Appendix D

DRAFT QUALITY ASSURANCE PROJECT PLAN

TRUCK CITY SITE PROPERTY
MOUNT VERNON, WASHINGTON

Prepared for
SKAGIT COUNTY
MOUNT VERNON, WASHINGTON
October 31, 2014
Project No. 0714.02.02

MAUL FOSTER ALONGI

Prepared by
Maul Foster & Alongi, Inc.
1329 N State Street, Suite 301, Bellingham WA 98225

CONTENTS

CONTENTS (CONTINUED)

TABLES AND ILLUSTRATIONS

FOLLOWING PLAN:

TABLES

ACRONYMS AND ABBREVIATIONS

ARAR	applicable or relevant and appropriate requirement
BTEX	benzene, toluene, ethylbenzene, and total xylenes
CAP	Cleanup Action Plan
COC	chain of custody
the County	Skagit County, Washington
FSDS	field sampling data sheet
LCS/LCSD	laboratory control sample and laboratory control sample duplicate
MFA	Maul Foster & Alongi, Inc.
MRL	method reporting limit
MS/MSD	matrix spike and matrix spike duplicate
PARCC	precision, accuracy, representativeness, completeness, and comparability
PID	photoionization detector
QA	quality assurance
QAPP	Quality Assurance Plan
QC	quality control
RPD	relative percent difference
SAP	Sampling and Analysis Plan
Site	the Truck City parcel
TPH	total petroleum hydrocarbons
USEPA	U.S. Environmental Protection Agency
VOC	volatile organic compounds

1 INTRODUCTION

On behalf of Skagit County, Washington (the County), Maul Foster & Alongi, Inc. (MFA) has prepared this Quality Assurance Project Plan (QAPPP) to guide the collection of soil and groundwater samples during remedial action at the Truck City parcel (the Site), located at 3216 Old Highway 99 S Road, Mount Vernon, Washington. The Site is associated with the County's proposed county jail property in Mount Vernon, Washington. This QAPP is to be used only in conjunction with the Cleanup Action Plan (CAP) and its Sampling and Analysis Plan (SAP). Figure 1 of the CAP presents a layout of the Site.

This QAPP was written to fulfill the requirements in Washington Administrative Code 173-340-410(3)(a).

The purpose of this QAPP is to describe the procedures that will be used to direct the remedial action process so that the following conditions are met:

- Data collected are high-quality, representative, and verifiable.
- Use of resources is cost-effective.
- Data can be used by the County and Ecology to support objectives stated in the CAP.

This document includes quality assurance (QA) procedures for field activities, as well as QA and quality control (QC) procedures for sampling. The QAPP provides a consistent set of QA/QC procedures that will be used throughout the various work phases identified in the CAP. This QAPP supports other documents (e.g., the SAP by forming the basis for data acquisition and analysis) and therefore is not expected to change significantly between phases of work. Through work plans or other documents, the scopes of work for the various activities outlined in this CAP will reference relevant parts of the QAPP for specifics. Because of this, the QAPP lists all currently foreseen analytical methods that may be used for analyzing soil and groundwater, even though a phase of monitoring may target only a specific suite of indicator compounds.

2 PROJECT ORGANIZATION AND RESPONSIBILITIES

The County, through its environmental consultant, MFA, will be responsible for seeing that the procedures and guidelines described in the QAPP are followed. MFA personnel responsibilities for quality assurance activities are summarized below.

Senior Project Director—Jim Darling

Coordinate with project task leaders and communicate with County and agency personnel, as needed. Allocate MFA's resources to the project and ensure that the objectives of the remedial action and the CAP are met. Assist task leaders with technical issues.

Senior Project Engineer—Justin Clary

Review data, reports, and other project-related documents prepared by MFA before their submittal to the County or to Ecology. Assist project staff with technical issues.

Project Manager—Yen-Vy Van

Oversee project performance to ensure compliance. Implement necessary action and adjustments to accomplish program objectives. Monitor field investigations. Coordinate field and laboratory sample tracking. Review all data and prepare reports and other project-related documents. Provide technical QA assistance. Monitor field investigations. Coordinate field and laboratory sample tracking. Arrange for other external procurement packages for QA needs. Coordinate corrective actions. Review analytical data and data validation reports. Act as liaison between the County or Ecology and contract personnel.

Analytical QA Officer—Brian Fauth

Ensure that the contract laboratory instruments are calibrated and maintained as specified, internal QC measures are performed and analytical methods are applied, the project QA coordinator is notified when problems occur and corrective action is taken, laboratory evaluation is complete and reported in the required deliverables.

