EHS–International, Inc.

Sampling and Analysis Plan

Federal Center South
4735 East Marginal Way
Seattle, Washington 98134

EHSI Project #10570-01

Prepared for:
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ACRYNOM LIST

BTEX .....Benzene, Toluene, Ethylbenzene, and Xylenes
COC.....Chain-of-Custody
CQCO.....Chemical Quality Control Officer
Ecology .....Washington State Department of Ecology
EHSI .....EHS-International, Inc.
EPA .....Environmental Protection Agency
FCS.....Federal Center South
GSA.....General Services Administration
HCL .....Hydrochloric Acid
ID .....identification
LDW.....Lower Duwamish Waterway
mg/kg .....milligram/kilogram
ml .....millilitre
MS/MSD .....Matrix Spike and Matrix Spike Duplicate
MTCA.....Model Toxics Control Act
QA .....Quality Assurance
QC.....Quality Control
SAP .....Sampling and Analysis Plan
TPH .....Total Petroleum Hydrocarbons
µg/L .....microgram/liter
USACE.....US Army Corps of Engineers
UST .....Underground Storage Tank
VOA .....Volatile Organic Analysis
VOCs.....Volatile Organic Compounds

1.0 INTRODUCTION

EHS-International, Inc. (EHSI) has prepared this Sampling and Analysis Plan (SAP) for US General Services Administration (GSA) for the Federal Center South (FCS) facility (subject property) located at 4735 East Marginal Way in Seattle, Washington (Figure 1). The subject property layout and features are shown on Figure 2.

2.0 SITE DESCRIPTION

The subject property is a 32.99-acre King County parcel located in Seattle, Washington. The property is currently occupied by the regional headquarters of the US Army Corp of Engineers (USACE). Surrounding land use consists of the Port of Seattle Terminal 118 property across Diagonal Way to the north. The Manson Construction Company operates a crane facility that is located across Slip 1 of the Lower Duwamish Waterway (LDW) to the south. Industrial warehouse properties and a large parking lot are located across East Marginal Way to the east of the subject property. The LDW bounds the subject property on the west.

3.0 ENVIRONMENTAL SETTING

The subject property lies within the alluvial valley of the LDW. The area of the subject property was extensively modified by hydraulic filling of estuarine tide flats early in the 20th Century (Jones, 1998). The subject property is underlain by sandy fill material and native alluvium deposits associated with the LDW. Golder Associates (2013) conducted a hydrogeological investigation of the subject property in 2013 and determined there were three groundwater flow directions (west, east, and south) with a potential groundwater mound occurring along the northern border of the property.

4.0 PURPOSE OF THE SAP

The purpose of this SAP is to establish sampling and analysis protocols and rationale for a site characterization study to be completed by EHSI. The site characterization study will focus on areas of concern identified in EHSI's Summary of Environmental Conditions Report (EHSI, 2012), the Washington State Department of Ecology's (Ecology) 2013 Opinion Letter (Ecology, 2013), and through verbal discussions with Ecology's Site Manager (Vick, 2014). The areas of concern are associated with soil and groundwater contamination involving total petroleum hydrocarbons (TPH) and volatile organic compounds (VOCs). These areas are shown on Figure 2 and listed below:

- Underground Storage Tank (UST)/Motor Pool and Central Excavation Area
- Debris Fill Excavation Area
- EHSI-MW-7 Area
- EHSI-MW-2 Area
- HCMW-2/HCMW-3 Area
- Site-Wide Groundwater Sampling

5.0 PROJECT ORGANIZATION AND RESPONSIBILITIES

The team organization established at EHSI for this project includes a Project Manager, a Project Chemist, a Project Geologist, and a Health and Safety Officer. The Project Chemist will also serve as the Chemical Quality Control Officer (CQCO) and Data Validator. Additional quality control (QC) or sampling staff may be added as necessary.

6.0 SCOPE AND OBJECTIVES OF FIELD ACTIVITIES

The objective of the site characterization study is to evaluate soil and groundwater quality and compare the data to applicable Model Toxics Control Act (MTCA) Cleanup Levels. The Washington State Department of Ecology has identified data gaps from previous investigations. The locations of soil borings and groundwater monitoring wells have been identified as needing further investigation as requested by Ecology. The number of proposed soil borings and monitoring wells represent the minimum quantity sufficient to satisfy some of the data gaps identified by Ecology reports from the six areas of concern with previous contamination. The depth of the soil borings at each location will be drilled between eight and ten feet. A summary of the field activities and rationale for sample collection in each area is presented below.

