QUALITY ASSURANCE PROJECT PLAN
Textron, Inc.
Former Wheatfield, New York Facility

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Acronyms and Abbreviations

ASP	Analytical Services Protocol
BAT	Bell Aerospace Textron Facility
DQO	Data quality objectives
DUSR	Data Usability Summary Reports
ELAP	Environmental Laboratory Accreditation Program
HASP	Site Specific Health and Safety Plan
IDLs	instrument detection limits
LCS	Laboratory Control Samples
MDLs	method detection limits
MS	matrix spike
MSD	matrix spike duplicates
NYSDEC	New York State Department of Environmental Conservation
PQLs	practical quantitation limits
PI	Preliminary Investigation
PID	photoionization detector
PPE	personal protective equipment
ppm	parts per million
QA/QC	Quality Assurance/Quality Control
QAPP	Quality Assurance Project Plan
RPD	relative percent difference
Shaw	Shaw Environmental and Infrastructure, Inc.
SOP	Standard Operating Procedure
SSHO	Site Safety and Health Officer
Textron	Textron Inc.
USEPA	United States Environmental Protection Agency
VOC	volatile organic compounds

1.0 INTRODUCTION

This Quality Assurance Project Plan (QAPP) has been prepared by Shaw Environmental and Infrastructure, Inc. (Shaw) on behalf of Textron, Inc. (Textron). The purpose of this document is to detail the quality assurance/quality control (QA/QC) procedures that will be followed during the collection, analysis and evaluation of analytical samples and data generated during the completion of the groundwater monitoring and gauging events completed at this site.

This document provides general information and references Shaw Standard Operating Procedures (SOP) related to analytical sampling, field equipment operation, calibration and management, data collection, field sampling and management and data quality requirements as detailed herein and in the approved contract.

2.0 QUALITY ASSURANCE PROJECT PLAN

This QAPP establishes function-specific responsibilities and authorities for data quality and defines procedures that will be followed to ensure that field sampling activities will result in the generation of reliable data. Inherent in the QA program is the implementation of QC measures. These measures provide assurance that the monitoring of quality-related events has occurred and that the data gathered in support of the project are complete, accurate, and precise. Implementation of this QAPP will help ensure the validity of the data collected and establish a firm foundation for decisions regarding this assessment. QA goals for the development and execution of the collection of data for this scope of work will be achieved through proper planning, organization, review, communication of objectives, auditing, reporting and corrective action. Personnel knowledgeable in QA theory and practice will carry out the QA program. Implementation of this QAPP requires that the program and project staff maintain an awareness of project procedures and goals. It is the policy of Shaw to provide a QA program that ensures information produced by its employees and subcontractors is valid and of known quality. These requirements include statements of completeness, comparability, representativeness, precision, and accuracy, where applicable.

2.1 Project Organization and Responsibilities

The key personnel positions for the completion of the site assessments and their responsibilities are summarized below. Project specific personnel will be determined for individual work assignments based upon experience, geographic location and discussions with the Textron Project Manager.

Project Manager: Responsible for ensuring that all activities are conducted in accordance with the approved work plans. The Project Manager will also provide technical coordination with the Textron representative. The Project Manager is responsible for management of all operations conducted for this project. He or she will ensure that all personnel assigned to this project, including subcontractors, review the technical plans before any task associated with the project is initiated. The Project Manager will monitor the project budget and schedule and ensure availability of necessary personnel, equipment, subcontractors, and services.

He/she will participate in the development of the field program, evaluation of data, development of conclusions and recommendations, and reporting.

Shaw Field Operations Leader: Provides management of the field activities. This person is responsible for ensuring that technical matters pertaining to the field program are addressed. They will extensively participate in data interpretation, report writing, and preparation of deliverables, and will ensure that work is being conducted as specified in the technical plans. Before field activities are initiated, the Shaw Field Operations Leader will conduct a field staff orientation and briefing to acquaint project personnel with the Site, and assign field responsibilities. The Shaw Field Operations Lead reports directly to the Project Manager.

Project QC Manager: Responsible for ensuring that the QC procedures and objectives in the project-specific work plans are met, reviewing selected field and analytical data to ensure adherence to QA/QC procedures, and approving the quality of data before they are included in the Preliminary Investigation (PI) Report. The Project QC Manager is also responsible for day-to-day compliance monitoring of the approved QC plans including records filing, archiving and reporting project activities. The Project QC Manager reports directly to the Project Manager.

Site Safety and Health Officer (SSHO): Responsible for day-to-day compliance with the approved Health and Safety Plan (HASP). This plan specifies site-specific personnel training; maintenance of the medical monitoring program; management of personal protective equipment (PPE), decontamination operations, and operations support to the on-site field staff. The SSHO will ensure that all field staff maintain Occupational Safety and Health Administration Hazardous Waste Operations and Response certifications and are current under medical monitoring programs meeting 29 Code of Federal Regulations 1910.120. For the project, the SSHO reports to the Project manager. Under the Shaw Corporate umbrella, the SSHO reports to Shaw's Regional Health and Safety Director.

Project Chemist/Data Validation Manager: Will ensure that the work performed is in accordance with the QAPP, Standard Operating Procedures (SOPs), and other pertinent analytical procedures. They will also be responsible for sample tracking, data management, laboratory coordination, data interpretation, and report writing. The Project Chemist/Data Validation Manager will be responsible for the review, evaluation, and validation of all analytical data for the project and will participate in interpreting and presenting the analytical data. This includes reviewing selected field and analytical data to ensure adherence to QA/QC procedures, and approving the quality of data before they are included in the investigation reports. The Project Chemist/Data Validation Manager will also oversee and incorporate the completion of Data Usability Summary Reports (DUSR) prepared by a third party data

validation subcontractor. The Project Chemist/Data Validation Manager reports directly to the Project QC Manager.