Project QC Officer—Mary Benzinger

Ensure that sample collection, preservation, storage, transport, and chain-of-custody (COC) procedures are followed. Track field and laboratory samples. Perform corrective actions. Validate analytical data. Inform project QA coordinator when problems occur, and communicate and document corrective actions taken.

3 QUALITY ASSURANCE OBJECTIVES FOR DATA MEASUREMENT

The overall QA objective is to collect acceptable data of known and usable quality. The general data quality objective is to provide data on soil and groundwater of sufficient accuracy and precision to identify impacts on the Site. This objective will be achieved and documented using the procedures and criteria set forth in the QAPP. For each measurement made to obtain quantitative data, a set of quality objectives will be used to aid in collecting usable data.

3.1 Chemicals of Potential Concern

The following chemicals of interest have been detected in soil/or and groundwater at the Site:

- Gasoline-range total petroleum hydrocarbons (TPH)
- Diesel-range TPH
- Petroleum-fuel-associated volatile organic compounds (VOCs), including benzene, toluene, ethylbenzene, and total xylenes (BTEX)

3.2 Laboratory Test Methods and Detection Limits

In accordance with the QA/QC requirements set forth in this QAPP, the analyses of soil and groundwater listed in Tables 1 and 2 of the SAP will be performed by the laboratory, using the following laboratory methods:

- Gasoline-range TPH by Northwest Method NWTPH-Gx
- Diesel-range TPH and residual-range TPH by Northwest Method NWTPH-Dx Extended
- VOCs associated with petroleum fuel, specifically BTEX, by U.S. Environmental Protection Agency (USEPA) 8021B

To permit the evaluation of risk to human health and the environment, routine detection limits for samples collected as part of this investigation should be below applicable or relevant and appropriate requirements (ARARs).

State and federal laws that contain ARARs that apply to the cleanup action at the Site are presented in Table 6 of the CAP. Local laws, which may be more stringent than specified state and federal laws, will govern where applicable.

3.3 PARCC Definitions and Objectives

Typically, quality objectives are categorized under precision, accuracy, representativeness, completeness, and comparability (PARCC) parameters. Routine analytical procedures to be used for measuring precision and accuracy include use of duplicate analyses, standard reference materials, surrogate spikes, matrix spikes (MSs), method blanks, and laboratory control samples (LCSs). Surrogate spikes, MSs, method blanks, and LCSs (blank spikes) will be analyzed by at the minimum frequencies specified below. Additional spikes and duplicate analyses may be performed. For the purposes of laboratory analysis, a sample "batch" is considered to be 20 or fewer samples of a single matrix that are extracted or prepared together or are received in the same shipment.

- Surrogate spikes: every sample analyzed for organic compounds will be spiked with selected nontarget analytes and analyzed to evaluate laboratory performance on individual samples.

- MSs and MS duplicates (MSDs): MS samples are analyzed to assess the matrix effects on the accuracy of analytical measurements. MS/MSD samples will be prepared by spiking investigative samples with known amounts of analytes before extraction and preparation and analysis. The recoveries for the MS/MSD samples will be used to assess the accuracy and precision in the analytical method by measuring how well the analytical method recovers the target compounds in the investigative matrices. For each matrix type, at least one set of MS/MSD samples will be analyzed for each batch of samples of 20 (or fewer) samples received.
- Method blank: Method blanks are prepared using analyte-free (reagent) water and are processed with the same methodology (e.g., extraction, digestion) as the associated investigative samples. Method blanks are used to document contamination resulting in the laboratory from the analytical process. A method blank shall be prepared and analyzed in every analytical batch. The method blank results are used to verify that reagents and preparation do not impart unacceptable bias to the investigative sample results. The presence of analytes in the method blank sample will be evaluated against method-specific thresholds. If analytes are present in the method blank above the method-specific threshold, corrective action will be taken to eliminate the source of contamination before proceeding with analysis. Investigative samples of an analytical batch associated with method blank results outside acceptance limits will be appropriately qualified by the data validation contractor.
- LCSs and LCS duplicates (LCSDs): LCSs are prepared by spiking laboratory-certified, reagent-grade water with the analytes of interest or a certified reference material that has been prepared and analyzed. The result for percent recovery of the LCS is a data quality indicator of the accuracy of the analytical method and laboratory performance. LDSs are prepared by the laboratory by splitting an investigative sample into two separate aliquots and performing separate sample preparation and analysis on each aliquot. The results for relative percent difference (RPD) of the primary investigative sample and the respective LDSs are used to measure precision in the analytical method and laboratory performance. For nonaqueous matrices, sample heterogeneity may affect the measured precision for the LDSs.

