister and replace canister in original shipping box.**
8. **Record start and stop time and initial and final vacuum on the chain of custody.**
9. Prior to sampling the influent samples, **the mechanical counter located on the extraction cylinder should be recorded to calculate the volume of air that moves through the system throughout the sample collection. Note the windmill should be moving to collect all samples so that air is being extracted from the landfill. If the wind stops blowing we may decide to stop a test early.**

The influent duplicate sample will have to be collected after the main influent sample. Therefore this work should be completed ASAP so it doesn't interfere with the concurrent groundwater sampling activities.

Call Kevin Suter with any questions or concerns 703 713-6502 or cell 302 559-1756.

[illegible]

ATTACHMENT B

COLLECTION OF GROUNDWATER SAMPLES FOR PERFLUOROOCTANOIC ACID (PFOA) AND PERFLUORINATED COMPOUNDS (PFCS) FROM MONITORING WELLS SAMPLE PROTOCOL DATED MARCH 3, 2016

Collection of Groundwater Samples for Perfluorooctanoic Acid (PFOA) and Perfluorinated Compounds (PFCs) from Monitoring Wells Sample Protocol

Samples collected using this protocol are intended to be analyzed for perfluorooctanoic acid (PFOA) and other perfluorinated compounds by Modified (Low Level) Test Method 537.

The sampling procedure used must be consistent with the NYSDEC March 1991 **SAMPLING GUIDELINES AND PROTOCOLS**

<http://www.dec.ny.gov/regulations/2636.html> with the following materials limitations.

At this time acceptable materials for sampling include: stainless steel, high density polyethylene (HDPE) and polypropylene. Additional materials may be acceptable if proven not to contain PFCs. **NOTE: Grunfos pumps and bladder pumps are known to contain PFC materials (e.g. Teflon™ washers for Grunfos pumps and LDPE bladders for bladder pumps).** All sampling equipment components and sample containers should not come in contact with aluminum foil, low density polyethylene (LDPE), glass or polytetrafluoroethylene (PTFE, Teflon™) materials including sample bottle cap liners with a PTFE layer. Standard two step decontamination using detergent and clean water rinse should be considered for equipment that does come in contact with PFC materials. Clothing that contains PTFE material (including GORE-TEX®) or that have been waterproofed with PFC materials must be avoided. Many food and drink packaging materials and “plumbers thread seal tape” contain PFCs.

All clothing worn by sampling personnel must have been laundered multiple times. The sampler must wear nitrile gloves while filling and sealing the sample bottles.

Pre-cleaned sample bottles with closures, coolers, ice, sample labels and a chain of custody form will be provided by the laboratory.

1. Fill two pre-cleaned 500 mL HDPE or polypropylene bottle with the sample.
2. Cap the bottles with an acceptable cap and liner closure system.
3. Label the sample bottles.
4. Fill out the chain of custody.
5. Place in a cooler maintained at $4 \pm 2^{\circ}$ Celsius.

Collect one equipment blank for every sample batch, not to exceed 20 samples.

Collect one field duplicate for every sample batch, not to exceed 20 samples.

Collect one matrix spike / matrix spike duplicate (MS/MSD) for every sample batch, not to exceed 20 samples.

Request appropriate data deliverable (Category A or B) and an electronic data deliverable.

ATTACHMENT C

UNITED STATES CORPS OF ENGINEERS STANDARD OPERATING PROCEDURE 047, PER/POLYFLUORINATED ALKYL SUBSTANCES (PFAS) FIELD SAMPLING, DATED MARCH 2016

STANDARD OPERATING PROCEDURE 047
Per/Poly Fluorinated Alkyl Substances (PFAS) Field Sampling

1.0 Scope

Given the extremely low detection limits associated with PFAS analysis and the many potential sources of trace levels of PFAS, field personnel are advised to err on the side of caution by strictly following these protocols when sampling for PFAS to help mitigate the potential for false detections.

2.0 General Preparation and Considerations

Food considerations:

- Some food packaging has historically been treated with PFAS to improve its ability to resist wetting. As such, field personnel are to avoid the use of paper bags and not to bring food on site in any paper packaging (i.e. do not bring any fast food to the sites that uses and form of paper wrapping such as sandwiches, coffee in paper cups, etc.). If possible use cotton or hard plastic food containers. Avoid products such as aluminum foil, coated papers, and coated textiles.
- Foods that have been fried on a frying pan should not be brought to the site as the Teflon coating on most frying surfaces is made of a fluorinated coating and could represent a potential source of PFAS.
- Snacks and meals (lunch) are not to be eaten in the field vehicle or in the immediate vicinity of the monitoring wells (i.e. within 10m). When field personnel require a break to eat or drink, they should remove their gloves and coveralls and move to an appropriate location (preferably downwind). When finished, field personnel should then tidy up and put their coveralls and gloves back on prior to returning to the work area.

Field Gear:

- Water resistant, water proof or stain-treated clothing will not be worn during the field program. Field clothing to be worn on site should be restricted to natural fibers (preferably cotton) and not synthetic. Field clothing should be laundered with minimal use of soap, no fabric softener or scented products and after they have been cleaned, the clothing should be rinsed again with water only before drying (no fabric softener, etc.). Preferably, field gear should be cotton construction, old and well laundered. New cotton clothing may contain PFAS related treatments. The use of new clothing while sampling or sample handling shall be avoided. Gore-Tex™ consists of a PFAS membrane. Gore-Tex™ clothing shall not be worn during the sampling program.
- To avoid plastic coating or glue materials, waterproof field books are not to be used. Field reports should be on loose paper on Masonite or aluminum clip boards (i.e. plastic clip boards, binders or spiral hard cover notebooks are not acceptable) using a pencil. Pens and sharpies should not be used.
- Most safety footwear are made from leather and synthetic fibers that have been treated to provide some degree of waterproofing/increased durability and represent a source of trace PFAS. For the health and safety of field personnel, the protection for footwear must be maintained. As such, contact with safety footwear will take place after field personnel remove themselves from immediate vicinity of the monitoring well (i.e. 10m). Contact with footwear will not begin until new gloves are donned to minimize any potential for skin contact. Gloves will be disposed of when footwear contact is prior to beginning any other activities.
- Disposable nitrile gloves must be worn at all times. Further, a new pair of nitrile gloves shall be donned prior to the following activities at each sample location:

March 2016

- Decontamination of re-usable sampling equipment;
- Prior to contact with sample bottles or “PFAS free” water containers
- Insertion of anything into the well (e.g. HDPE tubing, HydraSleeve, bailer, etc.);
- Insertion of silicon tubing into the peristaltic pump;
- Completion of monitor well purging, prior to sample collection;
- Handling of any QA/QC samples including field blanks and equipment blanks; and,
- After the handling of any non-dedicated sampling equipment, contact with non-decontaminated surfaces, or when judged necessary by field personnel.

Field Vehicle:

- The field vehicle seats may be treated with stain resistant products by the manufacturer. The seats of the vehicle shall be covered with a well laundered cotton blanket for the duration of the field program in order to avoid direct contact between field clothing and the seats of the vehicle.

Personnel Hygiene:

- Field personnel will not use shampoo, conditioner, body gel, cosmetic or hand cream as part of their personal cleaning/showering routine on the day of a sampling event, as these product may contain surfactants and represent a potential source of PFAS. It is strongly recommended that field personnel shower as per normal routine the night before and then rinse with water only on the morning of sampling event. Use of bar soap is considered acceptable, although soap containing moisturizing lotions should be avoided.
- Moisturizers, cosmetics and dental floss may contain PFAS and shall not be used throughout the duration of the field program, either on or off-site. Sunscreen and insect repellent also cannot be used.
- For washroom breaks, field personnel will remove themselves from the immediate vicinity of the sampling location (i.e. 10m) and then remove gloves and overalls. Field personnel should wash as normal with extra time for rinsing with water after soap use. When finished washing, the use of air dryer is preferred and the use of paper towel for drying is to be avoided (if possible).

Visitors:

- Visitors to the site are asked to remain at least 10m from sampling areas.

Rain Events:

- Field sampling will not take place when rain fall is consistent and persistent at a rate that it saturates the ground (i.e. formation of puddles) because rain gear is not permitted while sampling. Intermittent showers or fog are acceptable conditions to proceed. If/when showers occur; field gear will be removed from the monitoring well location until rain subsides.
- If project timelines are tight, teams should consider the use of a gazebo tent, which can be erected overtop of the monitoring well and provide shelter from the rain. It should be noted that the canopy material is likely a treated surface and should be treated as such; therefore, gloves should be worn when moving the tent, changed immediately afterwards and further contact with the tent should be avoided until all sampling activities have been finished and the team is ready to move on to the next site.

Table 1: Summary of Prohibited and Acceptable Items for Sampling of PFCs

PROHIBITED ITEMS	ACCEPTABLE ITEMS
Field Equipment	
Teflon® containing materials	High-density polyethylene (HDPE) materials
Low density polyethylene (LDPE)	Acetate liners
Aluminum foil	Silicon tubing
Waterproof field books	Loose paper (non-waterproof)
Plastic clipboards, binders, or spiral hard cover notebooks	Aluminum field clipboards or with Masonite
	Sharpies®, pens
Post-It Notes	
RE-usable Chemical (blue) ice packs	Regular ice in polyethylene bags (double bagged)
Field Clothing and Personal Protective Equipment (PPE)	
New cotton clothing or synthetic water resistant, waterproof, or stain- treated clothing, clothing containing Gore-Tex™	Well-laundered clothing, defined as clothing that has been washed 6 or more times after purchase, made of natural fibers (preferable cotton)
Clothing laundered using fabric softener	No fabric softener
Boots containing Gore-Tex™ Tyvek®	Boots made with polyurethane and polyvinyl chloride (PVC) Cotton Clothing
No cosmetics, moisturizers, hand cream, or other related products as part of personal cleaning/showering routine on the morning of sampling	<u>Sunscreens</u> - Alba Organics Natural Sunscreen, Yes To Cucumbers, Aubrey Organics, Jason Natural Sun Block, Kiss my face, Baby sunscreens that are “free” or “natural” <u>Insect Repellents</u> - Jason Natural Quit Bugging Me, Repel Lemon Eucalyptus Insect repellent, Herbal Armor, California
Sample Containers	
LDPE or glass containers and lined lids	HDPE or polypropylene
Teflon®-lined caps	Unlined polypropylene caps
Rain Events	
Waterproof or resistant rain gear	Gazebo tent that is only touched or moved prior to and following sampling activities
Equipment Decontamination	
Decon 90	Alconox® and/or Liquinox®
Water from an on-site well	Potable water from municipal drinking water supply
Food Considerations	
All food and drink, with exceptions noted on the right	Bottled water and hydration drinks (i.e. Gatorade® and Powerade®) to be brought and consumed only in the staging area

3.0 Equipment Cleaning Procedure

Field equipment that is utilized at each sample location will require cleaning between uses. Upon donning a new pair of nitrile gloves, equipment will be:

- Rinse with a Citranox® cleaning solution;
- Rinse with laboratory-provided, "PFAS-free" water; (Grade 3 distilled, Millipore deionized)
- Rinse with methanol; and,
- Rinse with laboratory-provided, "PFAS-free" water.

All rinsate should be collected in a sealed pail for disposal.

For groundwater sampling, the flow-through cell and any non-dedicated equipment (i.e. interface probe) that comes into contact with well water should be decontaminated between uses.

Field equipment used at locations that are suspected of containing AFFF (i.e. those that foam during shaking) will be cleaned as per above in triplicate.

4.0 Borehole & Monitoring Well Sampling and Installation Procedures

- If a drill rig is being used to drill for soil cores or to install monitoring wells, clean nitrile gloves shall be worn prior to the collection of each continuous soil sample collection. Soil samples are collected in laboratory-supplied, "PFAS free" HDPE jars and labelled in pencil. Samples should be stored in coolers and kept at 0 – 4 °C until transported to the lab.

4.1 Well Condition Survey/Water Level Monitoring

- Under normal conditions, one of the first steps in conducting a groundwater sampling program is to complete a well condition survey (including the measurement of static water levels and monitor well depths). However, due to the extremely low detection limits for PFAS, the surveys should be conducted after groundwater purging and sampling to help mitigate the possibility of cross-contamination.
- Once all monitoring wells have been sampled, field personnel should conduct monitor well inspections and recorded water levels. An interface probe should be used to evaluate presence/absence of non-aqueous phase liquid (NAPL). Depth to water should be measured from the top of the PVC riser and the total depth of the well should also be measured. This information should be recorded on the Field Reports.

4.2 Monitoring Well Development and Purging

- Do not use Teflon or low density polyethylene tubing for purging or sample collection. High density polyethylene (HDPE) tubing is acceptable. No materials should be re-used between wells. Upon completion of use, all disposable materials (e.g. HDPE and/or silicon tubing) should be removed and placed in heavy duty garbage bags for disposal.
- During development of the well, sufficient energy should be created to agitate the water column and create flow reversals in the well screen, filter pack and formation to loosen fine-grained materials and draw them into the well. The pumping or bailing action should then draw all drilling fluids and fine-grained material out of the borehole and adjacent formation and then out of the well. Monitoring wells should be developed until visibly clear water is discharged from the well.
- Low flow purge and sampling techniques as per the US EPA "Low Stress (low flow) purging and Sampling Procedure for the Collection of Ground Water Samples from Monitoring Wells" and the ASTM "Standard

Practice for Low-Flow Purging and Sampling for Wells and Devices Used for Ground-Water Quality Investigations" should be followed.

