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QUALITY ASSURANCE PROJECT PLAN

FOR THE COMPREHENSIVE GROUNDWATER MONITORING PLAN AT

CABOT CARBON/KOPPERS SUPERFUND SITE

(FORMER KOPPERS FACILITY)

GAINESVILLE, FLORIDA

Submitted to:

US ENVIRONMENTAL PROTECTION AGENCY
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i. Approvals

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02/15/2016

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2/17/16

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Laboratory Quality Assurance Coordinator
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1.0 INTRODUCTION

1.1 Problem Statement

This Quality Assurance Project Plan (QAPP) pertains to the former Koppers facility that is part of Cabot Carbon/Koppers Superfund Site (Site) in Gainesville, Florida. This QAPP was developed based on guidance from the US EPA documents *EPA Requirements for Quality Assurance Project Plans* (EPA QA/R-5, 2002) and *EPA Guidance on Systematic Planning Using the Data Quality Objectives Process* (EPA QA/G-4, 2006). The facility is a former wood treatment facility whose historical operations have affected soil and groundwater. The Site has been undergoing remedial investigation, remedial planning, and remedial action under the oversight of the US EPA since the late-1980s.

The primary objective of the groundwater monitoring within the context of the program is to generate consistent data of known quality that can be used to enhance the understanding of Site groundwater conditions. The groundwater monitoring frequency is defined in the Comprehensive Groundwater Monitoring and Sample Analysis Plan (CGMSAP). The target analytes and reporting limits for these groundwater monitoring events are also presented in the CGMSAP in Section 5.9 and on Tables 5-3, 5-4, and 5-6. A summary of the target analytes for evaluation, Federal Maximum Cleanup Target Levels (MCLs), Florida Groundwater Cleanup Target Level (CGTL), Record of Decision (ROD) cleanup goals, analytical methodology, and project reporting limits (RLs) have been provided on Table 1. A summary of additional semivolatile organic compounds (SVOCs), analytical methodology, and project RL have been provided on Table 2.

1.2 Project Description and Applicability

On behalf of Beazer East, Inc. (Beazer), Environmental Standards, Inc. (Environmental Standards) has prepared this QAPP. The QAPP presents the project organization, objectives, procedures, functional activities, and specific quality assurance (QA) and quality control (QC) activities associated with the evaluation of the potential presence of constituents related to the former Koppers facility in groundwater at the Site.

This QAPP includes the activities associated with the organization; laboratory, data management, and field activities; and data reporting and archiving for all field samples collected by Beazer for the purpose of groundwater monitoring at the Site (Project). The requirements of this QAPP are applicable to affiliated project personnel, support groups, contractors, and subcontractors. This QAPP is intended to establish an overall QA plan to provide the Project framework; additional requirements are presented in the CGMSAP. Data Quality Objectives (DQOs) and general requirements associated with various analysis, data generation, data reduction, and reporting activities are stipulated herein.

1.3 Purpose and Scope

The purpose of this QAPP is to detail the requirements for the performance of activities associated with the sampling and laboratory analysis necessary to defensibly establish the absence or presence (*e.g.*, concentration) of arsenic, chromium, semivolatile organic compounds, and volatile organic compounds in groundwater samples collected for the Project.

The scope of this document is to provide the appropriate QA procedures and QC measures to be applied throughout the Project and to address the following items:

- QA objectives
- Laboratory procedures
- Sample collection, handling, and preservation
- Sample analysis, data reduction, validation, and reporting
- Internal QC checks
- QA performance and system audits
- Preventive maintenance procedures and schedules
- Data assessment procedures, including processing, interpretation, and presentation
- Corrective actions
- QA reports to management

1.4 Data Quality Objectives

The goals of data collection during the ongoing groundwater monitoring sampling and subsequent analysis of project samples are to identify the presence and concentration of Site-related constituents with defensible accurate analyses. Specifically, meeting appropriate DQOs, which will allow Beazer to utilize the analytical data to the fullest extent possible, is required.

The Data Objectives for the project are established to ensure that the data generated are of known and acceptable quality. Primary Data Objectives of this project are to:

- Monitor the presence or absence of targeted analytes with a known degree of accuracy and precision.
- Generate consistent and defensible analytical data to provide an enhanced understanding of the groundwater conditions at the Site.
- Generate analytical data that meet or exceed the quality assurance and quality control indices detailed in Section 3.0 and on Tables 3 through 8.

Chemical analysis will be conducted on samples to determine if arsenic, chromium, a defined list of volatile organic compounds (VOCs), and a defined list of SVOCs are present in groundwater samples at the Site. The rationale for the selection of the specific analytes is presented in the CGMSAP.

To ensure that the data generated are of known and acceptable quality to meet or exceed the intended data collection purpose, this QAPP defines provisions for the following:

- Development of standards for performance related to the sampling and analytical Scope-of-Work.
- Monitoring performance to determine compliance with the established methods.
- Reporting the activities associated with performance monitoring.
- Documented correction when performance does not conform to the established standards.

To achieve the Data Objectives, QA measures will be implemented throughout the Project to ensure that the data generated meet or exceed the data quality indices relative to the accuracy, precision, representativeness, comparability, and completeness data quality indicators. In general, data quality will be monitoring and controlled through the documented calibration of field and laboratory equipment following US EPA protocols and the collection and analysis of field QC samples. Implementation of QA/QC measures will allow project personnel to assess data quality relative to the Data Objectives.

The data quality from fixed-based laboratory analyses (using US EPA methods) will be critically assessed by performing limited data validation for 90% of the data and full data validation for 10% of the data. These data validation activities are discussed in detail in Subsection 8.2.4.

1.5 Schedule

The anticipated schedule of activities is detailed below:

- Field sampling and analytical activities will be performed according to the schedules provided in Tables 2-1, 2-2, and 2-3 of the CGMSAP.
- Samples will be delivered to the laboratory on a daily basis via courier or over-night delivery.
- The laboratory will provide analytical results, complete data packages, and electronic data deliverable (EDD) within 15 business days of sample receipt.
- The EDD will be screened for acceptability relative to the project database within 7 business days of receipt.
- An initial completeness review (see Section 8.2.4) will be performed within 10 business days of each data package receipt.
- Data validation (see Section 8.2.4) will be performed within 20 business days of each data package and EDD receipt.
- A report will be prepared for Agency review within 90 business days of the receipt of the complete laboratory data deliverables.

1.6 Special Training/Certification

All field personnel will have completed a training course of at least 40 hours that meets the requirements specified in 29 CFR Part 1910.120(e) for safety and health at hazardous waste operations and a refresher course of at least 8 hours that meets the requirements of

29 CFR Part 1910.120(e) for safety and health at hazardous waste operations within the last 12 months.

All individuals who plan to participate in Project field activities will notify the Field and Technical Project Manager of their intent to participate and provide evidence of current health and safety training prior to commencement of sample collection activities. The Field Team Leader will ensure that all participants who arrive at the Site have provided evidence of health and safety training. No other specialized training is anticipated for this project. Specific requirements for training and document review associated with sample collection activities are addressed in Section 3.2 of the CGMSAP for field personnel.

Field personnel performing sample collection activities will be properly trained in equipment use and procedures necessary for each task prior to entering the field. The sampling contractor (Field & Technical Services, LLC [FTS]) will employ its internal processes/procedures for establishing that personnel are adequately experienced in the duties they are expected to carry out and receive any needed training. Training courses or workshops on specific equipment, techniques, or procedures shall all be documented. It will be the responsibility of the Field Team Leader to ensure that field personnel understand and comply with the applicable QAPP requirements for their individual tasks. Training records are maintained by each consultant in secure files within each consultant's office of record and will be made available to the US EPA for review upon Beazer Environmental Manager request.

Personnel who are responsible to conduct the various laboratory analyses are described in this QAPP. The laboratories participating in this Project will have training programs that are equivalent to those requirements in The NELAC Institute (TNI) Standards *Volume 1: Management and Technical Requirements for Laboratories Performing Environmental Analysis Module 2: Quality Systems General Requirements* (TNI 2009). The laboratory shall have sufficient personnel with the necessary education, training, technical knowledge, and experience for their assigned functions. No other specialized training is anticipated for this project. Training records are maintained by each consultant in secure files within each consultant's office of record and will be made available to the US EPA for review upon Beazer Environmental Manager request.

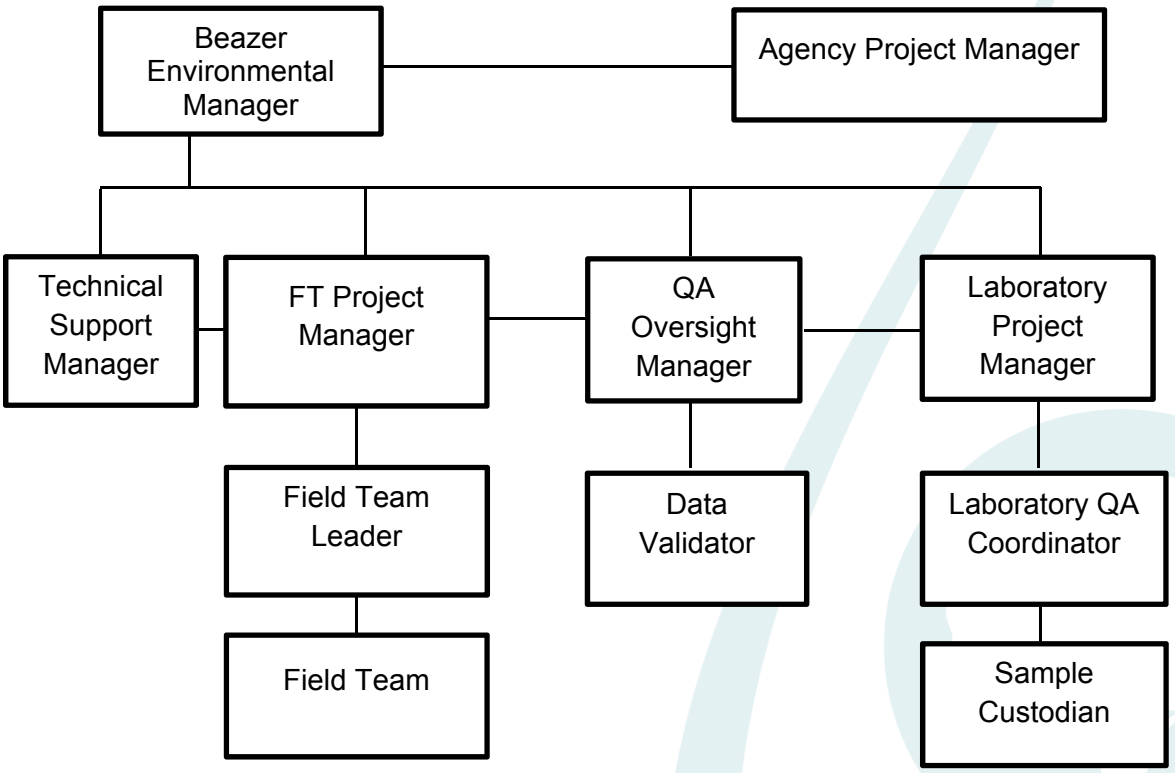
Personnel who are responsible for performing data validation will be trained by the QA Oversight Manager and several designees to conduct the evaluation of the laboratory analytical data described in this QAPP. The data validation company shall have sufficient personnel with the necessary education, training, technical knowledge, and experience for their assigned functions. No other specialized training is anticipated for this project. Training records are maintained by the data validation company and are available for review upon Beazer Environmental Manager request.

2.0 PROJECT ORGANIZATION AND RESPONSIBILITY

2.1 Project Organization

This section describes the organizational structure and lines of authority. Project activities will be performed within the framework of the organization and functions described in this section. Emphasis is placed on the organization and entities responsible for the implementation and administration of this QAPP. The organizational structure showing relationships of individuals with key responsibilities is presented in Figure 2-1.

FIGURE 2-1: ORGANIZATIONAL STRUCTURE



The organizational structure is designed to provide clear lines of responsibility and authority. This control structure encompasses the following activities:

- Identifying lines of communication and coordination.
- Monitoring project schedules and performance.
- Managing key technical resources.
- Providing periodic progress reports.
- Coordinating support functions such as laboratory analysis and data management.
- Rectifying deficiencies and issues.

Field and laboratory personnel providing services in support of Project efforts will perform work in strict compliance with the appropriate contract specifications for the activity.

All project personnel will have sufficient authority, independence, organizational freedom, and ability to perform the following actions during the execution of their assigned tasks:

- Identify procedural and reporting problems.
- Initiate, recommend, or provide solutions to problems through designated channels.
- Ensure that project activities, including processing of information, delivery of deliverables, and installation or use of equipment, are reviewed in accordance with QA objectives.
- Ensure that deficiencies/non-conformances are corrected.
- Ensure that further processing, delivery, or use of data is controlled until the proper disposition of a nonconformance, deficiency, or unsatisfactory condition.

2.2 Agency Project Manager

US EPA Region IV is the primary agency for this Site. Mr. Scott Miller of the US EPA is the Agency Project Manager. The Florida Department of Environmental Protection (FDEP), the Alachua County Environmental Protection Division (ACEPD), and the City of Gainesville are included on project correspondence and documents. The Agency Project Manager has regulatory oversight responsibilities for this Project, including:

- Schedule meetings, if necessary, between the Agency and representatives of Beazer.
- Review and comment on proposed schedules.
- Review and comment on documents and reports.

2.3 Beazer Environmental Manager

Mr. Mitchell Brourman is the Beazer Environmental Manager. The Beazer Environmental Manager holds the overall management responsibility for activities related to the former Koppers facility at the Site and will be responsible to define program objectives and procedures to ensure compliance with Agency requests and requirements, review planned objectives, and provide authorization to perform specific work tasks. The Beazer Environmental Manager holds overall management responsibility for the Project, including the following:

- Approve documents prior to submission to US EPA Region IV and other organizations.
- Represent Beazer at meetings.
- Negotiations, coordination with Agency PM, and public relations for the Site.
- Review and analyze overall task performance with respect to Project requirements.
- Decisions concerning technical issues and strategy policies in accordance with work assignments.
- Define project objectives for the Project as a whole.