The precision, accuracy, and completeness criteria to be used for analytical data are summarized in Table 1. Method reporting limit (MRL) goals are listed in Table 2.

PARCC parameters used for field measurements are not generally well defined in the guidelines and literature. These parameters have been defined using the best available guidelines to establish field measurement QA objectives, and will be followed as closely as possible.

3.3.1 Precision

Precision is the degree of agreement between replicate measurements of the same source or sample. Duplicate measurements can be made on the same sample or on two samples from the same source. Precision is generally assessed by duplicate measurements of a subset of samples (laboratory or field duplicate samples). The chemical analysis methods define the portion of the samples being analyzed

for which precision must be assessed. The precision of physical measurements, such as groundwater level measurements, and of field measurements, such as pH and specific conductance, will be based on the general body of data for the instruments and methods, but will not be calculated specifically.

When detected concentrations in either a sample or a duplicate are less than five times the MRL or the method detection limit, data quality objectives for precision suggest that sample and duplicate results should be within plus or minus the MRL of each other. When detected concentrations in the sample and duplicate are both greater than five times the MRL, data quality objectives for precision suggest that the RPD between the results should be less than or equal to 20 percent.

The RPD can be calculated as follows:

$$RPD = \frac{(c_1 - c_2) \times 100}{c}$$

where

RPD = relative percent difference

c_1 = concentration of an analyte in a sample

c_2 = concentration of an analyte in a duplicate sample

c = $(c_1 + c_2)/2$

Acceptable precision limits are based on historical databases, as defined by the USEPA. Laboratory duplicate measurements will be obtained for each set of samples submitted, and will be tested for inorganic analytes only (USEPA, 1994). Field duplicates will be evaluated similarly.

3.3.2 Accuracy

Accuracy measures the level of bias exhibited by an analytical method or measurement. To measure accuracy, a substance with a known value is analyzed or measured, and the result is compared with the known value.

The accuracy of laboratory analysis is assessed by measuring standard reference materials (instrument calibration) and spiked samples (surrogate recoveries, MSs, and LCSs). Standard reference materials are used to calibrate laboratory instruments. The analytical method specifies the frequency and accuracy required for a spiked sample analysis.

Spike recovery is determined by splitting a sample into two portions, spiking one portion with a known quantity of a constituent of interest, and analyzing both portions. Spike recovery is expressed as percent recovery:

$$\text{Percent Recovery} = \frac{(MC - KC)}{KC} \times 100$$

where

MC = known concentration of an analyte

KC = measured concentration of an analyte

Acceptable MS recovery limits are based on historical data sets, as defined by the USEPA methods. Acceptable surrogate recoveries for organic analyses are based on limits calculated by the laboratory, as described in the analytical method.

The accuracy of field measurements is inherent in the instrument and procedure used.

3.3.3 Representativeness

Representativeness is the degree to which data accurately and precisely represent a characteristic of the population, the natural variation at a sampling point, or an environmental condition. There is no standard method or formula for evaluating representativeness. Specific SAPs are designed to allow collection of representative samples. Representativeness is achieved by selecting sampling locations that are appropriate for the objective of the specific sampling task, and by collecting an adequate number of samples. The representativeness of the data will be evaluated and used to identify data gaps that can be addressed during or following completion of the specific investigation.

3.3.4 Completeness

Completeness is commonly expressed as a percentage of measurements that are valid and usable relative to the total number of related measurements. Completeness criteria between 80 and 85 percent are identified in the guidance (USEPA, 1987); these will be used to determine the adequacy of the results. The percent completeness is defined by the following equation.

$$\text{Percent completeness} = \frac{N \times 100}{N_t}$$

where

N = Number of samples that meet data quality goals

N_t = Total number of samples analyzed

3.3.5 Comparability

Comparability is a qualitative parameter expressing the confidence with which one data set can be compared with another. The use of standard techniques for both sample collection and laboratory analysis should make the data collected comparable to both internal and other data generated.

3.4 Quality Assurance Samples

QA samples will be collected in the field, as specified in the specific SAPs. Samples include field equipment rinsate blanks, trip blanks, and field duplicates. QA samples will be blind-labeled and preserved as if they were typical samples. QA samples will be clearly identified on the field sampling data sheets (FSDSs). Analytical results from the blanks and duplicates will facilitate data QC checks. Field and trip blank results may indicate possible contamination introduced by field or laboratory procedures, and field duplicates indicate overall precision in both field and laboratory procedures. Results will be evaluated by applying the PARCC criteria, and the evaluation will be discussed in the data validation report.