- To purge the well, if using HDPE tubing and a peristaltic pump, the end of the tubing should be inserted to the approximate depth of the midpoint of the screened section of the monitor wells. The length of HDPE tubing to be inserted into each monitoring well will be measured and pre-cut to approximate lengths (i.e. previously measured arm span of field technician) to avoid contact with any materials other than the monitoring well and peristaltic pump. The tubing should be kept at least 0.6 m from the bottom of the well to prevent intake of particulates. Flow rates should be as low as can be reasonably achieved. Purge water should be collected and disposed of appropriately.
- Silicon tubing should direct the purge water through a flow-through cell for field parameter measurements of pH, conductivity, temperature, dissolved oxygen and turbidity. The instrument should be calibrated in the field prior to use, and the instrument and flow-through cell should be decontaminated at each monitor well location prior to purging.
- Field parameters should be recorded in intervals (generally of three minute duration) to ensure purge water has cycled through the flow-through cell. Wells should be sampled after field parameter measurements indicate stabilization, which allows collection of representative formation water (generally acceptable standards are three consecutive pH readings to within ± 0.1 units, and three consecutive conductivity, temperature and dissolved oxygen measurements to within three percent). Turbidity is monitored, but should not be used as an indicator of purge completion. Field parameter measurements should be recorded at each well. As outlined below, drawdown should not be monitored throughout the purge in order to mitigate possible cross-contamination of groundwater samples introduced by the interface probe.
- If wells are suspected to be dewatering throughout the purge (i.e. reduced flow rate/difficulty pumping water or bubbles begin to come through the flow through cell), the pump should be turned off, and the water level allowed to recover for $\frac{1}{2}$ hour, followed by sample collection. This should be documented in the Field Reports.

5.0 Sample Collection

5.1 General

Prior to sampling, confirm sample container composition (polypropylene versus HDPE) with the selected analytical laboratory. For each sample, the required minimum volume of surface water and groundwater is 250mL per USEPA 2009 ⁽⁴⁾ and the required minimum amount of soil or sediment is at least 2g on a dry weight basis per ASTM 2014. These sampling requirements may vary by laboratory. Prior to sampling, confirm sample size requirements with the selected analytical laboratory. Sampling volume is determined by the analytical laboratory and should be adapted to expected PFOS levels and analytical capacities. The instrumental limit of detection is the main factor limiting the sensitivity and the volume should be enough to reach quantification levels. ⁽¹⁾

For drinking water, each 250mL sample bottle *may be* required to contain a small amount (1.25g) of Trizma®, a buffering reagent that removes free chlorine from chlorinated drinking water (USEPA, 2009), or similar sample additive as specified by the selected analytical laboratory. Prior to sampling drinking water for PFAS analysis, confirm the need for additive with the selected analytical laboratory and the USACE chemist.

The use of chemical or gel-based coolant products (e.g. BlueIce®) to maintain samples at 4°C following sample collection is prohibited. The acceptable alternative is ice which has been double-bagged (polyethylene plastic) and secured to avoid meltwater from contacting sample containers during overnight or same-day delivery to the analytical laboratory.

Table 1 should be reviewed to identify other products that may contaminate the sampling processing area. If in doubt about a particular product or item in contact with environmental media to be sampled or in close proximity to operations, collect and analyze a rinsate sample using laboratory-supplied PFAS-free water. Filtration upon sample collection is not recommended since the filter may absorb PFASs or be a source of contamination. ⁽¹⁾

Support personnel that are within 2–3m of the processing area are considered subject to the same restrictions related to precautionary measures for clothing and food, as applied to sampling personnel. During sample processing and storage, minimize the exposure of the sample to light.

5.2 Sample Containers:

- Different laboratories may supply sample collection containers of varying sizes dependent on the type of media to be sampled (i.e. soil, groundwater, etc.).
 - Results of ESG's inter-laboratory comparison suggest that standardizing sample container size and performing whole-sample analysis (i.e. no sub-sampling) will optimize inter-laboratory comparability and ensure result consistency for departments, regardless of which laboratory is used.
 - The use of different laboratory testing methods (i.e., SPE and DI) could be responsible for result variability between laboratories. Sub-sampling is inherent to the direct injection method and introduces possible bias in either direction. To achieve "reportable quantitative results" in aqueous samples, the use of the SPE method is recommended.
 - All samples should be collected in polypropylene or high density polyethylene (HDPE) bottles fitted with an unlined (no Teflon), polypropylene screw cap.
 - Container Labels will be completed using pen/pencil (i.e. NO MARKERS) after the caps have been placed back on each bottle.
 - Glass containers should also be avoided due to potential loss of analyte through adsorption.
- Sample Shipping Requirements:
- Samples should be maintained between 0–4 °C during shipping. Samples should be shipped via courier service with priority overnight delivery. Tracking numbers for all shipments should be provided once they have been sent out so to ensure their timely delivery.

5.3 Soil Sampling

- Clean nitrile gloves shall be worn prior to the collection of each sample.
- Samples are to be collected using a stainless steel trowel.
- Soil samples are collected in laboratory-supplied, "PFAS free" HDPE jars and labelled in pencil. Samples should then be placed in coolers and kept at between 0 – 4 °C until transported to the lab.
- Soil and sediment core samples must be collected directly from single-use PVC liners that must not be decontaminated or reused at different locations.

5.4 Groundwater Sampling

- Sample collection will take place upon stabilization of field parameters. The silicon tubing should be disconnected from the flow-through cell, enabling collection of groundwater samples prior to passing through the cell.

- Prior to collection of samples, field personnel must wash their hands and don a new set of nitrile gloves. Gloved hands must not be used to subsequently handle papers, pens, clothes, etc., prior to the collection of PFAS samples. The PFAS samples bottle caps must remain on the bottle until immediately prior to sample collection and the bottle immediately sealed after sample collection. This will minimize potential loss of PFAS, through volatilization. The bottle cap must remain in the other hand of the sampler, until replaced on the bottle. PFAS sample bottles will not be rinsed during sampling.
- During PFAS sampling, water turbulence should be minimized to avoid potential volatilization from aqueous solution; this could include: adjusting pump discharge prior to sampling and inclining the sample bottle neck, during filling of the bottle. Ensure the rim of the bottle does not come into direct contact with the pumping equipment or tubing. Environment Canada states that while PFOS has low volatility, many of its precursors are volatile.
- Groundwater samples will be collected in pre-labelled, laboratory-supplied "PFAS free" HDPE sample vials. Each "PFAS clean" sample vial should then be placed in a sealed Ziploc® bag. Labelling information and time of sampling should be recorded on the Field Reports. All sampling materials should be treated as single use and disposed following completion of sampling at each monitor well.
- A small portion of the sample (~10-25mL) should be collected and shaken by the sample collector on site. If foaming is noted within the sample, this should be documented when samples are submitted for analysis; the 'shaker test' vial can then be disposed of. This shaker test provides information about how each of the samples should be handled analytically.
- Samples should be placed in coolers and kept at a cool temperature until transportation to the lab. Samples must be kept at between 0–4 °C.

5.5 Sediment Sampling

- Sediment samples should be either collected manually using a stainless steel trowel or collected using petite ponar grab sampler depending on field condition at each sampling location during sampling program.
- Sediment samples will be collected within the upper 10 cm of sediment.
- For a sample to be acceptable the overlying water is present and has low turbidity; the sampler is not overfilled or contains vegetation; the sediment is undisturbed and sampler shows no signs of winnowing or leaking.
- Overlying water will be decanted and a stainless steel trowel will be used to collect only the upper 5 cm of sediment.
- Sediment will be placed directly into laboratory supplied containers suitable in both material and size, placed in supplied packaging and immediately stored in cooler with ice to ensure a whole sample is collected to mitigate issues with sample collection. Jar lids will remain in the gloved hand of the sampler until replaced on the bottle. Labels will be completed using pen/pencil (i.e. NO MARKERS) after the caps have been placed back on each bottle.

5.6 Surface Water Sampling

- Where surface water samples and sediment samples are collected at the same location, surface water samples will be collected first to minimize the siltation.
- Surface water must be collected by inserting a capped sampling container (polypropylene or HDPE) with

the opening pointing down to avoid the collection of surface films. At the time of container opening, the container must be more than 10cm from the sediment bed and more than 10cm below the surface water level and as close to the center of the channel as possible, where practicable. Point the container up to fill so that gloved hands, sample container, and sampler are downstream of where sample is being collected.

- Surface water pH, conductivity, temperature and total dissolved solids (TDS) will be measured at each location after sediment sampling.
- Surface water samples will be placed directly into laboratory supplied containers suitable in both material and size, placed in supplied packaging and immediately stored in cooler with ice to ensure a whole sample is collected to mitigate issues with sample collection. Jar lids will remain in the gloved hand of the sampler until replaced on the bottle. Labels will be completed using pen/pencil (i.e. **NO MARKERS**) after the caps have been placed back on each bottle.
- Sample collection will take place prior to measurement of water level and well depth as to minimize the potential for cross-contamination due to surface water/sediment contact with field equipment.

6.0 Quality Assurance & Quality Control Sampling

6.1 Equipment Blanks

- QA/QC sampling will include daily collection of equipment blanks using the laboratory supplied 'PFAS free' water. Sample will be collected in laboratory supplied containers. Bottle caps will remain in the hand of the sampler until replaced on the bottle. Labels will be completed using pen/pencil (i.e., **NO MARKERS**) after the caps have been placed back on each bottle. Samples will be sealed in suitable packaging and stored on ice in a cooler for shipment to the lab.

For peristaltic pump tubing, laboratory supplied "PFAS free" water should be poured into a clean HDPE sample bottle and then pumped through new HDPE tubing using the peristaltic pump (with new silicon tubing).

6.2 Field Duplicates

- QA/QC sampling will include the collection of one blind field duplicate for each 10-sample group. These samples will be collected immediately after the initial samples into laboratory supplied "PFAS clean" sample containers. Bottle caps will remain in the hand of the sampler until replaced on the bottle. Labels will be completed using pen/pencil (i.e., **NO MARKERS**) after the caps have been placed back on each bottle. Samples will be sealed in suitable packaging and stored on ice in a cooler for shipment to the lab.

6.3 Field Blank

- QA/QC sampling will include daily submission of laboratory supplied field blanks. The samples will be brought to the site in the laboratory supplied sample bottles and opened during the collection of a sample and then released. Bottle caps will remain in the hand of the sampler until replaced on the bottle. Labels will be completed using pen/pencil (i.e., **NO MARKERS**) after the caps have been placed back on each bottle. Samples will be sealed in suitable packaging and stored on ice in a cooler for shipment to the lab.

6.4 Trip Blank

- QA/QC sampling will include the submission of one laboratory supplied trip blank. The sample will be brought to the site in laboratory supplied sample bottle and will remain inside the cooler during the sampling program. Labels will be completed using pen/pencil (i.e., **NO MARKERS**). Samples will be sealed in suitable packaging and stored on ice in a cooler for shipment to the lab.

6.5 ***Spiked Samples – Laboratory Performance Evaluation***

- QA/QC sampling will include the submission of two laboratory supplied spiked samples of known concentration (one low level and one moderate level based on previous PFAS sample results) submitted blindly by the environmental consultant. These samples will be utilized in lieu of certified reference material (CRM) to assist in data validation. Labels will be completed using pen/pencil (i.e., **NO MARKERS**). Samples will be sealed in suitable packaging and stored on ice in a cooler for shipment to the lab.

6.6 ***Laboratory Analytical QA/QC***

- Internal laboratory QA/QC should consist of one laboratory blank per batch of samples; one soil or water matrix spikes and generally isotopically-labelled surrogates for analysis. Labels will be completed using pen/pencil (i.e., **NO MARKERS**). Samples will be sealed in suitable packaging and stored on ice in a cooler for shipment to the lab.
- As part of the internal QA/QC, relative percent difference (RPD) should be calculated between samples and corresponding field or laboratory duplicates. The laboratory quality assurance portion of the laboratory certificates should be reviewed to verify that all calculations/recoveries were within acceptable limits as established by the laboratory method.

6.7 ***Laboratory Analytical Sub-sampling***

The results of ESG's inter-laboratory comparison, however, still imply that subsampling is a significant cause of inter-laboratory variability, and it is a practice inherent to the DI method. The Ontario Ministry of the Environment recommends use of the SPE method to achieve reportable quantitative results for drinking water samples.

7.0 **Laboratories**

An accredited laboratory for analysis of PFAS will be used.