6.1 UST/MOTOR POOL AND CENTRAL EXCAVATION AREA

- One soil boring will be drilled in the former Motor Pool Excavation area located immediately north of the existing building. One soil sample will be collected from the base of the previous excavation and tested for TPH as diesel and oil. The purpose of this sample is to verify that contaminated soil has been removed from this area.
- Two soil borings will be drilled adjacent to the former Central Motor Pool Excavation that is currently located underneath the western edge of the building. Two soil samples will be collected from the maximum depth of the excavation between five and six feet and tested for TPH as diesel and oil. The purpose of these samples is to verify that contaminated soil has been removed from this area.
- Install a replacement well for FC-6 to evaluate groundwater quality next to the building. Samples will be collected and tested for TPH as gasoline/BTEX, diesel, and oil, and VOCs.

6.2 DEBRIS FILL EXCAVATION AREA

- Two soil borings will be drilled in the former Debris Fill Excavation located south of the existing building. One soil sample will be collected from each boring at the base of the former excavation and tested for TPH as diesel and oil. The purpose of these samples is to verify that contaminated soil has been removed from this area.
- Install a new groundwater well south of and not in the former Debris Fill Excavation to evaluate the extent of contamination detected at HCMW-1.

6.3 EHSI-MW-7 AREA

- Three soil borings will be drilled near EHSI-MW-7 to evaluate the extent of VOC contamination in this area. Both soil and hydro-punch groundwater samples will be collected and tested for VOCs. Two of these samples will also be analyzed for TPH as gasoline/Benzene, Toluene, Ethylbenzene, and Xylenes (BTEX), diesel, and oil.

6.4 EHSI-MW-2 AREA

- Four soil borings will be drilled around EHSI-MW-2 to evaluate the extent of TPH and VOC contamination in this area. Both soil and hydro-punch groundwater samples will be collected and tested for TPH as gasoline/BTEX, diesel, and oil, and VOCs.

6.5 HCMW-2/HCMW-3 AREA

- One soil boring will be drilled next to HCMW-2 to evaluate the extent of TPH and VOC contamination in this area. Both soil and hydro-punch groundwater samples will be collected and tested for TPH as gasoline/BTEX, diesel, and oil, and VOCs.
- One soil boring will be drilled next to the former location of HCMW-3 to evaluate the extent of TPH and VOC contamination in this area. Soil samples will be collected and tested for TPH as gasoline/BTEX, diesel, and oil, and VOCs. Install a replacement well for HCMW-3 due to past detections of vinyl chloride in this area.

6.6 SITE-WIDE GROUNDWATER SAMPLING

- All of the monitoring wells, including the new wells mentioned above, will be surveyed and sampled for TPH as gasoline/BTEX, diesel, oil, and VOCs. Ground water in all monitoring wells will be tested one time to establish current groundwater quality. The data will then be used to determine future actions in terms of potential groundwater cleanup and long term monitoring.

7.0 PROJECT DOCUMENTATION

The SAP will be prepared and submitted to Ecology for review and approval. All documents will be stored in project files. The following list identifies the step-by-step procedures for permanent documentation of each sample.

All samples:

- Sample assigned an unique number;
- Photograph of sample location – this is only done for the first round of sampling or when the sample collection point changes;
- At time of sampling, information recorded in field logbook, sample data sheet, and sample label;
- Chain-of-Custody Form;
- Cooler Receipt Form; and
- Laboratory data packages and electronic media.

7.1 Sample Chain-of-Custody

Chain-of-Custody (COC) forms will accompany sample containers during transit to the laboratory and upon receipt by the laboratory. A sample of the COC form is provided in Appendix B.

7.2 Field Logbook

All field notes will be maintained in a bound book, which is assigned to a specific person who is responsible for entry and information into the logbook. All information pertinent to the sampling effort will be recorded in a field logbook. Each page/form will be consecutively numbered. All entries will be made in indelible ink and all corrections will consist of lined-out deletions that are initialed and dated by the person making the corrections. Each page of the logbook should be signed and dated by the personnel responsible for observations. As a minimum, the applicable items for the entry into the logbook are listed below.