Project Engineer: Responsible for project planning, documentation, and technical support. This position will also coordinate Work Plan development, and assist in site evaluation and support operations. The Project Engineer will report directly to the Project Manager.

Shaw Project Team: Implements field activities, field QA/QC, and health and safety operations as required in the Work Plan, and Site Health and Safety Plan. The project team will get additional specific guidance for field modifications from the field operations leader and the SSHO. The Shaw Project Team reports directly to the Shaw Field Operations Leader.

Subcontractors: Support services will be procured through competitive bidding in accordance with SOX requirements or as directed by Textron. Subcontractors will be selected based upon demonstrated experience; technical approach; staff experience; cost and schedule commitments; and business classification.

As part of the subcontracting process, all labs will supply Shaw with a copy of their analytical QAPP for Shaw's review/approval. Subcontracted analytical laboratories will perform the chemical analysis of groundwater samples collected. The laboratories will maintain their certification with the New York State Department of Health Environmental Laboratory Approval Program (ELAP). All subcontractors performing field operations (e.g., drilling, surveying, abatement, etc) report to the Project Manager. Subcontracted laboratories and data validation providers report directly to the Project Chemist.

2.2 Sample Management

Sample collection, preservation, handling, storage, packaging, and shipping will be performed in a manner that minimizes damage, loss, deterioration, and artifacts. Procedures described are designed to eliminate external contamination and to ensure data quality through the use of approved standardized sampling procedures.

2.2.1 Sample Number and Type

All samples will be assigned a unique identification code consisting of three parts. These parts consist of the project or site code, the well designation and the sampling date. Examples of the codes which may be used for each sample type are identified in the following section.

2.2.1.1 Field Samples

Groundwater Samples:

Example: BAT-87-20(1)-121020
Where: BAT = Bell Aerospace Textron Facility
87-20(1) = Monitoring Well Number
When: 121020 = Date Code (YYMMDD)

2.2.1.2 Quality Assurance/Quality Control Samples

Matrix Spike/Matrix Spike Duplicate Samples: *QA/QC* samples will include matrix spike (MS) and matrix spike duplicate (MSD) samples at a frequency of not less than 5 percent (one MS/MSD pair per every 20 samples collected). They will receive the following code:

Examples: BAT-87-20(1)-121020 MS and BAT-87-20(1)-121020 MSD

Blind Duplicate Samples: Duplicate samples are sent "blind" to the laboratory. They will receive the following code:

Example: BAT-Dup 1-121020

The sample location where a blind duplicate is collected will be marked both on the field sampling data sheet and on the copy of the chain-of-custody record retained by Shaw. A blind duplicate sample will be collected at a frequency of one per every 20.

Equipment Blanks: Equipment blanks are not required when dedicated sampling equipment is used. If non-dedicated sampling equipment is used, equipment blanks will be analyzed at a frequency of not less than 5 percent (one equipment blank per every 20 samples collected). They receive the following code:

Examples: BAT-Equipment Blank 1 or BAT-EQ 1-121020

Trip Blanks: Trip blanks are used to monitor potential aqueous sample volatile organic contamination during shipment to and from the laboratory. It also provides information on laboratory water quality since the laboratory provides the trip blank water. One trip blank will be submitted for analysis for each day aqueous matrix volatile organic samples are collected. A trip blank will be included in each cooler that contains aqueous matrix volatile organic samples, therefore all volatile organic samples and containers will be shipped to and from the laboratory in the smallest number of coolers possible in order to minimize the number of trip blanks required.

Examples: Trip Blank-101020 or TB-101020

Field Blank: Field blanks are used to determine if contamination is being introduced by the sampling environment during sample collection. Field blanks will be prepared when equipment blanks are not necessary (i.e., dedicated equipment is used for sample collection). The field blank will be prepared at one of the sampling points by exposing de-ionized water to the air and transferring the water to a set of sampling bottles. Field blanks will be obtained each day of sampling or every 20 samples, whichever is more frequent.

Examples: BAT-Field Blank-101020 or BAT-FB-101020

Split Samples: Split samples are used in a sampling program to assess the replication of results from the same analysis between two laboratories. In this case, the New York State Department of Environmental Conservation (NYSDEC) and the United States Environmental Protection Agency (USEPA) have the right to split samples with Textron and have all or a portion of the analytical parameters tested by their laboratory of choice. A split sample will be identified by inserting an 'S' after the sample designation, as described above.

Example: BAT-87-20(1)-101020 S

If split samples are to be collected, the following procedure is to be used:

- Groundwater will be poured from the same bailer into four 40 mL vials for volatile organic compound (VOC) analysis, two vials will be kept by the sampling subcontractor and two will be relinquished to agency personnel.

2.2.2 Sample Containers

All sample containers used will be of traceable quality purchased and supplied by the laboratory and certified as clean. The selection of sample containers used to collect the samples is based on the following consideration:

- Sample matrix;
- Analytical methods;
- Potential contaminants of concern;
- Reactivity of container material with sample; and
- QA/QC requirements.

The anticipated project compound list is included as **Table 1**. The required containers, preservatives and holding times will conform to the NYSDEC Analytical Services Protocol (10/95) and are tabulated in **Table 2**. All sample containers will be labeled prior to sample collection. A non-removable label on which the following information is recorded with a permanent waterproof marker (pen for volatile samples) will be affixed to each sample container for shipment to the laboratory:

- Project name/location;
- Sample identification code;
- Date and time the sample was collected (except for blind field duplicates, where the time will be omitted); and
- Analysis requested.

2.2.3 Sample Preservatives

Preservatives will be used, as applicable, to retard hydrolysis of chemical compounds and complexes, to reduce volatility of constituents, and to retard biological action during transit and storage prior to laboratory analysis. Preservation acids and bases will be added to the sample containers at the laboratory, prior to shipment, when practical.