2.4 Technical Support Manager

Mr. Gregory Council, P.E. of Tetra Tech is the Technical Support Manager. The Technical Support Manager will assist the Beazer Environmental Manager with the overall project management, review of documents prior to submission to US EPA Region IV and other organizations, review technical issues and strategy policies, and representing Beazer at meetings. The Technical Support Manager reports to the Beazer Environmental Manager.

2.5 Field and Technical Project Manager

Ms. Angela Gatchie of Field & Technical Services, LLC (FTS) is the Field and Technical (FT) Project Manager. The FT Project Manager will assist the Beazer Environmental Manager with the overall Project, including objectives, scope, schedule, and regulatory submittals. The FT Project Manager reports to the Beazer Environmental Manager, Technical Support Manager, and QA Oversight Manager. The FT Project Manager's responsibilities include the following:

- Overall responsibilities for field and Agency reporting activities.
- Coordination and execution of sample collection for the Project.
- Coordination with the Laboratory Project Manager for the analysis and reporting of results.
- Promoting continuity of field activities.
- Perform data quality objective evaluation.
- Generation of regulatory submittals.
- Providing support and guidance for all Project activities.
- Execution of field activities as defined in the CGMSAP.
- Overall evaluation of completeness of field efforts.
- Communicate any deviations in field procedures to the Beazer Environmental Manager, Technical Support Manager, and QA Oversight Manager.
- Additional responsibilities are defined in Section 3.2 of the CGMSAP.

2.6 Field Team Leader

The Field Team Leader will be assigned by the FT Project Manager. The Field Team Leader will report to the FT Project Manager. The Field Team Leader is responsible for field activities and data evaluation, including the following:

- Ensuring that procedures for field activities are executed in compliance with CGMSAP.
- Coordinating field-related activities with the FT Project Manager.
- Communicate any deviations in field procedures to the FT Project Manager.
- Sampling supplies are available to execute the sampling effort efficiently.
- Supervising the collection of the samples and providing for their proper documentation, handling, and shipment to the laboratory.

2.7 Site Health and Safety Officer

The Site Health and Safety Officer (SHSO) will be assigned by the FT Project Manager. The SHSO will report to the FT Project Manager. The SHSO will be responsible for verifying that field personnel adhere to safety requirements. These responsibilities include:

- Conducting the health and safety training for project personnel and subcontractors, as per the Site-specific Health and Safety Plan (HASP).
- Modifying health and safety equipment or procedure requirements based on data gathered during Site work.
- Observing field personnel for symptoms of exposure or stress.
- Providing on-Site first aid, if necessary.
- Performing Site audits to verify adherence to the requirements of the Site-specific HASP.

2.8 QA Oversight Manager

Mr. Stephen T. Zeiner, CEAC of Environmental Standards, Inc. is the QA Oversight Manager. The QA Oversight Manager will oversee all quality assurance aspects of the Project. The QA Oversight Manager will report to the Beazer Environmental Manager and the Technical Support Manager. Specific tasks include:

- Supporting the analytical laboratories relative to sample preparation and analysis issues.
- Supporting the Project Team relative to sample collection and data issues
- Laboratory or field auditing.
- Initiating and follow-up for corrective actions when deviations are observed and reported.
- Communicate any deviations to the Beazer Environmental Manager, Technical Support Manager, and FT Project Manager.

Environmental Standards, Inc. will be performing the data validation for this Project. The QA Oversight Manager will be responsible for the execution and management of the data validation efforts. Management of the data validation efforts include:

- Coordinating receipt of data packages and electronic data deliverables from the laboratory.
- Routinely communicating with the laboratory regarding status and resubmission of data deliverables.
- Coordination the activities of staff chemists who are validating the laboratory data.
- Coordination peer review of report and qualified electronic data.
- Oversight of delivery scheduling and distribution of validation reports.

2.9 Data Validator

The Data Validator will be designated by the QA Oversight Manager. The Data Validator is responsible for reviewing laboratory-produced and reported data in accordance with this QAPP and the CGMSAP, and notifying the QA Oversight Manager of issues relating to the quality or validity of laboratory data and reporting.

2.10 Data Management Lead

Ms. Stephanie Lein of Environmental Standards, Inc. will be the Data Management Lead. The Data Management Lead will be responsible for overseeing data upload, addition of data qualifications, and notifying the QA Oversight Manager to issues relating issues electronic data. The Data Management Lead will also provide technical support to the Beazer Environmental Manager, Technical Support Manager, FT Project Manager, and Laboratory Project Manager with respect to the information management system and chemical data.

The Data Management Lead will be responsible for working with the laboratory to resolve any problems with the electronic data deliverables. Errors in format or content will be communicated to the Laboratory Project Manager for correction and resubmission. In addition, the Data Management Lead will be responsible for overseeing data processing staff entering qualifiers and generating tables for data validation reports.

2.11 Laboratory Responsibilities

ALS Environmental (ALS) of Jacksonville, Florida, will be the primary laboratory for the Project. ALS will be responsible for ensuring that the analyses of samples and the analytical data (inclusive of valid and complete data packages and EDDs) reported under this QAPP is in compliance with the analytical methods and this QAPP. Specific requirements for this Project are defined in the QAPP. ALS will be responsible for maintaining applicable certification or approval/accreditation with the State of Florida and the National Environmental Laboratory Accreditation Conference Institute (TNI). ALS is not permitted to transfer any work to an unapproved laboratory, even if such unapproved laboratory is owned by or affiliated with ALS, without prior written approval of the Beazer Environmental Manager and the QA Oversight Manager.

2.11.1 Laboratory Project Manager

Mr. Mike Kimmel of ALS is the Laboratory Project Manager. The Laboratory Project Manager will schedule project analytical activities, monitor analytical status/deadlines, approve laboratory reports, coordinate data revisions/corrections and resubmission of packages, and communicate sample preparation and analyses issues to the QA Oversight Manager and FT Project Manager on a real-time basis. The Laboratory Project Manager will provide direction/support for administrative and technical project staff, interface with laboratory project staff on technical issues, and provide QA oversight of analytical data. The Laboratory Project Manager will contact the FT Project Manager and QA Oversight Manager, if there is a technical reason to deviate from the QAPP.

2.11.2 Laboratory QA Coordinator

Mr. Eric Smith of ALS is the Laboratory QA Coordinator. The Laboratory QA Coordinator will ensure conformance with authorized policies, procedures, and sound laboratory practices as necessary. The Laboratory QA Coordinator will inform the Laboratory Project Manager of any non-conformances, introduce control samples into the sample train, and establish testing lots. In addition, the Laboratory QA Coordinator will approve laboratory data before reporting or transmittal to permanent storage and will be responsible for retention of supporting information such as control charts and other performance indicators to demonstrate that the systems that produced the data were in control. The Laboratory QA Coordinator will also review results of internal QA audits and recommend corrective actions and schedules for their implementation.

The responsibilities of the Laboratory QA Coordinator will include the following:

- Administering the laboratory QA/QC program.
- Implementing QC procedures for each test parameter.
- Reviewing analytical results, including raw data, calculations, and laboratory logbooks.
- Monitoring proper documentation and maintenance of the records.
- Identifying and implementing training requirements for the laboratory analytical personnel.
- Overseeing QA/QC implementation at the laboratory on a daily basis.
- Identifying QA/QC problems and recommending appropriate corrective action.
- Preparing status reports (progress, problems, and recommended solutions).
- Preparing reports documenting completion of corrective actions.

2.11.3 Laboratory Sample Custodian

The Laboratory Sample Custodian will be a specifically trained and knowledgeable ALS employee. The Laboratory Sample Custodian will receive samples from the field, sign and date the Chain-of-Custody Record, record the date and time of sample receipt, and record the condition of both shipping containers and sample containers (*e.g.*, temperature, headspace).

The Laboratory Sample Custodian will verify and record agreement or non-agreement of information on sample documents and containers. If there is non-agreement, the Laboratory Sample Custodian will record the problems/inconsistencies for the case file and inform the Laboratory Project Manager.

The Laboratory Sample Custodian will also label samples with laboratory sample numbers; enter the samples into the laboratory information management system; place samples into appropriate storage and/or secure area; and monitor sample storage conditions.

3.0 QUALITY ASSURANCE AND QUALITY CONTROL OBJECTIVES

3.1 General

DQOs are assessed by monitoring QA measures, such as accuracy, precision, representativeness, comparability, and completeness, as discussed in Subsection 1.4. Specific quantitative and qualitative DQOs are presented in detail in Section 11.0 and on Tables 6 through 8 of this QAPP. The objectives associated with accuracy and precision of laboratory results are assessed through an evaluation of the results of QC samples. The accuracy of field measurements for temperature and other field parameters will be assessed by equipment calibration, as described in the CGMSAP.

3.2 Quality Control Samples

QA will be verified by maintaining Site logs, by documenting field activities, and by collecting and analyzing QC samples. QC samples will be used to assess laboratory performance and gauge the likelihood of cross-contamination associated with both field and laboratory activities. QC samples will be collected and analyzed in conjunction with samples designated for laboratory analysis using US EPA methods.

3.2.1 Field Quality Control Samples

Standard analytical QC checks that will be instituted by field personnel may include the following:

- Trip Blank Samples
- Field Blank Samples
- Equipment Rinsate Blanks
- Filter Blank Samples
- Field Duplicate Samples
- Matrix Spike/Matrix Spike Duplicate (MS/MSD) Samples

Additional information concerning field quality control sampling and analysis requirements are summarized in the CGMSAP in Section 4.0 and on Table 4-1.

3.2.2 Laboratory Quality Control Samples

Standard analytical QC checks that may be instituted by laboratory personnel will include, but not be limited to, the following:

- Matrix Spike/Matrix Spike Duplicate (MS/MSD) Samples
- Surrogate Spiking
- Internal Standard Spiking
- Laboratory Method Blanks
- Laboratory Control Samples
- Temperature Blanks

These types of laboratory QC samples are discussed in the following subsections.

3.2.2.1 Matrix Spike/Matrix Spike Duplicate Samples

Matrix spike/matrix spike duplicate (MS/MSD) samples are investigative samples to which known amounts of compounds are added in the laboratory before extraction/digestion and analysis. The recoveries for spiked analytes can be used to assess how well the method used for analysis recovers target analytes in the Site-specific sample matrix. For this Project, at least one set of MS/MSD samples will be collected and analyzed for each 20 Beazer samples collected or one per shipment. The laboratory will prepare and analyze one set of MS/MSD samples for every batch of 20 (or less) samples. The laboratory will utilize a project sample for the MS/MSD pair for every batch that includes a project sample.

3.2.2.2 Surrogate Spiking

Surrogate spiking will be performed for organic analysis of samples and will consist of adding reference compounds to samples before sample preparation. Surrogate compound recovery will be used to assess method accuracy on a sample-specific basis. Surrogate compounds will be added to investigative and QA/QC samples as appropriate to the analytical method as indicated on Table 4 and Table 5.

3.2.2.3 Internal Standard Spiking

Internal standard spiking consists of adding reference compounds to samples after preparation but prior to analysis for both organic and inorganic methods. Internal standard analytes will be used to perform quantitation of all target analytes for SW-846 Methods 6020A, 8260B, and 8270D. Internal standard compounds will be added to all investigative and QA/QC samples as indicated on Tables 3, 4, and 5.

3.2.2.4 Laboratory Method Blanks

Method blanks consist of materials and reagents (*e.g*., analyte-free water) that are prepared in the same manner as the associated samples (*e.g.,* digested, extracted) and that are analyzed and reported in the same manner as the associated investigative samples. Method blanks are used to evaluate potential contamination due to sample preparation and analysis. Laboratory method blanks will be performed as indicated in the analytical method and as indicated on Tables 3, 4, and 5.

3.2.2.5 Laboratory Control Samples

A laboratory control sample (LCS) is a sample of laboratory certified material that is fortified (spiked) with the analytes of interest or a certified reference material that is prepared and analyzed in the same manner as investigative samples. LCS data are used to monitor analytical accuracy and laboratory performance. LCSs will be performed as indicated in the analytical method and as indicated on Tables 3, 4, and 5.

3.2.2.6 Temperature Blanks

The purpose of preparing temperature blanks and their shipment in sample coolers from the field is to enable the laboratory to determine cooler (and sample) temperature upon their receipt at the laboratory. A temperature blank will be provided in each cooler sent from the laboratory to the field.

4.0 FIELD INVESTIGATION PROCEDURES

Detailed descriptions of the procedures for the sampling, identification, packaging, and handling of project samples; the decontamination of sampling equipment; and the maintenance of sampling equipment are presented in the CGMSAP.

Field investigation and sampling procedures will be conducted such that samples are representative of the medium sampled and the resultant data can be compared to other data sets.

5.0 SAMPLE IDENTIFICATION, DOCUMENTATION, AND CUSTODY

Field sampling personnel are responsible for the collection, description, documentation, labeling, packaging, storage, handling, and shipping of samples obtained in the field. Proper field practices are necessary to ensure sample integrity from collection through laboratory analysis and data reporting. To meet the Data Objectives of this QAPP, information relative to the Project samples will be properly described and documented and samples will be labeled, preserved, packaged and shipped to the laboratory for analysis in appropriate sample containers, under the recommended temperature conditions, and with a Chain-of-Custody Record. The sample identification system for this Project is presented in the CGMSAP.

Laboratory-supplied sample kits with custody seals, field Chain-of-Custody Records, packing materials, and US EPA-recommended sample containers and preservation methods presented on Table 3-1 in the CGMSAP will be used for all Project samples during sample collection and transport to the laboratory.

5.1 Sample Chain-of-Custody

Laboratory evidentiary files will be maintained by the FT Project Manager and the Laboratory QA Coordinator and will include information that defines the Project in its entirety. The chain-of-custody will be initiated in the field and will continue through receipt at the laboratory.

5.1.2 Sample Custody in the Field

Procedures for sample custody in the field are provided in Section 5.6 of the CGMSAP.

5.1.3 Sample Custody in the Laboratory

The following subsections describe the Chain-of-Custody procedures associated with sample receipt, storage, tracking, and documentation by the laboratory.