GENERAL INFORMATION

- Date
- Start and finish times of work
- Weather conditions

- Name and signature of person making entry
- Names of personnel present
- Names of visitors

SAMPLING INFORMATION

- Date and time of sample
- Photograph identification
- Location of sample
- Type of sample
- Sample identification number
- Associated QC samples
- Flow rate
- Purge time
- Any unusual observations

The original field notes will be submitted as part of a final summary report.

Sampling situations vary widely. No general rules can specify the extent of information that must be entered in a logbook. However, records should contain sufficient information so that someone can reconstruct the sampling activity without relying on the collector's memory.

7.3 Sample Numbering System

Each sample is to be assigned a unique sample identification number by the Project Geologist or designee. Temperature blanks are to be identified as "Temperature Blank-" and then the cooler number. Samples for matrix spike and matrix spike duplicates are to be designated on the COC sheets and on the sample label. A list of all sample identification numbers will be maintained in the field logbook. Sample duplicates shall be submitted "blind" to the lab.

Each sample must have a unique number. Sample numbers will be generated as follows:

[Sampling Year] [FCS] [Type of Sample] [Sample Location]

- The year sampling occurred, but just the last two digits;
- FCS (Federal Center South);
- Three-digit code to identify the type of sample;
- The location identification (ID), which is the name of the monitoring well or soil boring;

The following examples are provided for clarification purposes:

- **14FCS001MW07** represents a sample collected during 2014; this is a primary sample (001) from monitoring well MW-7.
- **14FCS001MW07D** represents a sample collected during 2014; this is a field duplicate sample (D) from monitoring well MW-7.

A permanent record for each sample will be documented by the following: field logbook, sample data sheets, and COC.

Sample Labels A label will be affixed on each sample bottle prior to transportation to the laboratory. Information on sampling labels will include:

- Site name
- Project number

- Sample number (11 to 14 alphanumeric characters)
- Sample description
- Company name
- Parameters to be analyzed
- Preservative added, if any
- Date
- Sampler's name
- Time
- Notes: if any.

The label will be identified upon receipt by the laboratory and cross-referenced to the COC record. When the samples arrive at the laboratory following shipment, the sample custodian receives the samples. Any inconsistencies will be noted on the custody record.

Sample Data Sheets. A sample data sheet will be completed in the field by the sampler for every sample collected. A sample of the sample data sheet is provided in Appendix A.

Chain-of-Custody Records. Chain-of-custody record forms will accompany sample containers during transit to the laboratory and upon receipt by the laboratory. The COC record form will be a carbonless triplicate model. The white and yellow copy will be given to the laboratory sample custodian when samples are submitted to the laboratory. The pink copy will be retained in the project files.

Each cooler will contain COC record form(s) for only those samples contained in that cooler. The COC record form will be filled out using indelible ink and will include the following information:

- Project name and number;
- The signatures of the sampling personnel;
- Sample identification number;
- Sampling dates and sampling times (military format);
- List of the chemical analyses and any preservative used;
- Type of sample, whether "grab" or "composite", indicated by an "X" in the appropriate column;
- The total number of containers per sample and per cooler;
- Analyses, for each sample number indicate which analyses are to be performed on that sample;
- Sample relinquisher, date, and time;
- Hazards associated with samples;
- Courier or carrier air bill number and destination (if any); and
- Any remarks and or special instructions.

For the transfer of custody of samples from either the sampler in charge of sample custody or the field team shipper to a common carrier, the custody procedures are as follows:

- Sign, date, and enter time under "Relinquished by" entry.
- Enter name of carrier under "Received by".
- Enter bill-of-lading or air bill number under "Remarks".
- Place the original of the COC form in the appropriate sample shipping package. Retain a copy with field records.

Chain-of-custody for laboratory receipt will be established in the following manner:

- The carrier and the time of arrival are documented in the daily receipt log. The number of items on the air bill is checked with the actual number received to ensure that all samples arrived.
- Notation is made as to whether the sample container was sealed.
- The container is opened, the internal ambient temperature of the cooler and the temperature of the Temperature Blank are taken, and the samples are itemized. All deviations are noted and reported to the CQCO.
- Reference to field numbers will be documented in the appropriate logbook. All data are entered into the computer tracking system with analyses required by holding-time specified dates.

