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Final Remedial Investigation Work Plan

Oline Storage Yard

1915 Marine View Drive
Tacoma, Washington

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ABBREVIATIONS AND ACRONYMS

Abbreviation/ Acronym	Definition
AST	Aboveground storage tank
bgs	Below ground surface
CAP	Cleanup Action Plan
COC	Contaminant of concern
COPC	Contaminant of potential concern
CSM	Conceptual Site Model
DPT	Direct-push technology
Ecology	Washington State Department of Ecology
EPA	U.S. Environmental Protection Agency
EPI	Environmental Partners, Inc.
FS	Feasibility Study
GPC	Gel permeation chromatography
HASP	Health and Safety Plan
IDW	Investigation-derived waste
mg/kg	Milligrams per kilogram
MTCA	Model Toxics Control Act
OD	Outside diameter
Order	Agreed Order No. DE 8796
PAH	Polycyclic aromatic hydrocarbon
PCBs	Polychlorinated biphenyls
PID	Photoionization detector
PLP	Potentially Liable Person
PRS	Petroleum Reclaiming Services, Inc.
QA/QC	Quality Assurance/Quality Control
RCW	Revised Code of Washington
RI	Remedial Investigation
RI/FS	Remedial Investigation/Feasibility Study
RI WP	Remedial Investigation Work Plan
SAP	Sampling and Analysis Plan
Screening Levels	Preliminary screening levels
subject property	Oline Storage Yard - 1915 Marine View Drive, Tacoma, Washington
SVOC	Semi-volatile organic compound
TPCHD	Tacoma-Pierce County Health Department
TSCA	Federal Toxic Substances Control Act
EPA	U.S. Environmental Protection Agency
VOC	Volatile organic compound
WAC	Washington Administrative Code
WAP	Waste Analysis Plan
WARM	Washington Ranking Method

1.0 INTRODUCTION

1.1 Purpose

Environmental Partners, Inc. (EPI) has completed this *Remedial Investigation Work Plan* (RI WP) for the property located at 1915 Marine View Drive (also referred to as 1905 Marine View Drive) in Tacoma, Washington (subject property). The RI WP has been prepared in compliance with Agreed Order No. DE 8796 (Order) between the Washington State Department of Ecology (Ecology) and Mr. Don Oline, now The Estate of Don Oline. The effective date of the Order is January 3, 2012.

The Order was issued pursuant to the authority of the Model Toxics Control Act (MTCA), Revised Code of Washington (RCW), Chapter 70.105D.050(1). The Order identified Mr. Don Oline as an "Operator" and Mr. Ron Oline as an "Owner" as defined in RCW Chapter 70.105D.020(17)(a), Mr. Ron Oline is not a signatory to the Order, but does serve as the Trustee of The Estate of Don Oline.

The Order requires the identification and disposal of wastes located at the subject property (completed in March 2013), performance of a Remedial Investigation / Feasibility Study (RI/FS) of the subject property, and if necessary development of a draft Cleanup Action Plan (CAP) based on the outcome of the RI/FS.

The objective of the work described in this RI WP is to identify the likely presence or absence of impacts to the environment and, if present, to assess the nature and extent of such impacts to a level sufficient to select an appropriate remedy. Prior to preparation the scope of this RI WP has been discussed in detail with the Project Manager for the subject property, Mr. Marv Coleman of the Southwest Regional Office of Ecology.

This RI WP is being submitted to Ecology and Mr. Coleman for review and approval prior to implementation. EPI will appropriately address any comment received from Ecology and submit a final RI WP and prepare a schedule to perform the scope of work contained therein. The Feasibility Study (FS) required under the Order will be prepared after completion of the final RI Report and the scope of that FS will be similarly negotiated with Ecology.

1.2 Site Location, Ownership, and Adjacent Property Use

The subject property is located in Tacoma, Washington, as presented in Figure 1 General Vicinity Map. The Pierce County Assessor's Office describes the subject property as parcel number 0321362052 measuring approximately 6.6 acres with a land use code of 8505-Quarry Sand Rock. The Pierce County Assessor's records indicate the current owner is Mr. Ronald S. Oline. Vehicle access to the subject property is from the south through a gate located on the north side of Marine View Drive (see Figure 2 Site Representation).

Based on information obtained from the Pierce County Assessor's office, the properties adjacent to the subject property are listed below:

- North: 19.33-acre lot owned by the Port of Tacoma; land use code 9100-Vacant Land, Undeveloped; parcel number 0321253043.

- East: 6.25-acre lot owned by Leslie P. Sussman, et al.; land use code 9180—Vacant Industrial Land; parcel number 0321362051.

- South: 2.4199-acre lot owned by Manke Timber Company; land use code 9180—Vacant Industrial Land; parcel number 0321362035.

- West: 6.5886-acre lot owned by Jones Chemical, Inc.; land use code 2800—Chemical Manufacturing; parcel number 0321362049.

It is important to note that the east-adjacent property (also known as the 1913 Marine View Drive Site) is under Agreed Order No. DE-1679 for the improper disposal of the following:

- Lime sludge from the Occidental Chemical Corporation Tacoma Facility; and

- Auto-shredder residue (ASR) from General Metals of Tacoma.

The reviewer is directed to Agreed Order No. DE-1679 and supporting reports for additional information regarding the contaminants of concern and current regulatory status of the 1913 Marine View Drive Site.

1.3 Tax Description of Property

The tax description of the subject property provided by Pierce County Assessor records is:

> Section 36 Township 21 Range 03 Quarter 21 : BEG AT A PT 250 FT W OF NE COR GOVT LOT 1 TH CONT W ALG N LI SEC TO A PT 408.15 FT E OF E LI JULIAS GULCH RD TH S 10 DEG 37 MIN 12 SEC W 701.32 FT TO A PT ON SLY LI OF TR CYD TO FOSS LAUNCH & TUG CO BY FEE # 1942293 TH S 68 DEG 41 MIN 35 SEC E 306.18 FT TH NELY TO POB EASE OF RECORD OUT OF 2/050 SEG H 2352 BG

1.4 Subject Property History

Mr. Don Oline purchased the property on July 13, 1999 from Woodworth & Company, Inc. Mr. Don Oline titled the subject property in his son's name, Mr. Ronald S. Oline (Mr. Ron Oline). Soon after purchase, Mr. Don Oline began a heavy equipment dismantling operation at the subject property with the objective of recovering recyclable materials for off-site sale. In June 2002, inspectors from the Tacoma-Pierce County Health Department (TPCHD) conducted an inspection of the subject property and collected samples of stained surface soils. The analytical results indicated that "…*concentrations of diesel and heavy motor oil petroleum hydrocarbons were present at levels above MTCA cleanup standards.*" (Section V of the Order).

Ecology began an investigation at the subject property in May 2004. According to the Order, analysis of soil samples collected during this investigation indicated concentrations of polycyclic aromatic hydrocarbons (PAHs), phthalates, 2-4-dinitrotoluene, 2-nitroaniline, and petroleum hydrocarbons at concentrations greater than potentially applicable soil cleanup levels. Using data gathered from the

2002 TPCHD and 2004 Ecology inspections, the subject property underwent a Site Hazard Assessment (SHA) and in February 2008 Ecology calculated a Washington Ranking Method (WARM) score of 1 out of 5, which corresponds to Ecology's highest priority ranking while 5 is the lowest.

The U.S. Environmental Protection Agency (EPA) began an investigation at the subject property in November 2008. That investigation appears to have originated as a result of a complaint from a used oil recycler (Petroleum Reclaiming Services, Inc. [PRS]) who had reported the presence of polychlorinated biphenyls (PCBs) in oil that they had allegedly collected at the subject property. It is important to note that The Estate of Don Oline denies the claim that it had PCB-containing materials on its property. A previous lawsuit initiated by PRS against the Estate of Don Oline claimed damages due to PRS's alleged receipt of PCB contaminated oil from the subject property. In a summary judgment, all but one of PRS' claims were ruled in favor of the Estate of Don Oline. The final claim was then dropped by PRS.

During its investigation the EPA collected samples of both oil and soil from the subject property. Analysis of the oil samples indicated the presence of PCBs at a concentration greater than the applicable Federal Toxic Substances Control Act (TSCA) action level of 50 milligrams per kilogram (mg/kg). PCBs were also reported in several soil samples at concentrations exceeding the MTCA Method A Soil Cleanup Level for Unrestricted Land Use of 1 mg/kg. It should be noted that a soil cleanup level for PCBs has not been established for the subject property.

Mr. Don Oline contracted with EPI in October 2010 to review available information, conduct an initial subject property inspection and to meet with the EPA, Ecology, and TPCHD concerning the reported discovery of PCBs. Initial communications indicated that both Ecology and TPCHD had additional concerns regarding contaminants other than PCBs at the subject property. During subsequent meetings, it was agreed that Ecology would be the lead agency for the investigation and potential remediation of the subject property and that the mechanism for enforcement would be an Agreed Order.

In early 2011, Ecology indicated that although PCBs were a concern at the property, Ecology was equally concerned with the potential of releases of apparent hazardous liquids inadequately stored at the subject property. Prior to commencing any assessment, characterization, or remediation of PCBs, Ecology required performance of a waste inventory at the subject property and, if necessary, waste characterization of any identified liquids for ultimate off-site disposal or recycling.

The waste inventory was conducted on May 26 and 27, 2011 (see Section 1.5.4) and results were reported to Ecology in June 2011. Upon review of the waste inventory, Ecology stated in a letter dated June 9, 2011 that Mr. Don Oline would be required to prepare an approved *Waste Analysis Plan* (WAP) for the required characterization of wastes at the subject property.

Ecology proceeded with preparation of the Order naming Mr. Don Oline (as Operator under RCW 70.105D.020(5)) and Mr. Ron Oline (as Owner under RCW 70.105D.020(17)(a)) as PLPs. Only Mr. Don Oline is a signatory to the Order. The effective date of the Order is January 3, 2012.

Mr. Don Oline died on February 22, 2012. After his death, The Estate of Mr. Don Oline contracted with EPI to prepare the WAP in compliance with the Order. The WAP was submitted to Ecology on July 25,

2012 and approved on August 8, 2012. Representative samples of potential waste materials were collected between September 17 and 19, 2012. Upon receipt of final analytical results, waste removal for disposal and recycling was conducted between January and March 2013. PCBs were not detected in any of the waste characterization samples.

Mr. Ron Oline, Mr. Coleman, and Mr. Jerry Boyd of EPI met on January 29, 2013 to establish the necessary scope of actions to prepare this RI WP. During this meeting, Mr. Coleman expressed two concerns for the subject property:

1. Lime sludge documented to have been improperly disposed on the east-adjacent property (1913 Marine View Drive Site) may have also been placed in the central area of the subject property. Mr. Coleman's concerns were based on review of historical aerial photographs that appear to depict mounded, light-colored material in the central portion of the subject property. No other suggestion of lime sludge placement on the subject property is available.

2. The lateral and vertical extent of PCB concentrations in soil, as presented in the EPA inspection report, has not been characterized.

During this meeting, it was agreed that the RI WP would investigate surface and shallow subsurface soils in the vicinity of previously identified PCB impacts. Soil samples would be collected using direct-push technology (DPT) soil borings with several borings being advanced to terminal depths of 12 feet below ground surface (bgs) to assess the potential presence of lime sludge. If suspected lime sludge is observed, representative samples will be collected and analyzed for volatile organic compounds (VOCs) and semivolatile organic compounds (SVOCs). Detailed descriptions of sampling and analysis procedures are presented in Section 3.0, Sampling and Analysis Plan.

It was agreed during that meeting that if no lime sludge or related contaminants of concern were identified in soil at the subject property that further investigation, beyond what may be necessary to fully characterize the extent of PCBs, would not be necessary and that, pending full characterization of the extent of PCBs, the RI would be complete. It was agreed that upon completion of the RI and acceptance of the RI report by Ecology an FS would be prepared for the subject property.

1.5 Previous Investigations and Evaluation of Existing Data

The following sections present a brief review of each investigation performed to date at the subject property. The reviewer is directed to the source documents for additional detail.

1.5.1 TPCHD Inspection—June 2002

TPCHD personnel conducted an inspection of the subject property in June 2002. During this inspection, TPCHD collected samples of stained soils and reported that diesel and heavy motor oil petroleum hydrocarbons were measured at concentrations that were "*above MTCA cleanup standards*."

1.5.2 Ecology Inspection—May 2004

Ecology personnel collected soil samples during an inspection of the subject property in May 2004. Analytical results indicated that PAHs, phthalates, 2,4-dinitotoluene, 2-nitroanaline, and petroleum hydrocarbons were "*present at levels above MTCA cleanup standards*." Improper storage and lack of disposal records for apparent on-property wastes were also documented during that inspection.

In November 2008, Ecology used data collected from June 2002 through May 2004 to calculate a WARM score of 1, corresponding to the highest relative risk, for the subject property.

1.5.3 EPA TSCA / PCB Inspection Report—2008

EPA conducted an inspection of the subject property on November 12, 2008. The inspection was conducted at the request of Ecology who had received information from PRS, a used oil recycler, that they had allegedly received PCB-contaminated oil from an aboveground storage tank (AST) located at the subject property. During their inspection, EPA collected a total of eight samples and one duplicate. Sampled media included oil from several ASTs, oil reportedly pooled at the ground surface, soil from surface stained areas, and apparent abrasive blast media (ABM). All samples were analyzed for the presence of PCBs, with the exception of the ABM, which was analyzed for the eight Resource Conservation and Recovery Act (RCRA 8) metals.

On January 20, 2010, Mr. Clark Davis, the attorney for Mr. Don Oline prior to his death, received the *TSCA/PCB Inspection Report* documenting the November 2008 EPA inspection. The results indicated the following:

- Total PCB concentrations were measured up to 23,000 mg/kg in the oil samples. The highest concentration was measured in the oil sample collected from the AST where PRS allegedly collected the PCB-contaminated oil. PCBs were not detected in oils collected from other ASTs.

- Total PCB concentrations were measured up to 590 mg/kg in soil. Only two areas of the subject property had soil samples with concentrations of PCBs greater than the TSCA screening level of 1 mg/kg: the vicinity of the oil AST with the maximum PCB concentration (23,000 mg/kg), and an area approximately 100 feet southeast of the oil AST where surface staining was observed.

The detected PCBs from this inspection are summarized in Table 1 while the RCRA 8 metals are summarized in Table 2. Figure 2 depicts the areas where PCBs in soil exceeded a concentration of 1 mg/kg. These two areas are identified as Area of Potential Concern 1 (AOPC 1) and AOPC 2.

1.5.4 Waste Inventory—June 2011

EPI conducted a waste inventory of the subject property on June 26, 2011. Ecology based their request on previous inspection observations indicating that petroleum products and other liquids were improperly stored at the subject property and had the potential to be released to the environment. Approximately 175 potential containers were identified during the waste inventory.

The results of the waste inventory were released to Ecology in June 2011. Upon review, Ecology issued a letter dated June 9, 2011 that required Mr. Don Oline to characterize any potential wastes prior to disposal or recycling. Ecology also stated that they must approve of a WAP prior to the required characterization and ultimate disposal or recycling of the wastes.

1.5.5 EPI Waste Analysis Plan—July 2012

Mr. Don Oline died on February 22, 2012. After his death, the Estate of Don Oline contracted with EPI to prepare and implement the WAP. EPI submitted the WAP to Ecology on July 25, 2012 and received Ecology's approval in August 2012. The WAP was implemented starting in September 2012. Subsequent containerizing of wastes (e.g., over-packing, etc.) and preparing materials for recycling, reclamation, or disposal continued until March 2013.

1.6 Conceptual Site Model

A preliminary Conceptual Site Model (CSM) has not yet been developed for the subject property. The CSM will be developed based on the findings of the RI and in general accordance with Washington Administrative Code (WAC) 173-340-350(7)(b)-(ii) and 173-340-200. A current CSM will be presented in the RI Report.

1.7 Cleanup Levels

Based on previously reported data and consultation with Ecology, the only currently identified contaminant of concern (COC) for the subject property is PCBs. Other contaminants of potential concern (COPCs) may be identified during the performance of the RI WP.

As required in WAC 173-340-350(7)(b)(iii), EPI evaluated preliminary site cleanup levels (Screening Levels) based on the scope of the planned analyses in the SAP. A summary of COC Screening Levels is presented in Table 3. Analytical results from the RI will be compared to Screening Levels as a component of developing the CSM for the subject property.

Actual cleanup levels will be developed for the subject property based upon the CSM and other findings of the RI.

At present it is not anticipated that ground water will be encountered at the subject property. Based on local topographic, geologic, and hydrogeologic conditions, it is anticipated that ground water will be deeper than the currently anticipated maximum depth of exploration for this RI.

1.8 Identified Data Gaps

A review of the previous investigations and available data for the subject property identified several data gaps. As a component of evaluating the data necessary for the eventual selection of a cleanup action, as required by of WAC 173-340-350(7)(b)(v), EPI evaluated the existing data and identified areas where additional information is necessary to support a completed characterization of the subject property. The identified data gaps are presented below with a brief explanation:

- **Disposition of the Suspected PCB-Containing Oil AST.** The Order requires that the location and disposition of the AST that reportedly contained the PCB-contaminated oil be reported to Ecology. EPI observed the location and condition of the AST on November 3, 2010. EPI was not at the subject property again until May 26, 2011, at which time the AST was no longer present. It is presumed that Mr. Don Oline recycled the AST between November 2010 and May 2011. A review of available records located after the death of Mr. Don Oline has not provided any information pertaining to the AST. As of the date of the Final RI/FS WP, the disposition of the AST has not been determined and likely will not be determined since the only person to know this information has died.

- **Characterization of the distribution of PCBs in Soil.** The distribution of PCB impacts to soil, documented by EPA samples collected in November 2008, have not been characterized either horizontally nor vertically.

- **The potential presence of lime sludge/wastes.** Ecology has expressed a concern that lime sludge or other wastes associated with other documented Sites in the general area of the subject property may have been placed on the subject property at some time in the past. The likely presence or absence of those compounds has not been assessed.

The general objective of this RI WP is to fill these data gaps. However, environmental assessment is an iterative and ongoing process, and additional data gaps may be identified during the RI. The RI cannot be considered completed until the lateral and vertical extent of the COC has been characterized and the potential routes of exposure to the COC is understood.

2.0 SCOPE OF WORK

This Scope of Work is dynamic and is subject to modification. Given the nature of the subject property and the data gaps, the scope is iterative and progressive in that the results of later tasks build on the information provided by earlier tasks. The scopes and details of later tasks may be adjusted in response to earlier findings, with the overarching objective of filling the identified data gaps.

In developing this Scope of Work all reasonable attempts have been made to anticipate unknown environmental conditions. It is possible that the planned tasks will require adjustment during field activities to meet the project objectives. If modifications to the scope of work are necessary, the rationale for such modifications will be recorded and a written record of the revisions will be provided to Ecology in the RI Report.

2.1 Task 1—Establish Subject Property Boundaries and Topographic Elevations

Task 1 of the RI is to establish the property boundaries and topographic elevations using a licensed Washington State Land Surveyor. As previously stated, Mr. Don Oline purchased the subject property in 1999 and titled it in the name of Mr. Ron Oline. Although owned by Mr. Ron Oline, he has not operated the property and does not have detailed information on the property boundaries. Such information was also not available in the records of the Estate of Don Oline. Since Ecology is concerned that potential wastes from neighboring properties may have been placed at the subject property, an accurate property boundary survey must be performed.

To establish topographic elevations of the subject property, as required by TSCA and U.S. Code of Federal Regulations, Title 40, Part 761 (40 CFR §761), the subcontracted Washington State Land Surveyor will provide elevations determined through the practice of light detection and ranging (LIDAR) and referenced to the World Geodetic System (WGS). The LIDAR data will provide surface contours at 2.0-foot vertical intervals with an average accuracy of about 0.4 feet relative to the WGS datum.

2.2 Task 2—Concrete and Soil Assessment / Characterization

Soil samples will be collected in the area of previously reported PCB impacts as described in the *TSCA/PCB Inspection Report*. Figure 2 presents the locations of previously detected PCBs in two AOPCs in the central portion of the subject property. Figures 3 and 4 present proposed soil boring locations within each AOPC. Section 3.0 discusses the details of proposed soil sampling locations, rationale, and frequency.

In addition to the characterization of reported PCB impacts to soil, investigation into the potential for lime sludge deposits will occur within each AOPC. The first boring advanced in each AOPC will terminate at a depth of 12 feet bgs. Both AOPCs are located in the central, relatively flat portion of the subject property in the area where Ecology has expressed concerns that lime sludge may have been placed. It is presumed that if lime sludge deposits had been placed in these areas, it would be observed within the first 12 feet bgs.

2.3 Task 3—Preparation of RI Report

Upon completion of field activities and acquisition of final laboratory reports, an RI Report will be prepared for submission to Ecology as required by the Order. The RI Report will present a narrative description of the work performed, the findings of that work, and the conclusions supported by those findings. Section 4.0 discusses the specific components of the RI Report.

The report will be presented to Ecology within 60 days of receipt of all final laboratory data. Upon acceptance of the report, all data for the RI will be submitted to the Environmental Information Management (EIM) database maintained by Ecology.

3.0 SAMPLING AND ANALYSIS PLAN

This Section 3.0 presents a Sampling and Analysis Plan (SAP) prepared in accordance with WAC 173-340-350 and 173-340-820. The purpose of the SAP is to provide a description of sample collection and handling, as well as specific laboratory analytical methods.

A site-specific Health and Safety Plan (HASP) has been developed and is included as Attachment A. The HASP is a reference for EPI personnel and provides worker safety procedures and practices during all aspects of the proposed RI/FS WP herein.

3.1 Project Schedule

Figure 5 presents a tentative project schedule. The schedule is presented as elapsed time and is not linked to a defined start date. Upon Ecology approval of a final RI WP and authorization to proceed

from EPI's client, it is estimated that approximately 15 weeks will be necessary to complete the RI and prepare the report. This schedule is subject to change based upon subcontractor availability, access, or other considerations beyond the control of EPI or the PLPs.

The project schedule is tentative and must remain somewhat flexible due to uncertainties associated with the environmental condition of the subject property and the interpretation of new analytical data that becomes available. For example, if data from the initial soil assessment (Task 2) does not delineate the lateral and vertical extent of contaminant impacts, additional characterization will likely be necessary. Therefore, the schedule may necessarily be revised, with Ecology concurrence, if the scope of work is expanded.

3.2 Sampling Rationale

A total of 14 soil borings are initially proposed as part of this RI. Table 4 provides a listing of proposed sampling locations, a rationale for these locations, drilling methods, and anticipated sampling depths. Proposed sample locations for the initial soil investigation are presented in Figures 3 and 4. Field conditions encountered during the RI WP implementation may require changes to the details of the proposed sampling regimen. Field decisions will be documented and reported in the RI report.

3.3 Identification and Justification of Target Analytes

Review of the subject property history and consultation with Ecology and EPA Region 9 has identified PCBs as the sole COC while VOCs and SVOCs are COPCs. While all proposed samples will be submitted for analysis of PCBs per the rationale presented in Table 4, if suspected lime sludge deposits are observed during RI field activities, VOCs and SVOCs will be added to the analyte list. A discussion of applicable laboratory analytical methods and method detection limits is presented in Section 3.7.

3.4 Sampling Methodology

The following sections describe procedures for collection of concrete, soil, and (if present) ground water samples at the subject property.

A 10-foot equilateral triangular grid system has been developed that covers the entire subject property. Proposed sampling locations within AOPCs 1 and 2 will be on this grid system. If data indicate the need to expand sampling to horizontally delineate PCB impacts, future sample locations will also be placed within the grid system.

This grid system provides reference points for soil sampling locations and will aid in statistical analysis of data generated. The technical basis for selecting an equilateral triangular grid pattern with 10 feet between adjacent grid points includes:

- For identifying "hot spots," a triangular grid is efficient. It reduces the size of an identified contaminated area, compared to other grid patterns with the same number of samples covering the same area. A sample location spacing of 10 feet yields a sampling density of at least one sample per 87 square feet.

- This sampling approach is consistent with similar projects undertaken for characterization and remediation of PCBs. EPA provides guidance related to characterization and verification sampling for PCBs (e.g., 40 CFR §761, Subparts N and O). The conditions relevant to the sampling plan design are similar to other PCB release scenarios. Specifically, the origin of the contamination is strongly suspected and there is an expectation of some consistency to the spatial variability in concentrations.

- A fixed-grid sampling scheme enables statistical calculation of the likelihood (or confidence) of detecting a "hot spot" of a given size. A grid spacing of 10 feet provides a 50 percent or greater confidence level for detecting a circular "hot spot" with a radius of 3.0 feet or larger (i.e., it is more likely than not that such an area would be detected). This grid spacing provides a 95 percent confidence level for detecting a circular "hot spot" with a radius of about 4.0 feet or larger. This approach provides a high degree of probability that even small hot spots will be identified during the RI and a correspondingly low probability that small hot spots will not be identified.

3.4.1 Sampling Equipment Decontamination Procedure

Sampling equipment will be new and disposable to eliminate the possibility of cross-contamination. However, if disposable equipment is not available, sampling devices will be decontaminated prior to the collection of each sample. The decontamination procedure for all non-disposable equipment will consist of the following:

1. Scrub with a phosphate-free detergent (i.e., Liqui-nox®);
2. Rinse with distilled water;
3. Rinse with an organic solvent (e.g., hexane, acetone, etc.);
4. Rinse with distilled water; and
5. Final rinse with sprayed isopropyl alcohol.

Spent decontamination wash and rinse liquids will be segregated based on miscibility with water (i.e., phosphate-free detergent wash water will be placed into one container, organic solvents and alcohol will be placed in another container). Representative samples will be collected from each spent decontamination liquid container and the corresponding analytical results will be used to determine appropriate waste disposal.

3.4.2 Concrete Sampling Procedures

Several of the proposed soil boring locations are located on the concrete pad where the suspected source of PCBs (i.e., AST) was located. Surface concrete samples will be collected at these locations and submitted for PCBs analysis. Concrete samples will be generated using an impact-driven drill bit to pulverize the concrete. Only concrete to a depth of 1 centimeter (cm) will be sampled as to not bias the results with potentially uncontaminated, non-exposed concrete. Once pulverized, the concrete sample

will be collected using new, heavy paper stock to place the concrete in the appropriate, laboratory-supplied sample jar. As previously stated, the drill bit and all non-disposable equipment that could potentially contact the sample will be decontaminated following the procedures described in Section 3.4.1.

3.4.3 Direct-Push Technology Boring Procedures

Task 1 involves advancing and sampling a total of 14 DPT borings at the subject property. These borings will be advanced and sampled using standard DPT methods and procedures. Soils will be sampled and logged continuously to the terminal depth of the boring.