5.1.3.1 Sample Receipt

A designated Laboratory Sample Custodian will be responsible for samples received at the laboratory. The Laboratory Sample Custodian will be familiar with custody requirements and the potential hazards associated with environmental samples. In addition to receiving samples, the Laboratory Sample Custodian will also be responsible for documenting sample receipt, storage before and after sample analysis, and the proper disposal of samples. Upon sample receipt, the Sample Custodian will:

- Inspect the sample containers for integrity and ensure that custody seals are intact on the shipping coolers. The temperature of the samples upon receipt and the presence of leaking or broken containers will be noted on the Chain-of-Custody Record/sample receipt forms.
- Sign (with date and time of receipt) the Chain-of-Custody/sample analysis request forms, thereby assuming custody of the samples and assign the laboratory sample identification numbers.

- Compare the information of the Chain-of Custody Record/sample receipt with the sample labels to verify sample identity. Any inconsistencies will be resolved with the FT Project Manager before sample analysis proceeds.
- Store samples in accordance with Subsection 5.1.3.2.

5.1.3.2 Sample Storage

Analytical samples will be stored in a restricted access refrigerator and maintained at ≤ 6°C but not frozen, with the exception of the aqueous sample aliquots for metals that may be maintained at ambient temperature with acid preservation. The temperature will be monitored and recorded daily by laboratory personnel.

5.1.3.3 Sample Tracking

Each sample will receive a unique laboratory sample identification number at the laboratory when the sample is logged into the laboratory information management system.

A sample extraction or digestion record will be prepared. Laboratory data will be entered on the sample extraction form and permanently recorded in a laboratory logbook.

The laboratory will maintain a sample tracking system that documents the following:

- Organization/individual who performed sample analyses.
- Date of sample receipt, extraction or digestion, and analysis.
- Names of analysts.
- Sample preparation procedures.
- Analytical methods used to analyze the samples.
- Calibration and maintenance of instruments.
- Deviations from established analytical procedures, if applicable.
- QC procedures used to ensure that analyses were in control during data generation (instrument calibration, precision checks, method standards, method blanks, *etc.*).
- Procedures used for the calculation of precision and accuracy for the reported data.
- Statement of quality of analytical results.

5.2 Record-Keeping

This CGMSAP will be distributed to each contractor responsible for the collection, generation, and interpretation of field and analytical data. The Field Services Technical Manager will be responsible for ensuring that necessary revisions are made such that the CGMSAP is up-to-date with actual practices and will distribute the updates. The document control format used in this CGMSAP will identify the CGMSAP revision number and revision date.

Analytical data for this Project will be reported in both an electronic data deliverable (EDD) and an Adobe® Acrobat® .pdf electronic analytical data package. The .pdf format is described in Appendix A and the EDD format is presented as Appendix B. The EDD will be generated by the laboratory and will be used to facilitate loading the analytical data into the Project database.

Analytical data packages will be prepared by the laboratory for all sample analyses performed. Initial analytical results will be provided by the laboratory within 15 business days of sample receipt. Complete data packages will be provided by the laboratory in an Adobe Acrobat .pdf electronic format for all analyses within 15 business days of sample receipt. The Adobe Acrobat .pdf electronic data package will be submitted to the FT Project Manager. A summary of results will be provided to other necessary personnel for use in checking the Project analytical database against hardcopy results or other preliminary evaluation.

Appropriate records will be maintained to provide adequate documentation of the entire data generation process, including field sampling and laboratory analysis. Field sampling records will include maintaining field logs and sample Chain-of-Custody documentation. Field QA/QC samples will be documented on both the field log and sample Chain-of-Custody Records.

The final evidence file will be the central repository for documents relevant to sampling and analysis activities as described in this QAPP. Beazer, the FT Project Manager, and the Quality Assurance (QA) Project Manager will maintain the files for this Project, including all relevant records, correspondence, reports, logs, data, field records, pictures, subcontractor reports, analytical data, and data reviews. The file will include the following information if generated:

Field records

- Field data and data deliverables
- Photographs
- Drawings
- Sample logs
- Laboratory data deliverables
- Data validation reports
- Field and laboratory audit reports, if applicable
- QA reports
- Custody documentation

5.3 Sample Packaging and Shipment

Samples will typically be packed and delivered to the laboratory *via* laboratory courier or field personnel. If samples are shipped for overnight delivery to the contracted laboratory, all applicable US Department of Transportation (US DOT) regulations, consulting corporate guidelines, and International Air Transport Association (IATA) standards (as detailed in the most current edition of *IATA Dangerous Goods Regulations* for hazardous materials shipments) will be adhered to.

6.0 CALIBRATION PROCEDURES

This section provides the requirements for calibration of measuring and test equipment/ instruments used in field sampling and laboratory analysis. The calibration procedures stipulated in this QAPP are designed to ensure that field equipment and instrumentation are calibrated to operate within manufacturer specifications and that the required traceability, sensitivity, and precision of the equipment/instruments are maintained. Measurements that affect the quality of an item or activity will be taken only with instruments, tools, gauges, or other measuring devices that are accurate, controlled, calibrated, adjusted, and maintained at predetermined intervals to ensure the specified level of precision and accuracy.

6.1 Field Equipment Calibration and Procedures

The FTS Field Team will be utilizing equipment that will require calibration for this Project. All meters will be calibrated as described in Section 5.2.2 of the CGMSAP.

6.2 Laboratory Equipment Calibration

Instruments and equipment used in the laboratory will be controlled by a formal calibration program. The program will verify that the equipment has the proper calibration range, accuracy, and precision to generate data comparable with specific requirements. All calibration will be performed by laboratory personnel experienced in the referenced methods for the analysis of Project samples for the constituents of concern in accordance with Tables 3, 4, and 5.

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, required frequency, source of standards, response factors, linear range, check standards, and applicable control limits, as part of the data deliverables.

Before any instrument is used as a measuring device, the instrument's response to reference materials must be determined. The manner in which various instruments are calibrated is dependent on the particular type of instrument and its intended use. Preparation of reference materials used for calibration will be documented in a laboratory notebook.

The two types of laboratory instrument calibration are initial calibration and continuing calibration verification. Initial calibration procedures establish the calibration range of the instrument. Typically, multiple analyte concentrations are used to establish the calibration range and calibration data. The laboratory evaluates the resulting calibration data as detailed on Tables 3, 4, and 5.

Continuing calibration verification usually measures the instrument's response to fewer calibration standards and requires instrument response to fall within certain limits (*e.g.,* 20%) of the initial measured instrument response. Continuing calibration verification may be used within an analytical sequence to verify stable calibration throughout the sequence and/or to demonstrate that instrument response did not drift during a period of non-use of the instrument.

The QA/QC measures on Tables 3, 4, and 5 will be used for calibration, calibration verification, and subsequent sample analyses. In addition, the following procedures will be used for the calibration of balances and thermometers.

6.2.1 Balances

Laboratory balances will be calibrated and serviced annually by a certified external contractor. In addition, the analyst will check the balance daily before use. A record of calibrations and daily checks will be maintained in the balance log.

6.2.2 Thermometers

Oven and refrigerator thermometers will be calibrated annually against a NIST-certified thermometer in the range of interest. Annual calibrations will be recorded in a calibration notebook. Daily oven and refrigerator readings will be monitored and recorded.

6.2.3 Records

Records will be maintained as evidence of required calibration frequencies, and equipment will be marked suitably to indicate calibration status. If marking on the equipment is not possible, records traceable to the equipment will be readily available for reference.

7.0 ANALYTICAL PROCEDURES

Routine analytical services are performed using standard US EPA-approved methodology, such as SW-846 Test Methods for Evaluating Solid Waste, Physical and Chemical Final Update III (US EPA December 1996) and revisions. Analytical methods and RLs are cited on Tables 5-3, 5-4, and 5-6 of the CGMSAP and are summarized on Tables 1 and 2 of this QAPP. The laboratory analytical reporting and sensitivity limits are established using standard US EPA-approved procedures, such as, US EPA 40 CFR Part 136 Final Methods Update (US EPA, March 2008) and revisions.

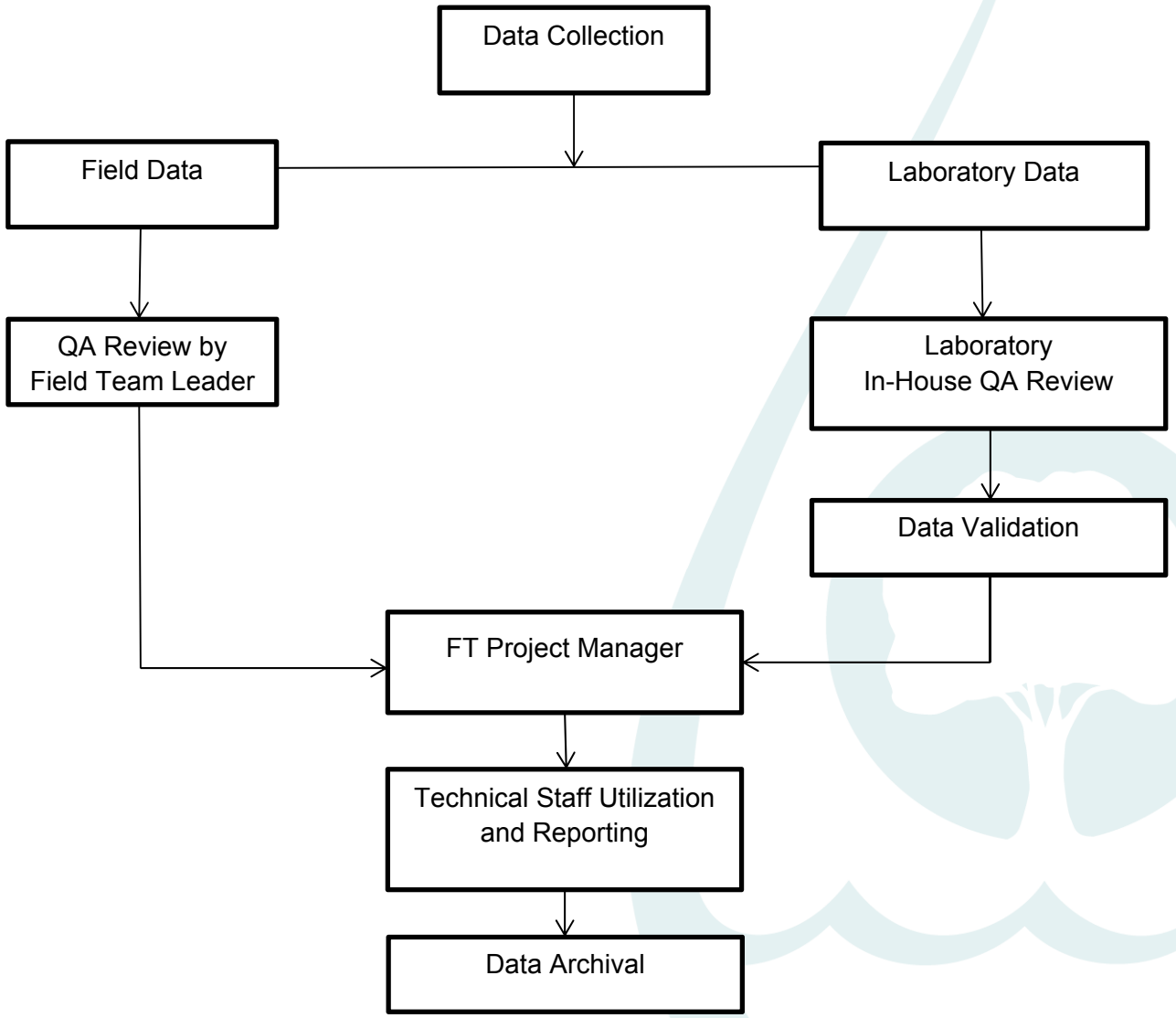
8.0 DATA REDUCTION, VALIDATION, AND REPORTING

A flow diagram depicting the general relationship of data collection, reduction, validation, management, and reporting is shown in Figure 8-1.

8.1 Field and Technical Data

Section 5.7 of the CGMSAP presents the data reduction, validation, and reporting requirements for the field and technical data.

FIGURE 8-1: DATA MANAGEMENT FLOW CHART



8.2 Laboratory Data Documentation

The laboratory for the Project will retain records of the analytical data for a minimum of 5 years after Project completion.

8.2.1 Data Reduction

Data reduction is performed by the individual analysts and consists of calculating concentrations in samples from the raw data obtained from the measuring instruments. The complexity of the data reduction is dependent upon the specific method and the number of discrete operations (*i.e.*, extractions/ digestion, dilutions, and levels/concentrations) involved in obtaining a sample that can be measured.

For all analytical methods, sample response will be applied to the average response factor or the regression line to obtain an initial raw result, which will then be factored into equations to obtain the estimate of the concentration in the original sample. Rounding will not be performed until after the final result has been obtained to minimize rounding errors; results will not normally be expressed in more than three significant figures.

Copies of raw data and calculations used to generate the final results will be retained on file to allow reconstruction of the data reduction process at a later date.

8.2.2 Laboratory Data Review

System reviews are performed at all levels. The individual analyst constantly reviews the quality of data through calibration checks, QC sample results, and performance evaluation samples. These reviews will be performed prior to submission to the Laboratory Project Manager.

Criteria for analytical data review/verification include checks for internal consistency, transmittal errors, laboratory protocol, and laboratory QC. QC sample results and information documented in field notes will be used to interpret and evaluate laboratory data. The laboratory QA Department will independently conduct a complete review of selected reports to confirm analytical results.

The laboratory will complete data verification procedures, including:

- Verifying analyses requested.
- Preliminary data proofing for anomalies - investigation and corrections, where possible.
- Reviewing laboratory data sheets for reporting/method detection limits, holding times, surrogate recovery performance, internal standard performance, and spike
- Recovery performance.
- Double-checking computerized data entry, if applicable.

The Laboratory Project Manager will review data for consistency and reasonableness with other generated data and determine whether Project requirements have been satisfied. Selected hardcopy output of data (chromatograms, spectra, integrations, *etc.*) will be reviewed to ensure that results are interpreted correctly. Unusual or unexpected results will be reviewed, and a determination will be made as to whether the analyses should be repeated. In addition, the Laboratory Project Manager may recalculate selected results to verify the calculation procedure.

The Laboratory QA Coordinator will independently conduct a complete review of the Project data to determine whether laboratory analytical requirements and the requirements for this QAPP have been met. Discrepancies will be reported to the Laboratory Project Manager for resolution.