2.2.4 Holding Times

Sample holding time is defined as the interval between sample collection to sample extraction and analysis such that a sample may be considered valid and representative of the sample matrix. The laboratory QA program will be responsible for ensuring the adequacy of the sample tracking system in precluding holding time deficiencies.

2.2.5 Packaging and COC Requirements

Sample coolers will be shipped to the laboratory via overnight courier or transported by laboratory personnel as soon as possible after sampling. The laboratory will be notified of the sample shipment and the estimated date of arrival of the samples being delivered.

2.2.5.1 Sample Packaging and Shipment

Samples will be transferred to the contract laboratory for analysis via insulated plastic coolers. Before samples can be put in the cooler, any drains will be sealed with tape to prevent leaking. Each cooler will be packed in the following manner:

1. Ensure sample lids are tight.
2. Wrap environmental samples and associated QC samples in bubble wrap and place in a watertight plastic bag.
3. Fill cooler with enough packing material to prevent breakage of glass bottles.
4. Place sufficient ice in cooler to maintain the internal temperature at 4 ± 2°C during transport. The ice will be double-bagged to prevent contact of the melt water with the samples.
5. Place associated COCs in a water proof plastic bag, and tape it with masking tape to the inside lid of the cooler.
6. Seal coolers at a minimum of two locations with signed custody seals or evidence tape before being transferred offsite. Attach completed shipping label to top of the cooler. Cover seals with wide, clear tape, and continue around the cooler.

2.2.5.2 Chain-of-Custody

Sampling will be evidenced through the completion of a COC form, which accompanies the sample containers in the field, during transit to the laboratory, and upon receipt by the laboratory. The COC will be annotated to indicate time and date that samples are relinquished. In addition, shipping containers will be affixed with custody seals.

The COC will be filled out using indelible ink and will include the following information:

- Project name and number;
- The signatures of the sampling personnel;
- The site code and sample number;
- Sampling dates, locations, and times (military format);
- List of the chemical analysis, volume, and preservatives used;
- Type of sample, whether "grab" or "composite";
- The total number of containers per location;
- The custody seal number;
- Sample relinquisher, date and time; and,
- Courier, or carrier airbill number, and analytical laboratory.

2.3 Sampling Equipment Field Decontamination

All non-dedicated manual equipment used to collect samples for chemical analyses (including trowels, spatulas, spoons, scoops, hand augers, and split spoons) will be decontaminated using the following procedures:

- Non-phosphate detergent wash;
- Water rinse (either tap water or bottled water);
- Nitric Acid wash (metals only)
- Water rinse (either tap water or bottled water);
- Laboratory-grade methanol or isopropanol rinse (only when non-aqueous phase liquids are encountered); and
- Distilled/de-ionized water rinse.

If equipment is to be stored for future use, it will be allowed to air dry, then wrapped in aluminum foil (shiny-side out) or sealed in plastic bags. Decontamination fluid will be discharged directly to the ground, away from any surface water. This equipment will be decontaminated again prior to its next use.

Pumps and Pumping Equipment: In general, all suction-lift pumps and pumping equipment that have come in contact with the water column during well development and/or purging will use dedicated and pre-cleaned tubing. If submersible pumps are used, the following cleaning procedure will be employed:

- Wash the exteriors of the pump, wiring, and cables with non-phosphate detergent;
- Pump a minimum of 5 gallons of non-phosphate detergent through the pump housing and through the pump tubing if a dedicated pre-cleaned discharge hose is not used for each well;
- Rinse with potable water;
- Pump a minimum of 25 gallons of potable water through the pump housing and through the pump tubing if a dedicated pre-cleaned discharge hose is not used for each well;
- Perform a final rinse by pumping 5 gallons of distilled/de-ionized water through the pump and pump tubing.

2.4 Analytical Methods

All samples will be analyzed using NYSDEC Analytical Services Protocol (ASP) (10/95) for Superfund CLP Volatile Organics (NYSDEC Method 95-I). The analytical methods, sample containers, preservatives and holding times are presented in **Table 2**. The QA/QC sampling frequency is presented in **Table 3**.

2.5 Data Quality Requirements

Data quality objectives (DQO) for data measurement are generally defined in terms of six parameters: precision, accuracy, representativeness, comparability, completeness and sensitivity (PARCC+S). The following DQO have been established to ensure that the data collected as part of this program are sufficient and of adequate quality for their intended uses. Data collected and analyzed in conformance with the DQO process described in this QAPP are used to assess the uncertainty associated with decisions related to the Site. The QAPP and the SOPs for each laboratory outlines the acceptable Surrogate Recovery, Laboratory Control Samples (LCS), Matrix Spike and Matrix Spike duplicates limits needed to calculate precision and accuracy (**Tables 4 – 7**). Method detection limits and reporting limits for each parameter are also located in the QAPP (**Table 8**) and SOPs. Data Reporting Conventions are included as **Table 9**.

2.5.1 Precision

Precision measures the reproducibility of measurements under a given set of conditions. To maximize precision, established sampling and analytical procedures are consistently followed. Analytical precision is monitored through analysis of matrix spike or laboratory duplicates and field duplicates. Matrix spike duplicates for organic compounds are analyzed at a frequency of once for every 20 samples as specified by the ASP. Precision is expressed as the relative percent difference (RPD):

$$RPD = 100 \times 2[(X1 - X2)/(X1 + X2)]$$

where X1 and X2 are reported concentrations for each duplicate sample and subtracted differences represent absolute values. The equation is taken from "Data Quality Objectives for Remedial Response Activities" (EPAl540lG-871003, March 1987).