7.4 Corrections to Documentation

The Project Manager is responsible for ensuring that the requisite QC records are generated and controlled. The CQCO will verify that these controls are implemented as follows:

- Measurements and observations are recorded at the time they are made.
- Documentation is orderly, legible, and traceable to relevant items/conditions.
- Documentation includes sufficient information to be readily interpreted by staff other than those responsible for its generation.
- Changes or revisions to a record are made in a manner that preserves the original data, such as by drawing a single line through a hard copy entry or maintaining historical records of electronic entries/files.
- Changes to records are signed (or initialed) and dated.
- As a minimum standard, changes to a record are subject to the same review and approval protocols as the original entry.
- Records adequately document digressions from specified procedures, Quality Assurance (QA) plan, or work plan and identify authorization for the digression.
- Project documents and records, including photographic and electronic records, are protected from loss, damage, misuse, or deterioration.

8.0 SAMPLING PROTOCOLS

The following sampling procedures will be followed.

- Site Safety. No sampling will be done if dangerous conditions exist in the sample site area. See the project Health and Safety Plan for more details on site safety conditions.
- Prior to Sampling. The volume of water in each groundwater monitoring well will be calculated. At least three well volumes will be removed from each well prior to sampling.
- Groundwater Sampling. Field personnel shall wear powder-free nitrile gloves during sample collection. All groundwater sample containers will be filled with water using a portable peristaltic pump with disposable plastic tubing. The tubing components will be changed between each well with new plastic tubing used.
- Soil Sampling. EPA 5035 methods will be used to collect soil samples for VOC analysis. Soil samples will be submitted in three pre-weighed 40 millilitre (ml) volatile organic analysis (VOA) vials with a magnetic stir bar and in 4 oz. glass jars.

- Post Sampling. Insure that all required data is collected. The disposal of the waste will be according to Section 15. Investigation-Derived Waste.
- Sample containers, preservation, and holding times are listed in Table 1. VOA vials will have a Teflon-lined septa and zero headspace. Packaging protocols described in this SAP will be followed.
- The requisite QC records for sampling and analysis activities are to be generated and controlled as specified below. Field documentation (i.e., QC records) for this project includes field logbooks, photographs, chain-of-custody forms, sample labels, and sample data sheets.
- Field Measurement Procedures and Criteria. Field measurements will consist of recording the location and depth of samples.
- Sample Containers and Preservation Techniques. All analytical sample containers will be obtained from a source that certifies them to be clean and that perform appropriate QC analyses to ensure cleanliness. Sample labels will be attached to the sample bottles and covered with wide, waterproof, transparent tape to ensure label integrity. The parameter for which each container is intended will be written on the sample label.
- Groundwater samples will be submitted in three 40-ml VOA vials with Teflon-lined septa and one 500 mL amber bottle. Headspace is to be zero. After three (3) attempts are made to capture zero headspace, start over with a fresh VOA sample vial.
- Table 1 describes the required container, minimum sample volume, preservation technique, and holding time for water samples.

Table 1: SAMPLE PRESERVATIVE AND HOLD TIMES

ANALYSES	CONTAINER	PRESERVATIVE	HOLDING TIME	Turn Around Time
USEPA Method 8260C/5030C *Volatile Organics*	3-40 ml VOA vials	No preservative Cool to 4°C	14 days for water analysis. 2 days for soil analysis.	14 days for analysis
NWTPH-Dx	500 mL Amber bottle for water. 4-oz. jar for soil	HCL for water. None for soil. Cool to 4°C	14 days for soil analysis. 7 days for water analysis	14 days for analysis
NWTPH-Gx/BTEX	3-40ml VOA vials	HCL for water. None for soil. Cool to 4°C	14 days for water analysis. 2 days for soil analysis.	14 days for analysis

Notes: VOA = Volatile Organic Analysis
HCL = Hydrochloric Acid
TURN-AROUND-TIME = days from sample delivery to laboratory package delivered to EHSI

Field Quality Control Sampling Procedures. The following quality assurance procedures apply to collection of field investigation samples:

- All data must be documented on sample data sheets.