References:

- (1) United Nations Environment Programme (UNEP), Division of Technology, Industry and Economics. 2015. *PFAS analysis in water for the Global Monitoring Plan of the Stockholm Convention, Set-up and guidelines for monitoring*. April.
- (2) Government of Western Australia, Department of Environmental Regulation. 2016. *Interim Guideline on the Assessment and Management of Perfluoroalkyl Substances (PFAS), Contaminated Sites Guidelines*. February.
- (3) Environmental Fate and Effects of Poly-and Perfluoroalkyl Substances (PFAS). 2016. CONCAWE (European Industrial Consortium)
- (4) USEPA Method 537: Determination of Selected Perfluorinated Alkyl Acids in Drinking Water by Solid Phase Extraction and Liquid Chromatography/Tandem Mass Spectrometry (LC/MS/MS), version 1.1, September 2009. National Exposure Research Laboratory, Office of Research and Development, U.S. Environmental Protection Agency.

ATTACHMENT D

PROJECT SPECIFIC WASTE MANAGEMENT PLAN DUPONT FERDULA LANDFILL, SOIL VACUUM EXTRACTION (SVE) SYSTEM DUPONT FERDULA LANDFILL, FRANKFORT, NEW YORK, DATED MAY 2016

Project Specific Waste Management Plan Ferdula Landfill Soil Vacuum Extraction (SVE) System

DuPont Ferdula
Frankfort, New York

Date: May 2010
Updated: May
2016

DuPont Job Number: 507052

AECOM Corporation
257 West Genesee Street
Buffalo, New York 14202-2657

Table of Contents

1.0	Purpose and Site Information.....	1
1.1	Purpose.....	1
1.2	Project Team	1
1.3	Hazardous Waste Generator Status.....	1
1.3.1	Generator Requirements.....	2
1.4	Universal Waste Generator Status	2
1.4.1	Generator Requirements.....	2
2.0	Scope of Work	4
3.0	Project Team Responsibilities.....	5
4.0	Generator Waste Classification.....	6
4.1	Applicability to Federal/State Listed Waste Codes	6
4.2	Applicability of Characteristic Waste Codes.....	6
5.0	Waste Management Procedures	7
5.1	Project Waste	7
5.2	Universal Wastes	8
5.2.1	Used Batteries.....	8
5.2.2	Fluorescent Light Bulbs	8
5.2.3	Computer Equipment	9
6.0	Waste Handling Procedures	10
6.1	Waste Storage and Inspection Requirements.....	10
6.2	Container Labeling Instructions.....	10
6.3	Waste Container Inventory Documentation.....	10
7.0	Spill Response and Reporting Requirements.....	11
7.1	Project Contacts	11

Figures

Figure 1 Ferdula Site Location Map

Appendices

Appendix A	Quarterly Carbon Change-Out Procedures
Appendix B	DuPont CRG Waste Management Network Protocol for Spent Aerosol-Can Management
Appendix C	CRG Battery Mangement
Appendix D	Waste Container Labels
Appendix E	Waste Management Field Documentation Form

1.0 Purpose and Site Information

1.1 Purpose

The very nature of environmental remediation lends itself to the generation of solid waste, hazardous waste, and investigation derived waste. This plan will outline general site waste generation information, classification justification, and storage and disposal procedures for project generated waste from the DuPont Ferdula Landfill soil vacuum extraction (SVE) system (see Figure 1). This plan will be used by field teams associated with the DuPont Corporate Remediation Group (CRG).

1.2 Project Team

Waste Management Consultants (AECOM Corporation)	
Tim Pezzino (Primary)	Email: Timothy_Pezzino@aecom.com Phone: 716-923-1111
Lance Holman (Secondary)	Email: Lance_Holman@aecom.com Phone: 302-781-5909
Site Representative (Parsons)	
Ed Ashton	Email: Edward.J.Ashton@parsons.com Phone: 315-552-9673
Project Manager (Parsons)	
Ed Ashton	Email: Edward.J.Ashton@parsons.com Phone: 315-552-9673
Project Director (DuPont)	
Thomas Stilley (DuPont CRG)	Email: Thomas.E.Stilley@dupont.com Phone: 757-301-3592
Other Contacts	
Greg Ertel (Parsons Safety Contact)	Email: Greg.Ertel@parsons.com Phone: 315-506-3939
Eric Hale (Site Contractor)	Marcy Excavation Services, LLC Phone: 315-724-4062

1.3 Hazardous Waste Generator Status

The DuPont Ferdula site is considered a Conditionally Exempt Small Quantity Generator (CESQG) as defined by the Resource Conservation and Recovery Act (RCRA). Even though the facility is considered a CESQG, it has U.S. Environmental Protection Agency (EPA) generator identification number: NYD980508261.

1.3.1 Generator Requirements

As a CESQG, the following general hazardous waste generator requirements are applicable for the DuPont Ferdula site along with any applicable site procedures.

- Notification of hazardous waste activity to EPA/state is not required. However, DuPont has done so based on historical RCRA generator status.
- There is no time limit to store hazardous waste on-site.
- No more than 1,000 kg of hazardous waste can be accumulated on-site at one time.
- Per DuPont policy, as generated, an accumulation start date must appear on each waste container.
- Per DuPont policy, as generated and as necessary, the words “Hazardous Waste” are required on each container.
- Per DuPont policy, the container storage location must be at least 50 feet from property line.
- Hazardous waste treatment is allowed in accumulation units.
- Per DuPont policy, a manifest must be used to ship hazardous waste off-site.
- Per DuPont policy, hazardous waste must be shipped using transporters and facilities that have EPA ID numbers.
- Per DuPont policy, as necessary, the site must prepare a land disposal restriction form (LDR).
- Per DuPont policy, the site will conduct and document personnel training and how it relates to hazardous waste disposal procedures.
- The site (in conjunction with DuPont CRG) will maintain all hazardous waste records.

1.4 Universal Waste Generator Status

The DuPont Ferdula site is a generator of universal waste and is considered a small quantity handler. All accumulated universal waste will be removed annually from the site.

1.4.1 Generator Requirements

The requirements for a small quantity universal waste handler are based upon the amount of universal waste created in a given year. Based on the amount of universal waste anticipated to be generated at the Ferdula site, the site will adhere to the following requirements.

Requirement	Small Quantity Handler
Volume generated per calendar year	< 500kg or 11,000 pounds per year
EPA notification and EPA ID number	Not required
Training	Employees must be informed or aware of proper waste handling and emergency release response procedures as described in this document.
Universal waste shipment recordkeeping	Not required
Waste shipment paperwork	Bill of lading is sufficient but must be properly labeled according to Department of Transportation (DOT).

2.0 Scope of Work

Overall, the Parsons Corporation is responsible for the operation and maintenance of the DuPont Ferdula SVE system. Other entities are also involved in relation to waste management procurement, organization, and reporting. The following identifies the primary scope of activities, which will be completed at the landfill:

- Routine installation or repair of polyethylene piping connections from the SVE extraction points to the treatment system
- Routine replacement of system air cylinders
- Change out of 'in-series' activated carbon units used for treatment of soil vapor
- Collection of semi-annual air samples
- Collection of semi-annual groundwater samples

3.0 Project Team Responsibilities

The following table identifies project team responsibilities for this project as they relate to waste management.

Project Team Responsibilities

Task	Organization	Individual
Conduct waste coordinator duties.	Parsons	Ed Ashton
Coordinate sampling activities.	Parsons	Ed Ashton
Oversee waste management activities.	AECOM WM Network	Tim Pezzino or Lance Holman
Label containers.	Parsons/Contractor TBD	Ed Ashton or designate
Move waste into the waste accumulation area.	Parsons/Contractor	Ed Ashton or contractor
Complete/submit Waste Management Field Documentation Form to the Waste Management Network.	Parsons	Ed Ashton or Parsons Field Team Lead
Provide characterization testing bottles and final analyses reports.	AECOM WM Network	Nate Carlson, or Sharon Nordstrom
Review analytical data to determine RCRA classification.	AECOM WM Network	Nate Carlson, or Tim Pezzino
Inspect RCRA Hazardous and HAZARDOUS WASTE - PENDING ANALYSIS wastes weekly (if needed)	Parsons	Ed Ashton or Parsons Field Team Lead
Label waste containers for shipment.	Parsons	Ed Ashton
Prepare shipping papers (i.e., manifests and LDR forms).	AECOM WM Network	Tim Pezzino or Lance Holman
Notify project team [Project Director (PD) and Project Manager (PM)] of waste disposal completion of activities.	AECOM WM Network	Tim Pezzino or Lance Holman
Prepare/submit related reporting.	AECOM WM Network	Tim Pezzino or Lance Holman
Archive and maintain all required documents.	DuPont	Thomas Stilley

4.0 Generator Waste Classification

Identified solid waste streams from this project have been reviewed to determine their applicability to RCRA hazardous waste regulations. The following outlines applicable interpretations.

4.1 Applicability to Federal/State Listed Waste Codes

DuPont has reviewed historical processes and waste management practices that have occurred at the Ferdula site. It has been determined that there is no record of a release of a RCRA hazardous waste nor does material being investigated meet a RCRA listed waste definition. Furthermore, insufficient information exists regarding potentially generated waste material to determine the exact origin of soil/groundwater constituents of concern.

4.2 Applicability of Characteristic Waste Codes

Investigation derived media [soil, personal protective equipment (PPE), or water] that does not contain listed waste(s) may be classified as hazardous if it exhibits a hazardous characteristic defined by the RCRA. There are four hazardous characteristics:

- Ignitable (D001)
- Corrosive (D002)
- Reactive (D003)
- Toxic (D004-043)

The determination of whether generated wastes exhibit RCRA characteristics will be based upon a combination of waste characterization sampling and current and historical laboratory testing.

Although, in general, the following is applicable:

- Excess purge water and decontamination water will be classified as RCRA non-regulated material and discharged back into system.
- General debris for disposal does not contain RCRA hazardous waste nor exhibit a RCRA hazardous characteristic and may be disposed of in on-site sanitary waste receptacles.
- System carbon canisters will be changed out and disposed of on a quarterly basis. Based on historical analytical when disposed they will be classified as RCRA HAZ (D029/D040) – Appendix A identifies disposal process.

If waste classification sampling is required for any unidentified waste stream, all bottles and analytical testing will be coordinated through the AECOM Waste Management Network.

5.0 Waste Management Procedures

5.1 Project Waste

The following waste streams and correlating storage, classification, and labeling requirements are identified below. Additional waste streams will be added as necessary. All waste will be stored or disposed of as identified below. Universal waste will be stored and disposed of as identified below and will be removed from site on a yearly basis (preferably every January).

Anticipated Waste Steams

Waste Stream	RCRA Classification	Waste Characterization Testing	Container Requirements and Estimated Volume	Labeling Requirements	Anticipated Disposal Method
Excess decontamination, development, and groundwater from surrounding monitoring wells	RCRA non-hazardous based on historical groundwater analysis	None	Temporarily containerize or directly discharge by hose connection to the on-site leachate collection system	As Necessary, Green Non-Hazardous label	On-site through WWT system
Spent activated carbon from the SVE treatment system (Removed and Changed Out on a quarterly basis)	RCRA Characteristically Hazardous (D029 and D040)	Annual Sampling for Waste Characterization as necessary for profile updates	Already contained in 2 closed-head 55-gal carbon drums. Must cap openings or over-pack for shipment.	Once removed from system – Material needs to be moved to Hazardous Waste Storage Area – See Appendix A for labeling and disposal instructions	Veolia – Profile 058763 – Refer to Appendix A
Office Trash, Sampling PPE, Construction Debris	Non Hazardous	None	Place in opaque trash bags and place in the on-site industrial waste dumpster	None	Off-Site - Contract (TBD)
Aerosol Cans & Calibration Gas Canisters (See Appendix B)	TBD	None	TBD	RCRA Hazardous Waste: Accumulation Date	Veolia – Profile (TBD)
Used Oil and Hydraulic Fluids	Non-Hazardous	None	Place in DOT-approved 55-gallon steel drum until full.	"Used Oil" or "Hydraulic Fluids," Date containerized	Veolia – Profile (TBD)

Anticipated Waste Streams

Universal Waste					
Waste Stream	RCRA Classification	Waste Characterization Testing	Container Requirements and Estimated Volume	Labeling Requirements	Anticipated Disposal Method
Used Batteries (Miscellaneous Types) See Appendix C	Universal Waste	None	TBD	TBD	Veolia – Profile
Fluorescent light bulbs	Universal Waste	None	Place in original container until full.	“Used Lamps,” Date containerized yearly shipment	Veolia – Profile (TBD)
Used/Old Computer/Electronic equipment	None	None	None	None	Disposal through DuPont Sales and Redeployment Center.

5.2 Universal Wastes

The following universal waste may be generated at the Ferdula Landfill. Once generated, it will be managed as identified.

5.2.1 Used Batteries

The Ferdula plant has identified that the following types of batteries are used at the site. See Appendix C for guidance on storage and disposal of used batteries identified at the site:

- Alkaline AA, AAA, C, and D batteries
- Mercury lighting fixture or illumination type equipment.
- NiCad batteries in calculators, computers, or laboratory equipment.
- Lead Acid batteries in site vehicles
- Lithium batteries in site laptop computers

Disposal is through Veolia Services. Once ready to be disposed of, your waste consultant will arrange proper disposal

5.2.2 Fluorescent Light Bulbs

The Ferdula plant will consider fluorescent light bulbs universal waste and will be stored, managed, and disposed accordingly to DuPont policy.