DPT drilling methods use a hydraulic ram to advance an acetate lined barrel into the subsurface to retrieve a representative soil core. The collection of the soil core allows for representative soil sampling and accurate description of the subsurface and potential contaminant migration pathways. It should be noted that impenetrable objects such as cobble and boulder-sized rocks cannot readily be penetrated by truck-mounted DPT rigs. If DPT refusal occurs prior to the desired terminal depth at a particular boring, a second attempt will occur within 2 feet of the original boring.

The locations of DPT borings will be field surveyed using a handheld global positioning system (GPS) unit with a horizontal accuracy of ±1.0 foot. In addition, the location will be marked with a metal shaft flag with the sample location descriptor written on the flag.

3.4.4 Field Screening

Collected soil samples will be field screened using visual-olfactory and sheen testing techniques. If material resembling lime sludge deposits are encountered, the potential presence of VOCs will be assessed with a photoionization detector (PID).

For sheen testing, a portion of the sample will be placed in a clean pan, sprayed with a small amount of de-ionized water, and a qualitative assessment of any observed sheen will be recorded. The results of field screening will be noted in the field logbook and on the boring logs.

PID screening will be conducted with a 10.6 electron volt (eV) lamp instrument calibrated following manufacturer's guidelines to 100 parts per million (ppm) isobutylene standard prior to use each day.

To establish a daily PID background concentration, a resealable plastic bag will be allowed to fill with ambient air on the upwind side of the property, sealed, and allowed to sit undisturbed for a minimum of 10 minutes. The PID inlet tube will then be inserted into the bag and the highest reading will be recorded as the daily PID background concentration.

For PID screening, a portion of the soil sample that is not intended for laboratory analysis will be placed in a resealable plastic bag, disaggregated, and allowed to sit undisturbed for a minimum of 10 minutes. The PID inlet tube will then be inserted into the bag and the highest observed reading will be recorded.

PID measurements above the daily PID background concentration will be deemed elevated and may be submitted for additional laboratory analyses including EPA Method 8260 for VOCs and EPA Method 8270 for SVOCs.

3.4.5 DPT Soil Sample Collection

Subsurface soil collection will be conducted using DPT drilling methods that allow for continuous collection of a vertical core of soil at each boring location. The boring will advance through the subsurface using a 2.125-inch outside diameter (OD) clean, decontaminated core barrel in 4-foot increments. Each increment will be continuously sampled inside a clear acetate line inside the core barrel. A new 1.5-inch OD acetate liner will be used for each 4-foot interval. Once the boring has been advanced 4 feet into the subsurface, the core barrel will be pulled back to the ground surface where the acetate liner will be removed and the soil core extracted for sample collection. This process is repeated until the terminal depth of each borehole is achieved. Anticipated sampling depths are presented in Table 4.

Soil samples will be collected from the extracted core. Soil samples retained for PCB analysis will be placed in a 4-ounce laboratory-supplied container. Samples submitted for analysis of VOCs will be collected using EPA Method 5035A or a functional equivalent. If the soil types do not allow the use of EPA Method 5035A without unduly disturbing the sample, the field professional may elect to cut a 3-inch- to 6-inch-long section from the acetate liner and cap the ends. This sample aliquot would then be labeled and transported to the laboratory.

The soil conditions encountered during drilling will be described using the Unified Soil Classification System (USCS) visual-manual procedures (ASTM 2488-06). The results of field screening and the soil conditions encountered during drilling will be presented on soil boring logs and included in the RI Report once the investigation is complete.

Immediately upon collection, all soil samples will be labeled and placed in an iced cooler pending submittal to the analytical laboratory. A written chain-of-custody form will be compiled listing all samples submitted to the laboratory during the investigation.

A total of 14 locations will be sampled. Unless overlain by the concrete slab, it is anticipated that two soil samples at each location (28 total) will be submitted to the analytical laboratory for PCB analysis. In addition, a total of three concrete samples will be collected following procedures described in Section 3.4.2. Other samples may be archived at the laboratory and select archived samples may be analyzed at a later time. Archived samples stored beyond EPA and MTCA allowable hold times may be analyzed, and the resulting data may be used for screening purposes. Any analytical results for samples outside their hold times will be appropriately noted on the RI Report tables.

Sample information will be written on a label affixed to the outside of the sample container. Samples will be given a specific designation that readily ties that sample to the sampling location and depth (i.e., CH370:1 will designate a sample collected from grid node CH370 at a depth of 1 foot bgs). All sample depths will be recorded in feet. Sample-specific information written on the sample label and in the field logbook will follow standard procedures documented in Section 3.4.7. Samples will be handled and

transported using the standard chain-of-custody procedures documented in Section 3.5. Quality control measures to evaluate laboratory precision will be performed according to procedures in Section 3.7.

3.4.6 DPT Ground Water Sample Collection

Although not anticipated, a reconnaissance ground water sample will be collected if free ground water is observed in any of the borings. Samples will be collected by inserting a temporary stainless steel well screen into the hollow center of the DPT probe and then retracting the protective outer casing to expose the screen to the saturated zone. The depth of the sample will be within about the upper 5 feet of the saturated zone. Samples will be extracted from the probe using a peristaltic pump and disposable tubing. The temporary well will be purged until turbidity measurements indicate less than 0.5 Nephelometric Turbidity Units (NTU). Once purged, an aliquot of water will be pumped directly into the laboratory-supplied container appropriate for the intended analysis. During sample collection the pumping rate will not exceed 100 milliliters/minute.

Ground water, if encountered, will be analyzed for the presence and concentrations of PCBs. If field screening and/or subsurface condition observations suggest the presence of suspected lime sludge deposits, samples will be collected for VOCs and SVOCs analyses.

Immediately upon collection, all samples will be labeled and placed in an iced cooler pending submittal to the analytical laboratory. All samples will be handled and transported using standard chain-of-custody procedures (Section 3.5).

3.4.7 Field Documentation

The collection of each sample will be recorded in the site-specific field logbook. Sampling information that will be recorded in the field logbook includes:

- General weather conditions;
- Time and date;
- Sample media (e.g., soil, concrete, etc.);
- Sample location descriptor;
- Location of sample collection including depth of sample; and
- Miscellaneous comments or observations concerning sample collection.

Copies of field documentation notes will be included in the final report described in Section 4.0.

3.5 Sample Custody and Transport

Samples will be in the custody of the field sampler(s) from the time of sample collection until the samples are transferred or dispatched properly. Samples will be retained in coolers with sufficient ice to maintain an internal temperature of 4^{o}C. Upon transfer of sample containers to subsequent

custodians, the persons transferring custody of the sample container will sign a "Chain-of-Custody/Analysis Request Form." A signed and dated seal will be placed on each shipping container prior to shipping. Upon receipt of samples at the laboratory, the shipping seal will be broken, and the condition of samples recorded by the receiver. Chain-of-custody records will be included in the analytical report prepared by the laboratory and provided in the final report described in Section 4.0.

3.6 Quality Assurance Administrative Plan

Quality assurance and quality control (QA/QC) measures will be taken to evaluate laboratory precision. QA/QC measures are separated into two phases: collection of field sampling QA/QC samples; and laboratory internal QC matrix spike samples, matrix spike duplicate samples, laboratory duplicate samples, and method blanks, as well as other QC samples required for individual methods.

Field sampling QA/QC will include the collection and analysis of several types of samples including:

- Blind duplicate samples; and
- Equipment blank samples.

Blind duplicate and equipment blank samples will be analyzed for PCBs using SW-846 Method 8082. If, and only if, suspected lime sludge deposits are observed during field activities, a laboratory-supplied trip blank will be analyzed for VOCs using SW-846 Method 8260.

Descriptions of each of these types of field sampling QA/QC practices are discussed in the following subsections. Description of laboratory QA/QC measures is presented in Section 3.7.

3.6.1 Blind Duplicate Samples

Blind duplicate samples will be collected from 10 percent of the soil sampling locations. Blind duplicates will be a split sample from the same location as the actual discreet sample. For any discreet sample and its corresponding blind duplicate submitted for PCBs analysis, the soil will be composited by thoroughly mixing in a new or decontaminated stainless steel bowl prior to placement in their respective sample jars. Due to the nature of VOCs and SVOCs, both the sample and blind duplicate collected for these analyses will be grab samples. Compositing of soil prior to collection of the sample and corresponding blind duplicate is forbidden if the sample is submitted for VOCs or SVOCs analyses.

Each blind duplicate sample will be submitted to the analytical laboratory with its own unique identification number (i.e., BD-x where x is the sequential number of the blind duplicate). The location where the blind duplicate sample was taken will not be released to the laboratory. However, the duplicate sample location will be recorded in the site-specific field logbook for future use and disclosure.

Blind duplicate sample results will be used as a quantitative measure of the reproducibility of soil sample results. Blind duplicate sample analytical results will be deemed conforming if their individual concentrations are within 50 percent of the relative percent difference (RFD) between the blind duplicate and its corresponding sample. If a blind duplicate concentration is not with 50 percent RPD,

the corresponding sample data may still be used but will be qualified to reflect that the blind duplicate was non-conforming.

3.6.2 Equipment Blank Samples

EPI will collect one equipment blank sample for each day when non-disposable equipment is used for verification soil sampling. If verification soil sampling is conducted entirely with disposable equipment, an equipment blank will not be collected during that day of sampling. The equipment blank will consist of collected distilled water that has been used as the final rinse during decontamination procedures described in Section 3.4.1. Equipment blank samples will be given the descriptor "EB-x", with the "x" being the sequential number of the equipment blank sample (e.g., EB-1 for the first equipment blank, EB-2 for the second, etc.). The collection of each equipment blank sample will be noted in the site-specific field logbook along with relevant data concerning time, date, and sampling personnel.

Equipment blank samples concentrations will be used to determine is equipment decontamination procedures are sufficient. If PCB concentrations are measured in an equipment blank sample, subsequent soil samples may be biased high and results will be qualified to reflect this possibility.

3.6.1 Trip Blank Samples

For each day of field activities that includes collection of samples for VOC analysis, one trip blank sample will be analyzed. The trip blank sample will be laboratory-prepared and consist of de-ionized water sealed in a 40-milliliter amber jar. The trip blank sample will accompany all sample vessels and be present during collection of each sample to ensure exposure to any atmospheric concentration of VOCs.

Trip blank samples will be used to evaluate whether external concentrations of VOCs from either sample handling and/or analytical processes are potentially contaminating the samples, independent of field sampling processes and procedures. If trip blank analytical results indicate the presence of measurable VOCs, aqueous samples collected that day will be qualified to reflect potential contamination from external sources.

3.7 Laboratory Analytical Plan

A Washington State laboratory licensed to perform appropriate extraction and analyses using EPA reference *SW-846 Test Methods for Evaluating Solid Waste* (SW-846) test methods will be used for analysis of all samples.

The analytical laboratory will conduct internal QA/QC checks adhering to established protocols for each method. All laboratory QA/QC methods will be reported within the laboratory reports for each set of samples submitted. Laboratory QA/QC procedures for the contract lab are to be, at a minimum, consistent with EPA's SW-846 methods and in compliance with the National Environmental Laboratory Accreditation Conference Institute (NELACI).

3.7.1 Extraction Methods

Per the requirements of 40 CFR §761, samples submitted for PCB analysis will be laboratory extracted using the following methods:

- Soil or Concrete: SW-846 Method 3540 or 3550; and
- Water: SW846 Method 3510, 3520, or 3535.

Extraction of VOCs and SVOCs is not stipulated by 40 CFR §761. If analysis for VOCs and SVOCs is necessary, extraction methods will follow standards provided in SW-846 for Methods 8260 and 8270, respectively.

3.7.2 Extraction Cleanup Methods

The presence of petroleum hydrocarbons (which may have been a carrier of PCBs), phthalates, and sulfur compounds can interfere with the accuracy of PCB analysis. To minimize interference during PCB analysis, some samples may be subjected to extraction cleanup procedures consisting of gel permeation chromatography (GPC) methods. GPC cleanup will only be used during rerun of samples that do not meet the minimum surrogate recovery criteria described in Section 3.7.4.

3.7.3 Analytical Methods

Target analytes identified in Section 3.3 have been identified as either reported or suspected to be present at the subject property. The following identifies target analytes along with appropriate laboratory analytical methods for each:

- PCBs using SW846 Method 8082;
- VOCs using SW846 Method 8260; and
- SVOCs using SW-846 Method 8270.

To be clear, VOC and SVOC analyses will not be conducted on any samples unless suspected lime sludge deposits are observed during subsurface investigation field activities. The appropriate sample container, preservatives, and holding times for each target analyte is presented in Table 5.

3.7.4 Surrogate Recovery Criteria

The acceptable matrix spike surrogate recovery criterion for SW-846 Method 8082 is between 50 to 150 percent of the matrix spike. Surrogate recoveries that fall outside of these criteria will be flagged. If recovery of a particular sample does not meet the acceptance criteria and if sufficient, non-extracted sample volume remains, an additional extraction will be collected and subjected to the GPC method described in Section 3.7.2 prior to follow-up analysis.

3.8 Investigation-Derived Waste Management

Investigation-derived waste (IDW) consisting of soil cuttings produced during boring advancement at the subject property will be placed in Department of Transportation (DOT)-approved drums, labeled as to the location where generated (e.g., Estate of Don Oline Storage Yard—Boring CN380 5–10 feet), and stored on-site until laboratory analysis indicates concentrations of target analytes. Individual drums may contain wastes from several locations and all locations will be indicated on a particular drum. Drums will be labeled "non-hazardous" unless proven otherwise through laboratory analysis.

Per 40 CFR §761.61, PCB remediation waste will be disposed based on the "as found" concentrations, composite sampling of the soil cuttings within drums will not be conducted.

Decontamination liquids will be collected in DOT-approved drums, labeled as to content, and stored on-site. Representative liquids and, if present, sediment samples will be collected from each drum and submitted for analysis for target analytes. Analytical results will be used to determine appropriate disposal options.

No IDW will leave the subject property until receipt of laboratory data and appropriate disposal methods have been approved.

4.0 REPORTING

Following completion of RI field activities and receipt of final analytical reports, an RI Report documenting assessment and characterization activities will be prepared and submitted to Ecology and EPA Region 10. The report will contain the following:

- A narrative description of the technical approach and the activities performed;
- A discussion of the findings and conclusions of the investigation;
- A current CSM for the site;
- Figures showing sampling locations and selected contaminant concentrations;
- Summary tables of analytical data;
- Final analytical laboratory data reports;
- Logs of the soil conditions encountered at the subject property; and
- Other information pertinent to the findings and conclusions of the report.

The report will be presented to Ecology within 60 days of receipt of all final laboratory data. Upon acceptance of the report, all data for the RI will be submitted to the Environmental Information Management (EIM) database maintained by Ecology.

Tables

Table 1
Summary of Reported PCBs (mg/kg)
EPA TSCA/PCB Inspection—November 2008
Oline Storage Yard, Estate of Don Oline
1915 Marine View Drive
Tacoma, Washington

EPA Sample Number	Latitude	Longitude	Media	Aroclors			Total PCBs
				1242	1248	1254	
8464300	47.27196154	-122.3681299	Soil	-	-	0.018	0.018
8464301	47.27201203	-122.36832	Water	-	-	-	Non-Detect
8464303	47.27152593	-122.368504	Oil	23,000	-	-	23,000
8464304	47.27153279	-122.3684662	Soil	-	59	-	59
8464305	47.27153279	-122.3684662	Soil— Duplicate	-	20	-	20
8464306	47.27151184	-122.3681997	Oil	-	-	-	Non-Detect
8464307	47.27145015	-122.3682103	Oil	-	-	-	Non-Detect
8464308	47.27136675	-122.3682207	Soil	450	-	90	540

Abbreviations:

-	Not reported in the TSCA/PCB Inspection (EPA, November 2008)
EPA	U.S. Environmental Protection Agency
mg/kg	Milligram per kilogram
PCBs	Polychlorinated biphenyls
TSCA	Toxic Substances Control Act

Table 2
Summary of Reported RCRA Metals in Blast Media (mg/kg)
EPA TSCA/PCB Inspection—November 2008
Oline Storage Yard, Estate of Don Oline
1915 Marine View Drive
Tacoma, Washington

EPA Sample Number	Latitude	Longitude	RCRA Metals				
			Arsenic	Barium	Cadmium	Chromium	Silver
8464302	47.27182825	-122.368728	26.9	398	1.2	53.5	1.8

Abbreviations:

EPA	U.S. Environmental Protection Agency
mg/kg	Milligram per kilogram
PCBs	Polychlorinated biphenyls
RCRA	Resource Conservation and Recovery Act
TSCA	Toxic Substances Control Act

Table 3
Selected Preliminary Screening Levels
Oline Storage Yard, Estate of Don Oline
1915 Marine View Drive
Tacoma, Washington

Contaminant of[a] Concern	Media	MTCA Method	Screening Level	Laboratory PQL	Units
PCBs	Soil	A	1	0.0081	mg/kg
	Ground Water / Surface Water	A	0.1	0.0666	µg/L

Notes:
a Additional contaminants of potential concern (COPCs) may become apparent during the course of the remedial investigation.

Abbreviations:
µg/L Microgram per liter
mg/kg Milligram per kilogram

Table 4
Proposed Sample Locations and Rationale
Oline Storage Yard, Estate of Don Oline
1915 Marine View Drive
Tacoma, Washington

Boring	Location and Rationale	Drilling Method	Anticipated Soil Sample[a] Depths for Immediate Analysis (feet)	Archived Soil Sample Depths (feet)	Anticipated[b] Analyses
CN300	Southwest of former oil AST location where EPA documented PCB concentration of 23,000 mg/kg; also in area where Ecology suspects lime sludge may have been placed	DPT	Concrete, 0, 1	2, 4, 6, 8, 10, 12	PCBs
CN310	Southeast of former oil AST location where EPA documented PCB concentration of 23,000 mg/kg	DPT	0, 1	2, 4	PCBs
CO290	West of former oil AST location where EPA documented PCB concentration of 23,000 mg/kg	DPT	Concrete, 0, 1	2, 4	PCBs
CO300	Location of former oil AST where EPA documented PCB concentration of 23,000 mg/kg	DPT	Concrete, 0, 1	2, 4	PCBs
CO310	East of former oil AST location where EPA documented PCB concentration of 23,000 mg/kg	DPT	0, 1	2, 4	PCBs
CP290	Northwest of former oil AST loction where EPA documented PCB concentration of 23,000 mg/kg	DPT	0, 1	2, 4	PCBs
CP300	Northeast of former oil AST location where EPA documented PCB concentration of 23,000 mg/kg	DPT	0, 1	2, 4	PCBs
CF380	Southwest of EPA sample location with PCB concentration of 540 mg/kg; also in area where Ecology suspects lime sludge may have been placed	DPT	0, 1	2, 4, 6, 8, 10, 12	PCBs
CF390	Southeast of EPA sample location with PCB concentration of 540 mg/kg	DPT	0, 1	2, 4	PCBs
CG370	West of EPA sample location with PCB concentration of 540 mg/kg	DPT	0, 1	2, 4	PCBs
CG380	Location of EPA sample location with PCB concentration of 540 mg/kg	DPT	0, 1	2, 4	PCBs
CG390	East of EPA sample location with PCB concentration of 540 mg/kg	DPT	0, 1	2, 4	PCBs
CH370	Northwest of EPA sample location with PCBs concentration of 540 mg/kg	DPT	0, 1	2, 4	PCBs
CH380	Northeast of EPA sample location with PCB concentration of 540 mg/kg	DPT	0, 1	2, 4	PCBs

Notes:

a Actual sample depths submitted for analysis will depend on field screening and observed subsurface conditions.

b PCBs will be analyzed by EPA Method 8082. If observed field conditions indicate the presence of suspected lime sludge deposits, analyses of the suspect material will include volatile organic compounds (VOCs) and semivolatile organic compounds (SVOCs) using EPA Methods 8260 and 8270, respectively.

Abbreviations:

AST Aboveground storage tank
DPT Direct-push technology
EPA U.S. Environmental Protection Agency
mg/kg Milligram per kilogram
PCBs Polychlorinated biphenyls

Table 5

Sampling and Analytical Criteria

Oline Storage Yard, Estate of Don Oline

1915 Marine View Drive

Tacoma, Washington

Analysis	MEDIA					
	Soil			Ground Water		
	Container	Preservative	Hold Time	Container	Preservative	Hold Time
PCBs by SW-846 Method 8082	4 oz. glass	4°Celsius	365 days[a]	1,000 mL amber glass	4°Celsius	7 days[b]
VOCs by[c] SW-846 Method 8260	40 mL vial with 50 g aliquot	Methanol, 4°Celsius	14 days	2 - 40 mL vial (glass)	Hydrochloric acid, 4°Celsius	14 days
SVOCs by[c] SW-846 Method 8270	4 oz. glass	4°Celsius	14 days	1,000 mL amber glass	4°Celsius	7 days[b]

Notes:

a Holding time for soil subjected to PCBs analysis can be as high as 365 days. Check with EPA Regional Office.

b The hold time is 7 days until extraction must be complete. The sample extract can be held for 40 days prior to analysis

c VOC and SVOC analyses will only be performed on suspected lime sludge deposits, if encountered.

Abbreviations:

EPA U.S. Environmental Protection Agency

g Gram

mL Milliliter

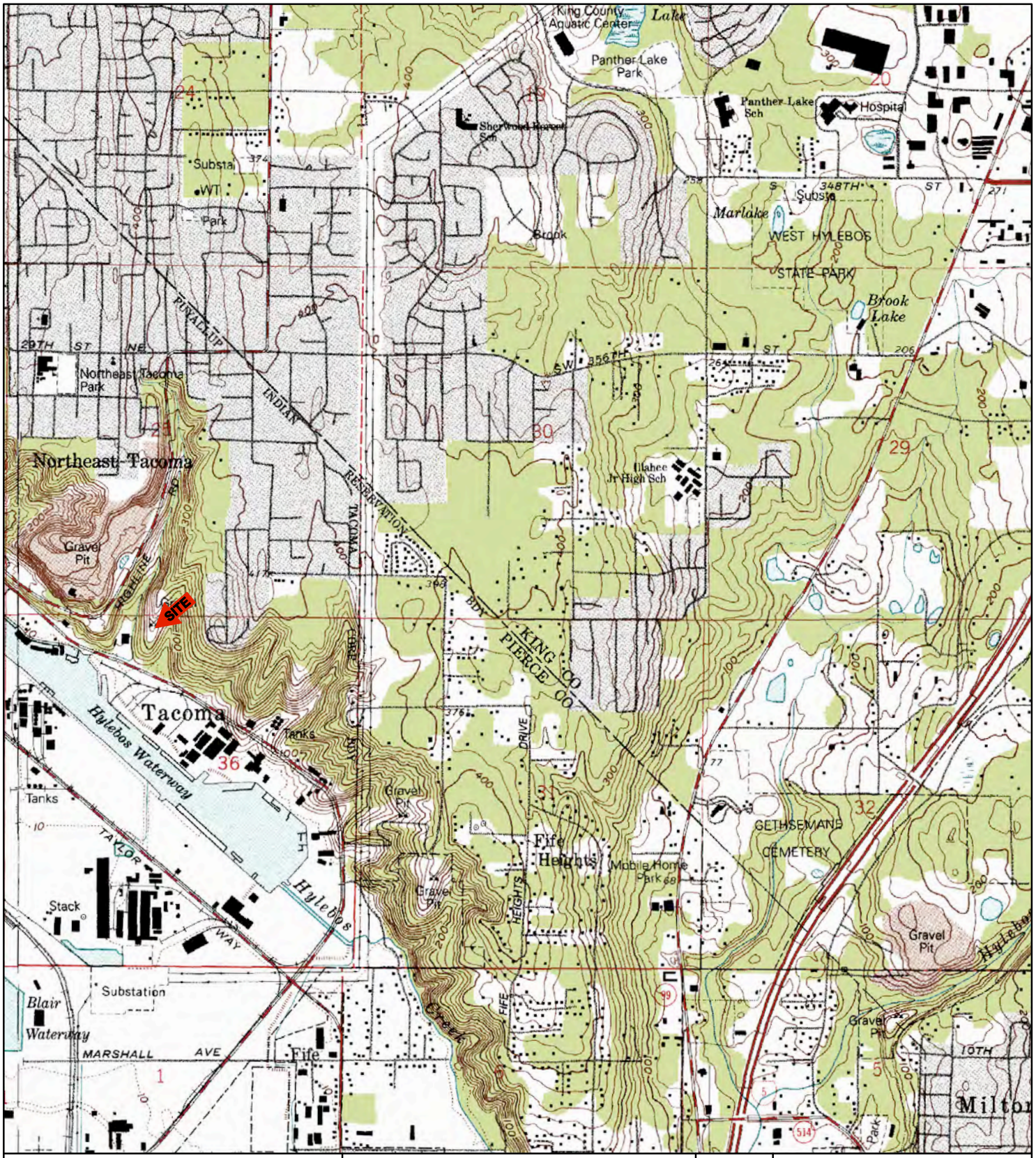
oz. Ounce

PCBs Polychlorinated biphenyls

SVOCs Semivolatile organic compounds

VOCs Volatile organic compounds

Figures



KEY:

SOURCE: USGS 7.5 MINUTE QUADRANGLE (TOPOGRAPHIC)