3.4.1 Trip Blanks

A trip blank monitors the potential for sample contamination during sample collection and transport. A trip blank consists of reagent-grade water in a new sample container, which is prepared at the same time as the primary sample containers. The trip blank will accompany the samples throughout collection, shipment, and storage. At least one trip blank should be included with each cooler in which samples for VOC analyses are stored.

3.4.2 Equipment Rinsate Blanks

To ensure that decontamination procedures are sufficient, an equipment rinsate blank will be collected when nondedicated, nondisposable equipment is used. At least one equipment rinsate blank will be collected for every 20 samples collected. If more than 20 samples are collected with the same equipment, or if high concentrations of contaminants are encountered, additional equipment rinsate blanks may be collected. Equipment rinsate blanks will be collected by passing laboratory deionized/distilled water through or over nondisposable sampling equipment.

3.4.3 Field Duplicates

Field duplicates are collected to measure sampling and laboratory precision. At least one duplicate sample will be collected for every 20 samples.

4 FIELD SAMPLING QUALITY ASSURANCE PROCEDURES

This section describes how samples will be documented, handled, preserved, and shipped, and also discusses equipment decontamination. The SAP outlines the data needs identified for this work and the specific procedures used to obtain representative samples to fulfill these data needs. Specific procedures addressed in the SAP include:

- Techniques used to select sampling sites
- Sampling procedures to be used
- Decontamination procedures for the preparation of sampling equipment and containers
- Time considerations for shipping samples promptly to the laboratory

If deviations are necessary, they will be discussed ahead of time in an addendum to this QAPP. In the case of a field modification, changes will be documented in field notes. Reference to this QAPP will provide field personnel and data reviewers with quantitation goals and other relevant parameters needed for data evaluation.

The information provided in this QAPP outlines the data documentation procedures that will be followed to generate technically defensible data. Any alterations to the field sampling documentation procedures described below will be described on the soil and groundwater FSDSs and in a memorandum written to Ecology.

4.1 Work Documentation

The following data forms will be used for documenting specific field observations and conditions:

- Soil FSDS
- Groundwater FSDS
- Log of exploratory boring

The following information will be recorded on the FSDS for each soil or sediment sample collected:

- Facility name
- Sample number
- Sampler's name
- Sample location (well, boring, or sample number)
- Sampling depth
- Sampling date and time
- Sampling method
- Composite or discrete sample
- Sample container size and material
- Sample preservative
- Climatic or other noteworthy conditions (e.g., nearby activities)
- Problems encountered with equipment or methods
- Decontamination methods
- Number of sample bottles filled
- Laboratory used

The sampler will record the following information on the FSDS for each groundwater sample collected:

- Facility name
- Sampler's name
- Sample number
- Well/boring/surface site number and location
- Well/boring condition, well depth, depth to groundwater, and date and time of measurement
- Well/boring purging method, volume, depth, date, and time
- Sampling method, depth, date, and time
- Type of sample container and preservative
- Climatic or other noteworthy conditions (e.g., nearby activities)
- Problems encountered with equipment or methods
- Decontamination methods
- Field measurements (pH, specific conductance, temperature, etc.)
- Number of sample bottles filled
- Laboratory to use

General field observations will be recorded in a field notebook.

4.2 Sample Containers, Preservation, and Handling

4.2.1 Preservation

Soil and groundwater sample containers and methods of preservation for each analysis are listed in the laboratory quality assurance manual. A summary is provided in Tables 1 and 2 of the SAP. Sample containers will be supplied by the laboratory for each sampling event and will include the appropriate preservatives.

4.2.2 Sample Packaging and Shipping

To ensure that the laboratory has ample time to complete all analyses within holding time requirements, and to reduce the potential for field degradation of samples, the samples will be shipped from the field to the laboratory at a minimum of every two days. Holding times for specific analytical methods are included in Tables 1 and 2 of the SAP. Samples will be stored at 4° Celsius (as measured with a thermometer) in iced shipping containers or a refrigerator designated for samples,

and then transported by courier to the laboratory in iced shipping containers with a custody seal affixed.

5 SAMPLE CUSTODY PROCEDURES

This section provides information about sample labeling and custody procedures.

5.1 Sample Labeling

Sample container labels will clearly indicate:

- Sample locations
- Sample number
- Depth at which sample was collected
- Date and time of sample collection
- Sampler's initials
- Any pertinent comments such as specifics of filtration or preservation

Labels will be filled out at the time of sampling. Sample labeling information will also be recorded on the FSDS and in a field notebook.

Samples that will be collected on a regular basis (e.g., groundwater samples collected from monitoring wells) will be assigned blind sample numbers to prevent laboratory bias and tampering. Each sample label may contain the following information:

- Sample number
- Sampler identification (person's initials)
- Date and time of sampling
- Place of collection

Blind sample numbers and actual sample locations will be recorded on the FSDSs. The FSDSs will not be sent to the laboratory.