Prior to final review/sign-off by the Laboratory Project Manager, laboratory personnel will verify that the report deliverable is complete and in proper format, screen the report for compliance to laboratory and QAPP requirements, and ensure that the Case Narrative addresses any noted deficiencies. The Laboratory Project Manager will perform the final laboratory review prior to reporting the results to FT Project Manager and QA Oversight Manager.

The Laboratory Project Manager will provide an electronic version (*e.g.*, .pdf) of the data package to the FT Project Manager and QA Oversight Manager. In addition, the Laboratory Project Manager will upload the analytical data (*e.g.*, EDD) into the environmental data and quality management system (EDQMS) utilized for the Project.

8.2.3 Data Reporting/Deliverable Package

The laboratory will be responsible for providing an approved electronic data deliverable (EDD; see Appendix B) as well as an Adobe Acrobat .pdf of the hardcopy report (see Appendix A). The deliverable package will contain final results (uncorrected for blanks and recoveries), analytical methods, reporting/method detection limits, surrogate recovery data, method blank data, and results of QC samples. In addition, special analytical problems and/or any modifications of referenced methods will be noted. The number of significant figures reported will be consistent with the limits of uncertainty inherent in the analytical method. Data are normally reported in units commonly used for the analyses performed. Concentrations in liquids are expressed in terms of weight per unit volume (*e.g.,* micrograms per liter [µg/L]).

In addition, 100% of the data will be reported in full "Contract Laboratory Program (CLP)-like" (as applicable to the SW-846 QC criteria) documentation data packages for independent data validation in accordance with guidance from US EPA *Guidance in Environmental Data Validation* (EPA QA/G-8, 2004). The format for the data package is provided in Appendix A.

QC results reported will include a method blank, matrix spike/matrix spike duplicate (MS/MSD) samples, field QC samples, and laboratory control samples (LCSs). Sample data results (including QC sample results) will also be provided in the electronic format. The laboratory is responsible for reviewing the electronic data to ensure that these data are consistent with hardcopy CLP-like results. Data discrepancies between the EDD submission and hardcopy (.pdf) results, if any, will be reconciled at validation; the Laboratory Project Manager and the

FT Project Manager will be informed by the QA Oversight Manager so that changes are made and the final hardcopy reports are made consistent with the EDD and the hard copies archived by the project team.

8.2.4 Data Review and Validation

The purpose of analytical data validation is to eliminate unacceptable data and to qualify data for any data quality limitations identified during validation. In addition to the laboratory QA review, the CLP-like reports will be evaluated and validated by the QA Oversight Manager for the following:

- Compliance with requested testing
- Completeness
- Reporting accuracy (including hardcopy to EDD)
- Confirmation of receipt of requested items

For this Project, 10% of the data will undergo full data validation and 90% of the data will undergo a limited data validation. The data validation effort will include evaluation of holding times, potential contamination, MS/MSD results, LCS results, surrogate recoveries, internal standard performance, initial calibration performance, initial calibration verification performance, continuing calibration standard performance, ICP/MS low-level initial calibration standard recoveries, ICP/MS interference check sample standard results, and ICP/MS serial dilution results. Raw data will not be evaluated for the limited data validation effort but will be evaluated for the full data validation. Both limited and full data validation efforts will be performed with guidance from the National Functional Guidelines for Organic Data Review (US EPA, June 2008) and National Functional Guidelines for Inorganic Data Review (US EPA, October 2004). Analytical data from fixed laboratories will be rejected and otherwise qualified with guidance on the National Functional Guidelines referenced above. The Beazer Environmental Manager has the authority to alter the analytical data validation scheme (*e.g.*, adjust percentage of data for limited and full data validation or scope of limited data validation effort). The Beazer East Environmental Manager will provide written notification if there is an alteration to the data validation scheme.

The data validation qualifiers listed below will be used for all Project samples.

- Data Validation Qualifiers

U	This analyte should be considered “not detected” because it was detected in a laboratory method blank at a similar level.
J	Quantitation is approximate due to limitations identified during data validation.
R	Unusable result; analyte may or may not be present in sample.
UJ	This analyte was not detected, but the reporting limit may or may not be higher due to a bias identified during data validation.

8.3 Data Management

A copy of the Chain-of-Custody Record will be delivered to the FT Project Manager for inclusion in the Project files. Upon receipt and log-in of the samples at the laboratory, the remaining sections of the Chain-of-Custody Record (*e.g.*, description of the sample condition at the time of receipt, assigned laboratory identification number, and any special conditions) will be completed. Discrepancies will be documented by the laboratory, and the FT Project Manager will be notified.

The field Chain-of-Custody Record information will be initially keyed into and maintained in the laboratory's database. A copy of the laboratory's Chain-of-Custody Record, referred to as sample receipt confirmation, will be sent to the FT Project Manager and Data Management Lead following sample log-in for verification of properly entered and handwritten Chain-of-Custody Record requests and information such as sample identification numbers, analyses requested, and the quantity of samples. In case of discrepancies between the Chain-of-Custody Record and the sample receipt confirmation, the appropriate revisions will be communicated to the laboratory for applicable Chain-of-Custody Record corrections. Corrected information on the Chain-of-Custody Record will be recorded into the project data management system.

The samples received by the laboratory will be analyzed following internal QC procedures. The information in the EDQMS is evaluated during the data validation process. The laboratory's hardcopies, on submission to the FT Project Manager, will be validated under the direction of the QA Oversight Manager with guidance from the National Functional Guidelines discussed in Subsection 8.2.4; corrected if required information is missing or is inadequately completed; and appropriate qualifiers will be added. Any data rejected during data validation due to imprecision, holding time exceedance, and failure of relevant QC measures will be qualified or not utilized for the Project.

The FT Project Manager will also be responsible for the export of validated data for reporting to the Agency. Tables with target analytes and levels of detection for Project samples and relevant QC samples will be compiled by the FT Project Manager to facilitate comparison with cleanup goals or risk-based target concentrations.

The laboratory EDD will be uploaded to an EQuIS Enterprise Database, referred to as EDQMS, utilized for this Project. Data are stored and hosted in a Microsoft SQL database using Earthsoft's EQuIS Enterprise SQL server data schema. Environmental Standards, Inc. administers the EDQMS. Access to the EDQMS is restricted by password access. The Beazer Environmental Manager is responsible for approval of access to the EDQMS. The laboratory EDD specification is provided as Appendix B.

The submission of data to the Agency will be performed in accordance with the requirements and process detailing in Section 8.0 of the CGMSAP. The FT Project Manager will provide an electronic submittal of data via CD or other delivery means in accordance with Region 4 policies, guidelines, and formats. The electronic submittal will be in compliance with the standardized format required by the Field Branches Quality System and Technical Procedures, and the Environmental Data Submission Guidance, SESD-106-R0 (or most recent version).

8.4 Data Archival

Applicable electronic field and laboratory data collected from the Site during sampling will be archived electronically. Backup media containing databases and programs or software utilities will be maintained in a secure location.

9.0 INTERNAL QUALITY ASSURANCE/QUALITY CONTROL

9.1 Field Analysis

Field analysis QC checks will consist of calibrations as detailed in the CGMSAP Section 5.2.2.

9.2 Laboratory Analysis

Internal laboratory QC checks will consist of the following:

- Instrument performance checks.
- Instrument calibration.
- Retrieval of documentation pertaining to instrument standards, samples, and data.
- Documentation of sample preservation, transport, and analytical methodology.
- Analysis of QC samples (discussed in Subsection 5.0).
- Meeting the specific method requirements on Tables 3, 4, and 5.

Laboratory analysts will be responsible for reviewing internal QC checks for compliance with the referenced analytical methods and Tables 3 through 8. The Laboratory QA Coordinator will be responsible for ensuring that appropriate corrective action is performed when sample analyses are determined to be noncompliant with the QAPP due to QC check failures.

9.3 Reporting Checks

After validated laboratory data have been made available, the data will be compiled into tables to facilitate the assessment of results. An independent check of the data entered into these tables will be performed for accuracy and completeness, and corrections will be made as addressed and discussed in Subsections 8.0 and 11.0.

10.0 PREVENTIVE MAINTENANCE

10.1 Field Equipment

The ability to collect valid samples requires that field equipment be appropriately cleaned and maintained. Field equipment will be maintained through following the procedures provided in Section 5.0 of the CGMSAP.

10.2 Laboratory Equipment

The ability to generate valid analytical data requires that analytical instrumentation be properly maintained. The laboratory will be responsible for appropriate maintenance for major instruments. The elements of an effective maintenance program are identified below and discussed in the following subsection:

- Instrument maintenance logbooks
- Instrument maintenance and repair
- Available spare parts

10.2.1 Instrument Maintenance Logbooks

Each analytical instrument will be assigned an instrument logbook. Maintenance activities will be recorded in the instrument logbook and the information entered will include:

- Date of service
- Person performing the service
- Type of service performed and reason for service
- Replacement parts installed (if applicable)
- Miscellaneous information

If service is performed by the manufacturer or its representative, a copy of the service record will be inserted into the page facing the logbook page where the above cited-information has been entered.

10.2.2 Instrument Calibration and Maintenance

An overview of the routine calibration procedures used for analytical instrumentation is presented in Section 6.0. Preventive maintenance and calibration by manufacturer service representatives will be provided on a routine basis.

In addition to maintenance by manufacturer service representatives, procedures for routine maintenance in accordance with manufacturer specifications for each analytical instrument will be followed by the laboratory. This maintenance includes maintaining inventories of spare parts used routinely (*e.g.*, vacuum pumps and filaments for GC/MS and spare torches for ICP/MS). Instrument operators have the responsibility to ensure that an acceptable inventory of spare parts is maintained.

11.0 DATA ASSESSMENT PROCEDURES

The overall QA objective for field activities, data analyses, and laboratory analyses is to produce data of sufficient and known quality to provide consistent data to enhance the understanding of groundwater conditions at the Site. Specifically, data will be developed using procedures appropriate for the intended use.

Standard procedures are used so that data of known accuracy, precision, representativeness, completeness, and comparability will be generated for each data set. Descriptions of these criteria are presented in the following subsections.

The specific QA/QC objectives for this Project are summarized on Tables 3 through 8.

11.1 Precision

The degree of agreement between the numerical values of a set of duplicate samples performed in an identical fashion constitutes the precision of the measurement. The Data Validator will assess precision during the data validation process.

During the collection of data using field methods and/or instruments, precision is checked by reporting measurements at one location and comparing results. For example, measurements are taken in pairs at a certain well and the values compared. The measurements are considered sufficiently precise only if the values are within a specified percentage of each other.

Analytical precision is calculated by expressing, as a percentage, the relative percent difference (RPD) between results of analyses of laboratory duplicate samples for a given analyte. Precision is expressed by the following formula:

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

Where: C_1 = Value of original sample
C_2 = Value of duplicate sample

Specific precision objectives for laboratory duplicate samples, including MSDs, are presented on Tables 6, 7, and 8.

For aqueous field duplicate samples, the evaluation criterion is 20% RPD if both results are greater than or equal to 5× the reporting limit; the difference must be less than the reporting limit if at least one of the results is < 5× the reporting limit.

11.2 Accuracy

Accuracy is the degree of agreement of a measurement, X, with an accepted reference or true value, T. Accuracy is usually expressed as the difference between the two values, X-T, or the difference as a percentage of the reference or true value, 100(X-T)/T;

accuracy is also sometimes expressed as a ratio X/T. Accuracy, which is a measure of the bias in a system, is assessed by means of reference samples and percent recoveries. Error may arise due to personal, instrumental, or method factors. The Data Validator will assess project data accuracy as part of the comprehensive data validation process.

The two types of analytical check samples are laboratory control samples and matrix spike samples. Analytical accuracy is expressed as the percent recovery of an analyte that has been added to the control sample or a standard matrix (*e.g.*, blank soil) at a known concentration prior to analysis.

The formula used to calculate accuracy for the laboratory control sample is:

$$\text{Accuracy} = \%\ \text{Recovery} = (A^T/A^F) \times 100$$

Where: A^T = The total concentration of the analyte measured or recovered.
A^F = The concentration of the analyte spiked.

When calculating accuracy in the matrix spike analysis, a correction for background concentration found in the un-spiked sample must be made. The formula is:

$$\text{Accuracy} = \%\ \text{Recovery} = \frac{A^T - A^O}{A^F} \times 100$$

Where: A^T = The concentration of the analyte measured or recovered.
A^O = The un-spiked concentration of the analyte.
A^F = The concentration of the analyte spiked.

In general, the accuracy objectives are based on the analytical method as indicated on Tables 6, 7, and 8.

11.3 Completeness

Completeness is a measure of the degree to which the amount of sample data collected meets the needs of the sampling program and is quantified as the relative number of analytical data points that meet the acceptance criteria (including accuracy, precision, and any other criteria required by the specific analytical method used). Completeness is defined as a comparison between actual numbers of usable data points expressed as a percentage of expected number of points. The Data Validator will be responsible for evaluating the completeness of the data report by the laboratory by reconciliation of the Chain-of-Custody Record to the hard copy data package and EDD. The FT Project Manager will be responsible for the overall evaluation of completeness of the execution of field efforts.

The QA objectives for completeness will be based upon QA protocols. The ability to meet or exceed this completeness objective is dependent on the nature of samples submitted for analysis. If data cannot be reported without qualification, project completion goals may still be met if the qualified data (*i.e.,* data of known quality, even if not perfect) are suitable for specified project goals. Percent completeness will be expressed as the ratio of the total number of usable results relative to the total number of analytical results. The total number

of usable analytical results will be the total number of results minus any results that are rejected during data validation activities. The project goal for completeness is 90%.

11.4 Representativeness

Representativeness expresses the degree to which sample data are accurate and precisely represents a characteristic of a population, parameter variations at a sampling point, or an environmental condition. Representativeness is a qualitative parameter associated with the proper design of the sampling program. The representativeness criterion can, therefore, be met through the proper selection of sampling locations, the collection of a sufficient number of samples, and using US EPA-approved and standardized sampling procedures to describe sampling techniques and the rationale used to select sampling locations to ensure representativeness of the sample data.

Representativeness will also be measured by the collection of field duplicates, as appropriate. Comparison of the analytical results from field duplicates will provide a direct measure of individual sample representativeness. The Data Validator will be responsible for the evaluation of representativeness through the evaluation of the field duplicate results.