- Single-use, disposable sampling equipment will be used when applicable. The equipment will be properly disposed of according to Section 15.0, Investigation-Derived Waste. Non single-use field equipment and instrumentation will be decontaminated before and after each sampling event, and between each different sampling site. Field personnel shall wear powder-free nitrile gloves during sample collection. Gloves will be changed before collecting each new sample.
- Decontamination Procedures. Decontamination will be performed in the field. To avoid cross-contamination, disposable and/or dedicated personal protection and sampling equipment will be used to the greatest extent possible. Preventing or minimizing cross-contamination in sampled media and in samples is important for eliminating the introduction of error into sampling results and for protecting the health and safety of site personnel. Removing or neutralizing contaminants that have accumulated on sampling equipment ensures protection of personnel from permeating substances, reduces or eliminates transfer of contaminants to sample cross-contamination. The following steps will be taken to ensure proper decontamination: physically remove visible contaminants from sampling equipment by rinsing with tap water; wash equipment with non-phosphate detergent solution such as LiquiNox®; rinse with tap water; and rinse with deionized, contaminant-free water.

9.0 SAMPLE PACKAGING AND SHIPPING

Samples will be transferred to the Certified Analytical Laboratory for analysis via waterproof sturdy coolers. All samples will be packaged and shipped daily to ensure that no sample is held at site for more than 24 hours. Before a sample can be put in the cooler, any drains must be sealed with tape to prevent leaking. Fill out pertinent information on the sample label. Each cooler will be packed in the following manner:

- Ensure sample lids are tight;
- Close the shipping cooler tap drain and seal it on the outside of the cooler with duct tape;
- Place sufficient inert cushioning material in bottom of the cooler;
- Seal all sample containers in a water-tight plastic-bubble bag through which sample labels are visible. Place samples upright in the cooler in such a way that they do not and will not touch during shipment;
- Fill cooler with enough packing material to prevent breakage of glass bottles;
- Place the temperature blank in the middle of the cooler.
- Place sufficient ice in cooler to maintain the internal temperature at approximately 4 degrees Celsius during transport. The ice will be double-bagged to prevent contact of the melt water with the samples. If chemical ice is used it should also be placed in a plastic bag;
- Evidence of sample custody shall be traceable from the time the sample is taken until the filled sample bottles are received by the laboratory; and
- Sample coolers will be sent by a courier to arrive the same day. The laboratory will be notified of the sample shipment and the estimated date of arrival.

10.0 QUALITY ASSURANCE PROJECT PLAN OBJECTIVES

The overall data quality objective of this sampling and maintenance program is to provide data of known and sufficient quality to evaluate concentration ranges of chemicals of potential concern in soil and groundwater at the subject property.

11.0 CHEMICAL ANALYSES

Each soil and groundwater sample collected will be analyzed for chemicals of concern by the following test methods:

Table 2: CHEMICAL ANALYSES		
Chemical	**Analytical Method**	**Practical Quantitation Limit**
Gasoline-range TPH	NWTPH-Gx	2 mg/kg soil, 100 µg/L water
Diesel-range TPH	NWTPH-Dx	50 mg/kg soil, 50 µg/L water
Oil-range TPH	NWTPH-Dx	250 mg/kg soil, 250 µg/L water
VOCs	EPA 8260C	0.05 mg/kg soil for most VOCs, 1 µg/L for most VOC 0.2 µg/L VC

12.0 LABORATORY QUALITY CONTROL

A copy of the Certified Analytical Laboratories Quality Assurance Program is included as Appendix C.

13.0 FIELD QUALITY CONTROL SAMPLES

Samples will be collected from the on-site monitoring wells. Each sample will be collected in three unpreserved 40-ml VOA (volatile organic analyte) vials with Teflon-lined septa with zero head space in the VOA vials and in 500 mL HCL-preserved bottles. The following protocol will be observed for locations where QC samples are to be collected: the first VOA vial for the primary and all associated QC samples will be filled; then the second VOA vial for the primary and all associated QC samples will be filled; then the third VOA vial for the primary and all associated QC samples will be filled. The process will be documented in the field logbook.

Soil samples will also be collected in the field. Samples collected for VOC analysis will follow Environmental Protection Agency (EPA) 5035 protocol and placed in 40 ml VOAs. Samples collected for TPH as diesel and oil will be placed in 4 oz. jars.