2.5.2 Accuracy

Accuracy refers to the bias in a measurement system. Laboratory accuracy is assessed through use of laboratory internal QC samples, matrix spikes, and surrogate recovery. The laboratory

objective for accuracy is to equal or exceed the accuracy demonstrated for the applied analytical methods on similar samples. A matrix spike and matrix spike blank are analyzed once for every twenty samples, as specified in the ASP.

Accuracy values can be presented in a variety of ways. Average error is one way of presenting this information; however, more commonly, accuracy is presented as percent bias or percent recovery. Percent bias is a standardized average error (the average error divided by the actual or spiked concentration and converted to a percentage). Percent bias is unit-less and allows accuracy of analytical procedures to be compared easily. Percent recovery provides the same information as percent bias. Routine organic analytical protocols require a surrogate spike in each sample, and percent recovery is defined as:

$$\% \text{ Recovery} = (RIS) \times 100$$

Where:

S = spike surrogate concentration

R = reported surrogate concentration

and % Bias = % Recovery – 100

This equation is taken from "Data Quality Objectives for Remedial Response Activities" (EPA/540/G-87/003, March 1987). Percent recovery criteria published by the NYSDEC as part of the NYSDEC ASP (10/95) and those determined from laboratory performance data are used to evaluate accuracy in matrix spike and blank spike quality control samples.

2.5.3 Representativeness

Representativeness is a qualitative parameter that expresses the degree to which sample data accurately and precisely represent actual conditions. In the field, the representativeness of the data depends on selection of appropriate sampling locations, collection of an adequate number of samples, and use of consistent sampling procedures. The sampling procedures, as described in the sampling and analysis plan, are designed with the goal of obtaining representative samples for each of the different matrices.

In the analytical laboratory, the representativeness of the analytical data is a function of the procedures used in processing the samples. The objective for representativeness is to provide data of the same high quality as other analyses of similar samples using the same methods during the same time period within the laboratory. Representativeness is determined by comparing the quality control data for these samples against other data for similar samples analyzed at the same time.

2.5.4 Comparability

Comparability is a qualitative parameter expressing the confidence with which one data set can be compared with another. Analytical results are comparable to results of other laboratories with the use of the following procedures/programs: Instrument standards traceable to National Institute of Standards and Testing, USEPA or NYSDEC sources; the use of standard methodology; reporting results from similar matrices in consistent units; applying appropriate levels of quality control within the context of the laboratory quality assurance program; and participation in inter-laboratory studies to document laboratory performance. By using traceable standards and standard methods, the analytical results can be compared to other laboratories operating similarly. The QA program documents internal performance and the inter-laboratory studies document performance compared to other laboratories. Periodic laboratory proficiency studies are instituted as a means of monitoring intra-laboratory performance.

2.5.5 Completeness

Completeness is the percentage of measurements made that are judged to be valid measurements. The completeness goal is to generate the maximum amount possible of useable data (i.e., 100 percent usable data). Data is considered usable unless qualified during validation as "R," rejected. In accordance with USEPA data validation criteria, estimated values are considered valid and usable.

2.5.6 Sensitivity (Reporting Limits)

The estimated reporting limits or practical quantification limits that are desired for each analysis are the Contract Required Quantitation Limits (for organics) and the Contract Required Detection Limits specified in the NYSDEC ASP (10/95). All such limits are dependent upon matrix interferences and reporting limits may vary as a result of dilution.

Sensitivity is achieved in the laboratory using instrument detection limits (IDLs), method detection limits (MDLs), and practical quantitation limits (PQLs). These limits are published with NYSDEC methods and are based on a reagent water matrix; therefore they do not account for specific sample matrices. The IDL samples estimate the instrument's detection limit under ideal conditions, and are introduced at a later stage of the analytical process where instrument sensitivity can be directly measured. MDLs estimate the detection limits by introducing a known concentration matrix to the total method process and thereby estimates the detection limits under more practical conditions. PQLs are the lowest concentrations a method can reliably achieve within limits of precision and accuracy. Laboratory control samples (LCS, method blanks, etc.)

should be able to achieve the majority of these published limits whereas environmental samples may not. Compliance for sensitivity will be verified during the data review and validation process.

2.6 Field Quality Assurance/Quality Control Samples

The following QA/QC samples will be taken in the field to help confirm that the Data Quality Objectives are attained. **Table 3** outlines the frequency that the QC samples will be taken. Samples will be labeled as noted in **Section 2.2.1.**

2.6.1 Blind Duplicate Samples

Blind duplicate samples are used to assess the variability of a matrix at a specific sampling point and to assess the reproducibility of the sampling method. Blind duplicate samples are defined as a second sample collected from the same location, at the same time, in the exact same manner as the first and placed into a separate container with no prior mixing. Blind duplicate samples are collected at a frequency of one per every 20 samples per matrix. Each duplicate sample is analyzed for the same parameters as the samples collected that day. Thus, both field and laboratory variability are evaluated. Acceptance and control limits for the laboratory follow NYSDEC ASP guidelines for organic and inorganic analyses, and any deviations in the data with respect to the limits will be discussed in the report. Although there are no established QC limits for field duplicate RPD data, Shaw considers RPD values of 50 percent or less for aqueous samples and 100 percent or less for soil samples an indication of acceptable sampling and analytical precision.

2.6.2 Equipment Blanks

Equipment blanks are not required when dedicated sampling equipment is used. If non-dedicated sampling equipment is used for the soil sampling program, equipment blanks will be analyzed at a frequency of not less than 5 percent (i.e., one equipment blank per every 20 samples collected).

2.6.3 Field Blanks

Field blanks will be prepared when equipment blanks are not necessary (i.e., dedicated equipment is used for sample collection). The field blank will be prepared at one of the sampling points by exposing deionized water to the air and transferring the water to a set of sampling bottles. Field blanks will be obtained each day of sampling or every 20 samples, whichever is more frequent.