In general, accumulating fluorescent light bulbs under the universal waste rule requires the following:

- At disposal, shipment under a standard bill-of-lading is used.
- During storage, the words “Used Lamps” are written on the storage container.
- A hazardous waste transport is not required.

“Used Lamps” will be disposed of on a yearly basis (i.e., every January 1st). Disposal arrangements will be completed by contacting CRG Waste Disposal Consultant.

5.2.3 Computer Equipment

Disposition of old computer/electronic/process equipment will be arranged through DuPont Sales & Redeployment Center in New Castle, Delaware. The AECOM Waste Management Network will work with asset management for proper disposal. The contact for DuPont asset management is:

Raymond Weitzel
DuPont Asset Management
DuPont Engineering & Operations
Chestnut Run Plaza, Bldg. 723/Rm 1156
302-999-2941 (office)
302-355-4199 (fax)
Raymond.Weitzel@USA.dupont.com

6.0 Waste Handling Procedures

6.1 Waste Storage and Inspection Requirements

Hazardous waste containers generated from this project will be stored in the treatment building and may remain in this area until shipment. Storage limits are generally the following.

Waste Type	Generator Status	Storage Time Limit	Inspection Requirements
RCRA Non-Hazardous	Not Applicable	1 Year	Initial Inventory, and as added
RCRA Hazardous	Conditionally Exempt Small Quantity Generator	NA	NA

6.2 Container Labeling Instructions

As necessary, all containerized waste will be staged in sealed DOT-approved containers and marked with the date waste was first placed in the storage container (e.g., roll-off box, drum). As necessary, the words HAZARDOUS WASTE will be noted on each container.

Example labels for the waste streams are included in Appendix D. Label information will be completed in a permanent marker by the DuPont Site Representative (DSR) or designee.

6.3 Waste Container Inventory Documentation

As necessary, a Field Documentation Form (Appendix E) needs to be forwarded by the field team AECOM Waste Management Group to facilitate disposal with appropriate vendors.

7.0 Spill Response and Reporting Requirements

7.1 Project Contacts

Should a release occur of any of the substances identified below, the release will be reported to the project contacts identified in Section 1.1. **At all times, plant reporting procedures should be followed first.**

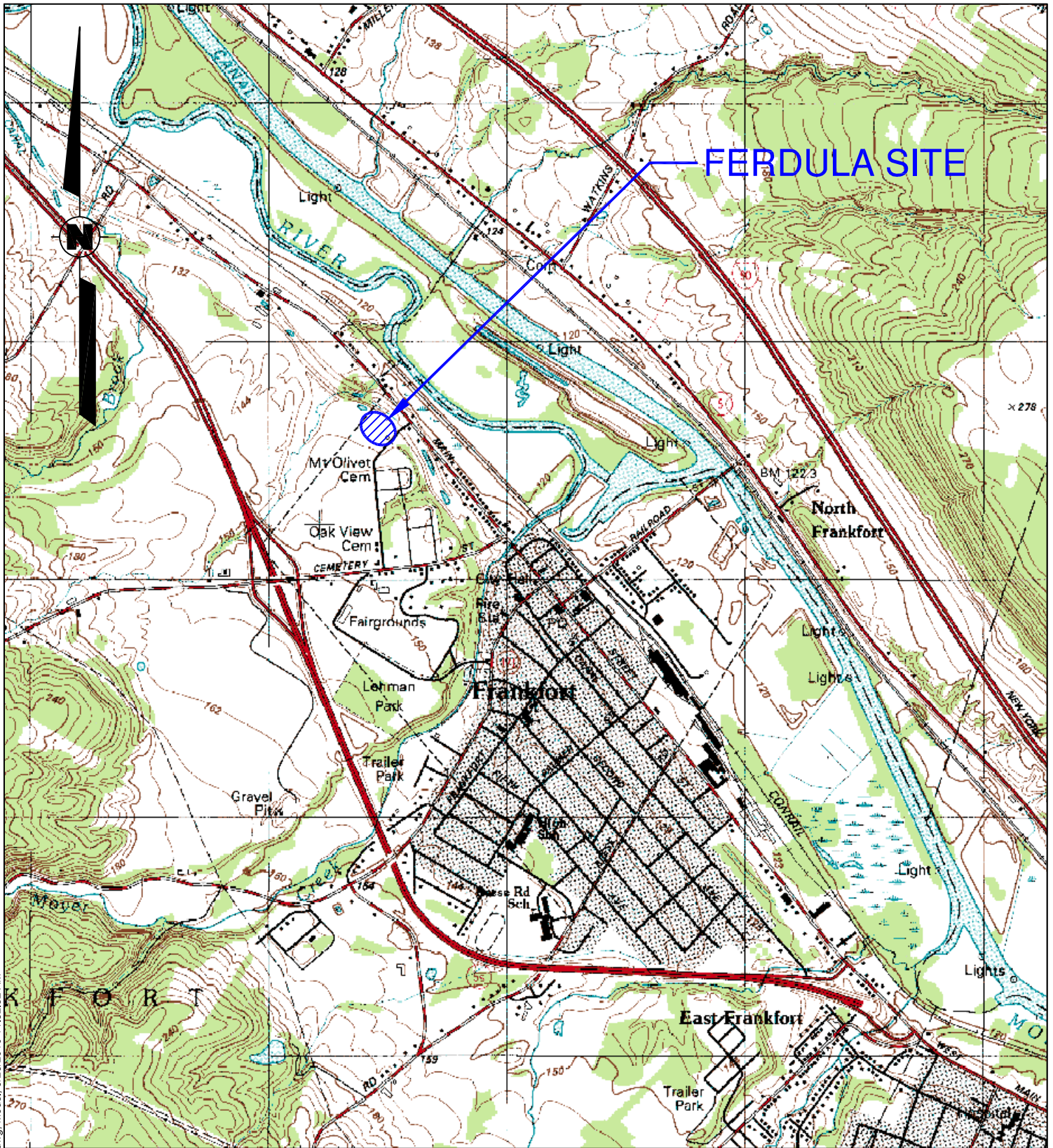
Chemical Substance	Reportable Quantity (RQ)
Petroleum Products (Motor Oil, Hydraulic Oil)	• Cannot cause a sheen on the surface of the water • Cannot violate applicable water quality standards • Cannot cause a sludge or emulsion to be deposited beneath the surface of the water or upon adjoining shoreline

If the release exceeds the quantity cited above the release may need to be reported to the appropriate federal and/or state agency.

Sathya Yalvigi shall notify the following agencies as necessary.

Name	Telephone
USEPA- National Response Center	800-424-8802
Local Emergency Planning Commission (LEPC)—	911
New York State Department of Environmental Conservation 24-hour Notification Number	800-457-7362

Figures



SCALE

2000 0 2000 FEET

SOURCE: USGS 7.5 MIN. QUADRANGLE: ILLON, NY

DESIGNED BY:

DRAWN BY:
D. LITTEL

DATA QUALITY CHKD:

APPROVED BY:



URS Corporation
4051 Ogletown Road, Suite 300
Newark, Delaware 19713
Ph.: (302) 781-5900

SITE LOCATION MAP

FERDULA LANDFILL
FRANKFORT, NEW YORK

PROJECT NO.
SITELOC

DATE
5/26/10

FIGURE No:

1



Appendices

Appendix A

Quarterly Carbon Change-Out Procedures

Standard Operating Procedure for Performing Disposal of Spent Carbon Drums at the Ferdula Landfill in Frankfort, New York

1. Parsons (Ed Ashton or Dale Dolph) will contact Tim Pezzino of AECOM Waste Management (WM) at 716-923-1111 or 716-570-6846 to inform AECOM WM that spent carbon drums from the above referenced site are available for disposal.
2. AECOM WM will then broker a disposal contractor to pick-up and transport the spent carbon drums to a disposal facility for proper disposal following all applicable federal, state, and local regulations. The following is the disposal contractor contact:
Profile Generator: 555840
Sales Representative: William J Clain
Phone: 518 878-7312
3. Once AECOM WM has brokered the vendor, AECOM will contact Parsons to schedule a date in which a Parsons representative and the vendor can meet at the site to perform the pick-up of spent carbon drums.
4. Prior to scheduled meeting date mentioned above, AECOM will mail all applicable paper work and waste manifests to Parsons so Parsons can have and give paper work/ manifests to vender's representative on scheduled meeting date.
5. When all spent carbon drums have been disposed and all required signatures on the manifests have been acquired. Parsons will forward a copy of completed manifests to AECOM WM. AECOM Delaware will maintain copies of all generated paperwork.

Parsons will also be responsible for acquiring new carbon drum for the site.

Appendix B

DuPont CRG Waste Management Network Protocol for Spent Aerosol-Can Management

GUIDANCE FOR AEROSOL CANS AND CALIBRATION GAS CANISTER DISPOSAL

1.0 Overview

The DuPont Corporate Remediation Group (CRG) frequently uses products in aerosol cans and equipment calibration gas in disposable canisters. CRG employees using these materials must dispose of them using the procedures outlined in this document.

2.0 Regulatory Basis

Aerosol products such as equipment lubricants, marking paint, starter fluid, and disposable calibration gas canisters contain compressed gases. These containers, along with their contents, are potential Resource Conservation and Recovery Act (RCRA) regulated hazardous wastes for disposal due to the following:

- ❑ Residual compressed gases within the container (e.g., empty spray cans can contain residual pressure)
- ❑ The nature of the product in the container (e.g., flammable solvents, flammable calibration gas)
- ❑ The nature of the aerosol propellant (e.g., propanol)

3.0 Recommended Aerosol Alternatives

Because of the difficulty in managing aerosol cans, all project teams should attempt to identify alternatives to using aerosol cans. Potential substitutions are listed below.

Common Aerosol	Alternative
WD-40	Liquid Wrench
Spray paint	Stakes and flags
Insect repellent	Pump spray bottle or lotion

4.0 Aerosol Can and Calibration Gas Canister Disposal Procedures

CRG contractors that bring aerosol containers or calibration canisters on-site for field activities are responsible for their disposal. Spent cans or canisters must be taken with them when leaving the site.

Aerosol can and calibration gas canister disposal procedures are detailed in the sections below.

4.1 Aerosol Can Disposal Procedure

Aerosol can disposal procedures for active sites are as follows:

1. Consult the area superintendent or site environmental coordinator and identify the location of the site aerosol accumulation area.
2. Place the aerosol can in the accumulation area/container for proper management per site-specific procedures.

Aerosol can disposal procedures for inactive or vacant sites are as follows:

1. Completely discharge the can contents until the propellant cannot be heard exiting the spray valve.
2. Locate a local recycling collection center or collection vessel for consumer quantity aerosol cans. Depositories for aerosol cans are usually located along with other recycling containers at schools and other public buildings.
3. Place aerosol cans in the recycling collection container.

4.2 Calibration Gas Canister Disposal Procedures

Calibration gas canister disposal procedures are as follows:

1. Completely empty the calibration gas canister using the regulator provided. No pressure should record on the register gauge and no hiss or escaping gas should be heard.
2. Write the word “empty” on the outside of the canister with a permanent marker.
3. When possible, dispose of empty canister in a DuPont-controlled waste receptacle or scrap metal container. If this is not possible, discard the canister in an industrial or other waste dumpster.

DO NOT SHIP PARTIALLY USED OR EMPTY CALIBRATION
CANISTERS BACK TO THE VENDOR.

5.0 Contacts

The individuals listed below are available to help with questions related to these disposal procedures.

Contact	Phone No.
<i>AECOM Diamond Waste Network</i>	
	(
Betsy Bishop	(303) 216-2558
<i>DuPont Environmental Treatment (DuET)</i>	
Mitch Press	(856) 540-4330

Appendix C

CRG Battery Mangement

DuPont Corporate Remediation Group

Battery Disposal Guidance

The following identifies proper disposal for various types of batteries.

Batteries that can be Disposed of in the Trash

Alkaline: e.g., flash light, wall clock, radio, smoke alarms, etc.

This type of battery is not an EPA Hazardous Waste. Disposal method is into the regular trash. If you are not sure use Battery Collection Containers or ask).

Batteries that need to be Managed as Hazardous Waste 90-Day Accumulation Area

Mercury: e.g., used in some lighting fixtures, watches, hearing aids, etc.

These batteries contain mercury and are therefore an EPA Hazardous Waste (Waste Code D009). They must be put into a secondary container (see below) and disposed of off-site.¹

NiCad: e.g., used in some watches, calculators, lab equipment, etc.

These batteries contain nickel and cadmium and are therefore an EPA Hazardous Waste (Waste Code D006). They must be put into a secondary container (see below) and disposed of off-site.¹

Lead Acid: e.g., used in emergency lights, vehicles, etc.