POVERTY BAY, WA
1961

REVISED 1994

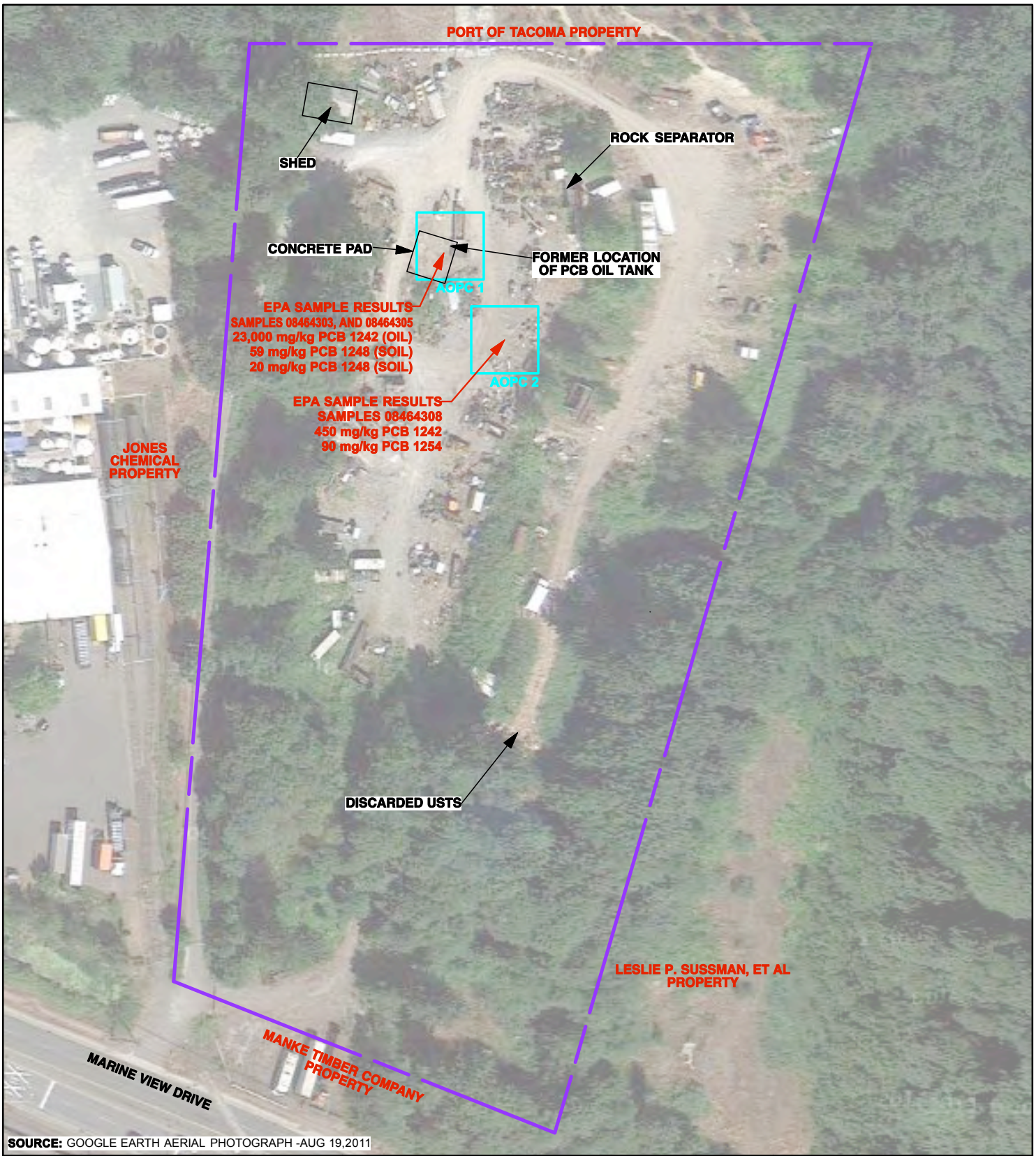
SCALE = 1:24,000

ENVIRONMENTAL PARTNERS INC
295 NE Gilman Boulevard, Suite 201
Issaquah, Washington 98027

FIGURE 1

GENERAL VICINITY MAP

PROJECT	60701.1		
PREPARED FOR	ESTATE OF DON OLINE		
LOCATION	1915 MARINE VIEW DRIVE TACOMA, WASHINGTON		
SHEET	***DRAWN BY***	***REVIEWED BY***	***DATE***
1 OF 1	ALW	JLB	2/8/13



SOURCE: GOOGLE EARTH AERIAL PHOTOGRAPH -AUG 19,2011

KEY:

APPROXIMATE PROPERTY BOUNDARY

AREA OF POTENTIAL CONCERN (AOPC)

N

0 25 50 100

APPROXIMATE SCALE: 1" = 100'

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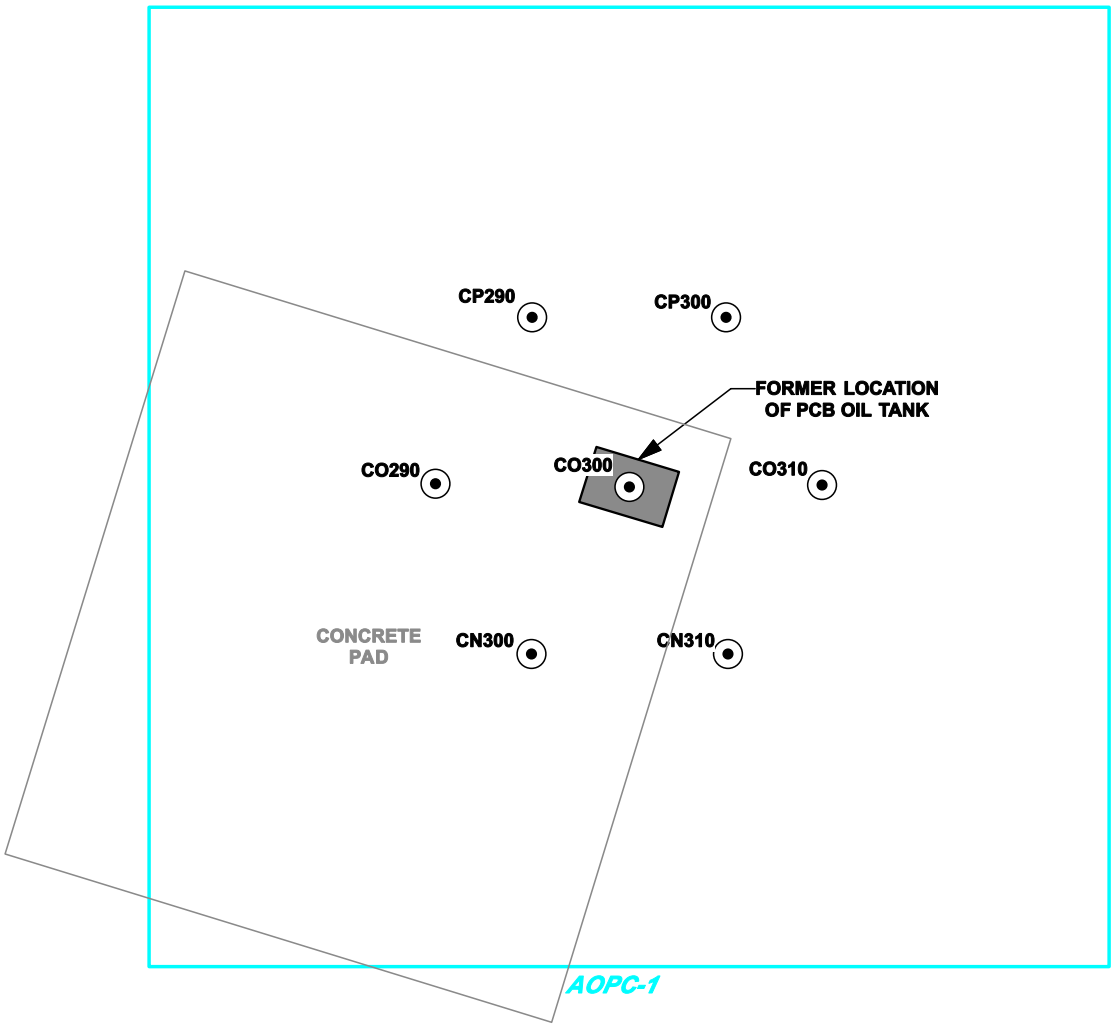
295 NE Gilman Boulevard, Suite 201
Issaquah, Washington 98027

FIGURE 2

SITE REPRESENTATION

PROJECT	60701.1		
PREPARED FOR	ESTATE OF DON OLINE		
LOCATION	1915 MARINE VIEW DRIVE TACOMA, WASHINGTON		
SHEET	***DRAWN BY***	***REVIEWED BY***	***DATE***
1 OF 1	ALW	JLB	3/22/13



KEY:

AREA OF POTENTIAL CONCERN

CO280 DPT SOIL BORING

N

0 2.5 5 10

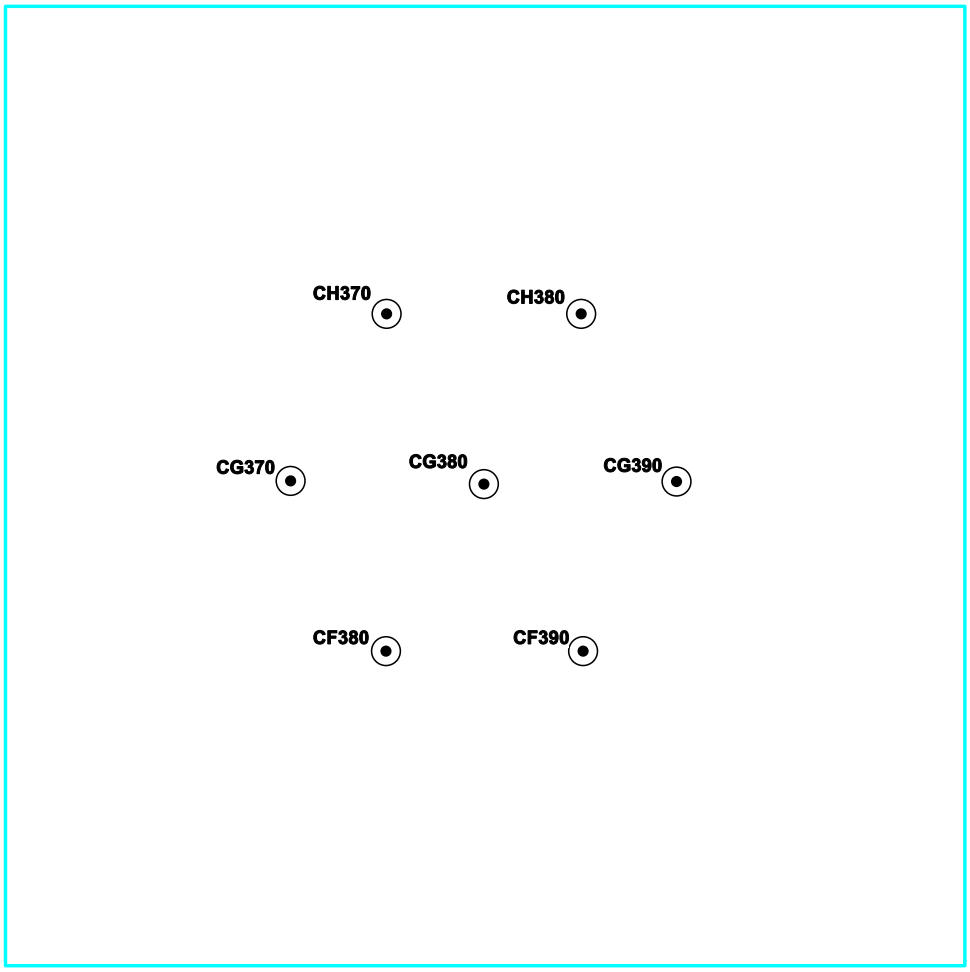
APPROXIMATE SCALE: 1" = 10'

ENVIRONMENTAL PARTNERS INC
295 NE Gilman Boulevard, Suite 201
Issaquah, Washington 98027

FIGURE 3

APOC-1 SAMPLE LOCATIONS

PROJECT	60701.1		
PREPARED FOR	ESTATE OF DON OLINE		
LOCATION	1915 MARINE VIEW DRIVE TACOMA, WASHINGTON		
SHEET	***DRAWN BY***	***REVIEWED BY***	***DATE***
1 OF 1	ALW	JLB	3/20/13



AOPC-2
CENTERED ON THE REPORTED LOCATION
OF EPA SOIL SAMPLE 08464308

KEY:

AREA OF POTENTIAL CONCERN

CO280 DPT SOIL BORING

N

0 2.5 5 10

APPROXIMATE SCALE: 1" = 10'

ENVIRONMENTAL PARTNERS INC

295 NE Gilman Boulevard, Suite 201
Issaquah, Washington 98027

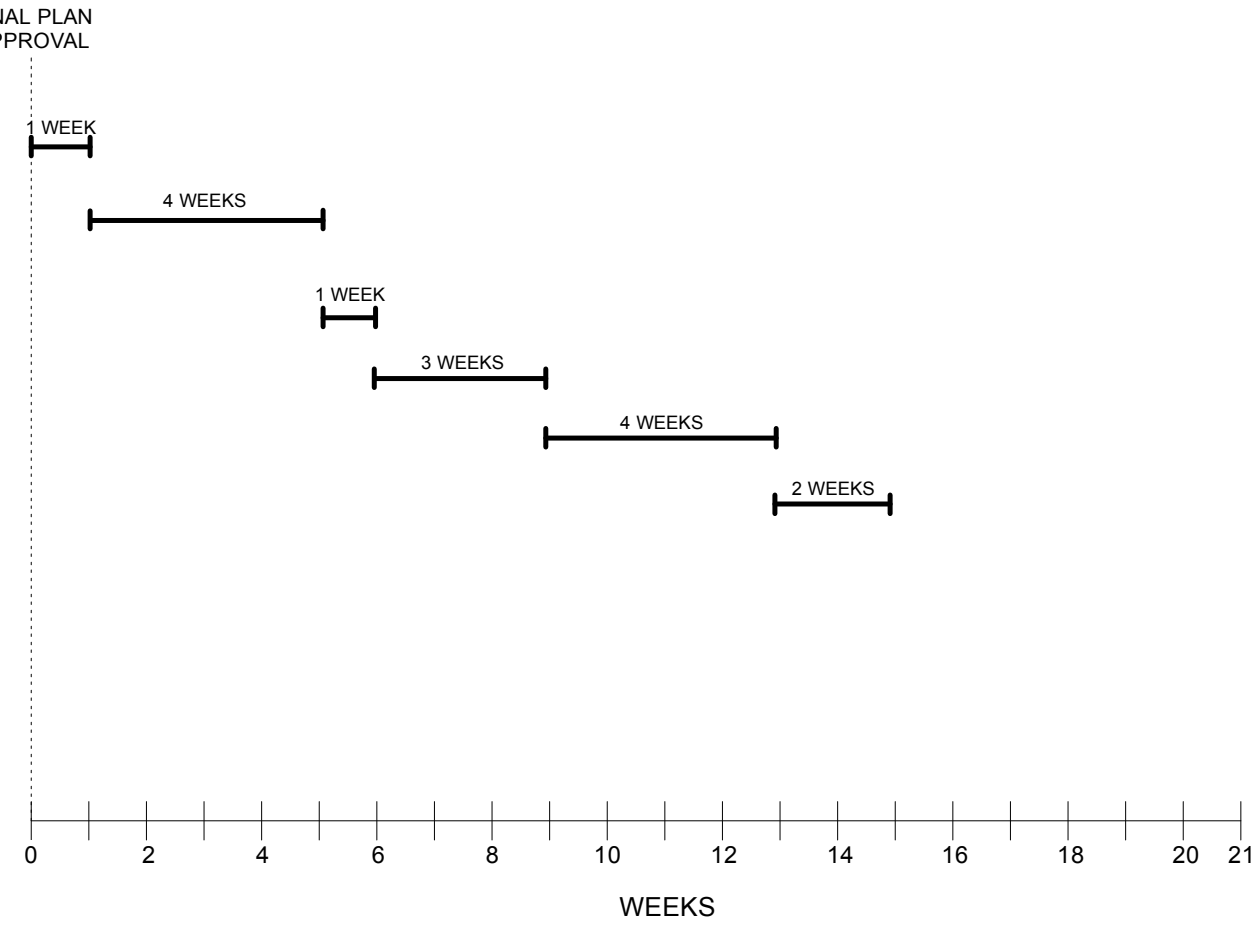
FIGURE 4

AOPC-2 SAMPLE LOCATIONS

PROJECT	60701.1			
PREPARED FOR	ESTATE OF DON OLINE			
LOCATION	1915 MARINE VIEW DRIVE TACOMA, WASHINGTON			
SHEET	**DRAWN BY**	**REVIEWED BY**	**DATE**	
1 OF 1	ALW	JLB	3/22/13	

TASKS:

1. CONTRACTOR NOTIFICATIONS AND UTILITY CLEARANCE
2. INITIAL SOIL CHARACTERIZATION (DPT) AND LABORATORY ANALYSES
3. DATA EVALUATION
6. DRAFT RI/FS REPORT PRODUCTION
7. ECOLOGY RI/FS REPORT REVIEW
8. RESPONSE TO COMMENTS AND FINAL RI/FS REPORT



* PROJECT SCHEDULE IS DEPENDENT UPON CONTRACTOR AVAILABILITY, LABORATORY ANALYTICAL RESULTS, AND SITE ACCESS.

KEY:

ENVIRONMENTAL PARTNERS INC
295 NE Gilman Boulevard, Suite 201
Issaquah, Washington 98027

FIGURE 5

PROJECT WORK SCHEDULE

PROJECT	60701.1		
PREPARED FOR	ESTATE OF DON OLINE		
LOCATION	1915 MARINE VIEW DRIVE TACOMA, WA		
SHEET	DRAWN BY	REVIEWED BY	DATE
1 of 1	JLB	TCM	03/18/2013

Attachment A
Health and Safety Plan (HASP)

Environmental Partners Inc.
Site-Specific Health and Safety Plan

Site Name: (attach site map/sketch)	Oline Storage Yard – Estate of Don Oline
Site Address:	1915 Marine View Drive, Tacoma WA
Client:	Estate of Don Oline
Site and /or Client Contact:	Ron Oline - 253.370.7222
EPI Job Number:	60701
EPI Health and Safety Representative:	Jerry Boyd

WORK PLAN

Task	Dates	Objective(s)
Soil and Ground water sampling	3/2013 – 4/2013	Collect representative samples of soil and if present ground water per the RI/FS Work Plan (EPI, March 2013)

Describe How Work Will Be Accomplished (approach, subcontractor(s), equipment)

Collection of representative soil and if present ground water samples using direct push technology (DPT). DPT to be conducted by subcontractor.

Physical Description of the Site/Facility (e.g., asphalted lot, one-story building, vacant field, …)

Center elevated portion of approximately 6.6-acre lot that contains a storage/wrecking yard for heavy equipment; perimeter of elevated portion falls way to the east, south, and west where runoff is collected in storm sewers that discharge to Commencement Bay.

Operational Description of the Site/Facility

Prior to July 1999, the property had been used as a quarry for sand / gravel. Post July 1999, property used for wrecking of heavy equipment for recycling.

Site/Facility Status

Environmental cleanup in accordance with Ecology Agreed Order dated January 2012.

HAZARD ASSESSMENT

Potential Chemical Hazards					
Chemical State	Liquid _X_	Solid _X_	Gas __	Vapor ___	Unknown ___
Chemical Characteristics	Corrosive	Flammable	Toxic X	Volatile	Other ___

Describe Potential Chemical Hazards and Modes of Exposure

Chemical Hazards: PCBs, potentially metals including Pb, Hg, As, Cr; potentially petroleum fuels; potentially lime sludge waste with concentrations of VOCs and SVOCs

Modes of Exposure: Inhalation, ingestion, dermal contact, absorption

Potential Chemical Hazards						
Chemical Name	Action Levels			Exposure Route	Target Organs	Symptoms
	PEL*	STEL*	IDLH*			
Lead	0.050 mg/m^3		100 mg/m^3	Inhalation; ingestion, direct contact	Eyes; GI tract; central nervous system; kidneys; blood; gingival tissue	Weakness; lassitude; insomnia; facial pallor; pale eyes; anorexia; low weight; malnutrition; constipation; abdominal pain; colic; anemia; gingival lead line; tremor; paralysis of wrist, ankles; encephalopathy; kidney disease; irritated eyes; hypotension
Mercury	0.50 mg/m^3 (skin)	0.1 mg/m^3 (ceiling)	10 mg/m^3	Inhalation, absorption, ingestion, skin/eye contact	Eyes; skin; respiratory system; central nervous system; kidneys	Irritated eyes, skin; cough, chest pain, bronchial pneuitis; tremor, insomnia, irritability, indecision, headache, fatigue, weakness; stomatitis, salivation; gastro-intestinal disturbance, anorexia, low-weight, proteinuria
Arsenic	0.10 mg/m^3	NIOSH 0.002 mg/m^3	5 mg/m^3	Inhalation; ingestion; absorption; skin/eye contact	Liver, kidneys, skin, lungs, lymphatic system (lung and lymphatic cancer)	Ulceration of nasal septum, dermatitis, gastro-intestinal disturbances, peripheral neuropathy, respiratory irritation, hyperpigmentation of skin
Chromium	0.5 mg/m^3	N/A	25 mg/m^3 as Cr(III)	Inhalation, ingestion, contact	Eyes, skin, respiratory system	Irriatated eyes, sensitization dermatitis
PCBs	0.5 mg/m^3 (skin)		5 mg/m^3	Inhalation, absorption, ingestion, contact	Skin, eyes, liver, reproductive system	Irritated eyes, chloracne, liver damage, reproductive effects
Benzene	1 ppm	5 ppm	500 ppm	Inhalation; ingestion; skin/eye contact	Blood, central nervous system; skin; bone marrow; eyes; respiratory system	Irritation of eyes, nose, respiratory; giddiness; headache; nausea; staggered gait; fatigue; anorexia; lassitude; dermatitis; bone marrow; depression
Ethylbenzene	100 ppm	125 ppm	800 ppm	Inhalation; ingestion; skin/eye contact	Eyes; upper respiratory system; skin; central nervous system	Irritation of eyes, mucous membrane; headache; dermatitis; narcosis; coma
Toluene	100 ppm	150 ppm	500 ppm	Inhalation; absorption,; ingestion; skin/eye contact	Central nervous system; liver; kidneys; skin	Fatigue; confusion, euphoria, dizziness, headache; dilated pupils; lacrimation; nervousness; insomnia; Paresthesia; dermatitis
Xylene	100 ppm	150 ppm	900 ppm	Inhalation; ingestion; absorption; skin/eye contact	Central nervous system; GI tract; blood; liver; kidneys; skin	Dizziness, excitement, drowsiness, incoordination, staggered gait; irritation of eyes, nose, throat; corneal vacuolization; anorexia; nausea; vomiting, abdominal pain; dermatitis
Tetra-chloroethylene (PCE)	100 ppm	None	150 ppm	Inhalation; ingestion; absorption; skin/eye contact	Eyes, skin, respiratory system, heart, liver, kidneys, central nervous system	Irritation of eyes, nose, throat; nausea; flush face, neck; vertigo, dizziness, in coordination; headaches; somnolence; skin erythema; liver damage
Trichloroethylene	100 ppm	100 ppm	1000 ppm	Inhalation; ingestion; absorption; skin/eye contact	Eyes, skin, respiratory system, heart, liver, kidneys, central nervous system	Irritation eyes, skin; headache, visual disturbance, lassitude, dizziness, tremor, drowsiness, nausea, vomiting; dermatitis, cardiac arrhythmias, paresthesia, liver injury
Napthalene	10 ppm	15 ppm	250 ppm	Inhalation; absorption; ingestion; skin/eye contact	Eyes, skin, blood, liver, kidneys, central nervous system	Irritation of eyes; headache, confusion, excitement, malaise; nausea, vomiting, abdominal pain; irritable bladder; profuse sweat; jaundice; hematoma, hemorrhage, renal shutdown; dermatitis; optical neuritis, corneal damage

Potential Physical Hazards				
Heat Stress X	Cold Stress X	Explosion/ Flammability ___	Oxygen Deficient Atmosphere ___	Confined Space Entry ___
Noise X	Trenching/ Excavation ___	Working at Elevation ___	Other ___	

Describe Potential Physical Hazards
Numerous tripping hazards

Potential Physical Hazards		
Category	**Cause**	**Prevention**
Foot/Ankle Hazards	Sharp objects, dropped objects, uneven and/or slippery surfaces, chemical exposure	Chemical resistant, steel-toed boots will be worn at all times
Eye Hazards	Sharp objects	Safety glasses or face shields will be worn at all times
Fall Hazards	Elevated and/or slippery or uneven surfaces. Trips caused by poor "house keeping" practices	Care should be used to avoid such accidents and to maintain good "house keeping". Fall protection devices must be used when work proceeds on elevated surfaces.
Lifting Hazards	Injury due to improper lifting techniques, overreaching/overextending, heavy objects	Use proper lifting techniques, mechanical devices where appropriate
Lighting Accidents	Improper illumination	Work will proceed during daylight hours only, or under sufficient artificial illumination.

Organization / Site Activity and Control Plan

EPI Personnel	**Name**	**Company**	**Telephone**	**Responsibility**
Site Health and Safety Officer		EPI		
Other EPI Site Personnel		EPI		
Project Manager	Jerry Boyd	EPI	425.358.0089	
Client Personnel				
Site Representative	Ron Oline	Estate of Don Oline	253.370.7222	
Subcontractors/Third Parties				
Will Client Rep be Present?	Yes ___	No ___	Sometimes X	

Attach Site Map (indicate work area(s), access, site-specific work or safety features – and describe below)
See attached.
Site Entry Procedure, Will Access to Work Area be Limited? How?
Enter site from gate off of Marine View Drive; contact Ron Oline to acquire access.
Criteria for Changing Personnel Protection
Observance of lime sludge deposit
Personnel Decontamination Procedures
Wash hands and face with soap and water; eye-wash kit.
Work Limitations (i.e., time of day, weather conditions, client restrictions, etc.)
Business hours unless otherwise directed.
Placement of Disposable Materials
Discarded PPE to be disposed as municipal solid waste at Subtitle D landfill
Placement of Investigation Derived Residuals (i.e., drilling spoils, decon. water, purge/dev. water)
Soil cuttings and decon water will be placed in separate 55-gallon drums onsite. Once characterized, liquid and solids will be disposed in accordance with local, state, and federal regulations.
Location of Nearest Facilities:

Cellular Phone:	With EPI field representative

Running (potable) Water:	1940 Marine View Drive (Hylebos Marina)			
Public Road:	Marine View Drive			
Lavatory:	1940 Marine View Drive (Hylebos Marina)			
Exact Locations of Chemicals	Known ___	Assumed X	Unknown ___	
Nearest Offsite Population	Residential X	Industrial X	Rural	Urban X

Special Safety Considerations

If there is more than one level of hazard, or if there are multiple "sites" within a site - the hazards associated with each should be identified. Identify each site on attached site map. **A separate "Special Safety Considerations" section should be completed for each "site."** (duplicate this section for each "site")
Work Location: Center of main yard
Objective of Work at this Location: Soil and if present, ground water characterization for PCBs and VOC/SVOCs if lime sludge is observed
Level of Protection Planned: Level C Level D Level D-Modified X (explain) Tyvek overalls and ready access to respirator
Possible Modifications to Level of Protection: Half-face respirator if and when conditions warrant

Monitoring Equipment				
OVA/Hnu	PID X	CGI X	O_2/H_2S Meter ___	Other _____ (describe)

Monitoring Action Guidelines		
Instrument	**Reading**	**Action Required**
SEE POTENTIAL CHEMICAL HAZARDS, PAGE 2		

Types of PPE to Be Used	
Foot	Steel-toed boots.
Hand	Nitrile gloves, leather work outer-gloves, temperature-appropriate gloves for protection during cold weather.
Eye/Face	Safety glasses
Clothing	Tyvek overalls and long pants are required
Respiratory	Based on monitoring requirements (half-face respirator should be accessible to all onsite workers)
Additional Gear	Hard hat, ear plugs or muffs when advancing borings

Emergency Planning

Service	Name	Number
Local Police		911
Local EMS		911
Local Fire Department		911
Local Hospital		911
Client Contact	Ron Oline	253.370.7222
Site Phone Number	Cell phone with EPI	425.988.4090
EPI Office (800-889-4747)	Doug Kunkel	425.395.0010 office 425.241.8170 cell

Directions to Nearest Medical Facility (Attach Map): The recommended route to Urgent Care and Occupational Medicine of Auburn Regional Medical Center is highlighted on the attached map. The hospital is located approximately 4.6 miles from the work-site.