2.6.4 Trip Blanks

Trip blanks are used to monitor potential sample volatile organic contamination during shipment to and from the laboratory. It also provides information on laboratory water quality since the laboratory provides the trip blank water. One trip blank will be submitted for analysis for each day that aqueous volatile organic samples are collected. A trip blank will be included in each cooler that contains aqueous volatile organic samples, therefore all aqueous volatile organic samples and containers will be shipped to and from the laboratory in the smallest possible number of coolers in order to minimize the number of trip blanks required.

2.7 Laboratory Quality Assurance Samples

In accordance with each laboratory's QAPP, the following samples will be taken, in the laboratory to help confirm that the Data Quality Objectives are attained.

2.7.1 Method Blanks

Method blanks are used to assess the background variability of the method and to assess the introduction of contamination to the samples by the method, technique, or instrument as the sample is prepared and analyzed in the laboratory. A method blank is defined as an aliquot of laboratory de-ionized water on which every step of the method is performed and analyzed along with the samples. Method blanks are analyzed at a frequency of one for every 20 samples analyzed, or every analytical batch, whichever is more frequent.

2.7.2 Spiked Samples

Two types of spiked samples are analyzed as part of the analytical *QA/QC* program, and include MS and MSD. Matrix spike samples are analyzed to evaluate instrument and method performance on samples of similar matrix. Matrix spike duplicates are analyzed to determine the precision of the method and instrument. These samples are analyzed and the percent recovery is determined to assess matrix interferences affects on the methods. One MS/MSD sample pair will be analyzed for every 20 samples.

2.8 Equipment Operation and Calibration Procedures

The following sections describe the operation and calibration procedures for the field and laboratory analytical instruments that are anticipated to be used during this program. Any equipment not listed herein should be maintained and calibrated pursuant to the manufacturers requirements and instructions.

2.8.1 Field Equipment Calibration

Calibration and maintenance of the field equipment will be conducted in accordance with manufacturer's recommendations to assure that accurate field data is collected. The calibrations will be documented for each measuring instrument and include at least the following information, where applicable.

- Name of instrument calibrated;
- Instrument serial and/or identification number;
- Frequency of calibration;
- Results of calibration;
- Name of person performing the calibration;
- Identification of the calibration gas (if applicable); and
- Buffer solutions (if applicable).

Equipment calibrations done in the field will be recorded in the field notebook. The calibration procedures and frequency for the field equipment is presented in the following sections.

2.8.1.1 pH Meters

Because of the great variety of pH meters available, operators should refer to the manufacturer's instruction manual for specific calibration, operation, and troubleshooting procedures for their instrument. The following general procedure is used for measuring pH in the field with a pH meter:

- The pH meter will be calibrated at the start of each day of activities with a minimum of 2 different buffer solutions bracketing the expected pH range of the samples;
- The instrument will be checked and calibrated prior to the initiation of the field effort. The pH electrodes will be kept moist at all times;
- Buffer solutions used for calibration should be checked. Buffer solutions will degrade upon exposure to the atmosphere;
- Select 4.0, 7.0 and 10.0 buffers for calibration;
- Make sure electrolyte solutions within the electrode(s) are at their proper levels and that no air bubbles are present within the electrode(s);
- Immerse the electrode(s) in a pH-7.0 buffer solution;

- Adjust the temperature compensator to the proper temperature (on models with automatic temperature adjustments, immerse the temperature probe into the buffer solution). It is best to maintain buffer solution at or near expected sample temperature before calibration;
- Adjust the pH meter to read 7.0;
- Remove the electrode(s) from the buffer and rinse well with distilled water. Immerse the electrode(s) in pH 4.0 or 10.0 buffer solution and adjust the slope control to read the appropriate pH. At least three successive readings during calibration, one minute apart, should be within $\pm$0.1 pH unit; and
- Rinse the electrode(s) with distilled water.

The pH meters will be calibrated at the commencement of each sampling day (minimum).

2.8.1.2 Specific Conductance Meters

Because many conductivity meters are available, operators should refer to the manufacturer's instruction manual for specific calibration, operation, and troubleshooting procedures. The following general procedure is used for obtaining specific conductance measurements:

- The conductivity meter will be calibrated at the start of each sampling day or more frequently if deemed necessary;
- Check batteries before going into the field;
- Check the µmhos/cm value of the potassium chloride standard solution normalized to 25^{o}C; and
- Calibrate the instrument using a potassium chloride standard solution.

2.8.1.3 Photoionization Detector

For ambient air monitoring for health and safety considerations during work activities and field screening of soil samples, a photoionization detector (PID) with a lamp energy of at least 10.2 electron volts will be used. The PID will be used to measure the total concentration of volatile compounds with ionization potentials less than the PID lamp energy. Because many PIDs are available, operators should refer to the manufacturer's instruction manual for specific calibration, operation, and troubleshooting procedures. The general operating and calibration procedure for the MiniRAE 3000 is provided below. If a different brand of PID is utilized, the unit will be calibrated in accordance with the manufacturer's guidelines. Operation of PIDs under wet conditions can cause erratic and potentially unreliable readings. The use of PIDs under wet conditions may not be practical.

A PID can be used to detect a variety of trace gases, particularly VOCs. The PID uses the principle of photoionization to detect and measure the VOC concentrations in the atmosphere or from a sample.

The following procedure is used for operating and calibrating the MiniRAE 3000 PID.