These batteries contain Lead (Waste Code D008) and acid (Waste Code D002) and are therefore an EPA Hazardous Waste. They must be put into a secondary container (see below) and disposed of off-site.¹

Lithium: e.g., used in laptop computers, cameras, office and lab equipment, etc.

Some lithium batteries are "Reactive" (D003) under certain conditions. Best Practice is to consider all Li batteries D003. They must be put into a secondary container (see below) and disposed of off-site.²

Battery Collection Containers / Battery Bins / Battery Satellite Containers

These containers are provided in some facilities to assist with battery disposal. Place by type in separate clear plastic bags to avoid cross contamination in case of leaks. These batteries will be collected by Waste Management, sorted and properly labeled for disposal.



¹ When mixed types in secondary container place each type in clear plastic bag.

² Lithium batteries are not subject to the D003/Reactivities Handling Procedure for other D003's.

Appendix D

Waste Container Labels

NON- HAZARDOUS Waste

OPTIONAL INFORMATION

SHIPPER DuPont – Ferdula Site

ADDRESS Route 5S & Rd 2 Box 3

CITY, STATE, ZIP Frankfort, NY 13340

CONTENTS

NON-HAZARDOUS WASTE

Hazardous Waste

Pending Analysis

LOCATION: DuPont Ferdula Landfill

ACCUM. DATE:

SAMPLE DATE:

MU-62395

UNIVERSAL WASTE

CONTENTS**ACCUMULATION START DATE****SHIPPER**

DuPont Ferdula Landfill

ADDRESS

Route 5S & Rd 2 Box 3

CITY, STATE, ZIP

Frankfort, NY 13340

Appendix E

Waste Management Field Documentation Form

Waste Management Field Documentation Form

The DuPont Site Representative (DSR) is to submit this form to the AECOM Waste Management Network Consultant via electronic mail at the completion of the project. The designated Waste Management Consultant for this project is:

WM Name: _____ Email: _____ Phone: _____

General Information

Field Event Date(s): _____

CRG Project No. _____ Project Manager: _____

Site Name: _____ Project Name: _____

Site Address: _____

DSR: _____ Phone: _____

Site Environmental Coordinator/Contact: _____ Phone: _____

Waste Information

1. Does this project need help from your AECOM WM Consultant to dispose of waste from this project?

_____ YES _____ NO

2. If the answer to the above question is NO, who will be responsible for disposal of the waste?

3. If the answer is YES, please complete the attached waste inventory sheet.

Waste Inventory Sheet

Container Number	Matrix (e.g. Soil, GW)	Container Type (e.g. roll-off, drum)	Percent Full	Label (e.g. Hazardous, Pending)	Accumulation Start Date	Waste Characterization Sample Name (If applicable)

ATTACHMENT E

PFAS TARGET ANALYTE LIST

sources of these chemicals. Like routine refinements to parameter lists based on investigative findings, the full PFAS target analyte list may not be needed for all sampling intended to define the extent of contamination. Project managers may approve a shorter analyte list (e.g., just the UCMR3 list) for some reporting on a case by case basis.

1,4-Dioxane Analysis and Reporting: The method detection limit (MDL) for 1,4-dioxane should be no higher than 0.28 µg/l (ppb). ELAP offers certification for both EPA Methods 8260 and 8270. In order to get the appropriate detection limits, the lab would need to run either of these methods in "selective ion monitoring" (SIM) mode. DER is advising the use of method 8270, since this method provides a more robust extraction procedure, uses a larger sample volume, and is less vulnerable to interference from chlorinated solvents (we acknowledge that 8260 has been shown to have a higher recovery in some studies).

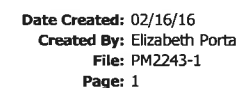
Full PFAS Target Analyte List

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	PFPaA	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/PFTriDA	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	Perfluorooctanesulfonamide	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

Bold entries depict the 6 original UCMR3 chemicals

ATTACHMENT F

PARAMETERS ANALYTICAL METHODS, REPORTING LIMITS, QUALITY CONTROL LIMITS, AND CONTAINER REQUIREMENTS



1,4 Dioxane via EPA 8270D-SIM (WATER)

Holding Time: 7 days
Container/Sample Preservation: 2 - Amber 500ml unpreserved

Please Note that the information provided in this table is subject to change at anytime at the discretion of Alpha Analytical, Inc.



Mansfield, MA • Mahwah, NJ • Albany, NY • Buffalo, NY



<u>Compound</u>	<u>CAS Number</u>	<u>MDL</u>	<u>LOQ</u>	<u>Units</u>	<u>Bottle Volume</u>	<u>Bottle Container</u>	<u>Bottle Count</u>	<u>Preservative</u>
6:2 fluorotelomersulfonate	27619-97-2	1	2	ng/l	250 ml	round plastic	1	None
8:2 fluorotelomersulfonate	39108-34-4	2	6	ng/l	250 ml	round plastic	1	None
NEtFOSAA	2991-50-6	1	3	ng/l	250 ml	round plastic	1	None
NMeFOSAA	2355-31-9	1	3	ng/l	250 ml	round plastic	1	None
Perfluoro-Octanesulfonic Acid	1763-23-1	0.4	2	ng/l	250 ml	round plastic	1	None
Perfluorobutanesulfonic Acid	375-73-5	0.3	1	ng/l	250 ml	round plastic	1	None
Perfluorobutanoic acid	375-22-4	2	6	ng/l	250 ml	round plastic	1	None
Perfluorodecanesulfonate	335-77-3	0.6	2	ng/l	250 ml	round plastic	1	None
Perfluorodecanoic acid	335-76-2	1	2	ng/l	250 ml	round plastic	1	None
Perfluorododecanoic acid	307-55-1	0.3	1	ng/l	250 ml	round plastic	1	None
Perfluoroheptanesulfonate	375-92-8	0.4	2	ng/l	250 ml	round plastic	1	None
Perfluoroheptanoic acid	375-85-9	0.3	1	ng/l	250 ml	round plastic	1	None
Perfluorohexanesulfonic Acid	355-46-4	0.4	2	ng/l	250 ml	round plastic	1	None
Perfluorohexanoic acid	307-24-4	0.4	2	ng/l	250 ml	round plastic	1	None
Perfluorononanoic acid	375-95-1	0.4	2	ng/l	250 ml	round plastic	1	None
Perfluorooctanesulfonamide	754-91-6	1	3	ng/l	250 ml	round plastic	1	None
Perfluorooctanoic acid	335-67-1	0.3	1	ng/l	250 ml	round plastic	1	None
Perfluoropentanoic acid	2706-90-3	2	6	ng/l	250 ml	round plastic	1	None
Perfluorotetradecanoic acid	376-06-7	0.3	1	ng/l	250 ml	round plastic	1	None
Perfluorotridecanoic acid	72629-94-8	0.3	1	ng/l	250 ml	round plastic	1	None
Perfluoroundecanoic acid	2058-94-8	0.4	2	ng/l	250 ml	round plastic	1	None

Reporting limits and statistical QC windows are evaluated periodically and are subject to change.

ATTACHMENT G

**QUALITY ASSURANCE PROJECT PLAN, NYSDEC PROJECTS
DATED OCTOBER 2017**

Quality Assurance Project Plan (QAPP)

Inactive Landfill Initiative (ILI)

Prepared For:



Division of Materials Management
625 Broadway, 12th floor
Albany, NY 12233-7012

Prepared By:

PARSONS

301 Plainfield Road, Suite 350
Syracuse, NY 13212



333 W. Washington Street
Syracuse, NY 13202

REVIEWED AND APPROVED BY:

Program Manager: _____

Date

October 2017

TABLE OF CONTENTS

	<u>Page</u>
SECTION 1 PROJECT DESCRIPTION	1-1
1.1 INTRODUCTION	1-1
SECTION 2 PROJECT ORGANIZATION.....	2-1
2.1 PROJECT AND Team ORGANIZATION	2-1
2.1.1 Analytical Services	2-1
2.2 SPECIAL TRAINING/CERTIFICATION	2-1
SECTION 3 DATA QUALITY OBJECTIVES AND DATA QUALITY CRITERIA.....	3-1
3.1 INTRODUCTION	3-1
3.1.1 Data Use Objectives	3-2
3.2 DATA QUALITY OBJECTIVES (PARCCS PARAMETERS)	3-2
3.2.1 Introduction	3-2
3.2.2 PARCCS Parameters (Data Quality Indicators).....	3-3
3.2.2.1 Precision	3-3
3.2.2.2 Accuracy	3-4
3.2.2.3 Representativeness	3-5
3.2.2.4 Completeness.....	3-6
3.2.2.5 Comparability	3-7
3.2.2.6 Sensitivity and Quantitation Limits.....	3-7
SECTION 4 DATA ACQUISITION.....	4-1
4.1 SAMPLING METHODS.....	4-1

**TABLE OF CONTENTS
(Continued)**

	<u>Page</u>
4.2 SAMPLE HANDLING AND CUSTODY	4-3
4.2.1 Sample Handling	4-3
4.2.2 Field Sample Custody.....	4-4
4.2.3 Laboratory Sample Management	4-6
4.2.4 Sample Receipt and Logging.....	4-6
4.2.5 Sample Storage Security.....	4-7
4.2.6 Retention and Disposal of Samples	4-8
SECTION 5 DATA MANAGEMENT	5-1
5.1 INTRODUCTION	5-1
5.2 FIELD DATA MANAGEMENT	5-1
5.3 LABORATORY DATA MANAGEMENT	5-2
SECTION 6 DOCUMENTS AND RECORDS	6-1
6.1 INTRODUCTION	6-1
6.2 FIELD RECORDS.....	6-1
6.2.1 Field Log	6-1
6.2.2 Electronic Field Data Management	6-2
6.2.3 Chain-of-Custody Record.....	6-2
6.3 LABORATORY RECORDS.....	6-3
6.3.1 Operational Calibration Records	6-4
6.3.2 Maintenance Records	6-5

**TABLE OF CONTENTS
(Continued)**

	<u>Page</u>
6.3.3 Nonconformance Memos	6-5
6.3.4 Corrective Action Request (CAR) Forms	6-5
6.3.5 Analytical Data Reports	6-5
6.4 DATA VALIDATION AND AUDIT RECORDS.....	6-6
6.4.1 Data Usability Summary Reports.....	6-6
6.4.2 Audit Reports.....	6-6
SECTION 7 ANALYTICAL PROCEDURES	7-1
7.1 INTRODUCTION	7-1
7.2 STANDARD OPERATING PROCEDURES	7-1
SECTION 8 QUALITY CONTROL.....	8-1
8.1 INTRODUCTION	8-1
8.1.1 Field Quality Control Samples	8-1
8.1.1.1 Equipment Rinse Blanks	8-2
8.1.1.2 Field Duplicates.....	8-2
8.1.1.3 Trip Blanks	8-2
8.1.1.4 Temperature Blank	8-2
8.1.2 Laboratory Quality Control Samples.....	8-3
8.1.2.1 Matrix Spike/Matrix Spike Duplicate/ Matrix Duplicates .	8-3
8.1.2.2 Laboratory Control Samples.....	8-4
8.1.2.3 Method and Preparation Blanks	8-4
8.1.2.4 Surrogate Spike Analyses.....	8-4

**TABLE OF CONTENTS
(Continued)**

	<u>Page</u>
8.2 INSTRUMENT/EQUIPMENT TESTING, INSPECTION, AND MAINTENANCE	8-5
8.2.1 Field Equipment	8-5
8.2.2 Laboratory Instrumentation	8-5
8.3 INSTRUMENT/EQUIPMENT CALIBRATION AND FREQUENCY.....	8-6
8.3.1 Field Instruments	8-6
8.3.2 Laboratory Instruments	8-6
8.3.3 Calibration System	8-7
8.3.3.1 Calibration Procedures	8-7
8.3.3.2 Equipment Identification	8-7
8.3.3.3 Calibration Frequency	8-8
8.3.3.4 Calibration Reference Standards	8-8
8.3.4 Operational Calibration	8-8
8.3.4.1 Preparation of a Calibration Curve.....	8-8
8.3.4.2 Periodic Calibration.....	8-9
8.4 INSPECTION/ACCEPTANCE OF SUPPLIES AND CONSUMABLES .	8-9
SECTION 9 DATA VALIDATION AND USABILITY ELEMENTS	9-1
9.1 DATA REVIEW, VERIFICATION, AND VALIDATION	9-1
9.2 VERIFICATION AND VALIDATION METHODS	9-3

**TABLE OF CONTENTS
(Continued)**

	<u>Page</u>
9.2.1 Laboratory	9-3
9.2.2 Analytical Data Validation	9-3
9.3 RECONCILIATION WITH USER REQUIREMENTS	9-6
SECTION 10 ASSESSMENT AND OVERSIGHT	10-1
10.1 ASSESSMENTS AND RESPONSE ACTIONS.....	10-1
10.2 PROJECT-SPECIFIC AUDITS	10-1
10.2.1 System Audits.....	10-1
10.2.2 Performance Audits	10-1
10.2.3 Formal Audits.....	10-2
10.2.4 Laboratory Audits.....	10-2
10.2.4.1 Laboratory Performance Audits	10-2
10.2.4.2 Laboratory Internal Audits	10-3
10.2.4.3 Laboratory Data Audits	10-3
10.2.4.4 Laboratory Audit Procedures	10-3
10.2.4.5 Laboratory Documentation.....	10-4
10.3 CORRECTIVE ACTIONS.....	10-4
SECTION 11 REPORTS TO MANAGEMENT.....	11-1
11.1 QA REPORTS	11-1
SECTION 12 REFERENCES.....	11-1