5.2 Sample Custody

Sample custody will be tracked from point of origin through final analysis and disposal, using a COC form, which will be filled out with the appropriate sample/analytical information as soon as possible after samples are collected. For purposes of this work, custody will be defined as follows:

- In plain view of an MFA field representative
- Inside a cooler that is in plain view of an MFA field representative
- Inside any locked space such as a cooler, locker, car, or truck to which the MFA field representative has the only available key(s)

The following items will be recorded on the COC form:

- Project name
- Project number
- MFA project manager
- Sampler's name
- Sample number, date and time collected, medium, number of bottles submitted
- Requested analyses for each sample
- Shipment method
- Type of data package required (Tier II½ in most cases)
- Turnaround requirements
- Signature, printed name, and organization name for all persons having custody of samples; date and time of transfer
- Additional instructions or considerations that would affect analysis (nonaqueous layers, archiving, etc.)

Persons in possession of the samples will be required to sign and date the COC form whenever samples are transferred between individuals or organizations. The COC will be included in the shipping containers with the samples, and the containers will be sealed with a laboratory custody seal. The laboratory will implement its in-house custody procedures, which begin when sample custody is transferred to laboratory personnel.

If samples are shipped via air or ground transportation (by a third party), the following custody procedures will be followed. Samples will be packed in shipping containers, and a custody seal will be placed on the container to reduce the potential for tampering. Proper shipping insurance will be requested, and the top two copies of the COC form will accompany the samples. The person shipping the samples will retain a third copy of the COC and shipping forms to allow sample tracking. The COC form will accompany the samples from point of origin in the field to the laboratory.

At the laboratory, a designated sample custodian will accept custody of the received samples, and will verify that the COC form matches the samples received. The shipping container or set of containers is given a laboratory identification number, and each sample is assigned a unique, sequential identification number that includes the original shipping container identification number.

6 EQUIPMENT CALIBRATION AND MAINTENANCE PROCEDURES

6.1 Field Instrumentation

The investigations will include the use of field instruments. The following field equipment will require calibration before use and periodically during sampling activities:

- pH meter
- Conductivity meter
- Dissolved-oxygen meter
- Photoionization detector (PID)

Field instrument calibration and preventive maintenance will follow the manufacturers' guidelines, and any deviation from the established guidelines will be documented. Generally, field instruments will be calibrated daily before work begins. Field personnel may decide to calibrate more than once a day if inconsistent or unusual readings occur, or if conditions warrant more frequent calibration. Calibration activities will be recorded in field logbooks.

6.1.1 Field Calibration

Calibration procedures, calibration frequency, and standards for measurement will be conducted according to manufacturer's guidelines. To ensure that field instruments are properly calibrated and remain operable, the following procedures will be used, at a minimum:

- Operation, maintenance, and calibration will be performed in accordance with the instrument manufacturers' specifications.
- All standards used to calibrate field instruments will meet the minimum requirements for source and purity recommended in the equipment operation manual. Standards will be used before any expiration dates that may be printed on the bottle.
- Acceptable criteria for calibration will be based on the limits set in the operations manual.
- All users of the equipment will be trained in the proper calibration and operation of the instrument.
- Operation and maintenance manuals for each field instrument will be brought to the Site.
- Field instruments will be inspected before they are taken to the Site.

- If used, PID and flame-ionization detector field instruments will be calibrated at the start and end of each work period. Meters will be recalibrated, as necessary, during the work period.
- Conductivity and pH meters will be calibrated at the start of each workday and, if deemed necessary, recalibrated during the workday.
- Calibration procedures (including time, standards used, and calibration results) will be recorded in a field logbook. Although not reviewed during routine QA/QC checks, the data will be available if problems are encountered.

6.1.2 Preventive Maintenance

Preventive maintenance of field instruments and equipment will follow the operations manuals. A schedule of preventive maintenance activities will be followed to minimize downtime and ensure the accuracy of measurement systems. Maintenance will be documented in the field logbook.

6.2 Laboratory Instrumentation

Specific laboratory instrument calibration procedures, frequency of calibration, and preparation of calibration standards will be according to the method requirements as developed by the USEPA, following procedures presented in SW-846 (USEPA, 1986).

6.2.1 Laboratory Calibration and Preventive Maintenance

The laboratory calibration ranges specified in SW-846 (USEPA, 1986) will be followed.