- Press and hold [MODE] and [N/-] until you see the Password screen;
- In Basic User Level, you do not need a password to perform calibrations. Instead of inputting a password, enter calibration by pressing [MODE];
- Calibration screen is now visible with Zero Calibration highlighted;
  - Press [Y/+] to select the highlighted calibrations (Zero Calib or Span Calib);
  - Press [MODE] to exit calibration and return to the main display and resume measurement;
  - Press [N/-] to toggle the highlighted calibration type.
- Proceed to perform a **Zero Calibration**
  - Press [Y/+] to start calibration;
  - Turn on Zero calibration gas;
  - Press [Y/+] to start calibration;
  - Zero calibration starts a 30-second countdown and displays this message 'Zeroing…'
  - When Zero calibration is complete, you see this message 'Zeroing is done! Reading 0.0 parts per million (ppm)
- The instrument will then show the Calibration menu on its display, with the Span Calib highlighted;
- Proceed to perform a **Span Calibration**
  - Press [Y/+] to enter Span calibration;
  - You will see the name of your Span gas (default is isobutylene) and the span value in ppm;
  - Turn on your Span calibration gas;
  - Press [Y/+] to initiate calibration;
  - Span calibration starts and displays this message 'Calibrating…'
  - There is a 30-second countdown and the instrument performs the Span calibration automatically;

- When Span calibration is complete, you see a message similar to this 'Span1 is done! Reading = 100.0 ppm'
    - Note: the reading should be very close to the span gas value.

PIDs will be calibrated at the commencement of each sampling day (minimum).

2.8.2 Laboratory Equipment

All laboratory equipment is calibrated according to the requirements of the respective NYSDEC ASP (10195) method for each analysis and/or in accordance with the manufacturer's specifications. In general, preventative maintenance of laboratory equipment follows the guidelines recommended by the manufacturer. Generally speaking, a malfunctioning instrument which cannot be repaired directly by laboratory personnel is repaired following a service call to the manufacturer. The laboratory specific QAPP will contain information on each specific laboratory's analytical equipment.

2.9 Field Documentation

A field notebook will be initiated at the start of on-site work and will include the following daily information, where applicable:

- Day and Date;
- Meteorological conditions;
- Crew members;
- Brief description of proposed field activities for that day;
- Locations where work is performed;
- Problems and corrective actions taken;
- Records of all field measurements;
- A description of all modifications to the work plan;
- A record of all field data sampling point locations;
- Pertinent sample collection information;
- Chain-of-custody information; and
- Documentation of the calibration of field instrumentation used.

The Shaw employee will sign the first line and sign and date the last line of each day's entry to maintain proper custody. Any changes made in the field notebook will be initial and dated by

the Shaw employee. Additionally, each entry in the field notebook will have a corresponding time (military) associated with it.

Once the Shaw field employee returns to the office, a copy will be made and retained in the project files of the field notes. This ensures proper documentation in case something happens to the original field notebook (e.g., it gets lost).

All original forms and notebooks used during field activities become part of the permanent project file. Additionally, project-specific questionnaires or data sheets will also be completely and accurately completed by Shaw personnel.

2.10 Corrective Actions

Corrective actions are required when a problem arises that impedes the progress of the investigation as detailed in the project plans, or when field or analytical data are not within the objectives specified in the Work Plan or QAPP. Corrective actions include those actions implemented to promptly identify, document, and evaluate the problem and its source, as well as those actions taken to correct the problem. These corrective actions are documented in the project file. Prior to implementing any deviations from the approved procedures contained in the QAPP, the Project Manager must be notified.

2.10.1 Field Procedures

Project personnel continuously monitor ongoing work performance as part of their daily responsibilities. If a condition is noted that would have an adverse impact on data quality, corrective actions are taken. Situations that require corrective action include the following:

- Standard operating procedures and or protocols identified in the project specific work plan or QAPP have not been followed;
- Equipment is not calibrated properly or in proper working order;
- QC requirements have not been met; and,
- Performance or system audits identify issues of concern.

The problem, its cause, and the corrective action implemented are documented. The Project Manager is responsible for initiating and approving corrective actions.

2.10.2 Laboratory Procedures

During all investigations/studies, instrument and method performance and data validity are monitored by the analytical laboratory performing the analyses. The laboratory calibrates its instruments and documents the calibration data. Laboratory personnel continuously monitor the performance of its instruments to ensure that performance data fall within acceptable limits. If instrument performance or data fall outside acceptable limits, or when any condition is noted that has an adverse effect on data quality, then the laboratory implements appropriate corrective actions. Situations that require corrective action include the following:

- Protocols defined by the project-specific QAPP have not been followed;
- Identified data acceptance standards are not obtained;
- Equipment is not calibrated properly or in proper working order;
- Sample and test results are not completely traceable;
- QC requirements have not been met; and
- Performance or system audits identify issues of concern.

The laboratory QA Officer is responsible for initiating and approving corrective actions. The corrective actions may include one or more of the following:

- Re-calibration or standardization of instruments;
- Acquiring new standards;
- Repairing equipment; and
- Reanalyzing samples or repeating portions of work.

System audits and calibration procedures with data review are conducted by the laboratory at a frequency so that errors and problems are detected early, thus avoiding the prospect of redoing large segments of work. Shaw provides independent data validation and/or data review and summary, and the laboratory is notified as soon as possible of any situation which requires corrective action so that the corrective action may be implemented in a timely manner.

2.11 Data Reduction, Review and Reporting

The laboratory is required to meet all applicable documentation, data reduction, and reporting protocols as specified in the NYSDEC ASP (10195) CLP deliverable format.

2.11.1 Data Reduction

The laboratory conducts its own internal review of the analytical data generated for a specific project prior to sending the data to Shaw. Deficiencies discovered during the laboratory internal data validation, as well as the corrective actions used to correct the deficiency, are documented in the laboratory Case Narrative submitted with each data package.

2.11.2 Data Review

In addition to the laboratory's in house review of the data, Shaw chemists or a qualified data validation subcontractor will review the laboratory standard quality control summary forms prior to its incorporation into a final report and complete a DUSR if required by the NYSDEC.