**TABLE OF CONTENTS
(Continued)**

LIST OF TABLES

Table 6.1 Summary of Field, Laboratory, and Data Management Records	6-7
Table 8.1 Summary of Field QC Sample Types and Collection Frequency.....	8-10
Table 8.2 Laboratory Quality Control Sample Frequency.....	8-11
Table 8.3 Operational Calibration Formulas	8-12
Table 8.4 Periodic Calibration Requirements.....	8-13
Table 8.5 Sample Concentration Calibration Formulas.....	8-14

LIST OF FIGURES

Figure 4.1 Sample Custody Flow Chart.....	4-9
Figure 4.2 Example Chain-of-Custody	4-10
Figure 10.1 Corrective Action Request Form.....	10-7

LIST OF ATTACHMENTS

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

LIST OF ACRONYMS

ASTM	American Society for Testing and Materials
BFB	4-Bromofluorobenzene
°C	Degrees Celsius
CAR	Corrective Action Request
CCV	Continuing Calibration Verification
CERCLA	Comprehensive Emergency Response, Compensation, Liability Act
CFR	Code of Federal Regulations
CLP	Contract Laboratory Program
cm/s	centimeter per second
COC	Chain-of-Custody
CPOI	Chemical Parameter of Interest
CVAA	Cold Vapor Atomic Absorption
cy	cubic yards
DFTPP	decafluorotriphenylphosphine
DOT	Department of Transportation
DQO	Data Quality Objective
DUO	Data Use Objective
DUSR	Data Usability Summary Report
EDD	Electronic Data Deliverable
FS	Feasibility Study
GC	Gas Chromatography
GC/ECD	Gas Chromatography/Electron Capture Detection
GC/MS	Gas Chromatography/Mass Spectroscopy
HSC	Health and Safety Coordinator
ICP	Inductively Coupled Plasma

LIST OF ACRONYMS (CONTINUED)

ICV	Initial Calibration Verification
IDL	Instrument Detection Limit
ICP/AES	Inductively Coupled Plasma/Atomic Emission Spectroscopy
LCS	Laboratory Control Sample
LIMS	Laboratory Information Management System
LNAPL	Light Non-aqueous Phase Liquid
LPM	Laboratory Project Manager
MD	Matrix Duplicate
mg/kg	milligram per kilogram
mL	milliliter
MS	Matrix Spike
MSB	Matrix Spike Blank
MS/MD	Matrix Spike/Matrix Duplicate
MS/MSD	Matrix Spike/Matrix Spike Duplicate
MSD	Matrix Spike Duplicate
NCM	Nonconformance Memo
ng	nanograms
NIOSH	National Institute of Safety and Health
NIST	National Institute of Standards and Technology
NYSDEC	New York State Department of Environmental Conservation
NYSDOH	New York State Department of Health
OM	Operations Manager
OSHA	Occupational Safety and Health Administration
PAHs	Polynuclear Aromatic Hydrocarbons
PARCCS	Precision, Accuracy, Representativeness, Completeness, Comparability, and Sensitivity
PCB	Polychlorinated Biphenyl

LIST OF ACRONYMS (CONTINUED)

PE	Performance Evaluation
PID	Photoionization Detector
PFCs	Perfluorinated Compounds
PRRL	Project Required Quantitation Limit
PT	Performance Testing
QA	Quality Assurance
QA/QC	Quality Assurance/Quality Control
QAO	Quality Assurance Officer
QAPP	Quality Assurance Project Plan
QC	Quality Control
QL	Quantitation Limit
RL	Reporting Limit
ROD	Record of Decision
RPD	Relative Percent Difference
SAP	Sampling and Analysis Plan
SDG	Sample Delivery Group
SMU	Sediment Management Unit
SOP	Standard Operating Procedure
SVOC	Semivolatile Organic Compound
TAL	Target Analyte List
TCL	Target Compound List
ug	Micrograms
USEPA	United States Environmental Protection Agency
VOC	Volatile Organic Compound

SECTION 1

PROJECT DESCRIPTION

1.1 INTRODUCTION

This Quality Assurance Project Plan (QAPP) has been prepared to support activities and specifies the quality assurance/quality control (QA/QC) procedures for field and laboratory sampling and measurements for the Inactive Landfill Initiative (ILI) Work Assignment issued by the New York State Department of Environmental Conservation (NYSDEC) under Superfund Standby Contract No. D007623-33 (WA #33). 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 USEPA guidance (USEPA, 2000a, 2002b). Project or site specific work plans will have additional scope and quality requirements that may not be addressed in this QAPP.

Project scope and descriptions of the ILI work assignment are provided in the ILI Work Assignment Scoping Documents and Field Activities Plan (FAP). The target analytes, perfluorinated compounds (PFCs), can be found in many standard environmental sampling materials, including: Fluoropolymer bailer/tubing, some decontamination solutions, and pump bladders/valves. One specific PFC compound, perflouroctanoic 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, and to avoid the introduction of external contaminant sources.

SECTION 2

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 in the ILI Work Assignment Scoping Documents and in Figure 2.1. The project organization is designed to promote the exchange of information and for efficient project operation. Key contact information is also summarized in the ILI Work Assignment Scoping Documents.

2.1.1 Analytical Services

The analytical laboratory (or laboratories) will analyze environmental samples collected for the ILI project. 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 all laboratory activities associated with 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 Leaders will check that all onsite personnel have read and understood the QAPP.

Field personnel will be required to adhere to the ILI Health and Safety Plan (HASP) and FAP. They must also follow applicable task-specific health and safety plans that project subcontractors develop before they begin investigation activities.

Laboratories will have trained and experienced staff capable of performing the analyses specified in this QAPP. Laboratories will have New York State Department of Health (NYSDOH) Environmental Laboratory Accreditation Program (ELAP) certification for all project analyses where applicable. Additionally, the laboratories 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,

QUALITY ASSURANCE PROJECT PLAN

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 NYSDEC Analytical Services Protocol (ASP) and the USEPA National Functional Guidelines with regional modifications.

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Vimal Minocha

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Regional Coordinators
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Scott Tucker (Regions 4, 5, 6)
George Moreau (Regions 7, 8, 9)

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Field Staff
Drilling Oversight
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Casey Fetsko
Henry Frenkel
Konrad Grochocki
Stephen Liberatore
Kevin McMullen
Peter Scharfschwerdt
Ellen Skiff
Jason Newton
Sara Hahne
Sarah Travaly
Nick Panzerra
Joe Perry

Total Station Crew
Jeff Nassimos
TBD

Groundwater Sampling /
Site Recon
Ed Ashton
Kristen Brooks
Dan Douglass
Evan Green
Nick Loizos
Kelly Miller
Chris Watson
Sara Travaly
Sara Hahne
Scott Moshier
Dan Rockefeller
Alayna Fuess
John McDougall
Technicians - TBD

SECTION 3

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 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 baseline VOCs, PAHs + 1,4-dioxane, and PFCs. 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 ILI activities, these project objectives are stated in the ILI Scoping Documents.

3.2 DATA QUALITY OBJECTIVES (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 Photoionization Detectors (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 ILI 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. 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 Table 3.1.

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:

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

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>i.e.</i> , the concentration of the analyte obtained by analyzing the sample
SA	=	Spiked analyte: concentration of the analyte spike added to the sample

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

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

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, 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 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 (rinse blanks, trip blanks, temperature blanks, field duplicates) and chain-of-custody 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) 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 (MDL) 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 (RL) 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 practical quantitation limit (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 method detection limit (MDL) is defined as "the minimum concentration of a substance that can be measured and reported with 99% confidence that the analyte concentration is greater than zero" (40 CFR 136 Appendix B). The MDL is the lowest concentration at which a specific analyte in a matrix can be measured and reported with 99% confidence that the analyte concentration is greater than zero. 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.

The MDLs to be used are intended to allow that both nondetected and detected target compound results will be usable to the fullest extent possible for the project. An MDL check sample (an interference-free MS with all method target compounds) must be analyzed following the MDL study to determine if reasonable MDL concentrations have been achieved. The MDL check sample should be at a concentration in the range of two to four times the MDL. If any target compound is not recovered, the MDL study must be repeated. In this case, the repeated MDL should be performed with a higher concentration, based on the analyst's judgment, of the target compounds that failed in the MDL check sample. MDLs must be determined annually at a minimum, and verified by analyzing an MDL check sample on each instrument used for the applicable method.

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."

All analytical results will be reported to the MDL. 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 GC/MS analyses (i.e., SW8260C and SW8270D), a preliminary 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 Table 3.2.

QUALITY ASSURANCE PROJECT PLAN

TABLE 3.1
QUALITY CONTROL LIMITS FOR WATER SAMPLES

Analytical Parameters	Analytical Method	Matrix Spike (MS) Compounds	MS/MSD (a) % Recovery	MS/MSD RPD (b)	Laboratory Accuracy and Precision		
					LCS (c) % Recovery	Surrogate Compounds	Surrogate % Recovery
Modified Baseline VOCs	8260C	all VOCs	70-130 or lab QC limit	0-20 or lab QC limit	70-130	Toluene-d8 4-Bromofluorobenzene 1,2-Dichloroethane-d4 Dibromofluoromethane	Lab QC Limit
PAHs + 1,4-dioxane	8270D SIM	all PAHs + 1,4-dioxane	70-130 or lab QC limit	0-20 or lab QC limit	70-130	Nitrobenzene-d5 2-Fluorobiphenyl Terphenyl-d14 Phenol-d5 2-Fluorophenol 2,4,6-Tribromophenol	Lab QC Limit
PFCs	537 modified	all PFCs	70-130 or lab QC limit	0-20 or lab QC limit	70-130	Select tracer PFCs	Lab QC Limit
Baseline Leachate Parameters	See Table 3.2	all Leachate Parameters	80-120	0-20 or lab QC limit	90-110	NA	NA
Modified Baseline Metals	SW6010C/S W7470A 1631E (e)	all Metals	75-125 80-120 (mercury)	0-20	90-110	NA	NA