Field QC samples shall include duplicate, matrix spike and matrix spike, trip blank, and temperature blank, samples. Field blanks may also be requested.

Field duplicates will be collected at a rate of 10 percent of total samples (or at the minimum of one per event) and submitted blind to the analytical laboratory to provide a means of determining the reproducibility and precision of data resulting from the field sampling program.

Matrix Spike and Matrix Spike Duplicate (MS/MSD) samples will be used primarily to assess matrix affects. One MS/MSD sample per analytical batch (not to exceed 20 samples) will be analyzed.

A blind trip blank will be provided for each cooler. It will consist of three 40 ml VOA vials containing analyte-free water. The analyte-free water must be preserved with concentrated HCL to a pH of less than or equal to a value of two, and prepared using the same sample preparation protocols as for the well samples. The vial will be filled with acidified water before the sampling event and will travel with the cooler. It will be placed in the same cooler as the samples collected at the beginning of the sampling day.

A temperature blank will be provided for each cooler. It will consist of one 40 ml VOA vial containing tap water. The temperature blank will be prepared at the time of shipment, and will be placed in the middle of the cooler.

Field blanks may also be provided whenever tripblanks or other sample results indicate the possibility of ambient contamination. Field blanks will consist of three 40 ml VOA vials filled in the field with analyte-free water provided by the analytical laboratory.

14.0 DATA REPORTING AND REVIEW

Data review is independent of the intended use of the data and determines the technical merit of the data by comparing the QC results to method specified criteria. Data are reviewed for traceability, documentation, calculations, transcription errors, and evaluation of the data deliverables for contract compliance.

Data Review – Field Parameters. Field crews are to review their data and implement any necessary corrective actions prior to submitting data for use. All field data must be within the acceptance criteria specified in the SAP before being used for decision-making purposes. Any corrective actions should be noted in the logbooks.

Data Review – Laboratories. For a description of the review process of laboratory reports from the Certified Analytical Laboratory see Appendix C.

15.0 INVESTIGATION DERIVED WASTE

EHSI has identified Emerald Services of Seattle, Washington as the Investigation-Derived Waste (IDW) repository of any hazardous waste generated during field operations. Investigation derived wastes may consist of soil cuttings and well purge water. Any IDW that is determined to be hazardous will be properly transported to the approved Treatment, Storage, and Disposal Facility for disposal. Used nitrile gloves and other disposable personal protective gear, and disposable sampling equipment will be placed in a garbage bag and disposed of as solid waste in a garbage dumpster. Detergent solution and water used for the decontamination of equipment will be contained in tanks or drums and disposed of appropriately.

16.0 RELEVANT PROJECT SCHEDULES

Table 3 contains a time table for approval of the SAP and implementation of the field work.

Table 3: SCHEDULE

Activity	Due Date	Duration/Business Days (BD)
Submit Draft SAP to GSA	March 21, 2014	0 BD
Revise SAP Based on GSA Comments and Submit to Ecology	April 17, 2014	10 BD
Receive Comments from Ecology	April 25, 2014	20 BD
Finalize SAP	May 2, 2014	3 BD
Finish Field Work	June 6, 2014	12 BD
Submit Draft Summary Report to GSA for Review	July 18, 2014	30 BD
Finalize Summary Report	August 15, 2014	

17.0 REFERENCES

Ecology. 2013. The Washington State Department of Ecology Voluntary Cleanup Program. Opinion Letter US GSA Federal Center S. VCP Project NW 2177. September 23, 2013.

EHSI. 2012. US General Services Administration Federal Center South Property Summary of Environmental Conditions Final Report. February 26, 2012.

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Jones, M. A. 1998. Hydrogeologic Framework for the Puget Sound Aquifer.

Vick. 2014. Personal communication between Heather Vick (Ecology Site Manager) and Kurt Easthouse (EHSI Project Manager), March 7, 2014.

18.0 SIGNATURES

This Sampling and Analysis Plan was prepared by the undersigned.

Jason Cass — Date
Washington Licensed Geologist, License #2562

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Figures

Appendix A
Field Forms

Appendix B
Sample Chain of Custody

Appendix C
Laboratory QA/QC Plan