This data review will follow the NYSDEC Guidance for Development of Data Usability Reports (Appendix D); complete validation of the data in accordance with the National Functional Guidelines will not be performed. Upon receipt of the laboratory data analytical package, the data reviewer:

1. Reviews the data package to determine completeness. It must contain all sample chain of custody forms, case narratives including sample analysis summary forms, QA/QC summaries with supporting documentation, relevant calibration data, instrument and method performance data, documentation of the laboratories ability to attain the method detection limits for target analytes in required matrices, data report forms with examples of calculations, and raw data. The laboratory is promptly notified of any deficiencies, and must produce the documentation necessary to correct the deficiencies within 10 calendar days.
2. Reviews the data package to determine compliance with the applicable portions of the work plan. The data reviewer confirms that the data is produced and reported consistent with the QAPP and laboratory quality control program, protocol required QA/QC criteria are met, instrument performance and calibration requirements were met, protocol required calibration data are present and documented, data reporting forms are complete, and problems encountered during the analytical process and actions taken to correct the problems are reported. Field duplicate data are evaluated to determine field variability.
3. Prepares a tabular summary of the reported data. The data reviewer summarizes the data in a tabular format to provide the data in more accessible format.

Third part validation of samples will be performed as directed by the NYSDEC. The third party validation will issue the DUSR.

2.11.3 Data Reporting

The laboratory reports the data in tabular form by method and sample. The laboratory is required to submit analytical results that are supported by a complete NYSDEC ASP CLP data package to enable the quality of the data to be determined. This standard backup data includes supporting documentation (chromatograms, raw data, etc.), sample preparation information, and sample handling information (i.e., chain-of-custody documentation).

2.12 Quality Assurance Controls

The Project QC Manager is responsible for ensuring that quality QA/QC records such as chain-of- custody forms, field notebooks, and data summaries are being properly prepared. The Project Manager is responsible for ensuring that all records are properly filed. Information received from outside sources, such as laboratory analytical reports, is retained by Shaw. Access to working project files is restricted to project personnel.

2.12.1 Field Audits

The Project Manager is responsible for ensuring that all field investigations are performed in accordance with the requirements and specifications outlined in this QAPP. As part of Shaw's field QA/QC program, a field audit may be performed by Shaw's Program Manager or a designated representative on projects where sampling activities extend for more than two weeks. The primary purpose of the field audit is to monitor project sampling practices. The QA/QC field audit is performed during sampling to evaluate the performance of work during the collection of samples for laboratory analysis. The QC manager will monitor field performance and document all work performed in field notes, a narrative, and/or a checklist of tasks, as appropriate. The Project Manager will review this documentation to ensure the necessary information has been recorded and conduct discussions with field team members to verify that field activities were performed according to the project Work Plan, QAPP and HASP. The QC Manager will communicate any concerns to the field team as appropriate.

2.12.2 Meetings

Periodic meetings between the Project Manager and QC Manager will be held to review quality assurance procedures, field work, laboratory performance and data documentation and review. Any potential problems identified during the review are documented and addressed. If necessary, they are reported to management for review and appropriate corrective action.

Tables

Table 1
Project Compound List
Former Textron, Inc.
Wheatfield, New York

VOCs by EPA Method 8260
Chloromethane
Vinyl chloride
Chloroethane
Bromomethane
1,1-Dichloroethene
Acetone
Carbon Disulfide
Methylene chloride
trans-1,2-Dichloroethene
1,1-Dichloroethane
cis-1,2-Dichloroethene
2-Butanone
Chloroform
1,1,1-Trichloroethane
Carbon Tetrachloride
Benzene
1,2-Dichloroethane
Trichloroethene
1,2-Dichloropropane
Bromodichloromethane
cis-1,3-Dichloropropene
4-Methyl-2-pentanone
Toluene
trans-1,3-Dichloropropene
1,1,2-Trichloroethane
Tetrachloroethene
2-Hexanone
Dibromochloromethane
Chlorobenzene
Ethylbenzene
m/p-Xylenes
o-Xylene
Styrene
Bromoform
1,1,2,2-Tetrachloroethane

Table 2
Sampling Containers, Preservation and Holding Times
Former Textron, Inc.
Wheatfield, New York

PARAMETER	MATRIX	CONTAINER	PRESERVATION	HOLDING TIME
EPA 8260	Aqueous	40 ml. VOA Vial w/TFE lined septum cap (3)	4^{o}C / HCl	7 days
pH	Aqueous	None	N/A	Performed on-site
Specific Conductance	Aqueous	None	N/A	Performed on-site
Dissolved Oxygen	Aqueous	None	N/A	Performed on-site
pH	Aqueous	None	N/A	Performed on-site

Notes:
N/A: Not applicable

Table 3
Number of Samples to be Collected and Analyses to be Performed
Former Textron, Inc.
Wheatfield, New York

QA/QC SAMPLES									
TYPE	**SOURCE**	**NUMBER OF SAMPLES**	**MATRIX**	**BLIND DUPLICATE[1]**	**FIELD BLANK[2]**	**EQUIPMENT BLANK[3]**	**TRIP BLANK[4]**	**MS/MSD[5]**	**ANALYSIS**
Groundwater (even numbered year)	Monitoring and Extraction Wells	31	Aqueous	2	2	2	2	2	EPA 8260

Notes:

1: 1 per 20 samples/matrix
2: 1 per day
3: 1 per week/sampling equipment used
4: 1 per 20 samples/day
5: 1 per 20 samples/matrix

QA/QC SAMPLES									
TYPE	**SOURCE**	**NUMBER OF SAMPLES**	**MATRIX**	**BLIND DUPLICATE[1]**	**FIELD BLANK[2]**	**EQUIPMENT BLANK[3]**	**TRIP BLANK[4]**	**MS/MSD[5]**	**ANALYSIS**
Groundwater (odd numbered year)	Monitoring and Extraction Wells	23	Aqueous	2	2	2	2	2	EPA 8260

Notes:

1: 1 per 20 samples/matrix
2: 1 per day
3: 1 per week/sampling equipment used
4: 1 per 20 samples/day
5: 1 per 20 samples/matrix

Table 4
Field Accuracy and Precision
Former Textron, Inc.
Wheatfield, New York

PARAMETER	SPIKING COMPOUND	WATER ACCURACY % RECOVERY	WATER PRECISION % RPD (1)
VOA	1,1 Dichloroethene	5	+/- 14% RPD
VOA	Trichloroethene	5	+/- 14% RPD
VOA	Benzene	5	+/- 11% RPD
VOA	Toluene	5	+/- 13% RPD
VOA	Chlorobenzene	5	+/- 13% RPD

%RPD is applicable above five times the contract required detection limit (CRDL). Below five times the CRDL use control limit of +/- the CRDL.