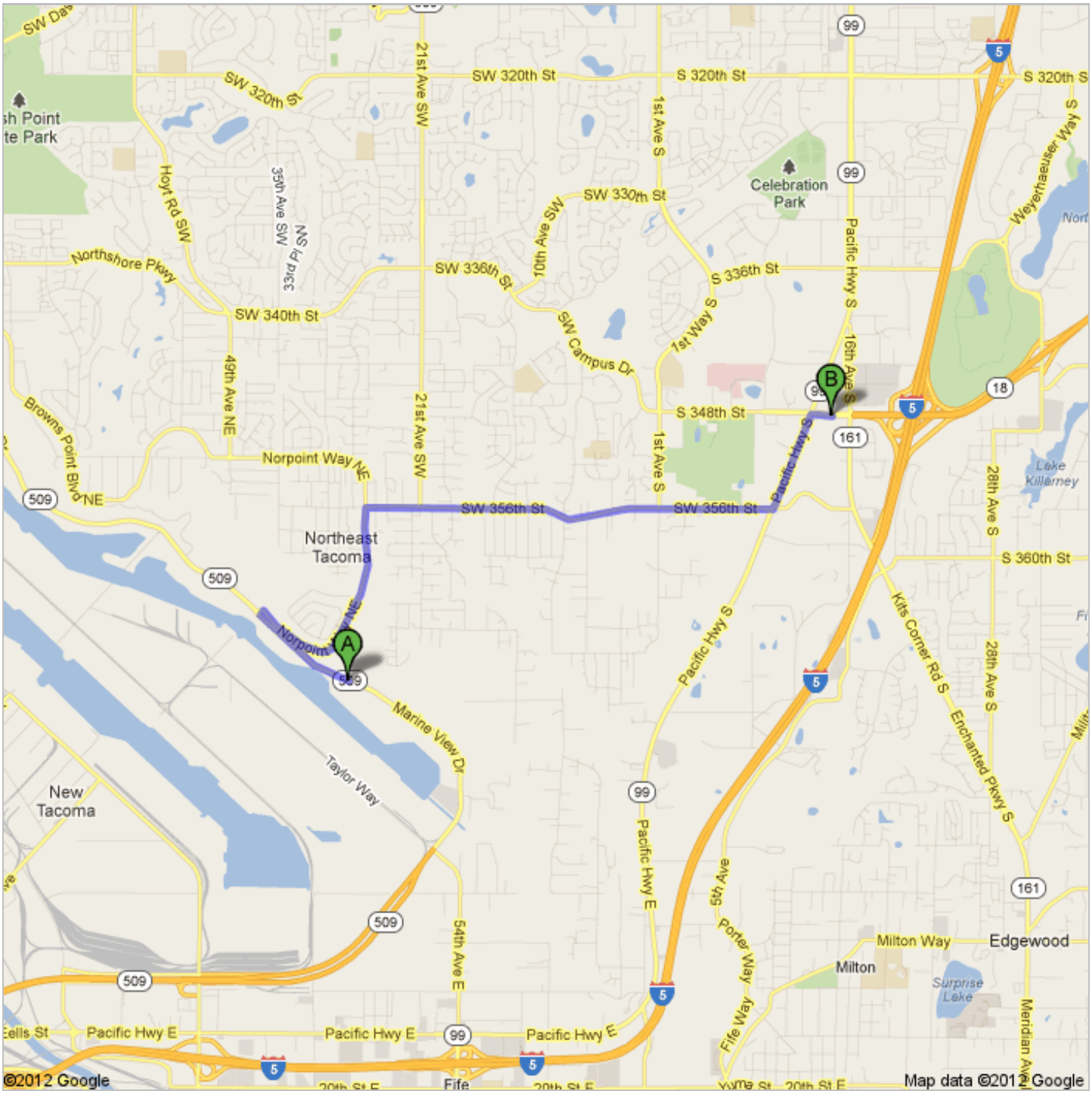
Site-Specific Health and Safety Plan Approvals		
Title: Personnel	**Signature**	**Date**
Site Safety Officer: Jerry Boyd		
Project Manager: Jerry Boyd		
Company H&S Officer: Doug Kunkel		

Additional Site Personnel

Printed Name and Company	Approval Signatures	Date

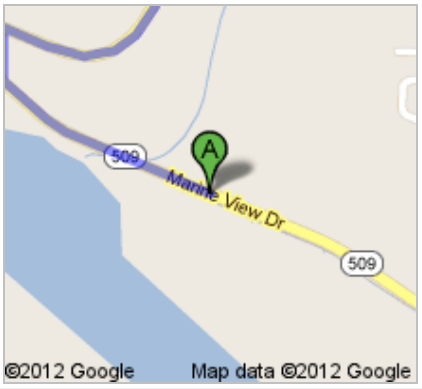
Attachments: Site map and directions to medical facility

Directions to Urgent Care and Occupational Medicine of Auburn Regional Medical Center
1413 South 348th Street, Federal Way, WA 98003 - (253) 874-2000
4.6 mi – about **11 mins**



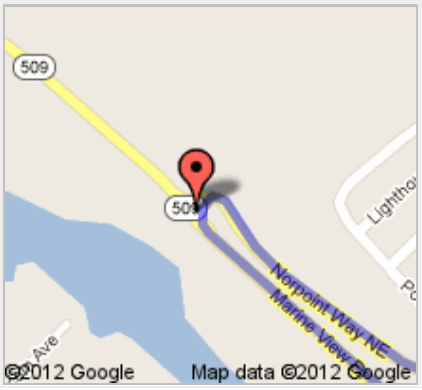
1915 Marine View Dr, Tacoma, WA 98422

1. Head **northwest** on **Marine View Dr** toward **Norpoint Way NE**
   About 1 min



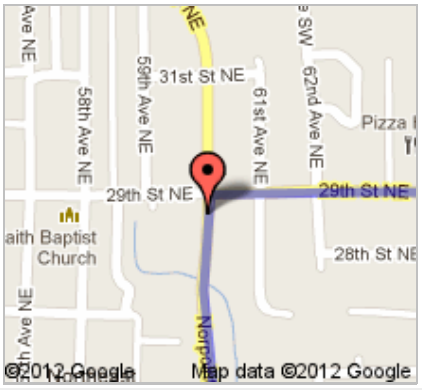
go 0.6 mi
total 0.6 mi

2. Take the 1st right onto **Norpoint Way NE**
   About 2 mins



go 1.2 mi
total 1.8 mi

3. Take the 1st right onto **29th St NE**
   About 54 secs



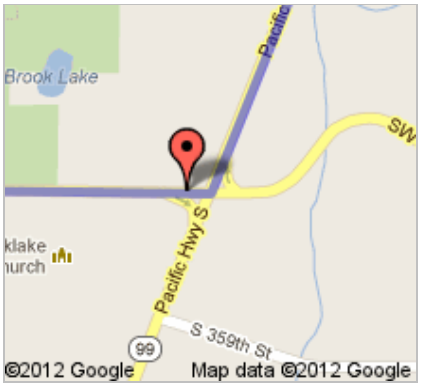
go 0.3 mi
total 2.1 mi

4. Continue onto **SW 356th St**
   About 4 mins

go 1.9 mi
total 4.0 mi

5. Turn left onto **WA-99 N**
   About 2 mins

go 0.5 mi
total 4.5 mi



6. Turn right onto **S 348th St**
Destination will be on the right

go 0.1 mi
total 4.6 mi

Urgent Care and Occupational Medicine of Auburn Regional Medical Center
1413 South 348th Street, Federal Way, WA 98003 - (253) 874-2000

These directions are for planning purposes only. You may find that construction projects, traffic, weather, or other events may cause conditions to differ from the map results, and you should plan your route accordingly. You must obey all signs or notices regarding your route.

Map data ©2012 Google

Directions weren't right? Please find your route on maps.google.com and click "Report a problem" at the bottom left.

Attachment B
Laboratory Quality Assurance Manual (QAM) & Analytical Methods

QUALITY ASSURANCE MANUAL

ALS ENVIRONMENTAL
Everett Facility
8620 Holly Drive, Suite 100
Everett, WA 98208
www.alsglobal.com

ALS ENVIRONMENTAL QUALITY ASSURANCE MANUAL

SOPID:	ALS QUALITY ASSURANCE MANUAL	Rev. Number:	08.0	Effective Date:	12/07/2012

Approved By: _____ Date: 12/7/12
QA Manager – Glen Perry

Approved By: _____ Date: 12/10/12
Laboratory Director – Rick Bagan

Archival Date: _____ Doc Control ID#: 12QAM002001 Editor: BAT

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1.0 INTRODUCTION

Forty years ago the environmental marketplace did not exist. Today it is a multi-billion dollar industry. Virtually all environmental actions involve analyses at some point in the process. The data from these analyses are used for many purposes, including: compliance with regulatory requirements; determination of the presence, concentration, and movement of hazardous materials in the environment; potential effects upon or protection required for persons; and the actions necessary for disposal or treatment of hazardous materials.

The purpose of the ALS Environmental (ALSEV) Quality Assurance Program is to create the procedures, system and policies necessary to provide data of verifiable quality that meet the data quality requirements characteristic to the method. To achieve this, a system is described which controls:

- Preservation of samples
- Receipt and handling of samples
- Processing and analyses of samples
- Analytical equipment
- Data verification
- Data reporting
- Records management
- Management and Quality Assurance Review and Auditing

It is stressed that all laboratory personnel affect data quality. This manual has been prepared so that staff members will be cognizant of the procedures adopted by ALSEV for the production of analytical data, and so they will be aware of their responsibilities.

With this manual, the terms Quality Assurance and Quality Control are defined and used as follows:

- Quality Assurance - The overall controls imposed upon laboratory operations. Actions taken by personnel and the documentation of laboratory performance are included as specified in the Quality Assurance Program.

- Quality Control - The daily, specific actions taken within the laboratory to verify sample integrity, performance of analyses, data processing, and record maintenance

1.1 OBJECTIVES OF THE QUALITY ASSURANCE PROGRAM

As stated, the overall objective of the Quality Assurance Program for ALSEV is to provide data which meet method quality requirements. To accomplish this, the laboratory must:

- Maintain an effective, ongoing Quality Control Program to measure and verify laboratory performance
- Meet data requirements for accuracy, precision, and completeness through the use of proven methodologies
- Provide sufficient flexibility to allow controlled changes in routine methodology to meet specific data requirements
- Monitor operational performance of the laboratory on a routine basis and provide corrective action as needed
- Recognize and promptly correct any factors which adversely affect quality
- Maintain complete records of sample submittal, laboratory performance, and completed analyses to verify resulting data

Specifically, procedures for the following actions must be established and followed:

- Procurement and control of instrumentation and supplies required for laboratory operation
- Sample receipt, chain-of-custody completion, and sample storage
- Calibration and preventive maintenance of instrumentation
- Establish a Performance Evaluation sample program within the laboratory
- Analyses in accordance with recognized analytical procedures
- Data processing, validation, and reporting
- Control and maintenance of laboratory records
- Identification and resolution of nonconformances requiring corrective action
- Audits to verify laboratory performance and the reporting of audit results to

management

- Training of analysts in technical and quality control procedures, including an orientation to the ALSEV Quality Assurance Program

1.2 ALSEV SUPPLEMENTAL QUALITY ASSURANCE DOCUMENTS

This Quality Assurance Manual (QAM) supplies overall QA/QC policy for the laboratory. It is recognized that supplemental documents may be needed on a case-by-case basis to address all issues. These additional documents might include the following:

- Standard Operating Procedures (SOPs) - These are written, detailed instructions describing in-house operations or non-standard methods. They specify what is done, whose responsibility it is to perform tasks and whose to verify their correctness; they are sufficiently detailed to provide data of acceptable quality and integrity, with a minimum loss of data due to out-of-control situations.

- Project-Specific Manuals - Frequently, contractual and regulatory demands, or uniqueness of a project's scope of work, require the preparation and implementation of a Project-Specific Quality Assurance program and Manual, generally referred to as a Quality Assurance Project Plan (QAPP).

  Project demands can include:

  - The development and/or use of new testing methods

  - Specific requirements for equipment calibration and maintenance

  - Specific detection limits for testing

  - Specific accuracy and precision limits or the statistical treatment of data

  - Additional or different document and record formats and maintenance

  If a specific project requires a unique Quality Assurance Program, that program will be implemented. Full documentation will be provided in a Project Specific Manual. The requirements of the project will take precedence over conventional ALSEV Quality Assurance practices for that work.

1.3.1 DOCUMENT CONTROL, DISTRIBUTION, AND REVISION

The Quality Assurance Manual and Project-Specific Manuals are approved and controlled documents.

Laboratory Director and/or Quality Control Director approvals are required before issue of the following documents:

- ALSEV Quality Assurance Manual
- Project-Specific Manuals

When the document is no longer needed, or the copyholder leaves ALSEV, it shall be returned.

So that all Quality Assurance documents can be revised as necessary, a standard format will be maintained. Before issue, revisions will require the same approvals as the original document. Also, revisions will be consecutively numbered and each page revised shall denote the numbered revision. To facilitate revisions, each page of all manuals shall contain the following:

Title or Document Identification
Revision No. ____
Date: (of issue)
Page __ of __

Revisions will be issued to all holders of controlled copies. Each copyholder will sign a revision receipt verifying that the revision has been received and properly placed in the document. The receipt will be returned to the issuing manager.

In all cases, external parties will be asked to return Quality Assurance documents when the need for the document has ended. Exceptions to this will be if the external party requires a copy for record purposes.

2.0 LABORATORY ORGANIZATION

This section discusses general positions and quality-related responsibilities that the laboratory must provide for the implementation of the Quality Assurance Program and completion of Quality Control activities. ALSEV will maintain a vertical management structure. Within this structure the Laboratory Director will be the highest-ranking laboratory employee. As size dictates, the laboratory will have a second level of management using titles of Laboratory Supervisor and Supervising Chemist. These supervisors will have the responsibility for managing the day-to-day operations of sections within the laboratory (Organics, Metals, General Chemistry, etc.). If a position is vacant the responsibilities of that position will default to the next highest position. Chemists and Analysts will have the primary responsibility of performing analyses.

2.1 ALSEV QUALITY-RELATED RESPONSIBILITIES WITHIN A LABORATORY

Listed below are the key quality related functions and the responsibilities and tasks for each position. In the event that a listed position is not filled, the Laboratory Director will take responsibility for performance of the task or assignment to another employee.

- Laboratory Director:
  - Implements the Quality Assurance Program within the laboratory
  - Periodically determines the effectiveness of the Quality Assurance Program in the laboratory
  - Approves the Quality Assurance Manual, Project-Specific Manuals (QAPPs), SOPs, and revisions
  - Supervises laboratory proficiency programs
  - Manages laboratory daily analytical operations
  - Supervises Quality Control activities performed as part of routine analytical operations
  - Oversees sample storage facilities
  - Establishes and supervises the preparation and maintenance of laboratory records

- Review and approval of final analytical reports prior to transmittal to client

- Serves as the "focal point" for the reporting and disposition of non-conformances

- Quality Control Director:

  - Reports directly to the Laboratory Director

  - Provides technical overview of laboratory activities

  - Serves as an "in-house" consultant for the applicability of general Quality Control practices to specific needs

  - Assists in the training of analysts in laboratory operations and analytical procedures

  - Evaluates analytical techniques, procedures, instrumentation and Quality Control procedures, and provides recommendations to the Laboratory Director

  - Defines the instrument preventive maintenance schedule

  - Defines the calibration program within the laboratory

  - Arranges Performance Evaluation studies

  - Performs statistical analyses utilizing results of Quality Control samples analyses

  - Resolves ongoing and recurring nonconformances within the laboratory

  - Recommends corrective actions for resolution of nonconformances

  - Reviews statistical data to verify the laboratory is meeting stated Quality Control goals

  - Closes findings and recommendations of Quality Assurance Audits

  - Stops production of data in a laboratory area where the review of quality control data or procedures shows significant problems

- Establishes and supervises the laboratory Quality Assurance training program

- Oversees preventive maintenance program

- Supervising Chemist:

  - Reports directly to the Laboratory Director

  - Oversight for the log-in of all samples received, completion of chain of custody records, and maintenance of sample logbooks

  - Responsible for the training and oversight of analysts in laboratory operations and analytical procedures

  - Oversees scheduling of the analytical testing program with consideration for sample-holding times

  - Performs calibration, analyses, interpretation and data recording in accordance with accepted methods

  - Assists in the log-in of all samples received, completion of chain-of-custody records, and maintenance of sample logbooks

  - Performs data processing

  - Review and approve analytical data and submit to Laboratory Director for final review and issue

  - Responsible for acceptable instrument performance and supervises instrument calibration and preventive maintenance programs

  - Immediately report out-of-control situations, instrument malfunction, calibration failure, or other nonconformances to the Laboratory Director or Quality Control Director, as appropriate

- Chemist:

  - Reports directly to the Laboratory Director or Supervising Chemist

  - Performs calibration, analyses and data interpretation and recording in accordance with accepted methods

  - Assists in the log-in of all samples received, completion of chain-

of-custody records, and maintenance of sample log books

- Performs data processing

- Review and approve analytical data and submit to Laboratory Director for final review and issue

- Responsible for acceptable instrument performance and supervises instrument calibration and preventive maintenance programs

- Immediately report out-of-control situations, instrument malfunction, calibration failure, or other nonconformances to the Laboratory Director, Supervising Chemist or Quality Control Director, as appropriate

- Laboratory Technician:

  - Perform analytical procedures and data recording in accordance with accepted methods

  - Perform and document calibration and preventive maintenance of instrumentation, as appropriate

  - Perform data processing

  - Immediately report out-of-control situations, instrument malfunction, calibration failure, or other nonconformances to the Laboratory Director, Supervising Chemist or Quality Control Director, as appropriate

3.0 STANDARD LABORATORY PRACTICE

Daily activities within an analytical laboratory are directed toward the analysis of samples. However, there are many laboratory functions which precede and follow analysis which are necessary to control and verify the analysis. These functions, as a total, represent the daily implementation of the Quality Assurance Program by the laboratory staff.

This section serves as an introduction to these functions and provides an overview of them as the total system providing Quality Assurance within the laboratory. Figure 3-1 presents a flow chart of functions for laboratory analyses. The functions shown can be divided into those which directly involve a sample, laboratory functions, and those which are independent (in general) of specific sample analysis, auxiliary functions.

Each function is discussed in detail in the sections which follow (Sections 4.0 through 13.0 as denoted in Figure 3-1). Following is a brief discussion of the activities performed for each function and their role in the Quality Assurance Program.

3.1 RECEIPT OF SAMPLES AND INITIATION OF TESTING PROGRAM

Upon receipt of samples in the laboratory, the following is done:

- Samples are examined for damage, checked for proper preservatives
- The Chain-of-Custody form is signed
- Samples are placed in the proper storage environment
- The testing program is defined by the Chain-of-Custody, Purchase Order or other appropriate means
- Acceptable holding times until samples must be extracted and/or analyzed are defined
- Samples are logged into the laboratory sample stream and internal paperwork generated
- Appropriate laboratory personnel are notified of sample receipt

3.2 MATERIAL AND INSTRUMENT PREPARATION

Concurrent with the performance of analysis, auxiliary functions are performed to provide appropriate materials to the Analysts, and verify and maintain instrument performance

3.2.1 Material Procurement and Control

- Specifying grades of reagents, solvents, gases, and water used within the laboratory for specific analyses, and verifying adequacy of these materials before use
- Controlling reagents, solvents, etc., during storage
- Cleaning protocol for laboratory vessels

3.2.2 Calibration

- Scheduled comparison of instrument performance against national standards for instruments which measure physical parameters, such as mass, time, and temperature. This type of calibration is independent of specific analyses and projects.

- Determination of instrument response to initial known chemical composition and concentration. Calibration may be part of daily instrument usage or as response checks during or at the completion of an instrument run. This type of calibration may be independent of or part of the analysis for a specific project.

3.2.3 Preventive Maintenance

- Servicing instruments on a scheduled basis to maintain performance.

- Maintaining a stock of instrument parts which are known to regularly degrade because of usage.

- Preparing records so that the historical performance of an instrument can be assessed.

3.3 ANALYTICAL PROCEDURES

The actual analysis of samples occurs during this function; however, for the analysis to be complete, several activities must be coincident:

- Sample holding times and storage environment are reviewed by the analyst to verify that sample integrity has been maintained

- Analysis is performed in accordance with standard methods adopted by ALSEV or as specified by the client. Analysis results include:

  - Prescribed daily instrument calibration and documentation.

  - Preparation and analysis of Quality Control samples and/or standards as part of the sample stream at the level of samples required.

3.4 PROCESS QUALITY CONTROL DATA

There are four steps involved in the total verification of analytical data:

- Computation of Quality Control sample data.
- Comparison of Quality Control data with analytical acceptance limits.
- Computation of analytical results from the data.
- Independent verification of analytical results.

In general, Quality Control data and analytical data are interconnected. However, for the purposes of this discussion, the preparation of Quality Control data and the processing and evaluation of analytical data will be discussed separately because of the difference in quality assurance requirements for each.

This section discusses Quality Control data, and Section 3.6 discusses the treatment of analytical data.

Quality Control sample results are analyzed and the Quality Control data are reviewed and compared against stated acceptance levels for accuracy and precision. The data are also used, as appropriate, to update control limits. If the Quality Control data meet acceptance levels, processing of the analytical data begins. If the Quality Control data are unacceptable, corrective action must be taken.

3.5 CORRECTIVE ACTION

If Quality Control data are unacceptable, the cause must be determined. If the cause can be resolved so that the integrity of the analytical data are not affected or can be corrected, the processing of the analytical data can proceed. Nonconformances which affect the integrity of analytical data will require resolution which may include reanalysis of the affected samples. Results shall be qualified in the report.

3.6 DATA PROCESSING AND VERIFICATION

- Analytical test results are calculated by the Analyst using computation methods prescribed for the various analytical methods.
- The resulting data are verified. Verification demonstrates and documents that the analyses have been properly performed, that proper input parameters (such as response factors or dilutions) have been used, and that mathematical manipulation is correct.

3.7 REPORTING

- Analytical data, and Quality Control data if appropriate, are summarized in presentation format.

- The data are reviewed by senior or supervising personnel to verify that the objectives of the analysis have been met.

- After approval the data are issued by the Laboratory Director.

- Please refer to the corporate SOP CE-GEN005 on proper document control procedures.

3.8 RECORDS MANAGEMENT

There are two categories of records prepared within the laboratory:

- Project-specific records which are related solely to the analysis performed for a group of samples such as chain-of-custody and raw analytical data

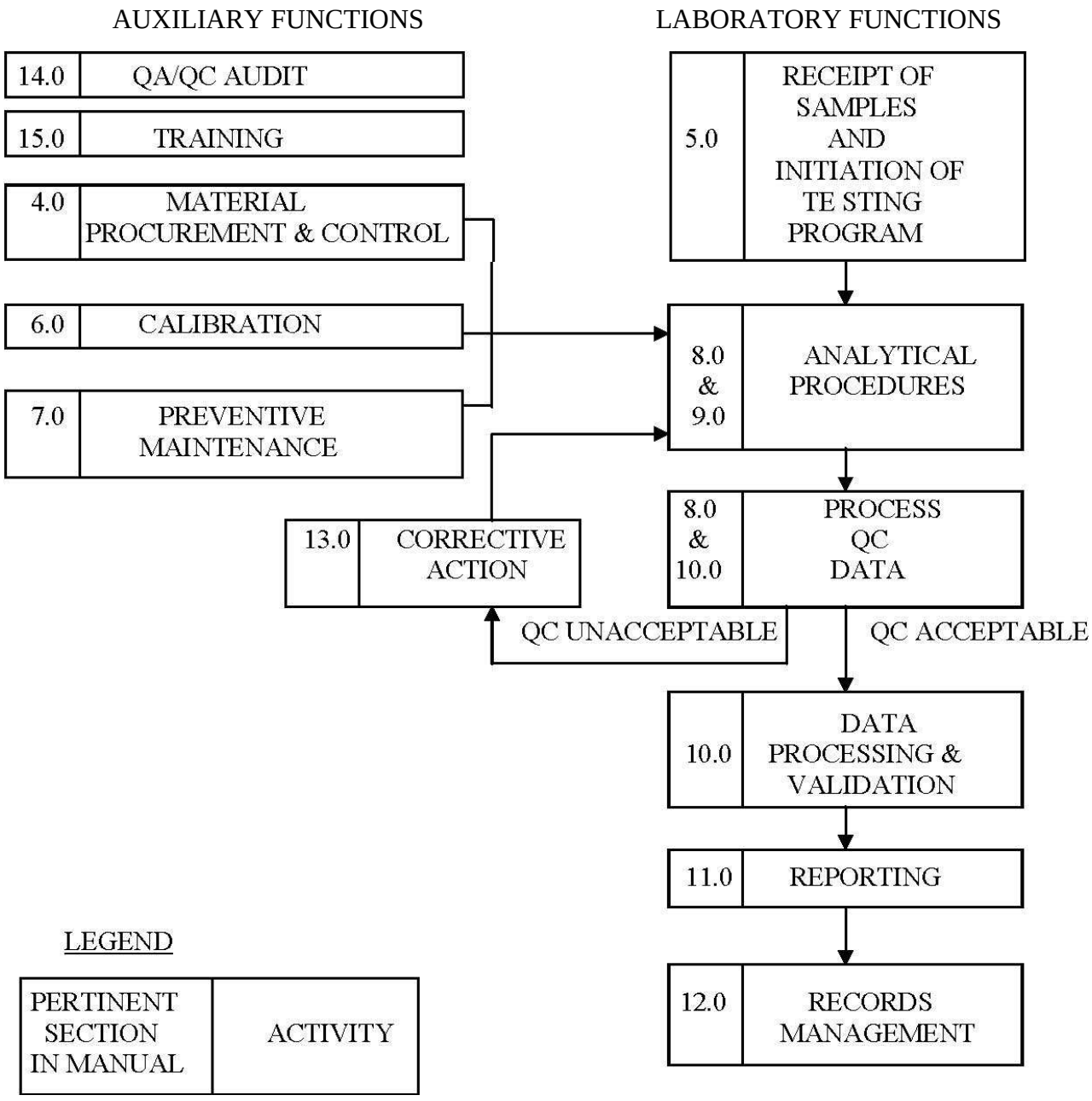
- Records which demonstrate overall laboratory operation, and are, in general, independent of specific projects, such as the master laboratory sample log-in book, equipment calibration records, and maintenance log books

Separate files are maintained for each category of records. However, the document control system enables cross-referencing of records (such as for instrument performance) so that implementation of the Quality Assurance Program can be demonstrated.