(a) Matrix Spike/Matrix Spike Duplicate

(b) Relative Percent Difference

(c) Laboratory Control Sample

(d) Total and dissolved mercury for surface water samples

NA - Not Applicable

Table 3.2 - Quantitation Limits

				Class GA	Lowest	Class A						Class B/C				
				Groundwater Standard	Surface Water Standard	Drinking Water	Human Consumption of fish	Fish Propagation	Fish Survival	Wildlife Protection	Aesthetic	Human Consumption of fish	Fish Propagation	Fish Survival	Wildlife Protection	Aesthetic
Parameter	Method	PQL	Units			H(WS)	Basis H(FC) code	A (C)	A (A)	W	E	Basis H(FC) code	A (C)	A (A)	W	E
Leachate Indicators																
Ammonia	350.1 / SM20 4500NH3 B/D	60	ug/L	2000	2000	2000	NS	** pH/Temp	NS	NS	NS	NS	** pH/Temp	NS	NS	NS
Chemical Oxygen Demand	410.4	50000	ug/L	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
Total Organic Carbon	EPA 9060 / SM20 5310B/C	10000	ug/L	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
Total Dissolved Solids	SM20 2540C	40000	ug/L	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
Sulfate	300	8000	ug/L	250000	250000	250000	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
Alkalinity	SM20 2320B	2000	ug/L	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
Chloride	300	2000	ug/L	250000	250000	250000	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
Bromide	300	1000	ug/L	2000 (G)	2000	2000 (G)	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
Total hardness as CaCO3	SM20 2340C	1000	ug/L	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
Inorganics																
Aluminum	SW6010C	200	ug/L	NS	100	NS	NS	100 *(I)	NS	NS	NS	NS	100 *(I)	NS	NS	NS
Antimony	SW6010C	60	ug/L	3	3	3	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
Arsenic	SW6010C	15	ug/L	25	50	50	NS	150 *(D)	340 *(D)	NS	NS	NS	150 *(D)	340 *(D)	NS	NS
Barium	SW6010C	20	ug/L	1000	1000	1000	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
Boron	SW6010C	200	ug/L	1000	10000	NS	NS	10000	NS	NS	NS	NS	10000	NS	NS	NS
Beryllium	SW6010C	3	ug/L	3 (G)	3	3 (G)	NS	11/1100 *(H1)	NS	NS	NS	NS	11/1100 *(H1)	NS	NS	NS
Cadmium	SW6010C	5	ug/L	5	5	5	NS	CALC *(H2)	CALC *(H3)	NS	NS	NS	CALC *(H2)	CALC *(H3)	NS	NS
Calcium	SW6010C	1000	ug/L	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
Chromium	SW6010C	10	ug/L	50	50	50	NS	CALC *(H4)	CALC *(H5)	NS	NS	NS	CALC *(H4)	CALC *(H5)	NS	NS
Cobalt	SW6010C	50	ug/L	NS	5	NS	NS	5	NS	NS	NS	NS	5	NS	NS	NS
Copper	SW6010C	25	ug/L	200	200	200	NS	CALC *(H6)	CALC *(H7)	NS	NS	NS	CALC *(H6)	CALC *(H7)	NS	NS
Iron	SW6010C	100	ug/L	300	300	NS	NS	300	NS	NS	300	NS	NS	NS	NS	NS
Lead	SW6010C	10	ug/L	25	50	50	NS	CALC *(H8)	CALC *(H9)	NS	NS	NS	CALC *(H8)	CALC *(H9)	NS	NS
Magnesium	SW6010C	1000	ug/L	35000 (G)	35000	35000	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
Manganese	SW6010C	15	ug/L	300	300	NS	NS	300	NS	NS	300	NS	NS	NS	NS	NS
Nickel	SW6010C	40	ug/L	100	100	100	NS	CALC *(H10)	CALC *(H11)	NS	NS	NS	CALC *(H10)	CALC *(H11)	NS	NS
Potassium	SW6010C	2000	ug/L	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
Selenium	SW6010C	35	ug/L	10	4.6	10	NS	4.6 *(D)	NS	NS	NS	NS	4.6 *(D)	NS	NS	NS
Silver	SW6010C	10	ug/L	50	0.1	50	NS	0.1 *(I)	NS	NS	NS	NS	0.1 *(I)	NS	NS	NS
Sodium	SW6010C	1000	ug/L	20000	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
Thallium	SW6010C	10	ug/L	0.5 (G)	0.5	0.5 (G)	NS	8	NS	NS	NS	NS	8	NS	NS	NS
Vanadium	SW6010C	50	ug/L	NS	14	NS	NS	14	NS	NS	NS	NS	14	NS	NS	NS
Zinc	SW6010C	20	ug/L	2000 (G)	2000	2000 (G)	NS	CALC *(H12)	CALC *(H13)	NS	5000	NS	CALC *(H12)	CALC *(H13)	NS	NS
Mercury	SW7470A	0.2	ug/L	0.7	0.7	0.7	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
MERCURY	E1631	0.0005	ug/L	0.7	0.7	0.7	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
DISSOLVED MERCURY	E1631	0.0005	ug/L	NS	0.0007	NS	0.0007 *(D)	0.77 *(D)	1.4 *(D)	0.0026 *(D)	NS	0.0007 *(D)	0.77 *(D)	1.4 *(D)	0.0026 *(D)	NS
VOLATILES																
Acetone	SW8260C	10	ug/L	50 (G)	50	50 (G)	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
Acrylonitrile	SW8260C	10	ug/L	5	0.07	0.07	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
Benzene	SW8260C	5	ug/L	1	1	1	10	210 (G)	760 (G)	NS	NS	10 A	210 (G)	760 (G)	NS	NS
Bromochloromethane	SW8260C	5	ug/L	5	5	5	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
Bromodichloromethane	SW8260C	5	ug/L	50 (G)	50	50 (G)	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
Bromoform	SW8260C	5	ug/L	50 (G)	50	50 (G)	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
Carbon disulfide	SW8260C	5	ug/L	60 (G)	60	60 (G)	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
Carbon tetrachloride	SW8260C	5	ug/L	5	0.4	0.4 (G)	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
Chlorobenzene	SW8260C	5	ug/L	5	5	5	400	5	NS	NS	20	400 B	5	NS	NS	NS
Chloroethane	SW8260C	5	ug/L	5	5	5 (G)	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
Chloroform	SW8260C	5	ug/L	7	7	7	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
Dibromochloromethane	SW8260C	5	ug/L	50 (G)	50	50 (G)	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
1,2-Dibromo-3-chloropropane	SW8260C	5	ug/L	0.04	0.04	0.04	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
1,2-Dibromoethane (Ethylene dibromide)	SW8260C	5	ug/L	0.0006	0.0006	0.0006	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
1,2-Dichlorobenzene	SW8260C	5	ug/L	3	3	3	NS	5 **	NS	NS	NS	NS	5 **	NS	NS	NS
1,4-Dichlorobenzene	SW8260C	5	ug/L	3	3	3	NS	5 **	NS	NS	30	NS	5 **	NS	NS	NS

Table 3.2 - Quantitation Limits

				Class GA	Lowest	Class A						Class B/C				
				Groundwater Standard	Surface Water Standard	Drinking Water	Human Consumption of fish	Fish Propagation	Fish Survival	Wildlife Protection	Aesthetic	Human Consumption of fish	Fish Propagation	Fish Survival	Wildlife Protection	Aesthetic
							Basis H(FC) code	A (C)	A (A)	W	E	Basis H(FC) code	A (C)	A (A)	W	E
Parameter	Method	PQL	Units			H(W S)										
trans-1,4-Dichloro-2-butene	SW8260C	5	ug/L	5	5	5 (G)	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
1,1-Dichloroethane	SW8260C	5	ug/L	5	5	5	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
1,2-Dichloroethane	SW8260C	5	ug/L	0.6	0.6	0.6	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
1,1-Dichloroethene	SW8260C	5	ug/L	5	0.07	0.07 (G)	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
cis-1,2-Dichloroethene	SW8260C	5	ug/L	5	5	5	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
trans-1,2-Dichloroethene	SW8260C	5	ug/L	5	5	5	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
1,2-Dichloropropane	SW8260C	5	ug/L	1	1	1	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
cis-1,3-Dichlororpropene	SW8260C	5	ug/L	0.4 **	0.4	0.4 **	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
trans-1,3-Dichlororpropene	SW8260C	5	ug/L	0.4 **	0.4	0.4 **	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
Ethylbenzene	SW8260C	5	ug/L	5	5	5	NS	17 (G)	150 (G)	NS	NS	NS	17 (G)	150 (G)	NS	NS
2-Hexanone	SW8260C	10	ug/L	50 (G)	50	50 (G)	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
Bromomethane	SW8260C	5	ug/L	5	5	5	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
Chloromethane (Methyl chloride)	SW8260C	5	ug/L	5	5	5	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
Dibromomethane	SW8260C	5	ug/L	5	5	5 (G)	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
Methylene chloride	SW8260C	5	ug/L	5	5	5	200	NS	NS	NS	NS	200	NS	NS	NS	NS
2-Butanone (Methyl ethyl ketone)	SW8260C	10	ug/L	50 (G)	50	50 (G)	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
Iodomethane (Methyl iodide)	SW8260C	5	ug/L	5	5	5 (G)	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
4-Methyl-2-pentanone (Methyl isobutyl ketone)	SW8260C	10	ug/L	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
Styrene	SW8260C	5	ug/L	5	5	5 (G)	NS	NS	NS	NS	50	NS	NS	NS	NS	NS
1,1,1,2-Tetrachloroethane	SW8260C	5	ug/L	5	5	5	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
1,1,1,2-Tetrachloroethane	SW8260C	5	ug/L	5	0.2	0.2 (G)	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
Tetrachloroethene	SW8260C	5	ug/L	5	0.7	0.7 (G)	1	NS	NS	NS	NS	1	NS	NS	NS	NS
Toluene	SW8260C	5	ug/L	5	5	5	6000 B	100 (G)	480 (G)	NS	NS	6000 B	100 (G)	480 (G)	NS	NS
1,1,1-Trichloroethane	SW8260C	5	ug/L	5	5	5	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
1,1,2-Trichloroethane	SW8260C	5	ug/L	1	1	1	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
Trichloroethene	SW8260C	5	ug/L	5	5	5	40	NS	NS	NS	NS	40	NS	NS	NS	NS
Trichlorofluoromethane	SW8260C	5	ug/L	5	5	5	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
1,2,3-Trichloropropane	SW8260C	5	ug/L	0.04	0.04	0.04	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
Vinyl acetate	SW8260C	5	ug/L	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
Vinyl chloride	SW8260C	5	ug/L	2	0.3	0.3	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
o-Xylene	SW8260C	5	ug/L	5	5	5	NS	65	590	NS	NS	NS	65 (G)	590 (G)	NS	NS
m,p-Xylene	SW8260C	5	ug/L	5	5	5	NS	65	590	NS	NS	NS	65 (G)	590 (G)	NS	NS
Xylenes, Total	SW8260C	5	ug/L	5	5	5	NS	65	590	NS	NS	NS	65 (G)	590 (G)	NS	NS
PAHs + 1,4-Dioxane																
Acenaphthene	8270D SIM	0.1	ug/L	20 (G)	5.3	NS	NS	5.3 (G)	48 (G)	NS	20	NS	5.3 (G)	48 (G)	NS	NS
Acenaphthylene	8270D SIM	0.1	ug/L	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
Anthracene	8270D SIM	0.1	ug/L	50 (G)	3.8	50 (G)	NS	3.8 (G)	35 (G)	NS	NS	NS	3.8 (G)	35 (G)	NS	NS
Benzo(a)anthracene	8270D SIM	0.1	ug/L	0.002 (G)	0.002	0.002 (G)	NS	0.03	0.23	NS	NS	NS	0.03 (G)	0.23 (G)	NS	NS
Benzo(a)pyrene	8270D SIM	0.1	ug/L	ND	0.0012	0.002 (G)	0.0012 (G)	NS	NS	NS	NS	0.0012 (G)	NS	NS	NS	NS
Benzo(b)fluoranthene	8270D SIM	0.1	ug/L	0.002 (G)	0.002	0.002 (G)	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
Benzo(g,h,i)perylene	8270D SIM	0.1	ug/L	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
Benzo(k)fluoranthene	8270D SIM	0.1	ug/L	0.002 (G)	0.002	0.002 (G)	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
Chrysene	8270D SIM	0.1	ug/L	0.002 (G)	0.002	0.002 (G)	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
Dibenzo(a,h)anthracene	8270D SIM	0.1	ug/L	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
Fluoranthene	8270D SIM	0.1	ug/L	50 (G)	50	50 (G)	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
Fluorene	8270D SIM	0.1	ug/L	50 (G)	0.54	50 (G)	NS	0.54 (G)	4.8 (G)	NS	NS	NS	0.54 (G)	4.8 (G)	NS	NS
Indeno(1,2,3-cd)pyrene	8270D SIM	0.1	ug/L	0.002 (G)	0.002	0.002 (G)	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
Naphthalene	8270D SIM	0.1	ug/L	10 (G)	10	NS	NS	13 (G)	110 (G)	NS	10	NS	13 (G)	110 (G)	NS	NS
Phenanthrene	8270D SIM	0.1	ug/L	50 (G)	5	50 (G)	NS	5 (G)	45 (G)	NS	NS	NS	5 (G)	45 (G)	NS	NS
Pyrene	8270D SIM	0.1	ug/L	50 (G)	4.6	50 (G)	NS	4.6 (G)	42 (G)	NS	NS	NS	4.6 (G)	42 (G)	NS	NS
1-4-Dioxane	8270D SIM	0.28 ¹	ug/L	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
Perfluorinated Compounds																
N-ethyl perfluorooctane sulfonamidoacetic acid	Modified 537	20	ng/L	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS

Table 3.2 - Quantitation Limits

				Class GA	Lowest	Class A						Class B/C				
				Groundwater Standard	Surface Water Standard	Drinking Water	Human Consumption of fish	Fish Propagation	Fish Survival	Wildlife Protection	Aesthetic	Human Consumption of fish	Fish Propagation	Fish Survival	Wildlife Protection	Aesthetic
Parameter	Method	PQL	Units			H(WS)	Basis H(FC) code	A (C)	A (A)	W	E	Basis H(FC) code	A (C)	A (A)	W	E
N-methyl perfluorooctane sulfonamidoacetic acid	Modified 537	20	ng/L	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
Perfluorobutanesulfonic acid (PFBS)	Modified 537	2.5	ng/L	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
Perfluorodecanoic acid (PFDA)	Modified 537	2.5	ng/L	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
Perfluorododecanoic acid (PFDoA)	Modified 537	2.5	ng/L	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
Perfluoroheptanoic acid (PFHpA)	Modified 537	2.5	ng/L	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
Perfluorohexanesulfonic acid (PFHxS)	Modified 537	2.5	ng/L	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
Perfluorohexanoic acid (PFHxA)	Modified 537	2.5	ng/L	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
Perfluorononanoic acid (PFNA)	Modified 537	2.5	ng/L	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
Perfluorooctanesulfonic acid (PFOS)	Modified 537	4	ng/L	70	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
Perfluorooctanoic acid (PFOA)	Modified 537	2.5	ng/L	70	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
Perfluorotetradecanoic acid (PFTeA)	Modified 537	2.5	ng/L	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
Perfluorotridecanoic Acid (PFTriA)	Modified 537	2.5	ng/L	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
Perfluoroundecanoic acid (PFUnA)	Modified 537	2.5	ng/L	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS

Notes:
PQL - Practical quantitation limit
(G) - indicates a guidance value
(1) - PQL based upon June 2017 Draft NYSDEC State Superfund (SSF) Guidance
NS - No standard.
** - standard refers to the sum of the isomers
A - Oncogenic, Human Health Basis code
B - Non-oncogenic Human Health Basis code
Source: NYSDEC Ambient Water Quality Standards and Guidance Values, 1998
*(D) - Dissolved
*(I) - Ionic
*(H#) - Calculated based on hardness

SECTION 4

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 project Field Activities Plan documents standard operating procedures, best practices, and field decontamination methods 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 bottlenecks, I-ChemTM 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 chain-of-custody 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 NYSDEC ASP and Table 4.1.