Preventive maintenance of laboratory equipment will be the responsibility of the laboratory personnel and analysts. This maintenance includes routine care and cleaning of instruments and inspection and monitoring of carrier gases, solvents, and glassware used in analyses. The preventive maintenance approach for specific equipment will follow the manufacturers' specifications and good laboratory practices. Maintenance will be documented in the instrument logbooks.

Precision and accuracy data will be examined for trends and excursions beyond control limits to determine evidence of instrument malfunction. Maintenance will be performed when an instrument begins to change as indicated by the degradation of peak resolution, shift in calibration curves, decrease in sensitivity, or failure to meet one or more of the QC criteria.

7 LABORATORY QUALITY CONTROL PROCEDURES

Samples will be analyzed by a laboratory that is qualified to perform the analyses using standard, documented laboratory procedures. The laboratory will have QA/QC plans and standard operation procedures that provide data quality procedures according to the protocols for the analytical method

and cleanup steps. The data quality procedures will be at a level sufficient to meet the sampling program's data quality objectives. The laboratory will perform, document, and report laboratory procedures.

The analytical methods and references for analyses that may be used during project implementation are summarized in Tables 1 and 2 of the SAP. Procedural details not specified in this QAPP will follow the protocols described in SW-846 (USEPA, 1986).

7.1 Internal Quality Assurance/Quality Control Checks

The laboratory will demonstrate its ability to produce acceptable results, using the recommended methods or their equivalent. The following criteria will be used internally by the laboratory to evaluate the data (as appropriate for inorganic or organic chemical analyses):

- Performance on test methods
  - MS
  - Gas chromatograph (tailing factors)
  - Blanks
  - Precision of calibration and samples
- Percentage recovery of surrogates (organics)
- Adequacy of detection limits
- Precision of replicate sample analyses
- Comparison of percentage of missing or undetected substances between replicate samples

Laboratory records of standard calibration curves and all other pertinent data will be held for possible inspection at the laboratory, and will be made available on request.

7.2 Quality Control Procedures

The laboratory QC procedures will consist of the following:

- Instrument calibration and standards as defined in the SW-846 manual for organic and inorganic analyses (USEPA, 1986)
- Laboratory blank measurements at a minimum of 5 percent or one per 20 frequency
- Data reports including appropriate QA/QC documentation

8 DATA REDUCTION, VALIDATION, AND REPORTING

The laboratory performing sample analyses will be required to submit analytical data supported by sufficient QA information to permit independent and conclusive determination of data quality. Data quality will be determined by MFA, using the data validation procedures described in this section. The results of the MFA evaluation will be used to determine if the project data quality objectives have been met.

MFA uses a database (EQuIS™) to manage laboratory data. The laboratory will provide the analytical results in electronic, EQuIS-compatible format. Following data evaluation, data qualifiers will be entered into the database.

8.1 Laboratory Evaluation

Initial data reduction, evaluation, and reporting at the analytical laboratory will be carried out as described in USEPA SW-846 manuals for analyses (USEPA, 1986), as appropriate. Additional laboratory data qualifiers may be defined and reported to further explain the laboratory's QC concerns about a particular sample result. Additional data qualifiers will be defined in the laboratory's case narrative reports.

8.2 MFA Evaluation

8.2.1 Validation

After MFA receives the analytical data, the data will be validated under the supervision of the project analytical QA manager. MFA will examine the data for precision, completeness, accuracy, and adherence to standard operating procedures. The laboratory will perform internal QC checks and MFA will validate laboratory analytical data, as described in the following sections. QC checks will be performed on laboratory information, using the sample log-in reports electronically transferred to MFA after samples are entered into the laboratory information management system. The reports will be assessed early in the process, which will allow QC checks to begin before sample holding times have expired or before errors are incorporated in the laboratory reports.

Validation procedures: MFA will evaluate the laboratory data for precision, completeness, accuracy, and compliance with the analytical method. MFA will review data according to applicable sections of USEPA organics and inorganics procedures (USEPA, 2008, 2010), as well as appropriate laboratory method-specific guidelines (USEPA, 1986).

Data qualifiers, as defined by the USEPA, are used to classify sample data according to their conformance to QC requirements. Common qualifiers are listed below:

- J—Estimate, qualitatively correct but quantitatively suspect.

- R—Reject, data not suitable for any purpose.
- U—Not detected at a specified reporting limit.

Poor surrogate recovery, blank contamination, or calibration problems, among other things, can require qualification of the sample data. The reasons for qualification of sample data should be stated in the data evaluation report.

QC criteria not defined in the guidelines for evaluating analytical data are adopted, where appropriate, from the analytical method.