Please refer to the corporate SOP (CE-GEN 005) for further guidance on proper document control procedures.

FIGURE 3-1

LABORATORY ANALYSIS FLOW CHART



4.0 MATERIAL PROCUREMENT AND CONTROL

The quality of reagents, solvents, gases, water, and laboratory vessels used in analyses must be known so that their effect upon analytical results can be defined. Materials purchased by ALSEV shall meet the requirements stated below or as denoted in specific analytical procedures, and be controlled as stated. Requirements are also stated for internally prepared materials such as water and compressed air.

The laboratory shall have an individual responsible for purchasing materials. This person can be the Laboratory Director or an employee assigned the task by the Laboratory Director. Duties include:

- Specifying in purchase orders or requisitions, suitable grades of materials (grade should be defined by the Quality Control Director or Laboratory Director).
- Verifying upon receipt that materials meet requirements and that, as applicable, materials certificates are provided and maintained in the laboratory record system.
- Overseeing identification and storage of materials.
- Verifying that material storage is properly maintained, and removing materials from use when shelf life has expired.

4.1 REQUIREMENTS FOR REAGENTS, SOLVENTS, AND GASES

Chemical reagents, solvents, and gases are available in a variety of grades of purity, ranging from technical grade to ultra-pure grades. The purity required varies with the type of analysis. The parameter measured and the sensitivity and specificity of the detection system are important factors in determining the purity required. For many analyses, including most inorganic analyses, analytical reagent (AR) grade is satisfactory. Other analyses, such as trace organic and metals frequently require special ultra-pure reagents, solvents, and gases. If the analytical method does not specify the purity of materials, it is generally intended that analytical grade be used. Materials of lesser purity than specified shall not be used. Prior to performing an analysis, the label of the material container should be checked by the Analyst to verify that the material purity meets analytical needs.

Materials are prepared and standardized against reliable primary standards whenever possible. They are re-standardized, or prepared fresh, as often as indicated by their stability.

4.1.1 General Inorganic Analyses

In general, AR grade reagents and solvents are adequate for inorganic analyses. Primary standard reagents shall be used for standardizing all volumetric solutions. All calibration reagents shall be checked for accuracy.

Individual analytical methods specify the reagents that require frequent standardization, or special treatment. The analyst must comply with these special operations. To minimize potential deterioration, the analyst should prepare a limited volume of such reagents, depending on the quantity required over a given period of time.

4.1.2 Trace Metals Analyses

All standards used for atomic absorption and emission spectroscopy shall be spectro-quality. It is recommended that other reagents and solvents also be spectro-quality. Standards are prepared by the analyst, or purchased provided purchased materials meet the requirements of the analytical method.

In general, fuel and oxidant gases used for atomic absorption or emission spectroscopy can be commercial grade. Compressed air can be commercially supplied, dry grade, or supplied by laboratory air compressors if adequate pressure is maintained and the air is filtered to remove oil, water, and possible trace metals.

4.1.3 Organic Chemical Analyses

In general, pesticide residue grade (nanograde) is the minimum acceptable grade for materials used for organic analyses. Reference grade standards should be used as necessary. Special note should be made of the assay of standard materials.

Some gas chromatography (GC) detectors require that solvents, reagents, and gases be free of certain classes of compounds. For example, use of the flame photometric detector requires that reagents and solvents be free of sulfur and phosphorus interference.

For sample cleanup procedures, the adsorbents most commonly used for column chromatographic cleanup of sample extracts are Florisil, carbon, silica gel, and alumina. These are pre-activated according to the analytical method requirements and checked for interfering constituents. The contents of each solvent lot must be checked to determine suitability for the analyses. Similarly, all analytical reagents and other chemicals must also be routinely checked.

4.1.4 Water

Deionized water is used as appropriate for dilution, preparation of reagent solutions, and final rinsing of glassware in the performance of certain analyses. Distilled water is usually not of sufficient purity because distillation does not remove certain contaminants. The specifications for ASTM Type II quality water shall be met for de-ionized water: Maximum Electrical Conductivity at 25EC of 1.0 µmho/cm, or Minimum Electrical Resistivity at 25EC of 1.0 M ohm/cm. Water quality shall be determined daily by measuring either conductivity or resistivity and recording measurements in a log book. TOC is also performed on Type II water quarterly.

Analyte-free water is required for volatile organic analyses. Analyte-free water may be verified by the purge-and-trap technique of the GC. However, when determining trace organics by solvent extraction and gas chromatography, specialty water such as high performance liquid chromatography (HPLC) grade water with sufficiently low background may be necessary. Pre-extraction of the water with the solvent used in the analysis, or nitrogen purging, may be helpful in eliminating organic compounds from the water.

4.1.5 Compressed Air

Compressed air must be free of oil, water, and dirt. If produced in the laboratory, appropriate filters shall be used at the compressor to prevent moisture from entering the piping system. Filters to remove oil shall be installed at the point of use for atomic absorption and gas chromatographic applications.

If purchased, or as a backup to an in-house compressor system, compressed air shall be high quality, dry grade.

4.2 REQUIREMENTS FOR LABORATORY CONTAINERS

Containers used in the laboratories can affect the quality of results. Material composition and volumetric tolerances are discussed below.

4.2.1 Material Composition of Laboratory Vessels

The glass recommended for general use is chemically resistant borosilicate glass, such as is manufactured under the trade names of Pyrex or Kimax. This glassware is satisfactory for analyses unless otherwise noted in the sampling or testing procedure.

The use of plastic vessels, containers, and other apparatus made of Teflon, polyethylene, polystyrene, and polypropylene is desirable for certain specified

applications. The following guidelines should be considered when selecting the material composition of laboratory vessels:

- Borosilicate or polyethylene bottles are to be used for the storage of reagents and standard solutions, unless otherwise specified.

- Plastic containers should not be used for reagents and solvents used in organic analyses.

- Dilute metal solutions have a tendency to plate out on container walls over long periods of time; therefore, dilute metal standard solutions should be prepared at the time of analysis.

- The use of disposable glassware is satisfactory for some analyses, such as the use of disposable test tubes as sample containers for use with some automatic samplers.

- Borosilicate glassware is not completely inert, particularly to alkali. Standard solutions of silica, boron, and the alkali metals should be stored in polyethylene bottles.

4.2.2 Volumetric Container Specifications

ALSEV shall use glassware of sufficient accuracy as required for the analytical procedure for the measurement of sample or reagent volumes. In general, Class A glassware shall be used for all volumetric measurements requiring a high degree of accuracy. This includes volumetric flasks, volumetric pipettes, and accurately calibrated burettes. Less accurate types of glassware, including graduated cylinders and measuring pipettes, have specific uses when less exact volumes are permitted by the analytical procedure.

Containers, primarily glassware, shall be purchased with the objective of meeting the correct end use of the container in an analytical procedure. Thus, for example, if an analytical method requires that Class A glassware be used, the analyst shall fully comply with the method.

4.3 STORING AND MAINTAINING REAGENTS AND SOLVENTS

The following shall apply for storing and maintaining reagents and solvents:

- Standard reagents and solvents are stored in accordance with manufacturers recommendations.

- Standard solutions shall be stored separately from samples to avoid possible

cross-contamination.

- Light-sensitive standard reagents or solvents are stored in a cool, dark place
- Organic reagent standards are stored at or below 4°C.
- All standards are to be disposed of no later than their expiration date.
- Reagents, solvents, acids, bases and standards should be dated and initialed at the time of receipt.
- Reagents transferred from storage containers maintain traceability back to the storage container.
- All reagents and their child standards and related records include the expiration date for the reagents.

4.4 GLASSWARE CLEANING REQUIREMENTS

Methods of cleaning glassware are selected according to the substances that are to be removed and the analytical analysis required. Water-soluble substances can be washed out with hot or cold water and the vessel finally rinsed with successive small amounts of deionized water. Other substances more difficult to remove may require the use of a detergent, organic solvent, dichromate cleaning solution, nitric acid, or aqua regia. In all cases, it is good practice to rinse a vessel with tap water followed by deionized water as soon as possible after use. Material allowed to dry on glassware is much more difficult to remove.

Chromic acid is an effective but dangerous cleaning agent. It may be prepared by adding 1 liter of concentrated sulfuric acid slowly, with stirring, to a 35-ml saturated sodium dichromate solution. This mixture must be allowed to stand for approximately 15 minutes in the vessel to be cleaned and may then be returned to a storage bottle. Following the chromic acid wash, the vessels are rinsed thoroughly with tap water, then with small successive portions of deionized water.

For certain determinations, especially trace metals, glassware shall also be rinsed with a nitric acid-water mixture. This is followed by thoroughly rinsing with tap water and successive portions of deionized water. This may require many rinses, especially if chromium is determined. A nitric acid rinse is also especially important if lead is to be determined.

Glassware used for phosphate determinations should not be washed with detergents containing phosphates. This glassware must be thoroughly rinsed with tap water and deionized water. For ammonia and Kjeldahl nitrogen determination, the glassware must be rinsed with ammonia-free water.

Glassware may be dried for immediate use by rinsing with redistilled acetone. Glassware should be stored immediately after drying to prevent any accumulation of dust and stored inverted or with the mouth of the glassware covered with foil.

Bottles used for the collection of samples for organic analyses should be rinsed successively with tap water, deionized water and, finally, several times with a redistilled solvent such as acetone, hexane, petroleum ether, or chloroform. Caps should be washed with detergent; rinsed with tap water, deionized water, and solvent. Liners are treated in the same way as the bottles and are stored in a sealed container. Pre-cleaned sample containers may also be purchased from a supplier.

Alternate methods for cleaning may be used if it is demonstrated (such as by blank analysis) that the result is satisfactory. Also, disposable or pre-cleaned glassware may be purchased if applicable to the analytical procedure.

5.0 SAMPLE RECEIPT AND INITIATION OF TESTING PROGRAM

Laboratory analyses are performed to produce data representative of conditions when the sample was obtained. To provide representative samples for analysis, both field and laboratory personnel must satisfactorily perform their activities. Although the purpose of this manual is to define the laboratory Quality Assurance Program, the interrelationship of field and laboratory operations in maintaining sample integrity is briefly discussed because the effect of field operations upon resulting data quality cannot be totally separated from laboratory operations. ALSEV personnel will not generally be involved in field sampling operations and therefore the responsibility of collecting a representative sample and conforming to the discussed requirements will be that of the client or engineering company. Figure 5-1 shows the sample collection, transport, and holding process. The steps presented are the basis for the following discussion.

5.1 FIELD COLLECTION AND SHIPMENT

Prior to collecting samples, the collection team must consider the analyses to be performed and the "hazard level" of the media being sampled so that proper sample containers and shipping containers can be assembled and the proper preservatives added to samples. In addition, field logs and record sheets and Chain-of-Custody forms must be assembled.

All records required for documentation of field collection must be completed by the field team. Several of the documents that affect laboratory operations are discussed herein. The primary documenting record is the Chain-of-Custody form.

In addition to initiating the Chain-of-Custody form, field personnel are responsible for uniquely identifying (required on the Chain-of-Custody form) and labeling samples, providing proper preservation, and packaging samples to preclude breakage during shipment.

Referring to Figure 5-2, every sample should be labeled to identify:

- Client name
- Sample identification (such as borehole and depth, or grid coordinates)
- Sampling date and time
- Project identification
- Method of sample preservation/conditioning

Samples must be placed in containers compatible with the intended analysis and

properly preserved to maintain sample integrity. Also, the collection of samples must consider the time interval between acquiring the sample and analysis (holding time) so that the analytical data is representative. Table 5-1 provides requirements for various analytical parameters with respect to the type of container, preservation method, and maximum holding time between collection and analysis.

As can be seen, normally, polyethylene or glass containers are required; and, in most cases, samples must be cooled to four degrees Centigrade. The table also provides the recommended sample volume for a specific analysis.

High hazard (medium/high concentration) samples must be packaged according to DOT regulations.

Shipping containers may be sealed with custody tape prior to shipment (see Figure 5-4) whether shipped by direct transport, by field personnel or commercial carrier. Custody tape may not be used while samples are in the custody of ALSEV personnel.

As soon as field personnel are aware they will have or have samples available for the laboratory, they shall notify the laboratory by telephone of the shipment. If the samples are transported by field personnel, the estimated time of arrival at the laboratory should be given. If the samples are shipped by commercial carrier, the laboratory should be telephoned as soon as the shipping containers are consigned to the shipper. If the laboratory is to pick up the samples, the time and location of pickup shall be decided.

It is imperative that the completed Chain-of-Custody form, including analytical parameters, be provided so that analytical requirements are defined and sample holding times are not exceeded. Quality Control requirements and deliverables, other than normal, must be stated on the Chain-of-Custody form.

5.2 CHAIN-OF-CUSTODY

An overriding consideration for data integrity is the ability to demonstrate that the samples have been obtained from the locations stated and that they have reached the laboratory without alteration. Additionally, evidence of collection, shipment, laboratory receipt, laboratory custody and disposal must be documented to complete the record. Documentation is accomplished through a Chain-of-Custody record that lists each sample and the individuals responsible for sample collection, shipment, and receipt. A sample is considered in custody if it is:

- In a person's actual possession.

- In view after being in physical possession.
- Locked or sealed so that no one can tamper with it after having been in physical custody.
- In a secured area, restricted to authorized personnel.

Figure 5-3 is the Chain-of-Custody form suggested for use by ALSEV clients.

The Chain-of-Custody form shall be signed by each individual who has the samples in their possession. Correct preparation of the Chain-of-Custody is as follows:

- The Chain-of-Custody record shall be initiated in the field by the person collecting the sample, for every sample. Every sample shall be assigned a unique identification number that is entered on the Chain-of-Custody form. Samples can be grouped for shipment and use a common form. If the number of samples to be shipped exceeds the spaces provided on the Chain-of-Custody forms additional forms are required.
- The record shall be completed in the field to indicate project, sampling team, etc..
- If the person collecting the sample does not transport the samples to the laboratory or deliver the sample containers for shipment, the first block for Relinquished By ____, Received By ____ shall be completed in the field.
- The person transporting the samples to the laboratory or delivering them for shipment shall sign the record form as Relinquished By ____.
- If the samples are shipped to the laboratory by commercial carrier, the Chain-of-Custody form shall be sealed in a watertight container, placed in the shipping container, and the shipping container sealed prior to giving it to the carrier
- If the samples are directly transported to the laboratory, the Chain-of-Custody form shall be kept in possession of the person delivering the samples.
- For samples shipped by commercial carrier, the waybill shall serve as an extension of the Chain-of-Custody record between the final field custodian and receipt in the laboratory.
- Upon receipt in the laboratory, the laboratory representative, shall open the shipping containers, compare the contents with the Chain-of-Custody form, and sign and date the record. Any discrepancies shall be noted on the Chain-of-Custody form.
- If discrepancies occur, the samples in question shall be segregated from normal sample storage and the client or field personnel immediately notified.

- Chain-of-Custody records shall be maintained with the records for a specific project, becoming part of the data package.

  Multi-part Chain-of-Custody forms may be used so that a copy remains with the person shipping the samples.

5.3 LABORATORY SAMPLE RECEIPT

The first step in the laboratory receipt of samples is notification of the Laboratory Director or appropriate personnel of the incoming samples.

Upon sample receipt, the laboratory representative shall:

- Note whether the samples were shipped as hazardous materials; if so, the sample container should be opened in a hood and the laboratory representative should wear gloves in case of improper packing or breakage

- Examine the shipping containers to verify that the custody seal, if used, is intact. If not, the sample shipper is notified. This nonconformance is documented, together with corrective actions and notification of client or field personnel, and Laboratory and Project Management. Figure 5-4 shows examples of custody seals.

- If samples have been damaged during shipment, the remaining samples shall be carefully examined to determine whether they were affected. Any samples affected shall also be considered damaged. It will be noted on the Chain-of-Custody form that specific samples were damaged and that the samples were removed from the sampling program. Client will be notified as soon as possible that samples were damaged and that they must be resampled, or the testing program changed, and an estimate of the cause of damage.

- Compare samples received against those listed on the Chain-of-Custody form

- Verify that sample holding times have not been exceeded

- Sign and date the Chain-of-Custody form and, if appropriate, attach the waybill

- If necessary, attach appropriate laboratory sample container labels with test and preservative information (Figure 5-2)

- Place the samples in adequate laboratory storage

- Enter the samples in the laboratory sample management computer system which contains the following information:

  - ALSEV job number
  - Sample numbers
  - Types of samples
  - Date received in laboratory

- Prepare Project file

- Notify the Laboratory Director or appropriate personnel of sample arrival

- Place the completed Chain-of-Custody records in the project file

5.4 LABORATORY STORAGE OF SAMPLES

The primary considerations for sample storage are:

- Maintenance at prescribed temperature, if required, which is typically 4°C

- Extracting and/or analyzing samples within the prescribed holding time for the parameters of interest

The requirements of Table 5-1 for temperatures and holding times shall be used. Placing of samples in the proper storage environment is the responsibility of Sample Receiving personnel who should notify the Laboratory Director if there are any samples which must be analyzed immediately because of holding-time requirements; refer to QAM, Section 6.3.2 for appropriate thermometer requirements.

5.5 INITIATION OF TESTING PROGRAM

As stated in Section 5.1, a Chain-of-Custody form, stating the analytical program, shall be submitted with the samples to the laboratory. If the analytical program is not defined with the sample shipment, the Sample Receiving personnel shall immediately notify the Laboratory Director or designee for definition of the analysis program.

The analytical program shall be entered in the laboratory sample log-in book and/or computerized information management system which includes at least the following information: client name; project contact name; received by; date received; requested report date; sample temperature; sample pH; sample identification; sample parameters; comments/special instructions.

The Laboratory Director, or supervisors as assigned by Laboratory Director, are responsible for prioritizing samples on the basis of holding time and required reporting time into the laboratory sample stream.

5.6 SAMPLE DISPOSAL

There are several possibilities for sample disposition:

- The sample may be completely consumed during analysis.
- Samples may be returned to the client for disposal. The returned samples are documented under chain of custody procedures.
- The samples may be disposed of by the laboratory.

In general, ALSEV will store samples for at least sixty days from sample receipt unless otherwise specified. When samples are removed from storage they become classified as solid waste. All waste not known to be non-regulated will be tested to determine whether it is regulated. All regulated and non-regulated waste will be disposed of in accordance with all federal, state and local regulations. The Laboratory Director, or appropriate designee, will oversee the waste disposal program.

FIGURE 5-1
SAMPLE COLLECTION, TRANSPORT, AND HOLDING FLOW CHART

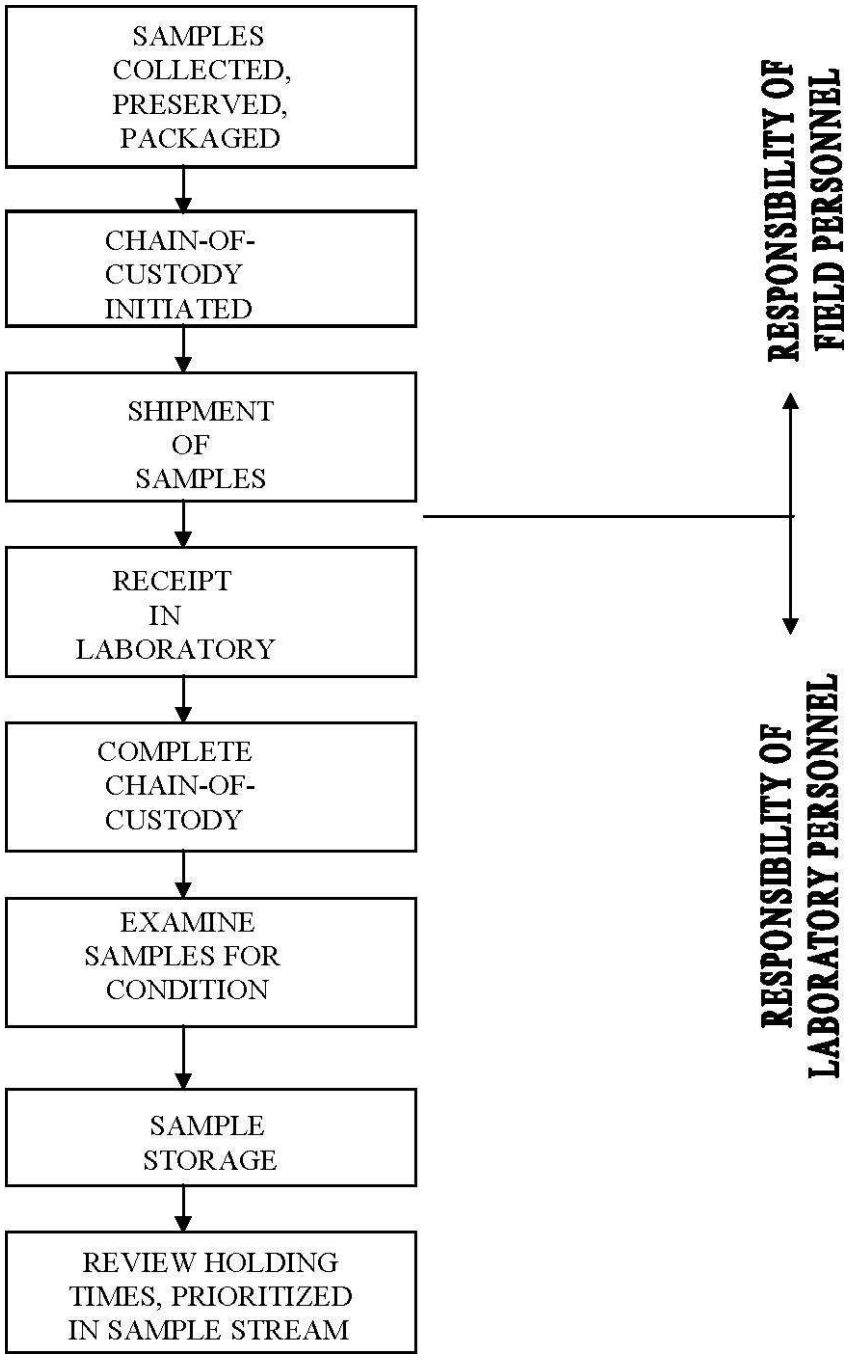


FIGURE 5-2
EXAMPLE – SAMPLE LABEL

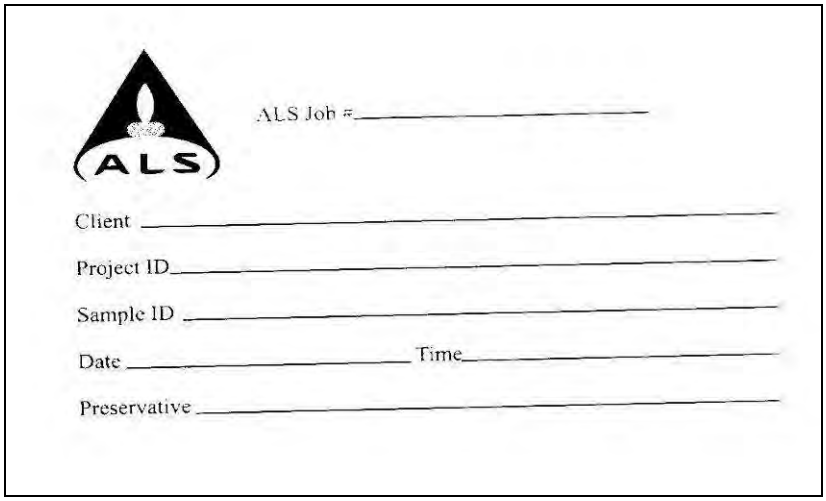


FIGURE 5-3
EXAMPLE – CHAIN OF CUSTODY

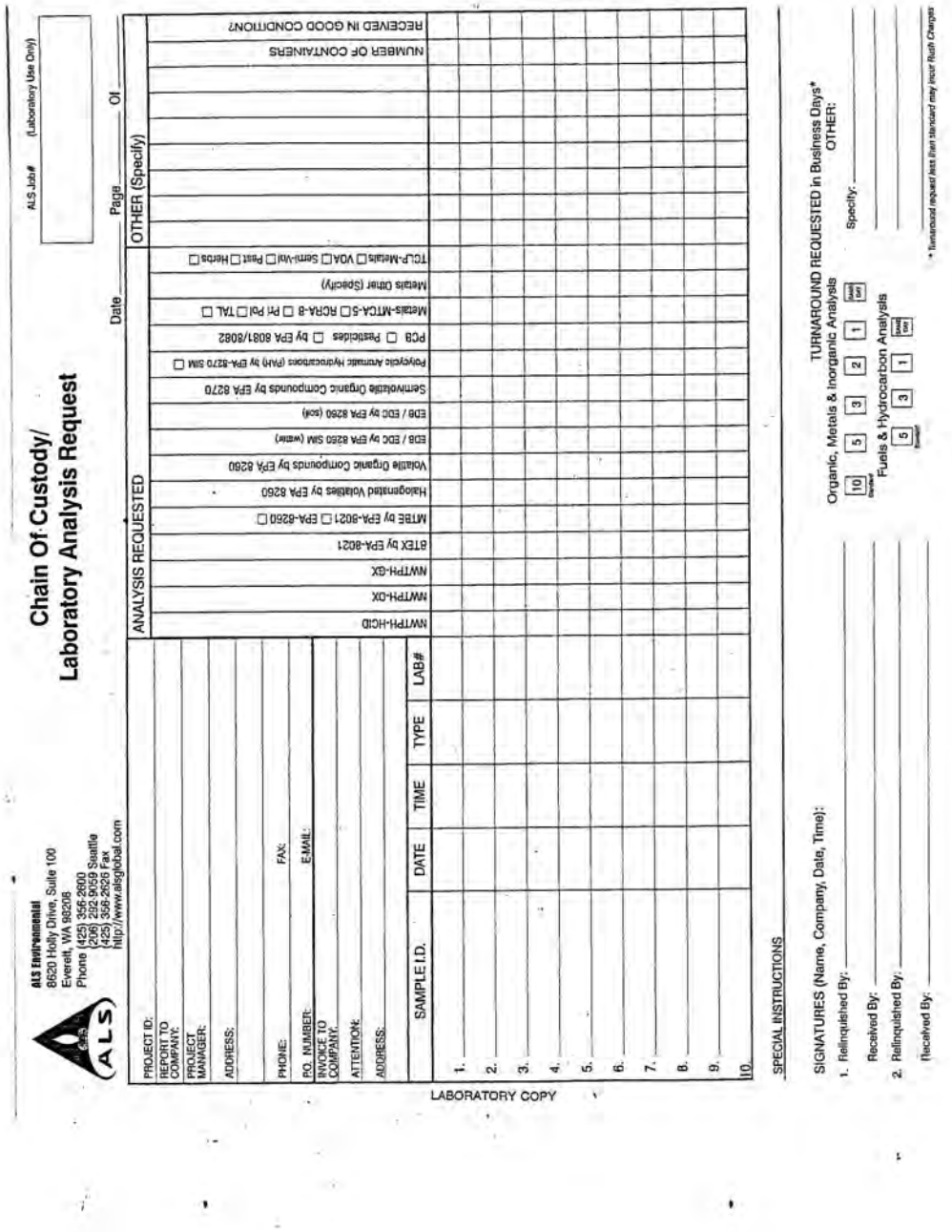


FIGURE 5-4

EXAMPLE - CUSTODY SEALS

ALS Environmental 8620 Holly Drive, Suite 100 Everett, WA 98208 (425) 356-2600	**Custody Seal - Do Not Tamper** Signature/Date: Printed Name and Phone No.:

TABLE 5.1
SAMPLING GUIDE

The following information is reprinted from various regulatory documents and industry accepted standards.