11.5 Comparability

Comparability is a qualitative parameter used to express the confidence with which one data set can be compared with another. The comparability of the data, a relative measure, is influenced by sampling and analytical procedures. By providing specific protocols for obtaining and analyzing samples, data sets should be comparable regardless of who collects the sample or who performs the sample analysis. The FT Project Manager will be responsible for the evaluation of comparability of the data to the historical project data set prior to reporting data.

The laboratory will be responsible for enhancing comparability by using the following controls:

- Adherence to current, standard US EPA-approved methodology for sample preservation and analysis.
- Compliance with holding times and analysis consistent with this QAPP.
- Consistent reporting units for each parameter of similar matrices.
- NIST-traceable standards, when applicable.

11.6 Reconciliation with Data Quality Objectives

The FT Project Manager in conjunction with the QA Oversight Manager will determine whether field and validated analytical data or data sets meet the requirements necessary for decision-making. The results of measurements will be compared to the goals and requirements set forth in this QAPP. As data are evaluated, anomalies in the data or data gaps may become apparent to the data users. Data that do not meet the data users' needs will be identified and appropriately noted so that decision-makers are aware of data limitations. Analytical data that have been qualified as unusable during data validation will not be used for decision-making. In addition, the FT Project Manager with consultation from

the Technical Support Manager and the QA Oversight Manager may reject analytical data if deemed warranted due to professional judgment and based on statistical or other evaluations of the data set.

The FT Project Manager is responsible for the reconciliation of project data to DQOs during the development of the Agency report. The process of reconciling project data with the DQOs will be performed with guidance from the *Guidance for Data Quality Assessment, Practice Methods for Data Analysis* (US EPA QA/G-9, July 2000); *Data Quality Assessment: A Reviewer's Guide* (US EPA QA/G-9R, February 2006); and *Data Quality Assessment: Statistical Methods for Practitioners* (US EPA QA/G-9S, February 2006). The FT Project Manager will provide the Beazer Environmental Manager with a report detailing any deviations from the DQOs.

12.0 FEEDBACK AND CORRECTIVE ACTION

Responsibilities for feedback and corrective action for the field team are described in Section 5.8 of the CGMSAP. Responsibilities for the laboratory are described in this section.

12.1 Feedback Mechanism

There are mechanisms within the Project structure that allow for the identification, feedback, and control of any non-conformances or deficiencies. In general, the technical personnel involved with the project are responsible for reporting suspected technical non-conformances through standard communication channels established by the organizational structure. In the same manner, Project personnel are responsible for reporting suspected QA non-conformances.

12.2 Corrective Action

The field team has the responsibility to monitor the quality of the sample collection and submission procedures. The field team will verify that procedures are followed. Each member of the field team is responsible to report any deviations or concerns to the field team leader, FT Project Manager, and/or the QA Oversight Manager for corrective action.

The laboratory has the responsibility to monitor the quality of the analytical system. The laboratory will verify that QC procedures are followed and that the analytical results of QC samples are within the acceptance criteria. The verification requires that the laboratory assess the correctness of the following items, as appropriate:

- Sample preparation procedure
- Initial calibration
- Calibration verification results
- ICP/MS interference check sample results
- Method blank result
- LCS results
- MS/MSD results
- Surrogate recoveries
- Internal standard performance

If the assessment reveals that the QC acceptance criteria are not met, the laboratory must immediately evaluate the analytical system and correct the problem. The analyst will notify the Laboratory Project Manager and Laboratory QA Coordinator of the problem and, if possible, will identify potential causes and suggest correct action. Figure 12-1 presents the pathway for corrective actions.

The nature of the corrective action obviously depends on the problem. For example, if a continuing calibration verification standard is determined to be out-of-control, the corrective action may require recalibration of the analytical system and reanalysis of all samples analyzed since the last acceptable continuing calibration standard.

When the appropriate corrective action measures have been implemented and the analytical system is determined to be "in control," the analyst will document the problem, the corrective action taken, and resultant data demonstrating that the analytical system is in control. Copies of the documentation will be provided to the Laboratory Project Manager, the Laboratory QA Coordinator, the FT Project Manager, and the QA Oversight Manager.

Data generated concurrently with an out-of-control system will be evaluated for usability relative to the nature of the deficiency. If the deficiency does not impair the usability of the results, data will be reported and the deficiency will be addressed in the Case Narrative. If sample results are impaired, the Laboratory Project Manager and FT Project Manager will be notified and appropriate corrective action (*e.g.*, reanalysis) will be taken.

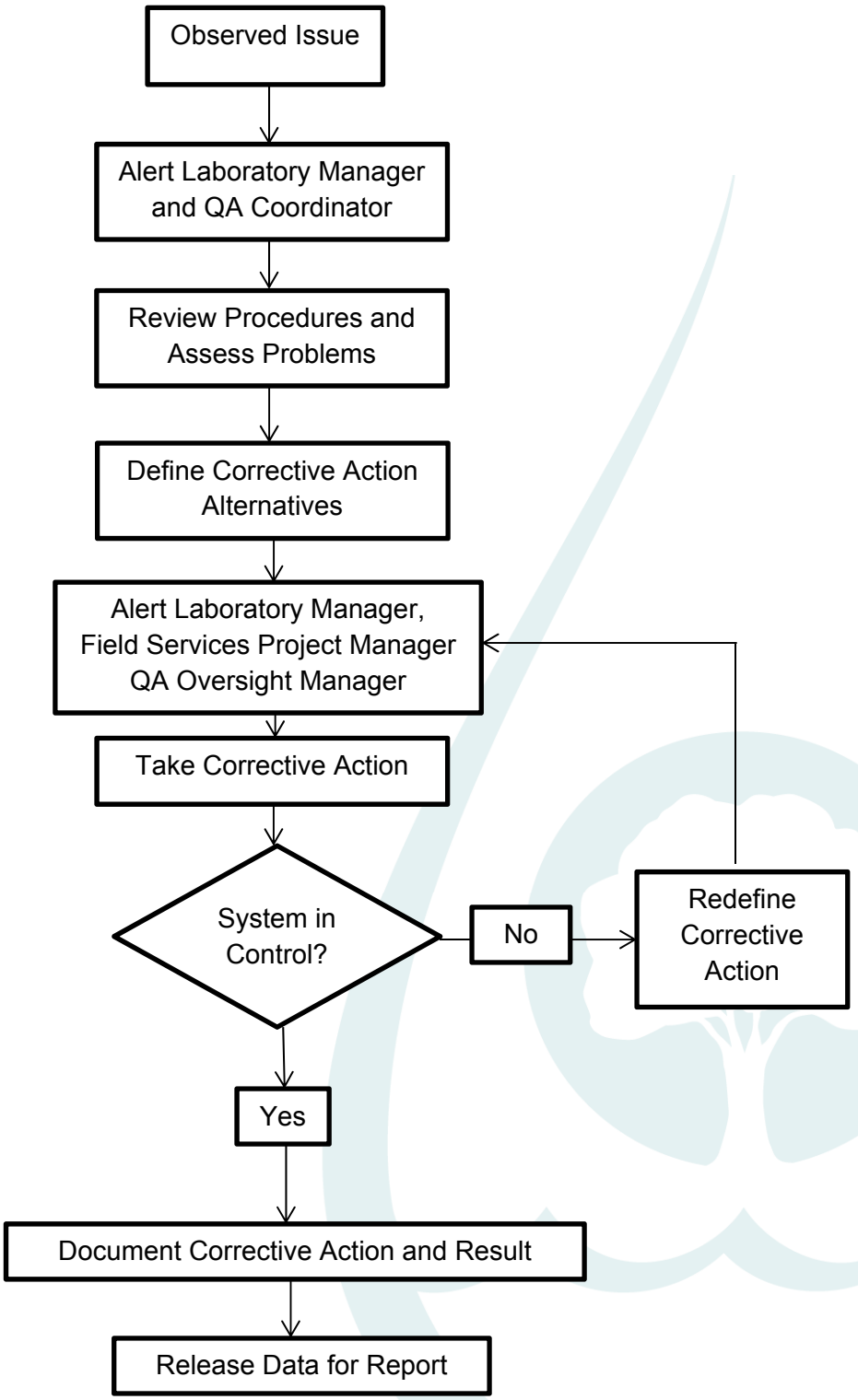
The specific approach to corrective action procedures for laboratory instruments will be those contained in the procedures specified in the laboratory quality assurance plan necessary to meet the DQOs of this QAPP.

The Data Validator will be responsible to review the field and laboratory QC information provided in the hard copy data package and EDD. The Data Validator is responsible to report any deviations or concerns to the FT Project Manager and/or the QA Oversight Manager for corrective action.

12.3 Response to Agency or Comments From Others

The Beazer Environmental Manager will be responsible to receive and ultimately respond to written comments from the Agency or other governmental organizations. The Beazer Environmental Manager will evaluate the comments from the Agency or others and assign additional review and response tasks to the appropriate project team member (*e.g.*, FT Project Manager, QA Oversight Manager, or Laboratory Project Manager). The Agency or other personnel providing the comments will be provided with a schedule of anticipated written response. The project team response to the written comments from the Agency or others will be reviewed by the Technical Support Manager and Beazer Environmental Manager. The Beazer Environmental Manager will be responsible for issuing the formal response.

FIGURE 12-1: CRITICAL PATH FOR LABORATORY CORRECTIVE ACTION



13.0 QUALITY ASSURANCE REPORTS

13.1 Field QA Reports

The requirements for field QA reporting are provided in Section 5.7.3 of the CGMSAP.

13.2 Laboratory QA Reports

The laboratory QA Coordinator will immediately notify the FT Project Manager and QA Oversight Manager of any significant laboratory QA situations that require corrective action.

13.3 Data Submittals

The electronic data deliverable and full data packages will summarize the deviations from approved protocols and significant data findings in the Case Narratives. The laboratory will provide the data packages to the FT Project Manager and QA Oversight Manager. The FT Project Manager will provide a report for delivery to Beazer and US EPA Region IV.

The submission of data to the Agency will be performed in accordance with the requirements and process detailing in Section 8.0 of the CGMSAP. The FT Project Manager will provide an electronic submittal of data via CD or other delivery means in accordance with Region 4 policies, guidelines, and formats. The electronic submittal will be in compliance with the standardized format required by the Field Branches Quality System and Technical Procedures, and the Environmental Data Submission Guidance, SESD-106-R0 (or most recent version).

Electronic and hardcopy data will be archived for a minimum of 5 years from the date of reporting.

13.4 Reports to Management

Effective communications among the project team is critical to ensure that problems are remedied and that solutions are documented in an effective and timely manner. QA summary reports will be prepared from each of the three areas listed below (field, laboratory, and data validation) for submission to the FT Project Manager, Laboratory QA Coordinator, or QA Oversight Manager for compilation and reporting to the Beazer Environmental Manager.

At the direction of the Beazer Environmental Manager, additional reports will be compiled and submitted to the FT Project Manager, Technical Support Manager, Laboratory Project Manager, or other entity as directed.

13.4.1 Field QA Reports

The field team leader will provide the FT Project Manager with daily field progress reports. The FT Project Manager will immediately notify the Technical Support Manager and copy (via e-mail) the QA Oversight Manager regarding any field situations that require corrective action. Copies of periodic internal and external audits detailing issues and recommendations for corrective action must be sent to the QA Oversight Manager, Technical Support Manager, and the Beazer Environmental Manager within 4 weeks of the audit. When internal and external audits are performed, the audit report will be included with the Data Submittal (Section 13.3) for delivery to the Agency.

13.4.2 Laboratory QA Reports

The Laboratory QA Coordinator will provide summary reports specific to the project to the QA Oversight Manager at the request of the Beazer Environmental Manager. These reports will summarize QA activities for the reporting period, including results of performance audits (external and internal), results of system audits (external and internal), summaries of corrective action to remedy out-of-control situations, and recommendations for revisions of laboratory procedures to improve the analytical systems. The Laboratory PM will immediately notify the QA Oversight Manager and the FT Project Manager about laboratory QA situations that appear to systematically impact data quality, including late or missing deliverables, missed holding times, improper receipt condition, non-compliant EDDs or sample receipt log-in, or analysis issues. When QA activity summaries are generated, the summary will be included with the Data Submittal (Section 13.3) for delivery to the Agency.

13.4.3 Data Validation Reports

The data validator will be responsible for providing data validation reports to the QA Oversight Manager. The QA Oversight Manager will be responsible to provide the data validation reports to the Beazer Environmental Manager and the FT Project Manager within 4 weeks of the receipt of the completed data package and corresponding EDD. The data validation reports will be included with the Data Submittal (Section 13.3) for delivery to the Agency.

14.0 REFERENCES

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US EPA (US Environmental Protection Agency). EPA Guidance on Systematic Planning Using the Data Quality Objectives Process. US EPA QA/G-4. Office of Environmental Information. Washington, DC, February 2006.