The following information will be reviewed during data evaluation, as applicable:

- Sampling locations and blind sample numbers
- Sampling dates
- Requested analysis
- COC documentation
- Sample preservation
- Holding times
- Method blanks
- Surrogate recoveries
- MS/MSD results
- Laboratory duplicates (if analyzed)
- Field duplicates
- Field blanks
- LCSs
- MRLs above requested levels
- Additional comments or difficulties reported by the laboratory
- Overall assessment

The results of the data evaluation review will be summarized for each data package. Data qualifiers will be assigned to sample results on the basis of USEPA guidelines, as applicable.

8.2.2 Reduction

MFA uses a database EQuIS) to manage laboratory data. The laboratory will provide the analytical results in electronic, EQuIS-compatible format. Following data evaluation, data qualifiers will be entered into the database.

Data may be reduced to summarize particular data sets and to aid interpretation of the results. Statistical analyses may also be applied to results. Data-reduction QC checks will be performed on hand-entered data, calculations, and data graphically displayed. Data may be further reduced and managed using one or more of the following computer software applications:

- Microsoft Excel (spreadsheet)
- EQuIS (database)
- Microsoft Access (database)
- AutoCad and/or Arc GIS (graphics)
- USEPA ProUCL (statistical software)

8.2.3 Reporting

After completion of data collection, validation, and reduction, the data will be used in reports. Copies of the reports will be kept in the main project file, submitted to the County for review, and then submitted to Ecology. The original copy of any document that MFA produces will remain in the main project file.

Ecology has requested that the County provide electronic copies of data for input into Ecology's Environmental Information Management system. MFA and the County will work with Ecology's Toxic Cleanup Program to make this possible.

9 INTERNAL QUALITY CONTROL

9.1 Field Checks

Daily internal QC checks will be performed for field activities. Checks will consist of reviewing field notes and field activity memoranda to determine whether the specified measurements, calibrations, and procedures are being followed. The need for and content of corrective action will be assessed on an ongoing basis, in consultation with the project manager.

9.2 Laboratory Checks

The laboratory will document the completion and evaluation of internal QC checks and any corrective actions or reanalyses that result.

9.3 Data Reduction Checks

Data reduction QC checks will be performed on all entered, calculated, and graphic data produced by MFA. Data entry will be compared with data generated during field activities and recorded in notebooks or on field data forms. Analytical data entry will be reviewed against laboratory reports and data validation reports.

10 PERFORMANCE AND SYSTEM AUDITS

MFA's project manager will monitor the performance of the field and laboratory QA program. Proper communication between field staff, project management, and the laboratory will be maintained so that consistent and appropriate methods and techniques are used throughout the project.

10.1 Field Performance

Field performance will be monitored through daily review of sample collection documentation, sample handling records (COC forms), field notebooks, field measurements, and periodic field inspections. All field and sampling procedures will be checked for compliance with relevant work plans.

10.2 Laboratory Performance and System Audits

The laboratory will audit in-house performance and systems under their in-house QA/QC guidelines. Two types of audits will be used at the facility: system audits to qualitatively evaluate the operational details of the QA program, and performance audits analyzing performance evaluation samples to quantitatively evaluate the outputs of the various measurement systems. Such audits will be made available for review on request. While samples for this investigation are analyzed, the project QA coordinator will be in contact with the analytical laboratory to assess progress toward obtaining the data quality objectives, and to take corrective measures as problems arise.

11 PREVENTIVE MAINTENANCE

Field equipment will be checked daily to detect any malfunctions. Steps will be taken to repair or replace any equipment that appears unreliable. Repairs will be made according to the manufacturers' guidelines, or by qualified repair technicians. Equipment will also be periodically serviced, according to the manufacturers' recommendations. Preventive maintenance procedures for field equipment as well as for analytical equipment are outlined in Section 6.

12 DATA MEASUREMENT ASSESSMENT PROCEDURES

Procedures to assess data precision, accuracy, and completeness will be completed routinely, through data validation reports. Precision and accuracy will be based on laboratory documentation. Completeness will be based on the usability of the data collected, relative to the data needs of an investigative task or the amount of data scheduled for collection. Completeness will be quantified when appropriate, but will be qualitatively evaluated with respect to the representativeness of the data when detection, or lack thereof, is the objective. The criteria that will be used for analytical data are summarized in Table 2. The laboratory is responsible for ensuring that the precision and accuracy limits for each laboratory analytical method and parameter are consistently met or exceeded.

13 CORRECTIVE ACTION

The need for corrective action will be evaluated on an ongoing basis, depending on the results of internal and laboratory QC checks.

Corrective action measures will generally result from either instrument failure or nonconformance or noncompliance with QA requirements by the laboratory or field personnel. The MFA project manager will be notified as soon as practical if a field or laboratory QA problem arises that could jeopardize the use of collected data. All project personnel are responsible for reporting lapses in QA procedures.