For each parameter the water method is listed first followed by the solid waste method.

If you have any questions, please call (425) 356-2600.

Parameter	Method	Sample Volume	Container	Preservative	Holding Time from sample date
UST PARAMETERS					
Hydrocarbon ID	NWTPH-HCID	1 liter	1 liter amber	cool 4•C	7 days
		50 g	4 oz cwm	cool 4•C	14 days
Gasoline Range Organics	NWTPH-Gx	2 x 40 ml	40 ml VOA vial	HCL pH<2	14 days
		50 g	4 oz cwm	cool 4•C	14 days
BTEX	EPA-8021	2 x 40 ml	40 ml VOA vial	HCL pH<2	14 days
		50 g	4 oz cwm	cool 4•C	14 days
Diesel Range Organics	NWTPH-Dx	500 ml	500 ml amber	cool 4•C	7 days
		50 g	4 oz cwm	cool 4•C	14 days
ORGANICS					
Chlorinated Herbicides	8150	1 liter	1 liter amber	cool 4•C	7 days to extract then 40 days to analyze
	8150	50 g	4 oz cwm	cool 4•C	14 days to extract then 40 days to analyze
Chlorinated Pesticides & PCBs	608/8081	1 liter	1 liter amber	cool 4•C	7 days to extract then 40 days to analyze
	8081	50 g	4 oz cwm	cool 4•C	14 days to extract then 40 days to analyze
Organophosphorous Pesticides	8141	1 liter	1 liter amber	cool 4•C	7 days to extract then 40 days to analyze
	8141	50 g	4 oz cwm	cool 4•C	14 days to extract then 40 days to analyze
Semivolatiles	625/8270	1 liter	1 liter amber	cool 4•C	7 days to extract then 40 days to analyze
	8270	50 g	4 oz cwm	cool 4•C	14 days to extract then 40 days to analyze
Volatiles	624/8260	2 x 40 ml	40 ml VOA vial	HCL pH<2	14 days
	8260	50 g	4 oz cwm	cool 4•C	14 days
METALS					
Hexavalent Chrome	218.4/7195	100 mls	500 ml HDPE	HNO3 pH<2	24 hours

				cool 4•C	24 hours
Mercury	245.2/7470	100 mls	500 ml HDPE	HNO3 pH<2	28 days
	7471	50 g	4 oz cwm	cool 4•C	28 days
All other metals	200/6010	100 mls	500 ml HDPE	HNO3 pH<2	6 months
	7000/6010	50 g	4 oz cwm	cool 4•C	6 months
CONVENTIONAL METHODS					
Acidity	305.1	100 mls	500 ml HDPE	cool 4•C	14 days
Alkalinty	310.1	100 mls	500 ml HDPE	cool 4•C	14 days
Ammonia nitrogen	350.1	50 mls	500 ml HDPE	H2SO4 pH<2	28 days
	350.1 M	50 g	4 oz cwm	cool 4•C	28 days
BOD	405.1	500 mls	500 ml HDPE	cool 4•C	48 hours
Parameter	Method	Sample Volume	Container	Preservative	Holding Time from sample date
Chloride	300.0	50 mls	500 ml HDPE	cool 4•C	28 days
Chlorine, residual	330.5	200 mls	500 ml HDPE	none	immediate
Color	110.2	50 mls	500 ml HDPE	cool 4•C	48 hours
Conductivity	120.1	100 mls	500 ml HDPE	cool 4•C	28 days
Cyanide, total	335.2	500 mls	500 ml HDPE	NaOH pH 12	14 days
	9012	50 g	4 oz cwm	cool 4•C	14 days
Fluoride	300.0	50 mls	500 ml HDPE	cool 4•C	28 days
Hardness	130.2	100 mls	500 ml HDPE	H2SO4 pH<2	6 months
Kjeldahl nitrogen	351.1	50 mls	500 ml HDPE	H2SO4 pH<2	28 days
	351.1M	50 g	4 oz cwm	cool 4•C	28 days
Nitrate nitrogen	300.0	50 mls	500 ml HDPE	cool 4•C	48 hours
	300.0M	50 g	4 oz cwm	cool 4•C	48 hours
Nitrite nitrogen	300.0	50 mls	500 ml HDPE	cool 4•C	48 hours
	300.0M	50 g	4 oz cwm	cool 4•C	48 hours
Nitrate + Nitrite	300.0	50 mls	500 ml HDPE	H2SO4 pH<2	28 days
	300.0M	50 g	4 oz cwm	cool 4•C	28 days
Oil & Grease	EPA-1664	1 liter	1 liter amber	H2SO4 pH<2	28 days
Orthophosphate	300.0	50 mls	500 ml HDPE	cool 4•C	48 hours
	300.0M	50 g	4 oz cwm	cool 4•C	28 days
pH	150.1	50 mls	500 ml HDPE	cool 4•C	immediate
	9045	50 g	4 oz cwm	cool 4•C	28 days
Phenols	420.1	500 mls	1 liter amber	H2SO4 pH<2	28 days
	9066	50 g	4 oz cwm	cool 4•C	28 days

Phosphorus, total	365.1	50 mls	500 ml HDPE	H_2SO_4 pH<2	28 days

	365.1M	50 g	4 oz cwm	cool 4•C	28 days
Solids, total	160.3	100 mls	500 ml HDPE	cool 4•C	7 days
	160.3M	50 g	4 oz cwm	cool 4•C	28 days
Solids, dissolved	160.1	500 mls	500 ml HDPE	cool 4•C	7 days
Solids, suspended	160.2	500 mls	500 ml HDPE	cool 4•C	7 days
Solids, volatile	160.4	500 mls	500 ml HDPE	cool 4•C	7 days
Solids, settleable	160.5	1 liter	1 liter HDPE	cool 4•C	48 hours
Specific Conductance	120.1	100 mls	500 ml HDPE	cool 4•C	28 days
Sulfate	300.0	50 mls	500 ml HDPE	cool 4•C	28 days
	300.0M	50 g	4 oz cwm	cool 4•C	28 days
Sulfide	376.1/376.2	500 mls	500 ml HDPE	NaOH pH>9	7 days
	9030	100 g	4 oz cwm	cool 4•C	28 days
Sulfite	377.1	50 mls	500 ml HDPE	cool 4•C	immediate
Surfactants	425.1	250 mls	500 ml HDPE	cool 4•C	48 hours
Total Organic Carbon	415.1	25 mls	500 ml HDPE	H_2SO_4 pH<2	28 days
	9060	50 g	4 oz cwm	cool 4•C	28 days
Turbidity	180.1	100 mls	500 ml HDPE	cool 4•C	48 hours
KEY for abbreviations					
cwm= clear wide mouth (jar)					
VOA= volatile organic analysis					
HDPE= high density poly ethylene					
HCL= hydrochloric acid					
HNO3= nitric acid					
H2SO4= sulfuric acid					
NaOH= sodium hydroxide					

6.0 CALIBRATION PRACTICES

A formal calibration program controls instruments and equipment used by ALSEV. The program verifies that equipment is in proper working order and provides accurate and precise data compatible with specified requirements. All instruments and equipment which measure a quantity, or whose performance is expected at a stated level, are subject to calibration. Calibration may be

performed by ALSEV personnel using reference standards, or externally by calibration agencies or equipment manufacturers.

Two types of calibration are discussed in this section:

- Operational calibration routinely performed as part of instrument usage, such as the development of a standard curve for use with a gas chromatograph. Operational calibration is generally performed for instrument systems.

- Periodic calibration that is performed at prescribed intervals for equipment, such as balances and ovens. In general, equipment that can be calibrated periodically is a distinct, singular purpose unit and is relatively stable in performance.

6.1 CALIBRATION SYSTEM

Following is a discussion of the elements comprising the calibration system.

6.1.1 Equipment Identification

Equipment that is subject to calibration shall be uniquely identified so that calibration records can be designated with a specific instrument. Equipment identification shall be by manufacturer, type, usage and a unique number assigned by ALSEV.

6.1.2 Calibration Frequency

Instruments and equipment shall be calibrated at prescribed intervals and/or as part of the operational use of the equipment. Frequency shall be based on the type of equipment, inherent stability, manufacturer's recommendations, values provided in recognized standards, intended data use, specified analytical methods, effect of error upon the measurement process, and prior experience.

6.1.3 Calibration Reference Standards

Two types of reference standards are used within ALSEV for calibration:

- Physical standards, such as weights for calibrating balances and certified thermometers for calibrating working thermometers and ovens, which are generally used for periodic calibration.

- Chemical standards such as Standard Reference Materials (SRMs) provided by the National Institute of Standards and Technology (NIST) or

purchased from commercial sources. These may include vendor certified materials traceable to NIST or EPA SRMs. These are primarily used for operational calibration.

Whenever possible, physical reference standards shall have known relationships to nationally recognized standards (e.g., NIST) or accepted values of natural physical constants.

Physical reference standards shall be used only for calibration and shall be stored separately from equipment used in analyses. In general, physical standards should be recalibrated every three years by a certified external agency.

6.1.4 Calibration Failure

Equipment that fails calibration or becomes inoperable during use shall be removed from service. If more than one employee uses the equipment or instrument, the unit shall be segregated to prevent inadvertent use, or shall be tagged to indicate it is out of calibration. Such equipment shall be repaired and satisfactorily recalibrated before reuse.

Scheduled calibration of equipment does not relieve the laboratory staff of the responsibility for using properly functioning equipment. If an equipment malfunction is suspected, the equipment shall be removed from service and recalibrated. If it fails recalibration, the above process shall apply.

6.1.5 Calibration Records

Records shall be prepared and maintained for each piece of equipment subject to calibration.

Records for periodically calibrated equipment shall include, as appropriate:

- Identification number of equipment and type of equipment, or assigned unique equipment number.
- Calibration frequency and acceptable tolerances.
- Identification of calibration procedure used.
- Date calibration was performed.
- Identity of ALSEV personnel and/or external agencies performing calibration.

- Calibration data.
- Certificates or statements of calibration provided by manufacturers and external agencies, and traceability to national standards.
- Information regarding calibration acceptance or failure and any repair of failed equipment.

Records for periodically calibrated equipment shall be recorded in the Laboratory Periodic Calibration records.

For instruments and equipment that are calibrated on an operational basis, calibration generally consists of determining instrumental response against compounds of known composition and concentration or the preparation of a standard response curve of the same compound at different concentrations. Records of these calibrations can be maintained in several ways:

- The calibration data can be kept with analytical sequence data (Analytical Series)
- A logbook can be prepared for each instrument that contains all calibration data

The files for the analytical series shall be stored in the Operations Records section of the Calibration Records area within the file storage area. If logbook calibration is used, the current logbook shall be maintained by the appropriate instrument. The logbook shall be titled and dated. Completed logbooks shall be maintained in a central logbook storage area. All entries in either record system shall be signed and dated by the analyst.

6.2 OPERATIONAL CALIBRATION

Operational calibration is generally performed as part of the analytical procedure. Included may be the analysis of a method blank and the preparation of a standard response (standard calibration) curve. Operational calibration is dependent upon the type of instrumentation.

Following is a brief discussion of the analysis of method blanks and preparation of standard curves. Guidelines for the major instrument systems within ALSEV follow. (See also Table 6-1.)

6.2.1 General Calibration Procedures

The initial phase of a laboratory testing program requires the selection and

certification of the method best suited for an individual parameter. Certification, or verification, is the elimination, or minimizing, of determinate errors which may be due to Analyst error, the use of less-than-optimum equipment, reagents, solvents, or gases. The quality of materials, even though they are AR grade or better, may vary from one source to another. The Analyst must determine, through the use of reagent and/or solvent blanks, if materials are free from interfering substances which could affect the analysis. Other steps in certifying the method include the determination of a method blank and the preparation of a standard calibration curve.

6.2.1.1 Method Blank

The method blank is prepared by following the procedure step by step, including the addition of all of the reagents and solvents, in the quantity required by the method to analyte free soil or water. If this cumulative blank interferes with the determination, steps must be taken to eliminate or reduce the interference to a level that will permit the combination of solvents and reagents to be used. If the blank interference cannot be eliminated, the magnitude of the interference must be considered when calculating the concentration of specific constituents in the samples analyzed.

A method blank should be determined whenever an analysis batch is performed. The number of blanks is determined by the method of analysis and the number of samples analyzed at a given time. (See also Section 8.1.4.)

6.2.1.2 Preparation of Standard Calibration Curve

Concurrent with the preparation of reagent and/or method blanks, a standard calibration curve is prepared for the instrumentation. Preparation of a standard calibration curve is accomplished by using calibration standards. The process is summarized as:

- Calibration standards are prepared by mixing the species to be analyzed into the solvent that is to be introduced into the instrument.
- The concentrations of the calibration standards are chosen to cover the working range of the instrument.
- All sample measurements are made within this working range.
- The calibration curve is generally prepared by plotting instrument response versus concentration of the species analyzed.
- Concentrations of the sample, prepared with the same procedure, are read

directly from the calibration curve or determined by interpolation.

6.2.2 Instrument Calibration Procedures

This section outlines the minimum operations necessary to satisfy analytical requirements associated with the determination of specific parameters in water, soil/sediment, and hazardous waste samples. Table 6-1 presents summary calibration requirements for analytical instrumentation. Specific methods may have slightly different requirements.

6.3 PERIODIC CALIBRATION

Periodic calibration shall be performed for equipment such as balances, thermometers, ovens, and furnaces that are required in analytical methods, but which are not routinely calibrated as part of the analytical procedure. Documentation of calibration shall be kept for each equipment item as discussed in Section 6.1.5. (See Figure 6-1)

Table 6-2 lists periodic calibration procedures for common laboratory equipment. Following are brief example discussions for the calibration of balances and thermometers with examples of calibration data sheets.

6.3.1 Balances

Verification of balance calibration shall be conducted at least every six months using weights traceable to the National Bureau of Standards (NIST). Calibration weights shall be Class S (or equivalent) or better. If balances are calibrated by an external agency, verification of their weights shall be provided.

Calibration of balances shall be to approximately 95 percent of balance capacity. Testing intervals over the operational range of the balance shall be approximately 5, 10, 15, 20, 25, 30, 40, 50, 60, 70, 80, 90 and 95 percent of capacity. Acceptance for balances which are direct reading to 0.01 gram shall be ±0.01 g for 0 to 100 g and ±0.1 percent of the applied weight over 100 g. In addition, balances shall be checked daily at, as a minimum, two weights bracketing the range of use during that day. Weights utilized for the daily calibration should be varied within the operating range of the balance. Daily checks must be accurate to 0.1 percent.

Figure 6-2 provides an example data sheet that can be used for balance calibration. Figure 6-3 provides a data form that can be used for calibration weight certification.

6.3.2 Thermometers

Certified, or reference, thermometers shall be maintained for use in calibrating

working thermometers. Reference thermometers shall be provided with NIST traceability for initial calibration. Reference thermometers shall be recertified every three years with equipment directly traceable to the NIST or replaced.

Working thermometers shall be compared with the reference thermometers every 12 months. In addition, working thermometers shall be visually inspected by laboratory personnel prior to use.

Either working thermometers or reference thermometers may be used for periodic calibration and other laboratory tasks.

Calibration temperatures and acceptance criteria for working thermometers shall be based upon the working range of the thermometer and the accuracy required for its use.

Figure 6-4 shows an example of a calibration record sheet for thermometer calibration.

6.3.3 Refrigerators and Ovens

Refrigerators and ovens that have temperature requirements shall have their temperatures monitored each day they are in operation. Examples would include sample storage refrigerators, moisture drying ovens, TDS ovens, and the like.

It is suggested that a thermometer be placed in the equipment to be monitored at all times. The thermometer should be immersed in either sand or water, as appropriate, as the temperature is recorded. The temperature should be recorded in a Refrigerator and Oven calibration log. Figure 6.5 shows an example of a calibration record sheet for refrigerators and ovens.

FIGURE 6-1

EXAMPLE - LABORATORY EQUIPMENT CALIBRATION RECORD

ALS ENVIRONMENTAL
LABORATORY EQUIPMENT CALIBRATION RECORD

EQUIPMENT NUMBER

EQUIPMENT NAME

REQUIRED CALIBRATION PERIOD

Date Performed	Calibration/Inspection Performed By	Date Performed	Calibration/Inspection Performed By

FIGURE 6-2

EXAMPLE - BALANCE CALIBRATION FORM

ALS ENVIRONMENTAL
QUARTERLY BALANCE CALIBRATION

Equipment Number

Equipment Name

Date | Date Last Calibrated

Weights Applied to Balance	Balance Reading	Does Balance Meet Standard	Weights Applied to Balance	Balance Reading	Does Balance Meet Standard

Signed _____

FIGURE 6-3

EXAMPLE - WEIGHT CERTIFICATION RECORD

WEIGHT CALIBRATION BY EXTERNAL AGENCY*					
Equipment Number					
Equipment Name					
Weight Class					
Name of External Agency Performing Calibration					
Date					
Provide in the table below the labeled weights versus the certified weight determination. All certification records are to be attached to this form.					
Weight as Labeled	Weight as Certified	Does Weight Meet Class Standard?	Weight as Labeled	Weight as Certified	Does Weight Meet Class Standard?

* Weight calibration is to be performed every three years.

FIGURE 6-4

EXAMPLE - THERMOMETER CALIBRATION RECORD

ANNUAL THERMOMETER CALIBRATION		
Equipment Number		
Equipment Name		
Date	Date Last Calibrated	
Temperature According to Reference	Thermometer Being Calibrated	Correction Factor

Signed_____

FIGURE 6-5

EXAMPLE - LABORATORY TEMPERATURE RECORD

REFRIGERATOR, OVEN, & TEMPERATURE DEVICE CALIBRATION RECORD											
EQUIPMENT NAME:						**THERMOMETER BIAS:**					
EQUIPMENT NUMBER: Daily when in use						**ACCEPTANCE CRITERIA:**					
REQUIRED CALIBRATION PERIOD:											
Temp.	Date/ Intl	Pass	Temp.	Date/ Intl	Pass	Temp.	Date/ Intl	Pass	Temp.	Date/ Intl	Pass

Instructions: Record correct temperature (thermometer reading +/- thermometer bias) in degrees C.

TABLE 6.1
SUMMARY OF CRITICAL OPERATIONAL CALIBRATION REQUIREMENTS

Instrument	Calibration Standards Used, Initial & Daily Minimum		Acceptance Limits	Corrective Actions	Ref
Atomic Absorption Spectrophotometer	Initial: Continuing:	3 levels + blank 1 check standard per 10 samples	Linear regression coefficient >.995; □20% of true value	Make new standards or establish new calibration curve	1
Gas Chromatograph	Initial: Continuing:	5 levels 1 level check standard	Calibration factor % RSD < 20% or linear regression coefficient >.990 15% of expected value	Make new standards, or establish new calibration curve	1
Inductively Coupled Emission Spectrophotometer	Initial Daily	Manufacturer's instructions Check standard and calibration blank	10% of expected value and blank w/i 3 standard deviations of limits	Establish new curve and or make new standards	1
Ion Chromatograph	Initial: Daily:	3 levels 1 level of check standards every 20 samples	□10% of expected value	Make new standards Recalibrate	

TABLE 6.1
SUMMARY OF CRITICAL OPERATIONAL CALIBRATION REQUIREMENTS

Instrument	Calibration Standards Used, Initial & Daily Minimum		Acceptance Limits	Corrective Actions	Ref
pH Meter	Daily:	2 levels	□0.1 pH unit	Clean or replace electrode or recalibrate	1
UV-Visible Spectrophotometer	Initial: Daily:	3 levels Check standard	□10% of original curve	Make new standards and/or curve	
Infrared Spectrophotometer	Initial: Daily:	5 levels 1 level of check standard	Curve agrees w/i 10% of expected value 10% of expected value	Make new standards and/or curve	2
Total Organic Carbon	Daily:	3 levels	□10% of expected curve	Make new standards and/or curve	1
Total Organic Halogen	Daily:	3 levels + blank	□10% of original curve	Make new standards	1

1. EPA SW-846, "Test Methods for Evaluating Solid Waste"

2. Washington State Department of Ecology, Guidance for Remediation of Releases from Underground Storage Tanks, Appendix L, 4-92

TABLE 6.2
SUMMARY OF PERIODIC CALIBRATION REQUIREMENTS

Instrument	Calibration Frequency		Acceptance Limit	Corrective Actions
Analytical Balance	Daily: Quarterly:	Sensitivity (with a Class "S" weight) Class "S" weights Check	0.001 gm	Service
Autoclaves and Sterilizers	(a) Sterilization effectiveness check daily			Service
	(b) Temperature-recording device calibrated semi-annually			Service
	(c) Automatic timing mechanism checked monthly		□0.5 minutes	Service
Thermometers	Calibrate in constant temperature baths at two temperatures against precision thermometers certified by NIST annually		Correct to +/- .5EC of reference thermometer	Remove or normalize
Pipettors	Gravimetric check quarterly		High volume (>100 µL): #1.0% relative error & RSD Low volume (<100 µL): #2.0% relative error & RSD	Service or replacement

7.0 PREVENTIVE MAINTENANCE

Within ALSEV, preventive maintenance is an organized program of actions (such as equipment cleaning, lubricating, reconditioning, adjustment and/or testing) taken to maintain proper instrument and equipment performance and to prevent instruments and equipment from failing during use. A preventive maintenance program considers the following:

- Instruments, equipment, and parts that are subject to wear, deterioration, or other change in operational characteristics without periodic maintenance
- Spare parts that should be available within the laboratory to minimize downtime
- Frequency that maintenance is required

Within the laboratory, the Laboratory Director or Quality Control Director is responsible for preparation and documentation of the program and verification of compliance. Chemists and Analysts shall implement the program.

The ALSEV preventive maintenance program shall include the following:

- Guidance document listing normal preventive maintenance items retained and frequency (Table 7-1 and Figures 7-3 through 7-9)
- A listing of the instruments and equipment that are included in the program
- For each instrument in the program provide:
  - A list of spare parts maintained by the laboratory (Figure 7-1)
  - External service contacts
- Records to document and describe preventive maintenance operations. The record of general maintenance can be documented using Figure 7-2 or maintained in a logbook. Comments should note symptoms, corrective actions, any parts which were replaced, observed deterioration, etc.

FIGURE 7-1

EXAMPLE - SPARE PARTS INVENTORY

SPARE PARTS INVENTORY

Qty	Description	Vendor	Part #

Service Contract in Effect: _____

Service Contact Company: _____

Service Contact Phone # _____

FIGURE 7-2

EXAMPLE - PREVENTIVE MAINTENANCE RECORD

ALS ENVIRONMENTAL

Instrument _____

Serial Number _____

Maintenance Frequency _____

Maintenance Performed By	Date	Comment

FIGURE 7-3

EXAMPLE - pH METER/SIE

PREVENTIVE MAINTENANCE RECORD

pH METER SIE

Maintenance Performed	Date/Initials				
Clean Electrode					
Calibrate/ Check Slope					

Clean Electrode Each Use

Check Slope Each Use

FIGURE 7-4

EXAMPLE - CONDUCTIVITY METER

PREVENTIVE MAINTENANCE RECORD

CONDUCTIVITY METER

Maintenance Performed	Date/Initials				
Clean Cell					
Meter Span Check					

Clean Cell Each Use

Meter Span Check Monthly

FIGURE 7-5

ICP/MS

PREVENTIVE MAINTENANCE RECORD

Maintenance Performed	Date/Initials				
Clean Torch Head					
Empty Waste Receptacle					
Clean Nebulizer Chamber					
Check Coolant level					
Gases Checked					
Air Filter Cleaned					

Torch Cleaned Each Use

Waste Reservoir Emptied as Needed

Nebulizer Chamber Cleaned Weekly

Optics Cleaned by Contract Personnel

Gases Checked Each Change of Tank

Air Filters Cleaned Quarterly

Pump Tubing Changed as Needed

FIGURE 7-6

EXAMPLE - GC PREVENTIVE MAINTENANCE RECORD

GC PREVENTIVE MAINTENANCE

Maintenance Performed	Date/Initials				
Detector Cleaned					
Septa Changed					
Gases Changed					
Other (Specify)					

Detector Cleaned as Needed

Septa Changed as Needed

Gases Changed as Needed

Other as Needed

FIGURE 7-7

EXAMPLE - GC/MS PREVENTIVE MAINTENANCE RECORD

GC/MS PREVENTIVE MAINTENANCE

Maintenance Performed	Date/Initials				
Source Cleaned					
Septa Changed					
Pump Oil Changed					
Gases Changed					
Other (Specify)					

Source Cleaned as Needed

Septa Changed as Needed

Turbo Oil Changed Quarterly

Pump Oil Changed Quarterly

Gases Changed as Needed

Others as Needed

FIGURE 7-8

EXAMPLE - SPECTROPHOTOMETER PREVENTIVE MAINTENANCE RECORD

SPECTROPHOTOMETER MAINTENANCE FORM

Maintenance Performed	Date/Initials				
Lamp Changed					
Wavelength Checked					
Cell Changed/ Cleaned					
Service					

Lamp Changed as Needed

Wavelength Checked Quarterly

Cell Changed/Cleaned as Needed

Service as Needed

TABLE 7-1
ADDITIONAL PREVENTIVE MAINTENANCE GUIDANCE

Instrument	Item Checked/Serviced	Frequency
Inductively Coupled Plasma Spectrophotometer	Sample introduction system Clean burner heads Check pumps Check electronics Clean nebulizer Clean mixing chamber Check nebulizer press Replace pump tubing Clean air filters	Daily Daily Daily Daily Monthly Monthly Monthly Monthly Monthly
Ion Chromatograph	Change plunger seals Check plumbing Oil pumps Check filter (inlet) Change column Check bed support Change fuses Change pump motor Replace plunger seals Clean check valve Clean, replace solvent reservoir filter Degas pump head Clean, replace cell packing, degas floor cell	Six months Daily Weekly (leak check monthly) Weekly Replaced < 2 weeks Change when pressure drops As needed As needed Semi annually Semi annually Semi annually As needed As needed or quarterly
Refrigerators Walk-in Coolers	Temperature checked and logged Temperature checked and logged	Daily Daily
Deionized/ Organopure Water	Conductivity check Ion exchange bed changed Replace filters	Daily As needed As needed
Vacuum Pumps and Air Compressor	Drain Condensate Lubrication, belts, etc.	Weekly As needed
Analytical Balance	Internal Weight Train, Gears, Electronics	Annual service

TABLE 7-1
ADDITIONAL PREVENTIVE MAINTENANCE GUIDANCE

GC/MS	GC/MS maintenance is the same as GC with the following additions:	
	Diffusion pump oil Mechanical pump oil Computer air filter Source-clean ceramics, polish lenses Clean poles and ceramics on the poles Clean contacts on the component boards Vacuum the component boards Clean all fan screens Vacuum outside of instrument Replace septum Injection port liner checked Column maintenance Defragment Disk Drive	Bi-weekly Quarterly As needed As needed As needed As needed As needed As needed As needed Daily (each shift) Daily As needed Monthly
Infrared Spectrophotometer	Clean cells	Daily
pH Meter	Electronics checked Electrolyte changed	Daily Checked weekly, change when low
Total Organic Carbon Instrument	Check oxygen purity Check heater Add phosphoric acid	Each new cylinder Monthly
UV/VIS Spectrophotometer	Lamp Wavelength checked Serviced	As needed Quarterly As needed
HPLC	Filters Pump drives	Monthly Quarterly

8.0 ANALYSIS OF QUALITY CONTROL SAMPLES

This section discusses samples which are routinely added to the normal laboratory sample stream to demonstrate that the laboratory is operating within prescribed requirements for accuracy and precision. Quality control samples are of known content and concentration (with the exception of field blanks) so that accuracy and precision can be determined and control limits can be prepared. As used in this document and in analytical laboratories the following definitions will hold true:

Accuracy: The degree of agreement of a measurement (or an average of measurements of the same thing), X, with an accepted reference or true value, T, 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, and sometimes expressed as a ratio, X/T. Accuracy is a measure of the bias and/or random error inherent in the system.