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Table 1

Target Analytes for Evaluation Summary

Analyte	Methodology	Reporting Limit (µg/L)	Federal MCL (µg/L)	Florida GCTL (µg/L)	ROD Cleanup Goal (µg/L)
Arsenic, total and dissolved	SW-846 6020A	0.5	10	10	10
Chromium, total and dissolved	SW-846 6020A	2	100	100	-
Benzene	SW-846 8260B	1	5	1	1
Ethylbenzene	SW-846 8260B	1	700	30	-
Toluene	SW-846 8260B	1	1,000	40	-
Xylene, total	SW-846 8260B	3	10,000	20	-
2,4-Dimethylphenol	SW-846 8270D	5	-	140	140
2-Methylnaphthalene	SW-846 8270D	5	-	28	28
2-Mthylphenol	SW-846 8270D	5	-	35	35
3&4-Methylphenol*	SW-846 8270D	5	-	3.5	3.5
Acenaphthene	SW-846 8270D	5	-	20	20
Acenaphthylene	SW-846 8270D	5	-	210	210
Anthracene	SW-846 8270D	5	-	2,100	-
Carbazole	SW-846 8270D	1.8	-	1.8	1.8
Dibenzofuran	SW-846 8270D	5	-	28	28
Fluoranthene	SW-846 8270D	5	-	280	280
Fluorene	SW-846 8270D	5	-	280	280
Naphthalene	SW-846 8270D	5	-	14	14
Pentachlorophenol	SW-846 8270D	1	1	1	1
Phenanthrene	SW-846 8270D	5	-	210	210
Phenol	SW-846 8270D	5	-	10	10
Pyrene	SW-846 8270D	5	-	210	-

Notes:

* 3-Methylphenol and 4-Methylphenol cannot be quantified separately using SW-846 Method 8270D.
\- Indicates that no criteria are available for this parameter.
GCTL Florida Groundwater Cleanup Target Level
MCL Federal Maximum Contaminant Level
ROD Record of Decision

Table 2

Additional Semivolatile Organic Compounds Summary

Analyte	Methodology	Reporting Limit (µg/L)
Benzo(a)anthracene	SW-846 8270D	5
Benzo(a)pyrene	SW-846 8270D	5
Benzo(b)fluoranthene	SW-846 8270D	5
Benzo(g,h,i)perylene	SW-846 8270D	5
Benzo(k)fluoranthene	SW-846 8270D	5
Chrysene	SW-846 8270D	5
Dibenzo(a,h)anthracene	SW-846 8270D	5
Indeno(1,2,3-cd)pyrene	SW-846 8270D	5

Table 3

Metals Analysis by SW-846 Method 6020A
QA/QC Requirements

Procedure	Frequency	Acceptance Criteria	Corrective Action
Tune	Analyze once every 24 hours before instrument calibration.	Resolution and mass calibration meet method requirements.	Terminate analysis, correct problem, retune.
Initial Calibration[1]	Every 24 hours. At a minimum, the initial calibration consists of a blank and a mid-level standard or a three-point curve and a blank with the lowest non-zero standard at the reporting limit (RL)	Both curves are verified with the ICV and LLICV standards described below. The correlation coefficient (r) for a three-level curve calibration must be $\geq$ .990.	1. Evaluate system. 2. Correct system and recalibrate. Criteria must be met before sample analysis may begin.
Initial Calibration Verification (ICV)[2]/ Initial Calibration Blank (ICB)	Once per 24 hours and each time the instrument is calibrated. Immediately after instrument calibration, the ICV and ICB are analyzed.	ICV within 90% - 110% recovery. Absolute value of ICB must be < RL.	1. Reanalyze once. 2. Terminate analysis, correct problem, and recalibrate Instrument.
Low Limit Initial Calibration Verification (LLICV)	After the analysis of the daily ICV and ICB, a LLICV must be analyzed.	LLICV is within 70% - 130% recovery. This must be at the RL.	1. Reanalyze once. 2. Terminate analysis, correct problem, and recalibrate instrument.

Table 3

Metals Analysis by SW-846 Method 6020A
QA/QC Requirements

Procedure	Frequency	Acceptance Criteria	Corrective Action
Continuing Calibration Verifications (CCV)/ Continuing Calibration Blank (CCB)	Analyzed after every 10 samples and at the end of the analytical batch.	Recovery of CCV between 90% - 110%. Absolute value of CCB must be < RL.	1. Reanalyze once. 2. If CCV does not meet criteria, terminate analysis, correct problem, and recalibrate instrument. Reanalyze all project samples since the last compliant CCV. Exception: If arsenic is out high in the CCV and not detected in the project samples, samples can be reported. If concentration of arsenic in associated samples is greater than 10× the absolute value of the CCB, report results and narrate in Case Narrative.
Internal Standards	Internal standards responses monitored.	Between 30% - 170% of the corresponding internal standard in the mid-level standard of the initial calibration.	Reanalyze samples if only samples are affected (dilution may be necessary to bring responses within criteria). If CCV or CCB is affected, stop analysis and correct problem and reanalyze samples as necessary.
Interference Check Samples (ICSA and ICSAB)	Analyze at the beginning and end of each analytical batch.	1. Recovery of analytes in ICSAB within 80% - 120%. 2. Concentration of analytes in ICSA must be < the RL.	1. Reanalyze once. 2. Terminate analysis, correct problem, and recalibrate Instrument. Reanalyze all project samples bracketed.

Table 3

Metals Analysis by SW-846 Method 6020A
QA/QC Requirements

Procedure	Frequency	Acceptance Criteria	Corrective Action
Preparation Blank	One per digestion batch of ≤ 20 samples per batch. Must undergo all sample preparative procedures and analysis.	Less than the RL.	1. All samples with positive results less than or equal to 10-times the preparation blank concentration must be re-digested and reanalyzed. 2. Samples with no positive results for the analyte present in the preparation/ method blank or with a concentration greater than 10× the method blank concentration are acceptable. Narrate in Case Narrative.
Laboratory Control Sample (LCS)[3]	One per batch of ≤ 20 samples. Must undergo all sample preparative procedures and analysis.	See Table 6 for acceptance limits.	1. LCS may be analyzed once. 2. All project samples have to be re-prepared and reanalyzed.
Matrix Spike/Matrix Spike Duplicate (MS/MSD) (pre-digestion)[3]	One project sample per batch of ≤ 20 samples. Must undergo all sample preparative procedures and analysis.	See Table 6 for acceptance limits. Not applicable if sample concentration is > 4× spike added.	1. Perform a post-digestion spike. 2. Flag data 3. Narrate in Case Narrative.
Post-Digestion Spike	Perform if MS/MSD fails.	The acceptance for post-digestion spike is ± 20% of the known value.	1. Evaluate Data 2. Dilute sample, re-spike and analyze.

Table 3

Metals Analysis by SW-846 Method 6020A
QA/QC Requirements

Procedure	Frequency	Acceptance Criteria	Corrective Action
Serial Dilution (1:5)	Perform serial dilution if post - digestion spike recoveries are outside of ± 20% acceptance range.	If the undiluted result is > 50× the MDL, the 1:5 dilution within 10% of undiluted value.	1. Evaluate analyses 2. Narrate in Case Narrative.

Notes:

1. Calibration equations that are forced through zero is acceptable when used with a multipoint calibration provided that the zero-point standard (calibration blank) is analyzed with and included in the calibration curve and provided that all other calibration checks and quality control analyses are acceptable.

2. ICV must be a certified reference standard from a source different from the calibration standards and must have a vendor-defined expiration date. Only the ICV standard is required to be from a source separate from the calibration standards.

3. LCS, MS, and MSD samples must include each analyte of interest.

4. If a post-digestion spike sample is prepared and analyzed, the results and calculated recoveries must be reported in the data package and any flags applied to the data whether or not the MS/MSD recoveries are acceptable.

Table 4

Semivolatile Organic Compound Analysis by SW-846 Method 8270D
QA/QC Requirements

Procedure	Frequency	Acceptance Criteria	Corrective Action
Decafluorotriphenyl-phosphine (DFTPP) Mass Spectrometer Tune (50 ng or less)	Analyze at the start of each 12-hour period before initial calibration or continuing calibration verification.	1. Resolution and ion abundance criteria meet method requirements. 2. Tailing factor for pentachlorophenol and benzidine is < 2.0. 3. DDT degradation < 20%.	1. Retune 2. Do not proceed with analysis until DFTPP meets ion abundance and tailing factor criteria.
Initial Calibration	Establish initially with a minimum of 5 different concentration levels with low standard at or below the reporting limit (RL)..	The %RSD should be ≤ 20% if average response factor is to be used for quantitation. If regression model is applied, a curve must have a correlation coefficient (r) ≥ 0.99 or a coefficient of determination (COD) ≥ 0.99.	1. Evaluate system; ensure same dwell times and secondary ions are applied to all standards and QC and project samples. 2. Correct system and recalibrate. Criteria must be met before sample analysis may begin. 3. Primary and secondary ion ratios must be within QC limits. Dwell time, RT, and RRT must be same for all calibration, QC, and project sample analysis.
Initial Calibration Verification (ICV)	After Initial Calibration at mid-range of calibration.	% Difference ≤ 30% for all target analytes.	1. Evaluate system. 2. Reanalyze once. 3. Retune and recalibrate if necessary. Do not proceed with analysis until ICV recovery is in control.

Table 4

Semivolatile Organic Compound Analysis by SW-846 Method 8270D
QA/QC Requirements

Procedure	Frequency	Acceptance Criteria	Corrective Action
Continuing Calibration Verification (CCV)	After tune, if initial calibration is not necessary.	1. % Difference is ≤ 20% for all target analytes. 2. Internal standard area counts must be within 50% to 200% of the middle level concentration of most recent initial calibration. 3. Internal standard retention times must be within 30 seconds of the middle level concentration of the most recent calibration.	1. Evaluate system. 2. Reanalyze once. 3. Retune and recalibrate if necessary. Do not proceed with analysis until CCV acceptance criteria are met.
Laboratory Control Sample (LCS)	One per batch of ≤ 20 samples. Must undergo all preparative procedures. Analyze prior to the analysis of blank and project samples.	See Table 7 for limits.	If concentration falls outside of the limits, the extraction/concentration processes are out-of-control. The extraction batch has to be repeated and all relevant QC and project samples have to be re-extracted. Exception: If target recoveries are greater than acceptance limits and no positive results were observed
Surrogate	Added to all project samples, blanks, and QC samples prior to extraction.	See Table 7 for limits.	1. Evaluate sample. 2. If recovery is high and no positive results in samples, narrate in Case Narrative. 3. Reextract and reanalyze to confirm matrix effect.

Table 4

Semivolatile Organic Compound Analysis by SW-846 Method 8270D
QA/QC Requirements

Procedure	Frequency	Acceptance Criteria	Corrective Action
Internal Standards	Added to all project samples, blanks and QC samples prior to analysis.	Area counts must be within 50% - 200% of the associated CCV.	1. Evaluate sample analysis. 2. Prepare a second aliquot of sample extract and reanalyze to Confirm matrix interference.
Method Blank	Prepared with each group of samples (samples started through the extraction process to a maximum of 20 samples)	Less than the RL.	1. All project samples with positive results less than or equal to 10× the method blank concentration must be re-extracted and analyzed. 2. Project samples with no positive result for the target detected in the method blank or with a concentration greater than 10× the method blank concentration are acceptable. Narrate in Case
Matrix Spike/Matrix Spike Duplicate (MS/MSD)	One project sample per batch of ≤ 20 samples per 12-hour shift. Must undergo all preparative procedures.	See Table 7 for limits.	1. Evaluate, confirm matrix effects. 2. Flag data, narrate in Case Narrative.
Qualitative/Quantitative Issue	If instrument level of any compound in a sample exceeds the instrument level of that compound in the highest level standard, the sample must be diluted to approximately mid-level of the calibration range and reanalyzed.	The instrument level of all compounds must be within the upper calibration range for all samples.	Dilute the sample to bring the level of the highest concentration of target compounds with the calibration range.

Table 5

Volatile Organic Compound Analysis by SW-846 Method 8260B
QA/QC Requirements

Procedure	Frequency	Acceptance Criteria	Corrective Action
Bromofluorobenzene (BFB) Mass Spectrometer Tune (50 ng)	Analyze at the start of each 12-hour period before initial calibration or continuing calibration verification.	Resolution and ion abundance criteria meet method requirements.	1. Retune. 2. Do not proceed with analysis until BFB meets ion abundance criteria.
Initial Calibration	Establish initially with a minimum of 5 different concentration levels.	The %RSD should be ≤ 15 if average response factor is to be used for quantitation. If regression model is applied, r must be ≥ 0.995.	1. Evaluate system; ensure same dwell times and secondary ions are applied to all standards and QC and project samples. 2. Correct system and recalibrate. Criteria must be met before sample analysis may begin. 3. Primary and secondary ion ratios must be within QC limits. Dwell time, RT, and RRT must be same for all calibration, QC, and project sample analysis.
Initial Calibration Verification (ICV)	After Initial Calibration at mid-range of calibration.	% Difference ≤ 20% for all target analytes.	1. Evaluate system. 2. Reanalyze once. 3. Retune and recalibrate if necessary. Do not proceed with analysis until ICV recovery is in control.

Table 5

Volatile Organic Compound Analysis by SW-846 Method 8260B
QA/QC Requirements

Procedure	Frequency	Acceptance Criteria	Corrective Action
Continuing Calibration Verification (CCV)	After tune, if initial calibration is not necessary.	1. % Difference is ≤ 20% for all target analytes. 2. Internal standard area counts must be within 50% to 200% of the middle level concentration of most recent initial calibration. 3. Internal standard retention times must be within 30 seconds of the middle level concentration of the most recent calibration.	1. Evaluate system. 2. Reanalyze once. 3. Retune and recalibrate if necessary. Do not proceed with analysis until CCV acceptance criteria are met.
Laboratory Control Sample (LCS)	One per batch of ≤ 20 samples. Must undergo all preparative procedures. Analyze prior to the analysis of blank and project samples.	See Table 8 for limits.	If concentration falls outside of the limits, the extraction/concentration processes are out-of-control. The extraction batch has to be repeated and all relevant QC and project samples have to be re-extracted. Exception: If target recoveries are greater than acceptance limits and no positive results were observed in the project samples, narrate in the Case Narrative.

Table 5

Volatile Organic Compound Analysis by SW-846 Method 8260B
QA/QC Requirements

Procedure	Frequency	Acceptance Criteria	Corrective Action
Surrogate	Added to all project samples, blanks, and QC samples prior to extraction.	See Table 8 for limits.	1. Evaluate sample. 2. If recovery is high and no positive results in samples, narrate in Case Narrative. 3. Re-extract and reanalyze to confirm matrix effect.
Internal Standards	Added to all project samples, blanks, and QC samples prior to analysis.	Area counts must be within 50% - 200% of the associated CCV.	1. Evaluate sample analysis. 2. Prepare a second aliquot of sample extract and reanalyze to confirm matrix interference.
Method Blank	Prepared with each group of samples to a maximum of 20 samples	Less than the RL.	1. All project samples with positive results less than or equal to 10× the method blank concentration must be re-extracted and analyzed. 2. Project samples with no positive result for the target detected in the method blank or with a concentration greater than 10× the method blank concentration are acceptable. Narrate in Case Narrative.