Organics Analysis, Document Number OLM01.0, Section D-55, Table 7, Section D-59, Table 7 and Section D-60, Subsection 16.4.

For organic parameters control limits for individual matrix spike compounds are to be found in tables 11.1

VOA - Volatile Organic Compounds

Table 5
Laboratory Accuracy and Precision
Former Textron, Inc.
Wheatfield, New York

PARAMETER	SPIKING COMPOUND	WATER ACCURACY % RECOVERY	WATER PRECISION % RPD (1)
VOA	1,1 Dichloroethene	5	+/- 14% RPD
VOA	Trichloroethene	5	+/- 14% RPD
VOA	Benzene	5	+/- 11% RPD
VOA	Toluene	5	+/- 13% RPD
VOA	Chlorobenzene	5	+/- 13% RPD

%RPD is applicable above five times the contract required detection limit (CRDL). Below five times Organics Analysis, Document Number OLM01.0, Section D-55, Table 7, Section D-59, Table 7 and Section D-60, Subsection 16.4.

For organic parameters control limits for individual matrix spike compounds are to be found in tables 11.1 and 11.2.

VOA - Volatile Organic Compounds

Table 6
Percent Spike Recoveries
Former Textron, Inc.
Wheatfield, New York

FRACTION	MATRIX SPIKE COMPOUND	WATER
VOA	1,1 Dichloroethene	61-145
VOA	Trichloroethene	71-120
VOA	Chlorobenzene	75-130
VOA	Toluene	76-125
VOA	Benzene	76-127

VOA Volatile Organic Analysis

Table 7
Percent Surrogate Spike Recovery Limits
Former Textron. Inc.
Wheatfield, New York

FRACTION	SURROGATE COMPOUND	WATER
VOA	Toluene-d_8	88-110
VOA	4-Bromofluorobenzene	86-115
VOA	1,2-Dichloroethane-d_4	76-114
VOA	Dibromofluoromethane	76-114

Once 20 samples of a given matrix are evaluated, statistical control should be developed as described in section 14. The surrogate limits for other parameters should also be updated when 50 samples of a given matrix have been evaluated, or sooner as needed.

These limits are advisory purposes only. They are not used to determine if a sample should be reanalyzed. When sufficient data becomes available, the NYSDEC ASP may set performance based contract required windows.

VOA - Volatile Organic Analysis

Table 8
Target Compound List and Contract Required Limits
Former Textron, Inc.
Wheatfield, New York

Volatile Compounds	CAS No.	Water (µg/L)	CRQL (µg/L)	Detection Unit (mg/L)
Chloromethane	74-87-3	5	---	---
Bromomethane	74-83-9	5	---	---
Vinyl Chloride	75-01-4	5	---	---
Chloroethane	75-00-3	5	---	---
Methylene Chloride	75-09-2	5	---	---
Acetone	67-64-1	10	---	---
Carbon Disulfide	75-15-0	5	---	---
1,1-Dichloroethene	75-35-4	5	---	---
1,1-Dichloroethane	75-34-3	5	---	---
cis-1,2-Dichloroethene	156-59-2	---	---	---
trans-1,2-Dichloroethene	56-60-5	---	---	---
Chloroform	67-66-3	5	---	---
1,2-Dichloroethane	107-06-2	5	---	---
2-Butanone	78-93-3	10	---	---
1,1,1-Trichloroethane	71-55-6	5	---	---
Carbon Tetrachloride	56-23-5	5	---	---
Bromodichloromethane	75-27-4	5	---	---
1,2-Dichloropropane	78-87-5	5	---	---
cis-1,3-Dichloropropene	10061-02-5	5	---	---
Trichloroethane	79-01-6	5	---	---
Dibromochloromethane	124-48-1	5	---	---
1,1,2-Trichloroethane	79-00-5	5	---	---
Benzene	71-43-2	5	---	---
trans-1,3-Dichloropropene	10061-02-6	5	---	---
Bromoform	75-25-2	5	---	---
4-Methyl-2-pentanone	108-10-1	10	---	---
2-Hexanone	591-78-6	10	---	---
Tetrachloroethene	127-18-4	5	---	---
Toluene	108-88-3	5	---	---
1,1,2,2-Tetrachloroethane	79-34-5	5	---	---
Chlorobenzene	108-90-7	5	---	---
Ethylbenzene	100-41-4	5	---	---
Styrene	100-42-5	5	---	---
m-Xylenes	108-38-3	10	---	---
p-Xylenes	106-42-3	10	---	---
o-Xylene	95-57-6	10	---	---

Notes:

Specific quantification limits are highly matrix dependent. The limits listed herein are provided for guidance and may not always be achievable.

--: Not analyzed

Table 9
Data Reporting Conventions
Former Textron, Inc.
Wheatfield, New York

Name Analysis	Units	Decimal Accuracy
VOLATILES BY GC Water	µg/l	0.1
TEMPERATURE	^{o}C	0.1
pH	pH UNITS	0.1
SPECIFIC CONDUCTANCE	µmhos/cm	0.1