Precision: A measure of mutual agreement (or variability) among individual measurements of the same property, usually under prescribed similar conditions. Precision is most desirably expressed in terms of the standard deviation but can be expressed in terms of the variance, range, or other statistic.

Bias: A systematic (consistent) error in test results. The difference between the population mean and the true or reference value, or as estimated from sample statistics, the difference between the sample average and the reference value. An example of bias would be control chart values being consistently high or consistently low due to one or more reasons.

Random Error: Variations of repeated measurements that are random in nature and individually not predictable.

Table 8.1 summarizes the quality control samples which are analyzed at ALSEV. Included in the table are:

- Type of sample.
- Purpose of the sample.
- General frequency with which the sample is to be analyzed within the normal sample stream.

- Applicability of the sample to organic or inorganic analyses, with a citation if the sample is for GC/MS analysis only.

- Whether the sample is used for the statistical evaluation of accuracy and/or precision.

- Person responsible for introducing the quality control sample into the sample stream. If the sample is introduced by the Quality Control Director, the content and/or concentration of the sample and its occurrence are unknown to the Analyst. Samples unknown to the Analyst provide independent verification of laboratory operation.

Following is a discussion of the major types of quality control samples. Quality Control samples will be analyzed as recommended herein, unless analytical procedures prescribe specific sample analysis. Not all QC samples will be analyzed with each batch but, as a minimum each batch must contain a blank and samples documenting precision and accuracy. Additionally, surrogate standards will be analyzed with all appropriate analyses. If the procedure is specific, the procedural requirements will be met.

Section 10.1 presents the statistical analysis of these samples.

8.1 TYPES OF QUALITY CONTROL SAMPLES

Type of Quality Control Sample	SectionNo.
Trip Blank Analyses	8.1.1
Field Blank Analyses	8.1.2
Rinsate Blank Analyses	8.1.3
Method Blank Analyses	8.1.4
Reagent Blank Analyses	8.1.5
Bottle Blank Analyses	8.1.6
Duplicate Sample Analyses	8.1.7
Continuing Calibration Std (Check Standard Analyses)	8.1.8
Surrogate Standard Analyses	8.1.9
Laboratory Matrix Spike Analyses	8.1.10
Laboratory Matrix Spike Duplicate Analyses	8.1.11
Verification Analyses	8.1.12
Blank Spike Analyses	8.1.13
Standard Reference Material	8.1.14
Replicated Sample Analyses	8.1.15
	8.1.16

Split Sample Analyses 8.1.16

8.1.1 Trip (Travel) Blank Analyses

Volatile organics samples are susceptible to contamination by diffusion of organic contaminants through the Teflon-faced silicone rubber septum of the sample vial; therefore, trip blanks (also referred to as travel blanks) shall be analyzed to monitor for possible sample contamination during shipment. Trip blanks will be prepared by filling two hydrochloric acid preserved VOA vials (40 ml) with organic-free water and shipping the blanks with the field kit. Trip blanks accompany the sample bottles through collection and shipment to the laboratory and are stored with the samples. Following the analyses, if the trip blanks indicate possible contamination of the samples, the sample group will be evaluated to determine the nature and extent of the contamination. The client should be notified and appropriate action discussed. Results of trip blank analyses should be maintained with the corresponding sample analytical data in the project file.

8.1.2 Field Blank Analyses

A field blank is a volume of water (or soil) that is provided by the sample collectors to demonstrate the absence of contamination during sampling. Analyte-free water or soil is placed into sample containers by the sample collection crew, packaged, and shipped with the other field samples. If analysis of the field blanks indicates possible contamination of the samples the client shall be notified and appropriate actions discussed. Contamination sources to be checked include: Containers, sample storage facilities, field handling procedures, sampling tools (also see rinsate blanks). Results should be maintained with the corresponding sample analytical data in the project file.

8.1.3 Rinsate Blank Analyses

A rinsate blank is a volume of rinse solution used to rinse a sampling tool which contacts multiple samples. The rinse solution is collected after the tool has collected a sample and has been cleaned, to demonstrate that there is no residual contamination remaining on the tool to carry over into the next sample. If the rinsate blank indicates possible contamination of the succeeding samples, the client shall be notified and appropriate actions discussed. Results of rinsate blank analyses should be maintained with the corresponding sample analytical data in the project file.

8.1.4 Method Blank Analyses

A method blank is a volume of analyte-free water for water samples, or a purified solid matrix for soil/sediment samples carried through the entire analytical procedure. The volume or weight of the blank must be approximately equal to the sample volume or sample weight processed. A method blank should be performed with each group of samples. Analysis of the blank verifies that method interferences caused by contaminants in solvents, reagents, glassware, and other sample processing hardware are known and minimized. A method blank should contain less than the reporting limit for the parameter. Results of method blank analyses should be maintained with the corresponding analytical data in the project file or analytical series. (See also Section 6.2.1.1.) Method blank results should be summarized on the quality control data summary sheet.

8.1.5 Reagent Blank Analyses

A reagent blank is composed of the materials which will be added to samples during preparation, and then will be analyzed for specific parameters. It is run prior to the use of the materials on "real" samples, to verify that no contaminants are present at levels which would affect sample results. If such contaminants are found, corrective actions must be taken. Records of reagent blanks, including solvent lots and column adsorbent test results, are stored in Quality Operation files. The reagent blank may be run as a method blank with client samples, but if contamination is present, samples will require reanalysis with a clean blank demonstrating reagent purity.

8.1.6 Bottle Blank Analyses

At a frequency of 1 percent or greater, laboratory-prepared sample containers are tested to verify that the glassware cleaning procedure is performed acceptably. Parameters of concern for the particular container are tested (metals for plastic containers, organics for glass, etc.). Vendors must supply certificate of cleanliness for purchased, pre-cleaned, containers. If certified, pre-cleaned containers are purchased, bottle blanks will not routinely be performed.

8.1.7 Duplicate Sample Analyses

Duplicate analyses are performed to evaluate the precision of an analysis. Results of the duplicate analyses are used to determine the relative percent difference between replicate samples. Criteria for evaluating duplicate sample results are provided in Section 10.1. A duplicate analysis should be performed at a rate of at least one per analytical batch or as specified in the method, whichever is greater. Duplicate analysis data should be maintained in the appropriate project file. RPD criteria and results should be summarized on the quality control data summary sheet.

8.1.8 Continuing Calibration Standard (Check Standard Analyses)

Because standards and calibration curves are subject to change and can vary from day to day, a midpoint standard or check standard should be analyzed with each group of samples. Analysis of this standard is necessary to verify the standard curve and may serve in some cases as sufficient for calibration. Continuing calibration standards shall be performed, as appropriate, at the rate of at least one in every twenty samples and usually of the rate of one every ten samples. All calibration standards will be made traceable through laboratory records through the use of extraction logbooks or run/sequence logs.

8.1.9 Surrogate Standard Analyses

Surrogate standard determinations should be performed on all samples and blanks for GC/MS and certain GC analyses. All samples and blanks are fortified with surrogate spiking compounds before purging or extraction to monitor preparation and analysis of samples. Recoveries should meet governing agency criteria which are established or be within laboratory control limits. Surrogate standard data should be maintained, as appropriate, in either the analytical series or project file.

8.1.10 Laboratory Matrix Spike Analyses

To evaluate the effect of the sample matrix upon analytical methodology, a separate sample aliquot may be spiked with the analyte of interest and analyzed with the sample. The percent recovery for the respective compound will then be calculated. If the percent recovery falls outside established quality control limits the data shall be evaluated and possible causes investigated. Matrix spike results should be summarized on the quality control data summary sheet. This type of matrix spike does not necessarily reflect the behavior of the field-collected target analyte, especially if the target analyte is not stable during shipping or storage.

8.1.11 Laboratory Matrix Spike Duplicate Analyses

Similar in concept to the matrix spike sample above, it is a separate aliquot sample that is spiked with the analyte(s) of interest and analyzed with the associated sample and sample matrix spike. If the percent recovery falls outside established quality control limits, that data should be evaluated and possible causes investigated. The comparison of the recoveries of the spiked compounds in the matrix spike and the matrix spike duplicate samples is made to determine the relative percent difference between the MS/MSD samples. RPD criteria and results should be summarized on the quality control data summary sheet. If insufficient sample is received for analysis, MS/MSD will not be performed.

8.1.12 Verification Analyses

On a semiannual basis, the Quality Control Director or Laboratory Director will introduce a group of prepared or purchased verification samples into the analytical testing regime. These samples may be represented by Performance Evaluation samples. Results of these data will be summarized, evaluated, and presented to laboratory management for review and corrective actions, if appropriate. The data are reported to and summarized by the Laboratory Director or designee.

8.1.13 Blank Spike Analyses

A blank spike is a volume of analyte-free water for water samples, or a purified solid matrix for soil/sediment samples which is spiked with parameters of interest and carried through the entire analytical procedure. Analysis of this sample with acceptable recoveries of spiked materials demonstrates that the laboratory techniques for this method are in control. This sample is recommended in conjunction with matrix spike/matrix spike duplicate (MS/MSD) samples on those sample matrices which are anticipated to cause analytical difficulties due to matrix interferences. If the MS/MSD pair shows poor recoveries due to interferences, yet the blank spike sample is acceptable, this is strong evidence that the method has been performed correctly by the laboratory for these samples, but matrix interferences have affected the results of the analysis sample. Results of blank spike analyses should be maintained with the corresponding analytical series file. Client requirements will dictate the list of spike compounds evaluated in a Laboratory Control Sample. Unless specified in the associated SOP, all compounds will be included in the Blank Spike sample.

8.1.14 Standard Reference Material

A purchased or laboratory prepared standard with known concentrations of specific analytes. This material also has statistically derived analyte acceptance ranges. These samples are used to verify the accuracy of an analysis. They are used in situations where a spiked sample is not possible or as an alternative to a spiked sample. As with a blank spike, this sample is recommended in conjunction with spike samples on those matrices that are likely to cause analytical difficulties due to matrix interferences.

8.1.15 Replicated Sample Analyses

A replicated sample is a sample that has been divided into two or more portions, at some step in the measurement process. Each portion is then carried through the remaining steps in the measurement process (see also duplicate sample 8.1.5).

8.1.16 Split Sample

A split sample is a sample divided into two portions, one of which is sent to a

different organization or laboratory and subjected to the same environmental conditions and steps in the measurement process as the one retained.

A replicated or split sample can be divided into portions (or split) at different points in the sampling and analysis process to obtain precision information on the various components of the measurement system. For example, a field replicated, or field split sample, provides precision information about all steps after sample acquisition including effects of storage shipment, analysis, and data processing; whereas, information on the intra- and inter-laboratory precision of sample preparation and analysis steps of the measurement system is provided by samples subdivided once they are received in the laboratory, i.e., laboratory replicated or laboratory split samples, respectively. A sample divided into two portions just prior to analysis, i.e., an analysis replicate, provides information on the precision of the analytical instrumentation. The replicated sample can provide short-term or long-term precision estimates by processing the two portions together or separating them for processing at different times and under different conditions as discussed above for collocated samples.

8.2 PERFORMANCE EVALUATION SAMPLES

On a semi annual basis or more often, ALSEV will participate in a national level Performance Evaluation program. Samples for this program will be received as blind samples and analyzed by the laboratory. Results will be sent to the sponsoring body and a statistical evaluation performed on all participating laboratories' results. The results of the statistical evaluation will be evaluated by the Laboratory Director and members of the laboratory team. Unacceptable results will be evaluated and corrected as necessary.

8.3 QUALITY CONTROL LEVELS

There are several types of Quality Control samples which may be applied to different projects at varying frequencies; these may also be reported in summary fashion or in detail with all raw and associated data provided. This section describes the QC reporting levels available from ALSEV and their applications. When different, method required QC will take priority over general ALSEV QC levels.

Level 1 - ALSEV standard practice. Use appropriate analytical procedures. Fifteen percent Quality Control samples (blank, spike and/or surrogate as applicable, duplicate for every 20 samples). Quality Control samples will not necessarily be performed for a specific project, but rather as part of compiled sets of samples. Surrogate spikes, as applicable, are reported with the data report. Additional Quality Control data are not necessarily reported as part of analytical results.

Level II - Use appropriate analytical (reference) methods. Fifteen percent Quality

Control samples (blank, spike and/or surrogate as possible, duplicate for every 20 samples). Quality Control summary report including surrogate spike recoveries, method blank results, duplicate sample results and spike sample results is issued as part of the analytical results reported. No raw data are included.

Level III - This level requires use of referenced regulatory procedures and/or established/ verified procedures. Fifteen percent Quality Control samples (blank, spike and/or surrogate as possible, duplicate for every 20 samples). Control samples are project or client specific. A Quality Control summary report including surrogate spike recoveries, method blank results, duplicate sample results and spike sample results is supplied with supporting data. All raw data is included.

Level IV - The highest level requires use of referenced regulatory procedures and/or established/verified procedures. Fifteen percent Quality Control samples (blank, spike and/or surrogate as possible, duplicate for every 20 samples). Data deliverable package will follow EPA Contract Lab Program or contain similar type content.

Project-specific requirements must be defined in a specific Quality Assurance Project Plan or Work Plan. Project specific documentation must be submitted to the laboratory before beginning work. Project requirements for Quality Control samples cannot be less than Level I.

TABLE 8.1 QUALITY CONTROL SAMPLES						
Type	**Purpose of Sample**	**Frequency**	**Applicability**		**Accuracy & Precision Application**	**Introduced by Field Sampler/ Analyst/QC Director**
			Inorganic	**Organic**		
Trip Blank	40-ml VOA vial filled with organic free water and taken with field sample collection kit. Used to verify that contamination of soil/water VOA Samples have not occurred due to shipment and sample containers being in field.	As requested by Client		X	Accuracy	Supplier of Containers
Field Blank	A volume of "clean" collection media is added to the container to verify absence of field contamination. May be water, soil or other material.	Specified in Project Work Plan	X	X	Accuracy	Field Sampler
Rinsate Blank	Rinse of field sample collection equipment to verify cleanliness, eliminate carry-over of contamination to later samples.	Specified in Project Work Plan	X	X	Accuracy	Field Sampler

TABLE 8.1
QUALITY CONTROL SAMPLES

Type	Purpose of Sample	Frequency	Applicability		Accuracy & Precision Application	Introduced by Field Sampler/ Analyst/QC Director
			Inorganic	Organic		
Method Blank (Process Blank)	The analysis is performed using only the reagents and solvents used in the method. Determines cumulative interference. If interference cannot be eliminated, it must be considered when computations are performed.	With each group of samples.	X	X	Accuracy	Analyst
Reagent Blank	Determine the background of each reagent/solvent to be used in an analysis. Must use identical conditions to actual analyses including detection system. Background must not interfere with intended analyses.	Can be done as part of method blank, determine separately with each new batch of reagent/solvents.	X	X	Accuracy	Analyst
Bottle Blank	Rinse of cleaned sample container, analyzed prior to field shipment to demonstrate lack of contaminants.	At least 1% of each container batch; does not apply to vendor-certified containers.	X	X	Accuracy	QC Director or Shipping/ Receiving Clerk

TABLE 8.1
QUALITY CONTROL SAMPLES

Type	Purpose of Sample	Frequency	Applicability		Accuracy & Precision Application	Introduced by Field/Sampler Analyst/QC Director
			Inorganic	Organic		
Duplicate	An aliquot of a sample known to Analyst. Calculate Relative Percent Difference.	1 out of 20 or at least 1/analysis batch, whichever is greater.	X	X	Precision	Analyst
Check Standard	Analysis of standard with concentrations at midpoint or low end of standard curve to verify standard calibration curve.	Normally at the rate of 1 per 10 or at least 1/analysis batch, whichever is greater.	X	X	Accuracy	Analyst
Surrogate Standards	For GC/MS and GC analysis the addition of non-priority pollutants as spikes in standards, method blanks and samples.	All standards, method blanks, and samples.		X	Accuracy	Analyst
Spiked Samples (Laboratory Matrix Spikes)	A known concentration of a specific parameter is added to an aliquot of a sample with the matrix of interest. Percent recovery is determined and spike is compared against an unspiked aliquot.	As appropriate, 1 out of 20 or at least 1/analysis batch, whichever is greater.	X	X	Accuracy	Analyst

TABLE 8.1
QUALITY CONTROL SAMPLES

Type	Purpose of Sample	Frequency	Applicability		Accuracy & Precision Application	Introduced by Field Sampler/ Analyst/QC
			Inorganic	Organic		
Matrix Spike Duplicate	Percent recovery is determined and compared against matrix spike sample.	As appropriate, 1out of 20 or at least 1/analysis batch, whichever is greater.		X	Both	Analyst
Standard Reference Materials	Standards prepared by recognized external agency and used to determine performance of entire system, instrumentation and Analysts.	As appropriate, 1 out of 20 or at least 1/analysis batch, whichever is greater.	X	X	Accuracy	Analyst or QC Director
Blank Spike (Laboratory Control Sample)	Blank material spiked with parameters of interest. Recovery evaluated for proper execution of technique or analytical method.	As necessary, 1 out of 20 or at least 1/analysis batch, whichever is greater.		X	Accuracy	Analyst
Replicated Sample	Collected sample that has been split into two or more parts in the field, sent to the same laboratory for analysis.	5 percent recommended.	X	X	Precision	Field Sampler
Split Sample	Sample split into two or more portions, and sent to several laboratories for analysis.	1 percent recommended.	X	X	Precision	Field Sampler or QC Director

9.0 ANALYTICAL PROCEDURES

It shall be the intent of ALSEV to utilize industry-accepted methods whenever possible. Any deviation shall occur only after equivalency has been documented or after approval of the issuing agency. In-house methods or client-specified methods shall only be utilized when no other alternatives exist. All in-house or client-specified methods shall be well documented and have a corresponding SOP.

Analytical procedures for the analysis of samples include the following:

- Prescribed method for sample preparation, including observance of stated sample holding times (such as shown on Table 5.1) and necessary extractions, dilutions, etc.
- Instrument standardization, including calibration and preventive maintenance
- Analytical techniques to be used in processing the sample
- Applicable method specific Quality Control issues
- Method for computation of analytical results, which can be included on the data sheet

9.1 ANALYTICAL METHODS

Whenever possible, ALSEV will utilize industry-recognized analytical methods from source documents published by agencies such as the U.S. Environmental Protection Agency (USEPA), Washington Department of Ecology (WDOE) and American Society for Testing and Materials (ASTM).

9.2 DETECTION LIMITS AND PRACTICAL QUANTITATION LIMITS

The method detection limit (MDL) of a method is generally defined as the smallest amount of an analyte a method can reliably detect when the sample containing the analyte is processed through the entire preparation and analysis procedure. Analytes present in concentrations below the detection limit WILL NOT appear as present in the sample when using this analytical technique. Detection limits will generally be calculated using the procedure set forth in 40 CFR Part 136 Appendix B.

The practical quantitation level (PQL)) of a method is generally defined as the smallest amount of an analyte a method can reliably detect and quantitate when

the sample containing the analyte is processed through the entire preparation and analysis procedure. The PQL is normally the MDL multiplied by a factor. It is the policy of ALSEV to multiply the MDL by a factor of 3 to obtain the PQL. The PQL may also be set equal to the concentration of the low calibration standard taken through any extraction and dilution calculations.

The MDL and PQL are normally obtainable in a clean water matrix. It is important to remember that specific detection limits are highly matrix dependent and may not always be obtainable for actual samples. In addition, factors such as dilution or sample cleanup technique will affect detection limits.

In cases where the regulatory threshold is sufficiently high, it will be the practice of ALSEV to report practical quantitation limits for a parameter rather than method detection limits. A result obtained at a concentration less than the PQL shall be reported as not detected (ND) followed by a less than value (<) and the PQL (or MDL) quantity. This less than value does not indicate that an analyte is not present in a sample but only that it is present at levels below the reporting limit.

9.3 VARIANCE FROM STATED ANALYTICAL METHODS

Analyses will be performed in accordance with the methods cited herein unless specific project requirements or needs dictate adoption of an alternate method or modification of the cited methods.

If analysis is performed in an alternate manner, the method shall be documented in the project records as discussed in Section 12.1 of this manual.

10.0 DATA VERIFICATION

Data verification represents the steps taken within an analytical laboratory so that reported results correctly represent the analyses performed. There are two basic verification activities:

- The processing of quality control sample results to demonstrate that analyses are within laboratory-prescribed bounds for accuracy, precision, and completeness

- Data review to demonstrate that numerical computation of data is correct and that it is correctly reported

This section discusses how data verification is performed. Section 12.0 discusses maintenance of resulting records.

10.1 PROCESSING OF QUALITY CONTROL DATA

This section discusses the analytical treatment of the data resulting from the quality control samples discussed in Section 8.0.

10.1.1 Specific Routine Procedures Used to Assess Data Precision and Accuracy

Following are the procedures recommended for evaluating the precision and accuracy of all data generated within ALSEV. Quality Control sample analyses are performed as appropriate for organic or inorganic sample analyses as discussed in Section 8.0. A sample group or sample set shall be defined as 20 samples or samples extracted within a 7 day period, whichever is more frequent. The protocol used will be in accordance with specific analytical procedures if quality control requirements are stated in the procedure.

- A reagent and/or method blank is prepared and analyzed on each extraction day

- Field and trip blanks are analyzed to determine possible sample contamination during collection and shipment to the laboratory. Trip blanks are applicable to volatile organics analysis (VOA) where volatile contaminants can be introduced from ambient air during shipment. These samples must be submitted by field personnel.

- Rinsate blanks from the field are analyzed to show sampling equipment was properly cleaned between samples. These samples must be supplied by field personnel.

- A daily calibration curve consisting of at least three standards and a reagent blank, or as specified in the method, is prepared for each parameter. If the standard curve is known to be stable, the standard curve can be verified daily by the analysis of a check standard (continuing calibration standard).

- One sample in every sample set is analyzed in duplicate, or as a matrix sample duplicate

- One sample in every sample set is spiked at a level, as possible, equal to the expected concentrations of the samples. For applicable organic analyses performed in accordance with certain methods, surrogates may take the place of spikes.

- Verification or Performance Evaluation (PE) Samples are introduced at least semi-annually into the testing scheme as blind samples, by the Laboratory Director or Quality Control Director to evaluate the accuracy of standards, the testing procedure, and the Analyst's performance

- Standard Reference Materials (SRMs) are introduced periodically into the testing scheme as verification or reference standards, by the Laboratory Director or Quality Control Director to evaluate the accuracy of standards, the testing procedure, and the Analyst's performance

- A blank spike (or Laboratory Control Sample) consisting of analyte-free water or solid matrix spiked with the parameter of interest is analyzed with every sample group. Blank spikes are used to show the analytical technique is in control, although matrix effects may have been present in associated matrix spike samples. For applicable organic analysis surrogates may be substituted for a blank spike.

- Every sample is spiked with the appropriate surrogate standards prior to extraction and analysis for total petroleum hydrocarbons, volatile organic compounds, base-neutrals, acids, and pesticides/PCBs and most other GC or GC/Ms analytes

- Internal standards are added to all samples or extracts prior to GC/MS and certain GC analysis

- A check standard (continuing calibration standard) is run to verify the continued acceptability of a calibration curve before the beginning of each analytical sequence and at least every ten samples

- A replicated or split sample provides information about precision depending on the location in the sampling and analysis process where the split occurs. An analysis replicate gives information about the analytical precision; a field replicated or field split sample provides precision information for all steps after sample collection. Sample duplicates will generally take the place of replicate samples.

When the analyses of a sample set are completed, the results will be reviewed based on the following criteria:

- Reagent Blank Evaluation - The reagent and/or method blank results are evaluated for high readings characteristic of background contamination. If high blank values are observed, instrumentation, laboratory glassware and reagents should be checked for contamination and the analysis halted until the system can be brought under control before further sample analysis proceeds. A reagent blank should contain no greater than the parameter reporting limit for most parameters.

- Field Trip, Bottle, and Rinsate Blank Evaluation - Field blank results are

evaluated for high readings similar to the reagent and/or method blanks described above. If high field blank readings are encountered, the procedure for sample collection, shipment, and laboratory analysis should be reviewed. If both the reagent and/or method blanks and the trip blanks exhibit significant background contamination, the source of contamination is probably within the laboratory. In the case of VOAs, ambient air in the laboratory and reagents should be checked as possible sources of contamination. High field blank readings for other parameters may be due to contaminated sample bottles (unless bottle blanks are clean) or cross-contamination due to sample leakage and poorly sealed sample containers, or cross-contamination between samples collected if the rinsate blank is contaminated.