Table 5

Volatile Organic Compound Analysis by SW-846 Method 8260B
QA/QC Requirements

Procedure	Frequency	Acceptance Criteria	Corrective Action
Matrix Spike/Matrix Spike Duplicate (MS/MSD)	One project sample per batch of ≤20 samples per 12-hour shift. Must undergo all preparative procedures.	See Table 8 for limits.	1. Evaluate, confirm matrix effects. 2. Flag data, narrate in Case Narrative.
Qualitative/Quantitative issue	1. If instrument level of any compound in a sample exceeds the instrument level of that compound in the highest level standard, the sample must be diluted to approximately mid-level of the calibration range and reanalyzed. 2. A sample with a target compound concentration between the reporting limit but ≤ 5× the reporting limit immediately follows a sample which had a the concentration of the target analyte that exceeded the calibration range, then the sample following the high-level sample must be reanalyzed to determine if carryover occurred.	1. The instrument level of all compounds must be within the upper calibration range for all samples. 2. The sample analyzed immediately after a high- level sample must display concentrations less than the reporting limit or > 5 × the reporting limit.	1. Dilute the sample to bring the level of the highest concentration of target compounds with the calibration range. 2. A sample displaying concentrations of target compounds between the reporting limit and 5× the reporting limit that was analyzed immediately after a high-level sample must be reanalyzed. If the results do not agree within the reporting limit, report only the second analysis.

TABLE 6

Metals Precision and Accuracy Requirements for SW-846 Method 6020A

Parameter	Method	Matrix	MS/MSD Accuracy (% Recovery)	MS/MSD Precision (RPD)	LCS Precision (% Recovery)
Metals	6020A	Aqueous	75-125	20	75-125

Table 7

Semivolatile Organic Compound Precision and Accuracy Requirements for SW-846 Method 8270D

Target	Method	Matrix	MS/MSD Accuracy % Recovery	MS/MSD Precision RPD	LCS Accuracy % Recovery
2,4-Dimethylphenol	8270D	Aqueous	30-120	30	30-120
2-Methylnaphthalene	8270D	Aqueous	50-150	30	60-140
2-Methylphenol	8270D	Aqueous	30-120	30	30-120
3&4-Methylphenol	8270D	Aqueous	30-120	30	30-120
Acenaphthene	8270D	Aqueous	50-150	30	60-140
Acenaphthylene	8270D	Aqueous	50-150	30	60-140
Anthracene	8270D	Aqueous	50-150	30	60-140
Carbazole	8270D	Aqueous	50-150	30	60-140
Dibenzofuran	8270D	Aqueous	50-150	30	60-140
Fluoranthene	8270D	Aqueous	50-150	30	60-140
Fluorene	8270D	Aqueous	50-150	30	60-140
Naphthalene	8270D	Aqueous	50-150	30	60-140
Pentachlorophenol	8270D	Aqueous	30-120	30	30-120
Phenanthrene	8270D	Aqueous	50-150	30	60-140
Phenol	8270D	Aqueous	30-120	30	30-120
Pyrene	8270D	Aqueous	50-150	30	60-140
Surrogates					
2,4,6-Tribromophenol	8270D	Aqueous	30-150		
2-Fluorobiphenyl	8270D	Aqueous	30-150		
2-Fluorophenol	8270D	Aqueous	20-130		
Fluoranthene-d_{10}	8270D	Aqueous	30-150		
Fluorene-d_{10}	8270D	Aqueous	30-150		
Nitrobenzene-d_5	8270D	Aqueous	30-150		
Phenol-d_6	8270D	Aqueous	20-130		
Terphenyl-d_{14}	8270D	Aqueous	30-150		

Table 8

Volatile Organic Compound Precision and Accuracy Requirements for SW-846 Method 8260B

Target	Method	Matrix	MS/MSD Accuracy % Recovery	MS/MSD Precision RPD	LCS Accuracy % Recovery
Benzene	SW-846 8260B	Aqueous	70-130	30	70-130
Ethylbenzene	SW-846 8260B	Aqueous	70-130	30	70-130
Toluene	SW-846 8260B	Aqueous	70-130	30	70-130
Xylenes, total	SW-846 8260B	Aqueous	70-130	30	70-130
Surrogates					
Dibromofluoromethane	SW-846 8260B	Aqueous	70-130		
1,2-Dichloroethane-d_4	SW-846 8260B	Aqueous	70-130		
Toluene-d_8	SW-846 8260B	Aqueous	70-130		
4-Bromofluorobenzene	SW-846 8260B	Aqueous	70-130		

APPENDIX A

Appendix A

Data Package Deliverables

All hardcopy data packages will be supplied to Beazer as an indexed and searchable (OCR formatted) PDF file on CD or DVD media. The following sections describe in detail the type of data package for this project; the data package detailed has been developed for non-Contract Laboratory Program Methods. The US EPA CLP SOW has additional details concerning data packages that are specific to CLP analyses. The most recent Statement of Work should be referenced for details concerning CLP-style data packages. Note: the summary forms provided in these data packages should be in similar format and content to the CLP forms listed (as references) next to the form title. These CLP forms references are only provided as guidance on content and format and should be modified by the laboratory to meet method requirements.

1.0 Data Package Contents and Order of Presentation

The laboratory will be required to submit supporting documentation for the reported analytical results. The supporting documentation and the analytical results will be required to be reported in the data package deliverable below. The data package deliverables format must be submitted in the order in which the deliverables appear in the text.

2.0 Format for Data Package Deliverables

The Data Package will include data for analyses of all samples in one Sample Delivery Group (SDG), including field samples, reanalyses, secondary dilutions, blanks, LCSs, MS/MSDs, and/or laboratory duplicates. The Sample Data Package must be complete before submission and must be consecutively paginated. The Sample Data Package will be arranged in the following order:

A) Cover Letter/Letter of Transmittal

B) Title Page

C) Table of Contents

D) Case Narrative

This document shall be clearly labeled “SDG Narrative” and shall contain: laboratory name, SDG number, Beazer sample identifications, laboratory sample numbers, and detailed documentation of any QC, sample, shipment, and/or analytical problems encountered in processing (preparing and analyzing) the samples reported in the data package. A glossary of qualifier codes used in the SDG must also be provided.

The laboratory must also include reference to preparation and analytical methods performed and applicable project documents (*i.e*., QAPP), any problems encountered, both technical and administrative, corrective actions taken and resolution, and an explanation of all flagged edits (*i.e*., exhibit edits) on quantitation reports (including results flagged due to storage blank contamination).

Additionally, the SDG Narrative must be signed and dated by the laboratory manager or his designee. The SDG Narrative must include a statement or statements relative to compliance with this document and any applicable project documents and description of any deviations from these documents.

E) Field and Internal (Laboratory) Chain-of-Custody Records, Sample Receipt Documentation Log, and all Project Correspondence.

Copies of both the external and internal Chain-of-Custody Records for all samples within the SDG must be included in the deliverables. The Chain-of-Custody Records or sample receipt documentation will list all pH measurements for all samples requiring pH adjustment for preservation.

F) GC/MS Volatile Organic Data

1. QC Summary.

a. Surrogate Percent Recovery Summary (modified CLP SOW Form II VOA).

b. Matrix Spike/Matrix Spike Duplicate Summary (modified CLP SOW Form III VOA).

c. LCS Summary (modified CLP SOW Form III VOA).

d. Method Blank Summary (modified CLP SOW Form IV VOA) -- arranged in chronological order by date of analysis of the blank, by instrument.

e. GC/MS Tuning and Mass Calibration Summary (modified CLP SOW Form V VOA) -- arranged in chronological order, by instrument.

f. Internal Standard Area and Retention Time Summary (modified CLP SOW Form VIII VOA) -- arranged in chronological order, by instrument.

2. Sample Data

Sample data shall be arranged in packets consisting of the Analytical Results Summaries followed by the raw data for volatile samples. These sample packets should then be placed in increasing alphanumeric order by

Beazer sample identification. The order of each sample packet is as follows:

a. Target Compound Results (modified CLP SOW Form I VOA).

b. Reconstructed total ion chromatogram (RIC) and quantitation reports.

c. Copies of raw spectra and copies of background-subtracted mass spectra of each target compound identified in the sample and corresponding background-subtracted target compound standard mass spectra.

3. Standards Data

a. Initial Calibration Data (modified CLP SOW Form VI VOA and associated volatile standard reconstructed ion chromatograms and quantitation reports) -- for all initial calibrations associated with analyses in the SDG, in chronological order, by instrument.

b. Continuing Calibration Data (modified CLP SOW Form VII VOA and associated volatile standard reconstructed ion chromatograms and quantitation reports) -- for all continuing calibrations associated with analyses in the SDG, in chronological order, by instrument.

4. Raw QC Data

a. For each GC/MS tuning and mass calibration (in chronological order, by instrument):

i. Bromofluorobenzene (BFB) bar graph spectrum.

ii. BFB mass listing.

b. Method/Storage Blank Data - in chronological order, by instrument:

i. Target Compound Results (modified CLP SOW288 Form I VOA).

ii. RIC and quantitation reports

iii. Copies of raw spectra and copies of background-subtracted mass spectra of each target compounds identified in the blank and corresponding background-subtracted target compound standard mass spectra.

c. LCS Data:

i. Target Compound Results (modified CLP SOW288 Form I VOA).

ii. RIC and quantitation reports.

d. Matrix Spike Data:

i. Target Compound Results (modified CLP SOW288 Form I VOA).

ii. RIC and quantitation reports.

e. Matrix Spike Duplicate Data:

i. Target Compound Results (modified CLP SOW288 Form I VOA).

ii. RIC and quantitation reports.

f. Instrument sequence log – in chronological order by instrument. The sample pH measurements for each sample should be documented on the analytical sequence or provided as a separate summary form.

G) GC/MS Semivolatile Organic Data

1. QC Summary

a. Surrogate Percent Recovery Summary (modified CLP SOW Form II SV).

b. Matrix Spike/Matrix Spike Duplicate Summary (modified CLP SOW Form III SV).

c. LCS Summary (modified CLP SOW Form III SV).

d. Method Blank Summary (modified CLP SOW Form IV SV) -- arranged in chronological order by date of analysis of the blank, by instrument.

e. GC/MS Tuning and Mass Calibration Summary (modified CLP SOW Form V SV) -- arranged in chronological order, by instrument.

f. Internal Standard Area and Retention Time Summary (modified CLP SOW Form VIII SV-1, SV-2) -- arranged in chronological order, by instrument.

2. Sample Data

Sample data shall be arranged in packets consisting of the Analytical Results Summaries, followed by the raw data for semivolatile samples. These sample packets should then be placed in increasing alphanumeric order by Beazer sample identification. The order of each sample packet is as follows:

a. Target Compound Results (modified CLP SOW Form I SV-1, SV-2).

b. RIC and quantitation report.

c. Copies of raw spectra and copies of background-subtracted mass spectra of each target compound identified in the sample and corresponding background-subtracted target compound standard mass spectra.

3. Standards Data

a. Initial Calibration Data (modified CLP SOW Form VI SV-1, SV-2 and associated semivolatile standard reconstructed ion chromatograms and quantitation reports) -- for all initial calibrations associated with analyses in the SDG, in chronological order, by instrument.

b. Continuing Calibration Data (modified CLP SOW Form VII SV-1, SV-2 and associated semivolatile standard reconstructed ion chromatograms and quantitation reports) -- for all continuing calibrations associated with analyses in the SDG, in chronological order, by instrument.

4. Raw QC Data

a. For each GC/MS tuning and mass calibration (in chronological order, by instrument):

i. Decafluorotriphenylphosphine (DFTPP) bar graph spectrum. ii.

DFTPP mass listing.

b. Blank Data -- in chronological order, by instrument:

i. Target Compound Results (modified CLP SOW Form I SV-1, SV-2).

ii. TIC Results (modified CLP SOW Form I SV-TIC), if TIC searches are requested for any project sample.

iii. RIC and quantitation reports.

iv. Copies of raw spectra and copies of background-subtracted mass spectra of each target compound identified in the blank and corresponding background-subtracted target compound standard mass spectra.

c. LCS Data:

i. Target Compound Results (modified CLP SOW Form I SV-1, SV-2).

ii. RIC and quantitation reports.

d. Matrix Spike Data:

i. Target Compound Results (modified CLP SOW Form I SV-1, SV-2).

ii. RIC and quantitation reports.

e. Matrix Spike Duplicate Data

i. Target Compound Results (modified CLP SOW Form I SV-1, SV-2).

ii. RIC and quantitation reports.

H) Inorganic Data for Metals

1. Cover Page for the Inorganic Analyses Data Package.

2. Sample Results Summaries (modified CLP SOW Form I-INs) -- for all samples in the SDG, arranged in increasing alphanumeric order by Beazer sample identification.

3. QC and Quarterly Verification of Instrument Parameters Summaries:

a. Initial and Continuing Calibration Verification summaries (modified CLP SOW Form II [PART 1]-INs).

b. Low Level Calibration Verification Standards summaries (modified CLP SOW Form II [PART 2]-INs).

c. Blanks summaries (modified CLP SOW Form III-INs).

d. ICP/MS Interference Check Sample summaries (modified CLP SOW Form IV-INs).

e. Matrix Spike Sample Recovery summary (modified CLP SOW Form V [PART 1]-IN).

f. Post-Digest Spike Sample Recovery forms (modified CLP SOW Form V [PART 2]-IN).

g. Laboratory Duplicates summary (modified CLP SOW Form VI-IN).

h. LCS summary (modified CLP SOW Form VII-IN)

i. Serial Dilution summary (modified CLP SOW Form IX-IN).

j. Instrument Detection Limits (Quarterly) (modified CLP SOW Form X-IN).

k. Interelement Correction Factors (Annually) (modified CLP SOW Form XI [PART 1]-IN).

l. Linear Range Standard Summary (modified CLP SOW Form IV-LCIN).

m. Preparation Logs (modified CLP SOW Form XIII-INs).

n. Analytical Run Logs (modified CLP SOW Form XIV-INs).

o. ICP/MS Tuning and Response Factor Criteria (modified CLP SOW Form XIV-LCIN).

p. ICP/MS Internal Standards Summary (modified Form CLP SOW XV-LCIN).

4. Raw Data

For each reported value, the laboratory will provide all raw data used to obtain that value. This applies to all required QA/QC measurements and instrument standardization, as well as all sample analysis results. This statement does not apply to the Quarterly Verifications Parameters submitted as part of each data package. Raw data must contain all instrument readouts used for the sample results. Each exposure or instrumental reading must be provided, including those readouts that may fall below the MDL. All instruments must provide a legible hardcopy of the direct real-time instrument readout (strip charts, printer tapes, *etc*.). A photocopy of the instrument's direct sequential readout must be included. A hardcopy of the instrument's direct instrument readout for cyanide must be included if the instrumentation has the capability.