During field operation and sampling procedures, field personnel will be responsible for reporting any changes to specified sampling procedures. A description of any such change will be entered in the daily field logbook and on FSDSs.

If QC audits result in detection of unacceptable conditions or data, the project manager, in conjunction with the project quality assurance coordinator, will be responsible for implementing corrective action. Specific corrective actions are outlined in each SW-846 method and include, but are not limited to:

- Identifying the source of the violation
- Reanalyzing samples if holding time criteria permit
- Evaluating and amending sampling and analytical procedures
- Accepting data and flagging to indicate the level of uncertainty

Ecology and the County shall be notified of each field, laboratory, or project corrective action.

14 QUALITY ASSURANCE REPORTS TO MANAGEMENT

Reporting on the quality of data gathering will include regularly transmitting field and laboratory documentation to the project manager and summarizing the information. These reports will consist of field activity memoranda and reports and data validation reports, and will provide a means for management to evaluate accomplishment of the established QA/QC objectives.

After a complete data package is received from the laboratory and MFA has completed the data quality evaluation in accordance with this QAPP, a summary report will be prepared and presented concurrent with laboratory results. The data quality evaluation will summarize the overall quality of the chemical results in terms of the specific data quality goals identified in this QAPP, and will identify chemical results qualified by MFA.

Results of sample analyses will be transmitted to Ecology with a full data validation report that indicates the usability of each reported value. Reports will be maintained in the project files and will include results of performance and system audits; periodic assessment of measurement data accuracy, precision, and completeness; significant QA/QC problems and recommended solutions; and resolutions of previously identified problems.

LIMITATIONS

The services undertaken in completing this plan were performed consistent with generally accepted professional consulting principles and practices. No other warranty, express or implied, is made. These services were performed consistent with our agreement with our client. This plan is solely for the use and information of our client unless otherwise noted. Any reliance on this plan by a third party is at such party's sole risk.

Opinions and recommendations contained in this plan apply to conditions existing when services were performed and are intended only for the client, purposes, locations, time frames, and project parameters indicated. We are not responsible for the impacts of any changes in environmental standards, practices, or regulations subsequent to performance of services. We do not warrant the accuracy of information supplied by others, or the use of segregated portions of this plan.

REFERENCES

USEPA. 1986. Test methods for evaluating solid waste: physical/chemical methods. EPA-530/SW-846. U.S. Environmental Protection Agency, Office of Solid Waste and Emergency Response. September (revision 6, February 2007).

USEPA. 1987. Data quality objectives for remedial response activities, development process. U.S. Environmental Protection Agency.

USEPA. 2008. USEPA contract laboratory program, national functional guidelines for organics data review. EPA 540/R-08/01. U.S. Environmental Protection Agency, Office of Emergency and Remedial Response. June.

USEPA. 2010. USEPA contract laboratory program national functional guidelines for inorganic superfund data review. EPA 540/R-10/011. U.S. Environmental Protection Agency, Office of Superfund Remediation and Technology Innovation. January.

TABLES

Table 1
Objectives for Measurement
Truck City Site Property

Analysis	Matrix	Accuracy (%)	Precision (%)	Completeness (%)	Method	Reference	Maximum Holding Time
Total Petroleum Hydrocarbons							
Method 8015B	Soils	63–133	40	85	GC	Ecology	14 days
	Water	51–143	30	85	GC	Ecology	14 days
Volatile Organic Compounds							
Method 8260B	Soils	69–134	40	85	Purge+Trap GC/MS	SW-846	14 days
	Water	64–145	30	85	Purge+Trap GC/MS	SW-846	14 days

NOTES:
Ecology = Washington State Department of Ecology.
GC = gas chromatography.
MS = mass spectrometry.

Table 2
Comparison of MRL Goals with State Cleanup Standards
Recommended MRLs
Truck City Site Property

Analysis (method)	Soil (mg/kg)		Water (ug/L)	
	Quantitation Limit	MTCA Method A Cleanup Level	Quantitation Limit	MTCA Method A Cleanup Level
Gasoline-range TPH*	50	100	100	800
Diesel-range TPH	15	2,000	80	500
Benzene	0.025	0.03	0.3	5
Toluene	0.1	7	0.5	1,000
Ethylbenzene	0.1	6	0.5	700
Total Xylenes	0.3	9	1.5	1,000

NOTES:
mg/kg = milligrams per kilogram.
MRL = method reporting limit.
MTCA = Model Toxics Control Act.
TPH = total petroleum hydrocarbons.
ug/L = micrograms per liter.
*with presence of benzene.