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 bottlenecks is needed during the field activities. The field team must verify that the preservative has been added appropriately.

TABLE 4.1
WATER SAMPLE CONTAINERIZATION, PRESERVATION,
AND HOLDING TIMES

Analysis	Bottle Type	Preservation (a)	Holding Time (b)
Modified Baseline VOCs	3-40 mL glass vial w/ Teflon septum	HCl to pH<2 Cool to 4°C	14 days
PAHs + 1,4-Dioxane	1000 mL glass w/ Teflon lined cap	Cool to 4°C	7 days for extraction, 40 days for analysis
PFCs	2-250 mL HDPE	Cool to 4°C	14 days for extraction, 40 days for analysis
Modified Baseline Metals	500 mL plastic bottle	HNO ₃ to pH<2 Cool to 4°C	6 months 28 days (mercury)
Ammonia and COD	125 mL plastic bottle	H ₂ SO ₄ to pH<2 Cool to 4°C	28 days
TOC	3-40 mL glass vial w/ Teflon septum	HCl to pH<2 Cool to 4°C	28 days
TDS	125 mL plastic bottle	Cool to 4°C	7 days
Sulfate, Chloride, Bromide	125 mL plastic bottle	Cool to 4°C	28 days
Alkalinity	125 mL plastic bottle	Cool to 4°C	14 days
Hardness as CaCO ₃	250 mL plastic bottle	HNO ₃ to pH<2 Cool to 4°C	6 months

(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 chain of custody 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 chain of custody will be required.

4.2.1 Sample Handling

Samples to be collected for the ILI work assignment are specified in the work plan and FAP. 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 chain of custody 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:

- 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 PFC 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°C.
- Complete the chain-of-custody form (see Section 4.2.2). Place the chain-of-custody 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 chain-of-custody form; another copy is transmitted to the QAO and the Project Manager specified.
- 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 chain-of-custody 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 the holding times as stated in the NYSDEC ASP 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, date 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 chain-of-custody 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 chain-of-custody 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 chain-of-custody record is sent with each sample.

The REMARKS space on the chain-of-custody form is used to indicate if the sample is a matrix spike/matrix spike duplicate (MS/MSD) or matrix spike/matrix duplicate (MS/MD), 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 chain-of-custody 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 chain-of-custody 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 chain-of-custody 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 chain-of-custody 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 chain-of-custody 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 chain-of-custody form, and note any discrepancies. Specifically, the sample-receiving personnel note any damaged or missing sample containers. At this time, the field chain-of-custody 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 chain-of-custody 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 standard operating procedures for laboratory sample security will be implemented to confirm that the laboratory satisfies sample chain-of-custody requirements:

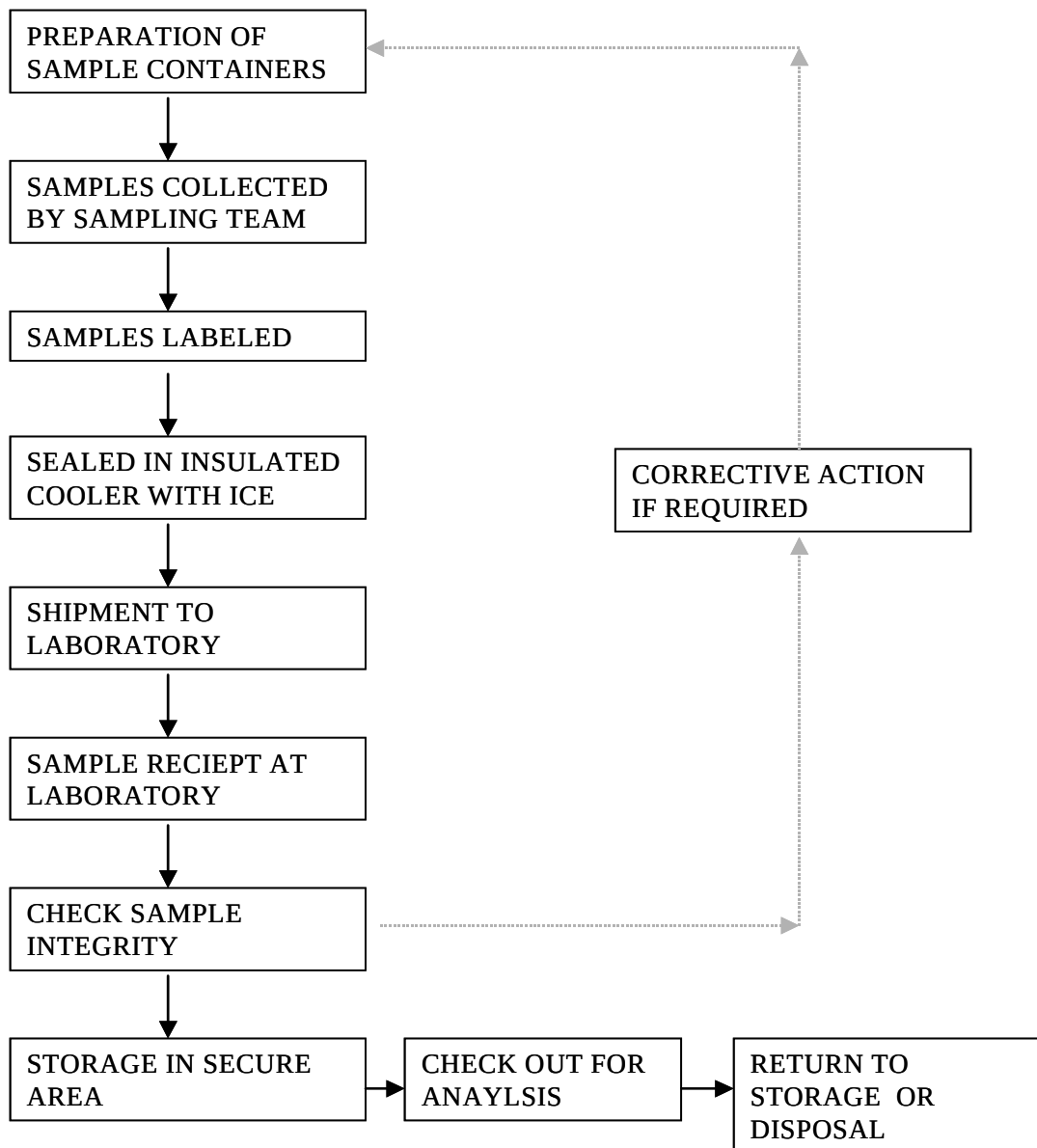
- Samples will be stored in a secure area.
- Access to the laboratory will be through a monitored area. Other outside access doors to the laboratory will be kept locked.
- Visitors must sign a visitor's log and will be escorted while in the laboratory.
- Refrigerators, freezers, and other sample storage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



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SECTION 5

DATA MANAGEMENT

5.1 INTRODUCTION

The electronic data management systems for each work assignment 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. He or his designee will be responsible for recording and documenting sampling activities in the field logs, on sampling records (as appropriate), and on chain-of-custody 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 will be coordinated with the Data Management Team. Each sample name will be unique to include location ID and field sample ID. 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.

SECTION 6

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, chain-of-custody 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 pre-design investigation 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 (<i>e.g.</i>, pH, temperature) - Information coordinating sample handling activities with appropriate field activities and chain-of-custody documentation <i>Daily calibration activities:</i> - 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 chain-of-custody record can be printed as well.

6.2.3 Chain-of-Custody Record

The chain of custody 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 chain-of-custody procedures. These procedures are necessary to support the validity of the data and will accompany each shipping container.

A copy of the chain-of-custody 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 Honeywell sample analyses will be maintained for the 5-yr 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 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 7 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 7 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, 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 laboratory project manager. 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 Electronic Data Deliverable (EDD) and as an analytical data package (two copies on CD-Rom and one hard copy). 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.

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, 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 Standard Operating Procedures (SOP) as described in Section 9. Additionally, the completed copies of the chain-of-custody 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 Reports

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 3.3. Additionally, the report will be used to identify, assess and present issues associated with the overall data.

6.4.2 Audit Reports

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

-	PERSON RESPONSIBLE FOR		STORAGE
	REPORT	MAINTENANCE	
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

SECTION 7

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, the Work Assignment Scoping Documents, NYSDEC ASP, 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

Standard Operating Procedures (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

SECTION 8

QUALITY CONTROL

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, 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 rinse blanks, field duplicates, and matrix spike/matrix spike duplicate (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. A rinse blank will be collected from disposable sampling equipment at a frequency of once per lot. For PFC sampling, 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 sample 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, rinse blanks will be used to evaluate the effectiveness of the decontamination procedures for chemical sampling equipment. Rinse blanks will be collected as part of all chemical sampling programs, except for waste characterization. An equipment rinse blank (rinse blank) is a sample of deionized water provided by the laboratory that is poured over or through the sampling equipment (such as split spoon, wipe template), into the sample container. A rinse blank will be collected at a frequency of 1:20 samples per type of sample collection activity using non-disposable sampling equipment. A rinse blank will be collected from disposable sampling equipment at a frequency of once per lot. For PFC sampling, rinse blanks will be collected daily using laboratory supplied PFC-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. 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 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 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 degrees Celsius (°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. The QC checks, their frequency, acceptance criteria, and corrective actions for noncompliance are summarized for each analytical method in the NYSDEC ASP.

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 wet chemistry parameters will be taken at a frequency of 1 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 rinse blanks 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 percent recovery and RPD control limits between the MS and MSD and the sample and the duplicate concentrations are provided in the NYSDEC ASP.

The original sample, MS/MSD, and MD 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 chain-of-custody 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

Laboratory Control Samples (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. LCS recoveries must meet the criteria specified in NYSDEC ASP.

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. The blank will be deionized water for water samples or a purified solid matrix such as sodium sulfate for extractable soil samples. 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. Surrogate spike recoveries should fall within the limits established by laboratory QC protocol and the NYSDEC ASP.

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. PFC-specific requirements for field sampling equipment are described in the FAP. 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
Rinse	Water	1:20 Samples. Once per lot for disposable sampling equipment. Daily for PFC sampling.
Field Duplicates	Water	1:20 Samples
Extra Volume Sample (collected for MS/MSD)	Water	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 A_x = 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 C_{is} = concentration of the internal standard (µg/L) A_x = area of the characteristic ion for the target compound A_{is} = 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:	Sensitivity (with a Class S-verified weight)	Adjust sensitivity
	Annually:	Calibrated by outside vendor against certified Class S weights	Service balance
Thermometers	Annually:	Calibrated against certified NIST thermometers	Tag and remove from service
Automatic Pipettors	Quarterly:	Gravimetric check	Service or replacement

TABLE 8.5

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	$R = (W - T)/V \times 1,000,000$	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 (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:

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

SECTION 9

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. All data will be validated following verification and reduction.

Qualified data validation personnel will assess and verify data; they will review the data against QC criteria, DQOs (Sections 3 and 9.2.2), NYSDEC ASP, 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 the FAP, 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 sample delivery group (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 chain-of-custody 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 7 yrs.

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 an EPA Level IV protocol (full validation), or an EPA 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 data usability summary report (DUSR), as defined by NYSDEC. 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 chain-of-custody 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 chain-of-custody 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 8.5 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 chain-of-custody 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 EPA 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 EPA 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 (USEPA LEVEL IV EQUIVALENT)	
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 CD-ROM and 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, 2016a, 2016b, 2016c, 2016d, 2016e). 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 chain-of-custody 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.

SECTION 10

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 FAP and this QAPP.

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 chain-of-custody 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 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 7 yr. 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.

10.2.4.5 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 nonconformance 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 _____				

SECTION 11

REPORTS 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.

SECTION 12

REFERENCES

- 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, 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)**

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 Standard Operating Procedures (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 Chain-of-Custody 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 Chain-of-Custody 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, pest/PCBs).

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 reanalyses, 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 (ie. 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 reanalyses;
- 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 reanalyses;
- 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 reanalyses;
- 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 reanalyses;
- 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 reanalyses;
- 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 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

REQUIRED LABORATORY DELIVERABLES (Continued)

Method Requirements	Laboratory Deliverables
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 SW8260B and decafluoro-triphenylphosphine (DFTPP) for method SW8270C	USEPA CLP form or equivalent instrument tuning/performance check summary form
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)/2 nd 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)

REQUIRED LABORATORY DELIVERABLES (Continued)

Method Requirements	Laboratory Deliverables
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)
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
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