APPENDIX B

Electronic Data Deliverables

EQEDD LabSampleV_1 This file should contain both field samples and laboratory QC samples.

POSITION	FIELD NAME	DATA TYPE	REQUIRED?	PRIMARY KEY?	REFERENCE VALUE?	DESCRIPTION
1	SYS_SAMPLE_CODE	TEXT(40)	Y	Y		Sample identifier listed on the COC.
2	SAMPLE_NAME	TEXT(50)	Y			Sample identifier listed on the COC.
3	SAMPLE_MATRIX_CODE	TEXT(10)	Y		RVF	Code which distinguishes between different types of sample matrices.
4	SAMPLE_TYPE_CODE	TEXT(20)	Y		RVF	Code which distinguishes between different types of samples.
5	SAMPLE_SOURCE	TEXT(10)	Y		RVF	Should be “Field” for field samples and “Lab” for laboratory QC samples.
6	PARENT_SAMPLE_CODE	TEXT(40)				The SYS_SAMPLE_CODE that uniquely identifies the sample that was the source (parent) for this sample.
7	SAMPLE_DELIVERY_GROUP	TEXT(20)				The sampling event with which the sample is associated.
8	SAMPLE_DATE	DATETIME	Y			Date and time sample was collected (in MM/DD/YYYY HH:MM:SS format)

POSITION	FIELD NAME	DATA TYPE	REQUIRED?	PRIMARY KEY?	REFERENCE VALUE?	DESCRIPTION
9	SYS_LOC_CODE	TEXT(20)				Location of sample collected
10	START_DEPTH	NUMERIC				Beginning depth (top) of sample.
11	END_DEPTH	NUMERIC				Ending depth (top) of sample.
12	DEPTH_UNIT	TEXT(15)			RVF	Unit of measurement for the sample begin and end depths.
13	COC	TEXT(40)				Chain of custody identifier.
14	SENT_TO_LAB_DATE	DATETIME				Date sample was sent to lab (in MM/DD/YYYY format)
15	SAMPLE_RECEIPT_DATE	DATETIME				Date that sample was received at laboratory (in MM/DD/YYYY format)
16	SAMPLER	TEXT(50)				Name or initials of the sample collector.
17	SAMPLING_COMPANY_CODE	TEXT(20)	Y			Name or initials of the sampling company.
18	SAMPLING_REASON	TEXT(30)				Sampling reason.
19	SAMPLING_METHOD	TEXT(40)				Sampling method.
20	TASK_CODE	TEXT(40)				Code used to identify the task under which the field sample was retrieved.

POSITION	FIELD NAME	DATA TYPE	REQUIRED?	PRIMARY KEY?	REFERENCE VALUE?	DESCRIPTION
21	COLLECTION_QUARTER	TEXT(5)				Format: YYQ# where YY is year and # is 1, 2, 3, or 4 representing the quarter.
22	COMPOSITE_YN	TEXT(1)	Y		ENUM	Enter “Y” where sample is a composite and “N” where a sample is not a composite.
23	COMPOSITE_DESCRIPTION	TEXT(255)				Description of composite sample (if composite_yn is 'Yes')
24	SAMPLE_CLASS	TEXT(10)				Navy sample class code.
25	CUSTOM_FIELD_1	TEXT(255)				
26	CUSTOM_FIELD_2	TEXT(255)				
27	CUSTOM_FIELD_3	TEXT(255)				
28	COMMENT	TEXT(2000)				Sample comments

EQEDD TESTRESULTSQC_V1

POSITION	FIELD NAME	DATA TYPE	REQUIRED?	PRIMARY KEY?	REFERENCE VALUE?	DESCRIPTION
1	SYS_SAMPLE_CODE	TEXT(40)	Y	Y		Sample identifier listed on the COC.
2	LAB_ANL_METHOD_NAME	TEXT(20)	Y	Y	RVF	Laboratory analytical method name.
3	ANALYSIS_DATE	DATETIME	Y	Y		Date and time of sample analysis (in MM/DD/YYYY HH:MM:SS format)
4	TOTAL_OR_DISSOLVED	TEXT(10)	Y	Y	RVF	Must be either 'D' for dissolved or filtered concentration, 'T' for total or un-dissolved, or "N" for everything else
5	COLUMN_NUMBER	TEXT(2)	Y	Y	ENUM	Values include either '1C' for first column analyses, '2C' for second column analyses or 'NA' for tests for which this distinction is not applicable.

POSITION	FIELD NAME	DATA TYPE	REQUIRED?	PRIMARY KEY?	REFERENCE VALUE?	DESCRIPTION
6	TEST_TYPE	TEXT(10)	Y	Y	RVF	Type of test. Valid values include 'INITIAL', 'REEXTRACT1', 'REEXTRACT2', 'REEXTRACT3', 'REANALYSIS', 'DILUTION1', 'DILUTIONS2', and 'DILUTIONS3'
7	LAB_MATRIX_CODE	TEXT(10)	Y		RVF	Laboratory identified medium
8	ANALYSIS_LOCATION	TEXT(2)	Y		ENUM	Must be either 'FI' for field instrument or probe, 'FL' for mobile field laboratory analysis, or 'LB' for fixed based laboratory analysis
9	BASIS	TEXT(10)	Y		ENUM	Must be either 'Wet' for wet weight reporting, 'Dry' for dry weight reporting, or 'NA' for tests for which this distinction is not applicable.
10	CONTAINER_ID	TEXT(30)				Sample container identifier.
11	DILUTION_FACTOR	NUMERIC	Y			The factor by which the sample was diluted. If no dilution was preformed, enter “1”

POSITION	FIELD NAME	DATA TYPE	REQUIRED?	PRIMARY KEY?	REFERENCE VALUE?	DESCRIPTION
12	PREP_METHOD	TEXT(20)			RVF	Laboratory sample preparation method.
13	PREP_DATE	DATETIME				Beginning date and time of sample preparation (in MM/DD/YYYY HH:MM:SS format)
14	LEACHATE_METHOD	TEXT(15)				Laboratory leachate generation method.
15	LEACHATE_DATE	DATETIME				Beginning date and time of leachate preparation (in MM/DD/YYYY HH:MM:SS format)
16	LAB_NAME_CODE	TEXT(20)	Y		RVF	Unique identifier of the laboratory
17	QC_LEVEL	TEXT(10)			ENUM	May be either 'screen' or 'quant'
18	LAB_SAMPLE_ID	TEXT(20)	Y			Laboratory sample identifier
19	PERCENT_MOISTURE	TEXT(5)				Percent moisture of the sample portion used for applicable test. Do not include “%” symbol.
20	SUBSAMPLE_AMOUNT	TEXT(14)				Amount of sample used for test
21	SUBSAMPLE_AMOUNT_UNIT	TEXT(15)			RVF	Unit of subsample amount

POSITION	FIELD NAME	DATA TYPE	REQUIRED?	PRIMARY KEY?	REFERENCE VALUE?	DESCRIPTION
22	ANALYST_NAME	TEXT(50)				Name or initials of the sample analyst.
23	INSTRUMENT_ID	TEXT(60)				Instrument identifier
24	COMMENT	TEXT(2000)				Test comment
25	PRESERVATIVE	TEXT(20)			RVF	Sample preservative used
26	FINAL_VOLUME	NUMERIC				Amount of sample measured after sample preparation.
27	FINAL_VOLUME_UNIT	TEXT(15)			RVF	Unit of final volume
28	CAS_RN	TEXT(15)	Y	Y	RVF	Chemical Abstract Registry number for reported analyte
29	CHEMICAL_NAME	TEXT(255)	Y			Analyte Name reported
30	RESULT_VALUE	NUMERIC				Analytical result reported at an appropriate number of significant digits. Should be blank for non-detects.
31	RESULT_ERROR_DELTA	TEXT(20)				Error range applicable to the result value; typically used only for radiochemistry results.

POSITION	FIELD NAME	DATA TYPE	REQUIRED?	PRIMARY KEY?	REFERENCE VALUE?	DESCRIPTION
32	RESULT_TYPE_CODE	TEXT(10)	Y		RVF	Must be either 'TRG' for a target or regular result, 'TIC' for tentatively identified compounds, 'SUR' for surrogates, 'IS' for internal standards, or 'SC' for spiked compounds.
33	REPORTABLE_RESULT	TEXT(10)	Y		ENUM	Must be either 'Yes' for results which are considered to be reportable, or 'No' for other results.
34	DETECT_FLAG	TEXT(2)	Y		ENUM	Maybe either 'Y' for detected analytes or 'N' for non-detects or 'TR' for trace.
35	LAB_QUALIFIERS	TEXT(20)				Qualifier flags assigned by the laboratory
36	VALIDATOR_QUALIFIERS	TEXT(20)				Qualifier flags assigned by the validation firm.
37	INTERPRETED QUALIFIERS	TEXT(20)			RVF	Qualifier flags assigned by the validation firm.
38	ORGANIC_YN	TEXT(1)	Y		ENUM	Must be either 'Y' for organic constituents or 'N' for inorganic constituents
39	METHOD_DETECTION_LIMIT	TEXT(20)	Y			Method detection limit

POSITION	FIELD NAME	DATA TYPE	REQUIRED?	PRIMARY KEY?	REFERENCE VALUE?	DESCRIPTION
40	REPORTING_DETECTION_LIMIT	NUMERIC	Y			Concentration level above which results can be quantified with confidence. It must reflect conditions such as dilution factors and moisture content.
41	QUANTITATION_LIMIT	TEXT(20)	Y			Concentration level above which results can be quantified with confidence.
42	RESULT_UNIT	TEXT(15)	Y		Y	Units of measurement for the result
43	DETECTION_LIMIT_UNIT	TEXT(15)	Y		Y	Units of measurement for the detection limit(s).
44	TIC_RETENTION_TIME	TEXT(8)				Retention time in seconds for tentatively identified compounds
45	RESULT_COMMENT	TEXT(2000)				Result comment
46	QC_ORIGINAL_CONC	NUMERIC				The concentration of the analyte in the original (unspiked) sample.
47	QC_SPIKE_ADDED	NUMERIC				The concentration of the analyte added to the original sample.

POSITION	FIELD NAME	DATA TYPE	REQUIRED?	PRIMARY KEY?	REFERENCE VALUE?	DESCRIPTION
48	QC_SPIKE_MEASURED	NUMERIC				The measured concentration of the analyte. Use zero for spiked compounds that were not detected in the sample.
49	QC_SPIKE_RECOVERY	NUMERIC				The percent recovery calculated as specified by the laboratory QC program. Report as percentage multiplied by 100 (*e.g.*, report "120%" as "120").
50	QC_DUP_ORIGINAL_CONC	NUMERIC				The concentration of the analyte in the original (unspiked) sample.
51	QC_DUP_SPIKE_ADDED	NUMERIC				The concentration of the analyte added to the original sample.
52	QC_DUP_SPIKE_MEASURED	NUMERIC				The measured concentration of the analyte in the duplicate. Use zero for spiked compounds that were not detected in the sample.
53	QC_DUP_SPIKE_RECOVERY	NUMERIC				The duplicate percent recovery calculated as specified by the laboratory QC program. Report as percentage multiplied by 100 (*e.g.*, report "120%" as "120").

POSITION	FIELD NAME	DATA TYPE	REQUIRED?	PRIMARY KEY?	REFERENCE VALUE?	DESCRIPTION
54	QC_RPD	TEXT(8)				The relative percent difference calculated as specified by the laboratory QC program. Report as percentage multiplied by 100 (*e.g.*, report "30%" as "30").
55	QC_SPIKE_LCL	TEXT(8)				Lower control limit for spike recovery. Report as percentage multiplied by 100 (*e.g.*, report "60%" as "60").
56	QC_SPIKE_UCL	TEXT(8)				Upper control limit for spike recovery. Report as percentage multiplied by 100 (*e.g.*, report "60%" as "60").
57	QC_RPD_CL	TEXT(8)				Relative percent difference control limit. Report as percentage multiplied by 100 (*e.g.*, report "25%" as "25").
58	QC_RPD_STATUS	TEXT(10)			ENUM	Used to indicate whether the spike recovery was within control limits. Use the "*" character to indicate failure, otherwise leave blank.

POSITION	FIELD NAME	DATA TYPE	REQUIRED?	PRIMARY KEY?	REFERENCE VALUE?	DESCRIPTION
59	QC_DUP_RPD_STATUS	TEXT(10)			ENUM	Used to indicate whether the spike recovery was within control limits. Use the "*" character to indicate failure, otherwise leave blank.
60	QC_RPD_STATUS	TEXT(10)			ENUM	Used to indicate whether the relative percent difference was within control limits. Use the "*" character to indicate failure, otherwise leave blank.

EQEDD TESTBATCH_V1

POSITION	FIELD NAME	DATA TYPE	REQUIRED?	PRIMARY KEY?	REFERENCE VALUE?	DESCRIPTION
1	SYS_SAMPLE_CODE	TEXT(40)	Y	Y		Sample identifier listed on the COC.
2	LAB_ANL_METHOD_NAME	TEXT(20)	Y	Y	RVF	Laboratory analytical method name.
3	ANALYSIS_DATE	DATETIME	Y	Y		Date and time of sample analysis (in MM/DD/YYYY HH:MM:SS format)
4	TOTAL_OR_DISSOLVED	TEXT(10)	Y	Y	RVF	Must be either 'D' for dissolved or filtered concentration, or 'T' for total or un-dissolved, or "N" for everything else.
5	COLUMN_NUMBER	TEXT(2)	Y	Y	ENUM	Values include either '1C' for first column analyses, '2C' for second column analyses or 'NA' for tests for which this distinction is not applicable.

POSITION	FIELD NAME	DATA TYPE	REQUIRED?	PRIMARY KEY?	REFERENCE VALUE?	DESCRIPTION
6	TEST_TYPE	TEXT(10)	Y	Y	RVF	Type of test. Valid values include 'INITIAL', 'REEXTRACT1', 'REEXTRACT2', 'REEXTRACT3', 'REANALYSIS', 'DILUTION1', 'DILUTIONS2', and 'DILUTIONS3'
7	TEST_BATCH_TYPE	TEXT(10)	Y	Y	RVF	Lab batch type. Valid values include 'Prep', 'Analysis', and 'Leach'. This is a required field for all batches.
8	TEST_BATCH_ID	TEXT(20)	Y			Unique identifier for all lab batches.