- Calibration Standard Evaluation - The daily calibration curve is evaluated to determine linearity through its full range, and that sample values are within the range defined by the low and high standards. If the curve is not linear ($r \leq 0.995$), sample values must be corrected for nonlinearity by deriving sample concentrations from a graph or by using an appropriate algorithm to fit a nonlinear curve to the standards.

- Duplicate Sample or Duplicate Matrix Spike - Duplicate sample or duplicate matrix spike analysis for the sample set is used to determine the precision of the analytical method for the sample matrix. If the RPD exceeds the control limits the corrective action may include the re-analysis for the parameter(s) in question. Attainable precision limits are taken from published methods or are calculated based on actual data.

- Matrix Spike and Laboratory Control Samples Evaluation - The observed recovery of the spike versus the theoretical spike recovery is used to calculate accuracy as defined by the percent recovery. If the accuracy value exceeds the control limit the corrective action may include the re-analysis for the parameter(s) in question. If interferences are present in the samples spiked, a laboratory control sample is used to demonstrate that the laboratory technique is in control. The results of matrix spike and matrix spike duplicate analyses are also compared as duplicate samples described above (RPD). Attainable spike recovery limits are taken from published methods or are calculated based on actual data. For certain organic methods surrogates may replace matrix and laboratory control samples.

- Quality Control Check - Prepared as blank spikes, these samples are used for initial and ongoing proficiency demonstration of Analysts, methods and equipment

- Verification or Performance Evaluation - Sample values are compared by the Laboratory Director or Quality Control Director with "true" values as soon as available to determine acceptability. Parameters outside the acceptance range are investigated immediately to determine the source of error. A second round of samples may be introduced to ensure the correction of the problem.

- Standard Reference Material Evaluation - Standard Reference Materials analyses are compared with true values and acceptable ranges. Values outside the acceptable ranges require corrective action to determine the source of error and provide correction. Data reporting may be halted pending this evaluation. Following correction of the problem, the Standard Reference Material should be reanalyzed.

- Check Standard Evaluation - The results of check standard analysis are compared with the original calibration curve, and the relative percent difference of the check standard is calculated to determine if the calibration system is in control. If correction is required, the check standard should be reanalyzed to demonstrate that the corrective action has been successful.

- Surrogate Standard Evaluation - The results of surrogate standard determinations are compared with the true values spiked into the sample matrix prior to extraction and analysis and the percent recoveries of the surrogate standards are determined. Values outside the acceptable ranges require investigation and/or corrective action. Corrective action will usually involve re-extraction of the sample. Percent recoveries attained shall be in accordance with current governing agency requirements or laboratory-generated control limits.

- Replicate Sample Evaluation - Replicate sample analysis for the same set is used to determine the precision of the sampling and analytical method for the sample matrix. Field splits provide precision information about all steps after collection; analytical splits, or laboratory duplicates, provide information about instrument precision.

10.1.2 Statistical Evaluation of Quality Control Data

As part of the analytical Quality Control program, ALSEV will determine precision and accuracy for each parameter or class of parameter analyzed.

10.1.2.1 Evaluation of Data Using Control Limits

ALSEV will apply precision and accuracy criteria to parameter(s) that are

analyzed. When analysis of a sample set is completed, the Quality Control data are reviewed and evaluated. Part of evaluation includes use of control limits to approve the data set.

Control limits are established for all major analytical parameters. This discussion of control limits is a guideline which shall be used unless other provisions are stated. In general, control limits, with limits defined in the appropriate methods, will be utilized. In the absence of method defined limits, laboratory generated control limits will be utilized. Control limits for both accuracy and precision will be compared with actual precision and accuracy results periodically to verify that the current control limits are appropriate. If control limits are not appropriate they shall be updated using laboratory generated accuracy and/or precision data. This review will also evaluate whether any methods are exhibiting a significant bias. If a bias is found appropriate, corrective action will be taken. Reviews shall be performed by the QA Director or Laboratory Director. In general, three standard deviations of the RPD should be used for laboratory generated control limits. It shall be understood that, unless specified otherwise, method defined recoveries or ranges shall be control limits.

10.1.2.2 Evaluation of Analytical Precision

General Considerations

To determine the precision of the method and/or laboratory Analyst, a routine program of duplicate analyses is performed. The results of the duplicate analyses are used to calculate the relative percent difference (RPD), which is the governing Quality Control parameter for precision.

The RPD for replicate analyses is defined as the difference (range) of each replicate set divided by the average value (mean) of the replicate set, times 100 percent. For replicate results D_1 and D_2, the RPD is calculated from Equation 10-1:

$$RPD\ \%= \frac{(D_1 - D_2)}{\frac{(D_1 + D_2)}{2}} \times 100\ \%$$

(Equation 10-1)

10.1.2.2.1 Generation of Analytical Precision Control Limits

Control limits will either be given in analytical methods or generated from laboratory data. To generate laboratory control limits the RPD is obtained for at

least twenty replicate pairs, the average RPD and the standard deviation are calculated using:

$$\bar{m} = \frac{\sum_{i=1}^{n} m_1}{n}$$

(Equation 10-2)

and

$$Sm = \sqrt{\frac{\sum_{i=1}^{n} (m - \bar{m})^2}{n - 1}}$$

(Equation 10-3)

where:

m = the RPD of a replicate pair

$\bar{m}$ = the average of the Relative Percent Difference determinations,

Sm = the standard deviation of the data set of RPD determinations, and

n = the number of RPD determinations.

When generating control limits for a specific parameter, warning and control limits are then
calculated as follows: $\bar{m} \pm 2Sm$ and $\bar{m} \pm 3Sm$, respectively.

10.1.2.2.2 Evaluation of Analytical Precision Using Control Limits

The evaluation of precision using control limits will simply be the RPD or range limits given in the method or as generated by the laboratory compared to the RPD or range obtained during the analysis. Acceptability should be evaluated as follows:

- The calculated RPD or range of each replicate pair is compared to the warning and control limits or range given in the corresponding analytical method or generated within the laboratory.

- If an RPD result is outside the criteria, the Laboratory Director or Quality Control Director is notified, the nonconformance is investigated, a determination made of the source and appropriate corrective action taken.

- Factors that influence precision include: Analyst skill, instrument stability, sample homogeneity, reagents quality, ambient conditions

10.1.2.3 Evaluation of Analytical Accuracy

In addition to the evaluation of analytical precision, ALSEV evaluates accuracy.

To determine the accuracy of an analytical method and/or the laboratory Analyst, a program of spiking is conducted. The results of surrogates, matrix, matrix spike duplicate, or blank spikes are used to calculate the Quality Control parameter for accuracy evaluation, the Percent Recovery (%R).

The %R is defined as the observed concentration, minus the sample concentration, divided by the true concentration of the spike, times 100 percent.

$$\%R = \frac{O_i - O_s}{T_i} \times 100\ \%$$

(Equation 10-4)

where:

%R = the Percent Recovery,

O_i = the Observed Spiked Sample Concentration,

O_s = the Sample Concentration, and

T_i = the True Concentration of the Spike.

10.1.2.3.1 Generation of Analytical Accuracy Control Limits

Control limits will either be given in analytical methods or generated from laboratory data. As with precision evaluation, accuracy control limits may be laboratory generated when the Percent Recovery has been obtained for at least twenty spiked samples, the mean percent recovery and the standard deviation are calculated using the formula:

$$\%\,\bar{R} = \frac{\sum_{i+1}^{n} \%R_i}{n}$$

(Equation 10-5)

and

$$S_R = \sqrt{\frac{\sum_{i=1}^{n} (\%R_i - \%\,\bar{R})}{n-1}}$$

(Equation 10-6)

where:

%R = the Mean Percent Recovery

$\%R_i$ = the Percent Recovery of a Single Spiked Sample

n = the number of results

S_R = the Standard Deviation of the data set of Percent Recovery

When establishing control limits for a specific parameter the warning and control limits are then calculated from the following: $\%R \pm 2S_R$ and $\%R \pm 3S_R$,

respectively.

10.1.2.3.2 Evaluation of Analytical Accuracy Using Control Limits

Accuracy control limits are evaluated as follows:

- The calculated percent recovery of each spike sample is compared to the established control limits given in the corresponding analytical method or as determined within the laboratory
- If a percent recovery is outside criteria the Laboratory Director or Quality Control Director is notified, the nonconformance is investigated, a determination made of the source and appropriate corrective action taken
- Factors that influence bias (accuracy) include: interference, calibration, contamination, losses during preparation, instrument drift, sensitivity resolution, analyst techniques

10.2 DATA REVIEW

Data review is the process whereby data are screened and accepted or rejected, based on a set of criteria. Data will have been provided by trained analysts using approved methods and instrument systems in control.

Data review begins with the processing of data and continues through the reporting of analytical results. Data processing can be performed by the analyst who obtained the data or another analyst. Data review starts with a separate evaluation to ensure that data processing has been correctly performed and continues through verifying that the reported analytical results correspond to the data acquired and processed. Checks are made for internal consistency, proper identification, transmittal errors, calculation errors and transcription errors. Final review of the data to be reported is by the Laboratory Director or designee.

As stated, the first step in review is data processing. In general, data will be processed by an analyst in one of the following ways:

- Manual computation of results directly on the data sheet or on calculation pages attached to the data sheets. These may be within a logbook or analytical series.

- Input of raw data for computer processing

- Direct acquisition and processing of raw data by a computer

If an analyst manually processes data, all steps in the computation shall be provided including equations used and the source of input parameters such as response factors, dilution factors, and calibration constants. If calculations are not performed directly on the data sheet, calculations should be attached to the data sheets. The analyst shall sign or initial and date, in ink, the first page of calculations.

For data that are input by an analyst and processed using a computer, a copy of the input shall be kept and uniquely identified with the job number(s) and other information as needed. The samples analyzed shall be evident and the input signed and dated by the Analyst.

If data are directly acquired from instrumentation and processed, the analyst shall verify that the following are correct: job and sample numbers, calibration constants and response factors, output parameters such as units, and numerical values used for reporting limits (if a value is reported as less than (<)). The Analyst shall sign and date the resulting output.

10.2.1 Review of Data Processing

Following is a discussion of the method to be used for reviewing (checking) data processing.

The procedure is as follows:

- The checker will review all data to ensure that data is correct and/or meets the technical (Quality Control) requirements of the methods(s). This review shall include, as appropriate, evaluation of raw data, calibration or continuing calibration, blanks, duplicates, surrogates, spikes, etc.

- The checker will also review a portion of the data to ensure that mathematical and clerical functions were performed accurately and appropriately. This review shall include, as appropriate, inspection of units, appropriateness of equations used, correctness of numerical input and significant figures reported, accuracy of rounding, etc.

- The checker shall sign originals and date in ink at least the first page of the data package. Signing and dating indicates that the reviewer agrees with the calculations and that any changes made have been agreed to by the originator and entered on the originals.

- The reviewed data are maintained as discussed in Section 12.0

10.2.2 Review of Data Reporting

Review of data reports is required to verify that information reported by a laboratory corresponds with processed analytical results.

After the data report is prepared, the reported results should be checked against the reviewed processed data so that transcription errors do not occur. The checking process follows:

- Using the data report, all data entries are checked. The checker will generally be the Laboratory Director or laboratory management although the checker can be an Analyst. The checker is not required to be independent of the work because only the transcription from the reviewed data to the data report is being checked.

- The data report should be checked so that the items cited for data presentation in Section 11.0 are complete and correct. Corrected entries are marked through with a single line and the correct entry provided;

changes are documented with initials and date.

- If computer output is used directly as the data report without further transcription, only the input requires review as discussed in Section 10.2.1

- The Lab Director or designee shall review all final reports

11.0 DATA REPORTS

The format and content of a data report are dependent upon project needs, such as: whether or not explanatory text is required, client or contract requirements, and government agency report requirements. The following are applicable to data presentation:

- The final data presentation shall be checked in accordance with data verification requirements of Section 10.2.2 and approved by the Laboratory Director. When the Laboratory Director is unable to approve reports a designee will be appointed.

- Data are presented in a tabular format whenever possible

- Data presentation includes:

    1) Sample identification number used by ALSEV and the sample identification provided to the laboratory

    2) Chemical parameters analyzed, reported values, units of measurement, and analytical method used for the types of analysis specified

    3) Reporting limit of the analytical procedure if less than the reporting limit is observed (e.g., ND (<10) where 10 is the reporting limit), the reporting limit will generally be the practical quantification limit

    4) Data for a chemical parameter reported with consistent significant figures for all samples

    5) Results of Quality Control samples analysis if appropriate (see Section 8.3, Quality Levels)

    6) Achieved accuracy, precision, and completeness of data if appropriate

7) Footnotes referenced to specific data if required to explain reported values

- Data should be released from the laboratory only by the Laboratory Director or designee

As necessary, a letter of transmittal/memorandum will include:

- Date of sample receipt, number and type of samples
- Person transmitting the data
- Document if the chain of custody was not provided or correct, if any samples were damaged in shipment, if sample containers were inappropriate for analysis, or if volume provided was inadequate for proper analysis
- Brief discussion of samples analyzed and the analytical program
- Discussion of any apparent data anomalies
- Discussion of any analytical difficulties

Any analytical results verbally communicated are considered preliminary until data are presented in hard copy. Data transmitted by telecopy that has not been verified as described in Section 10.0, must be stamped or otherwise identified as preliminary prior to transmission.

CERTIFICATE OF ANALYSIS

CLIENT: XYZ ENVIRONMENTAL CONSULTING
123 PUGET SOUND BOULEVARD
BELLEVUE, WA 98005

DATE: 8/1/02
ALS JOB #: 207123
ALS SAMPLE #: 1
DATE RECEIVED: 7/23/02
WDOE ACCREDIATION # C142

CLIENT CONTACT: TERRY ENGINEER

CLIENT PROJECT ID: MAJOR TANK FARM
CLIENT SAMPLE ID: SOUTH END OF TANK 2, 5FT 6IN, 7/23/02 10:00AM

DATA RESULTS

ANALYTE	METHOD	RESULTS*	UNITS**	ANALYSIS DATE	ANALYSIS BY
TPH-VOLATILE RANGE	NWTPH-GX	ND	MG/KG	7/27/02	LAH
MTBE***	EPA-8021	ND(<0.1)	MG/KG	7/27/02	LAH
BENZENE	EPA-8021	ND(<0.03)	MG/KG	7/27/02	LAH
TOLUENE	EPA-8021	ND(<0.05)	MG/KG	7/27/02	LAH
ETHYLBENZENE	EPA-8021	ND(<0.05)	MG/KG	7/27/02	LAH
XYLENES	EPA-8021	ND(<0.2)	MG/KG	7/27/02	LAH
TPH-SEMIVOLATILE RANGE	NWTPH-DX	55	MG/KG	7/26/02	MJL

NOTE: CHROMATOGRAM INDICATES SAMPLE CONTAINS PRODUCT WHICH IS LIKELY DIESEL

* "ND" INDICATES ANALYTE ANALYZED FOR BUT NOT DETECTED AT LEVEL ABOVE REPORTING LIMIT. REPORTING LIMIT IS GIVEN IN PARENTHESES OR AS FOLLOWS:

GASOLINE(VOLATILE RANGE) REPORTING LIMIT IS 3 MG/KG

DIESEL RANGE REPORTING LIMIT IS 25 MG/KG

LUBE OIL RANGE REPORTING LIMIT IS 50 MG/KG

** UNITS FOR ALL NON LIQUID SAMPLES ARE REPORTED ON A DRY WEIGHT BASIS

*** ANY POSITIVE MTBE RESULT SHOULD BE CONFIRMED BY GC/MS ANALYSIS

APPROVED BY: _____

12.0 RECORDS MANAGEMENT

The ALSEV Quality Assurance Program has been developed to provide analytical results of verifiable quality which meet the data quality requirements characteristic of the method. To demonstrate that quality has been achieved, the laboratory maintains a records management system that includes documents which demonstrate the analytical performance of the laboratory.

Laboratory records are maintained in two broad categories:

- Documents which are specific to a project or a group of samples within an ongoing project, such as chain-of-custody and raw analytical data

- Documents which demonstrate overall laboratory operation, such as instrument log books and calibration records. These records will directly affect the data for a specific project, but in general their applicability is not limited to one project.

The criteria for an acceptable records management system are that the data must be secure, retrievable, and complete. All laboratory records from time of sample receipt through reporting and disposal must be available and stored in a manner that safeguards their integrity from tampering or physical damage and loss. Any documentation that bears on the reported results must be available if requested by the client or an authorized regulatory agency or court.

12.1 PROJECT RECORDS

Project files are maintained for each group of samples analyzed at the laboratory. The records are filed by laboratory job number. There are several categories of information within a project file.

Table 12-1 presents the information that may be contained within a project file. It is not expected that all categories will be applicable for every project. Following is a brief discussion of documents and categories which are included within ALSEV project files:

- Correspondence - All correspondence pertinent to a specific analytical program is maintained. This includes letters to and from clients, internal memoranda, records of telephone calls, purchase orders, etc. The correspondence is updated as necessary.

- Chain-of-Custody - Chain-of-custody records maintained by the laboratory are filed for groups of samples as received. Copies of chain-of-custody records for samples sent to other laboratories are maintained so the custody chain is unbroken.

- Calibration Records - In general, calibration records are maintained with laboratory operation records. However, if an analytical program requires calibration which is performed solely for a project, the records are maintained in the project file. If calibration is performed as an integral part of the analytical process, the calibration records are maintained with the analytical data.

- Analytical Data - Analytical data files are completed for a group of samples in accordance with the needs of the project. The project file may contain raw data or a data summary sheet which references the instrument series in the operation files which contain analytical data, processing of the data and/or data reduction. Data verification records (as appropriate) will be kept in the project file.

- Quality Control Summary and Samples – Copies of the Quality Control Summary Sheet or like information shall be stored with the project file. If Quality Control samples, such as field blanks, are processed for a specific project, the data is maintained with the project records. The results of Quality Control samples processed on a general basis are included in the laboratory operations records.

If Quality Control samples are processed as an integral part of a group of samples such that the data cannot be readily separated, the Quality Control sample data is

stored with the analytical series.

- Data Reports - Complete copies of all reports issued by the laboratory are kept in the project records. With the reports is the draft copy, as appropriate, checked to verify the data.

- Project Specific Requirements - If a project requires analytical procedures other than those adopted in the ALSEV Quality Assurance Program, the requirements are included in the project file. Specific requirements may be due to government regulation, specific contracts, or project need. Changes from stated practice may include, for example, the frequency of Quality Control sample analysis, test method, statistical data evaluation, and reporting format.

- Nonconformances - Copies of nonconformance documentation which are specific to a project are included in the file

- Quality Assurance Plans - Any specific Quality Assurance Project Plans, and revisions, which are prepared for a project, are stored or referenced in this section

- Miscellaneous - The miscellaneous section includes all records not applicable to the previous categories. Each distinct record(s) in this section is entered in the project index or project checklist.

- Method Description - Description of all methods used are maintained by the laboratory. If a unique or special method is used for a project, the procedures are kept with the project record.

- Work Order Records - Internal tracking documents used by the laboratory (e.g., computer-generated records, etc.) are included as part of the traceability of the project samples through the laboratory

- Subcontractor Records - Correspondence and reports and raw data (samples, calibration, and Quality Control) must be received from the subcontractor following analysis reporting

- Client Invoice - A copy of the client invoice will be maintained in the project file

12.2 GENERAL LABORATORY OPERATIONS RECORDS

General laboratory records document overall laboratory performance and operation. These records are filed separately from project records and will be maintained so they can be referenced to project records if necessary. An example of a general record pertinent to a project record is instrument log book. There are two types of general laboratory records:

- Documents which demonstrate laboratory performance
- Reference documents for laboratory operations

Records which demonstrate laboratory performance shall be filed in categories. Reference documents are not indexed and their usage is not controlled.

Table 12.2 recommends the laboratory performance records to be maintained and the category system for their maintenance.

Many of the laboratory operations records are in daily use, such as the Sample Log-In Book, instrument calibration records, and maintenance records. It is not intended that the records be stored daily when they are in use. However, when individual log books, etc., are filled, they shall be placed in the appropriate file or storage area.

Index File

The index will serve as the master laboratory operations records log. The log will be kept in the archive area and updated whenever a new record or logbook is created. The index will be divided into categories as shown in Table 12.2.

A description of each category of laboratory operation records is as follows:

A Sample Log-In LIMS - The Laboratory Information Management System (LIMS) chronologically records all samples entering the laboratory, independent of project designation.

B Instrument Maintenance Logs - Separate maintenance files should be kept for each instrument incorporated in the preventive maintenance program. The file shall include records of maintenance performed in-house or by outside groups. Service contracts should be included in the file for the applicable instrument.

C Calibration Records - Calibration records shall be divided into two main groups; periodic calibration and operation calibration. All periodic calibration performed independent of a specific analytical project shall be recorded by instrument or equipment number. A separate file should be maintained for all equipment subject to calibration. Operational calibration will include initial calibration records or other non series specific calibration information. Operation calibration should be filed by instrument or parameter.

D Performance Evaluation Records - Laboratory participation in Performance Evaluation Programs shall be documented in this category.

E Certification Program Records - If the laboratory participates in Certification Programs, such as the Washington DOE Program, the results shall be maintained in this category. Records should include all correspondence, analytical data, agency results, and certificates of performance.

F Method Detection Limit (MDL) and Instrument Detection Limit (IDL) Records - This file should include the results of all analyses used in the calculation of IDLs and MDLs. The results shall be organized chronologically. All analyses for a particular study for a particular parameter shall be placed in a manila file folder.

G Control Limits - As necessary, control limits should be filed chronologically for each parameter monitored.

H Purchased Material Certificates and Standard Preparation Records - Certifications supplied by vendors for purchased materials are maintained in a three ring binder. Records of preparation of standards shall be maintained in a logbook. Due to size limitations these binders or logbooks may be stored outside of the file cabinets.

I Nonconformance Record and Analyst Notes - Nonconformance records, corrective actions, and analyst notes which are supplied to the Quality Control Director are placed in this file.

J Audit Records - Formal audit reports of internal system and performance audits are to be filed in this category, by date and topic (items audited). Where the audit is project-specific, it should be cross-referenced to the project audited.

K Training Files - Training files of individuals are to be maintained current in this filing category. Records of method training receiving; proficiency tests passed, external training obtained, etc., are documented in this

category chronologically by individual and by topic.

L SOPs - A listing of the current laboratory Standard Operating Procedures (SOP) is maintained as an index, together with a complete collection approved SOPs and their issue dates. Due to size limitations, this binder may be stored outside of the file cabinets.

M Analytical Series - This section will contain records of analytical runs on a parameter basis. Records may take the form of logbooks (for single parameters or several like parameters) or packets of records. On a batch basis, all analytical data, calibrations, quality control, etc. will be included.

Table 12.3 lists reference documents which should be available within the laboratory. These documents need not be included in the laboratory record system and may be kept where used. Reference documents shall be revised and updated as necessary to maintain them as "currently applicable documents."

12.3 RECORD RETENTION

ALSEV will maintain records associated with specific projects for five years. If a specific contractual requirement, project demand, or government regulation requires that records be maintained for a longer period of time, project files will be kept as required. For projects that must be kept beyond the periods stated above, the project index shall be marked to indicate the required retention period.

12.4 SAMPLE STORAGE

Analytical samples will be routinely stored (regardless of reason for analysis) by ALSEV, after submittal of a data report, for four weeks prior to disposal or return to client.

Samples will be stored for different periods if specified by project or contractual requirements.

TABLE 12-1

PROJECT RECORDS FILING CATEGORIES

Record Description

- Correspondence
- Chain-of-Custody
- Calibration Records
- Analytical Data
- Quality Control Summary
- Data Reports
- Project-Specific Requirements
- Nonconformances
- Quality Assurance Plans
- Miscellaneous
- Method Description
- Work Order Records
- Subcontractor Records
- Client Invoice

TABLE 12.2
EXAMPLE - LABORATORY PERFORMANCE RECORDS FILING CATEGORIES

Category	Record Description
---	Index File
A	Master Sample Log-In - LIMS
B	Instrument Maintenance Logs
C	Calibration Records Operational Records (CA) Periodic Records (CB)
E	Performance Evaluation Records
F	Certification Program Records
G	MDL & IDL Study Records
H	Control Limits
I	Purchased Material Certificates and Standard Preparation Logs
J	Nonconformance Memos and Analyst Notes
K	Audit Records
L	Training Files
M	SOPs
N	Analytical Series

TABLE 12-3

REFERENCE DOCUMENTS

- Instrument Manuals
- Computer/Software Instruction Manuals
- Analytical Procedures

13.0 NONCONFORMANCES AND CORRECTIVE ACTION

Refer to SOP CE-QA008

14.0 QUALITY ASSURANCE/QUALITY CONTROL

Audits of an analytical laboratory are described as:

- Performance audits conducted on an ongoing basis within the laboratory by the Quality Control Director or Laboratory Director. These audits are reported to the laboratory management.
- System audits performed on a scheduled, periodic basis by the Quality Control Director (QCD) or Laboratory Director (LD). System audits will also be performed by regulatory certifying agencies (WDOE), industry associations (American Association for Laboratory Accreditation), or clients.

Audits of the laboratories are performed for the following reasons:

- To determine that contractual and regulatory obligations are fulfilled
- To determine that the ALSEV Quality Assurance manual is being followed
- To establish that Quality Assurance objectives are met, including holding times, reporting turnaround times, use of approved analytical methods, and stated objectives for precision, accuracy, representativeness, and completeness

- To identify potential or actual deficiencies for the purposes of evaluating compliance with requirements and providing the means for correction

- To determine that records are prepared/maintained as required

Audits are not conducted to assign blame.

The content and conduct of the audits are discussed below.

14.1 PERFORMANCE AUDITS

As stated in Section 2.1, the Quality Control Director (QCD) or Laboratory Director (LD) is responsible for the preparation or purchase of Quality Control samples, insertion into the sample stream, and analysis of the results. The samples are analyzed on an ongoing basis and provide the means for demonstrating data quality. This serves as a portion of the Performance Audit. Additionally, the QCD or LD shall provide audits of laboratory operations. The review is conducted on behalf of laboratory management to verify that the laboratory Quality Assurance Program is implemented and functioning on the daily basis. Laboratory operation audits are detailed inspections of specific areas of a laboratory and its Quality Assurance program, performed by the QCD or LD. Laboratory operation audits do not re-quire as extensive planning and preparation as do system audits, and prior communication with the surveyed group or personnel is not necessary. The QCD or LD shall observe the activity of interest while it is in process and/or review objective evidence. This audit is intended to be a spot check and should include:

- Sample maintenance
  - Are stated temperatures for sample storage provided?
  - Are samples processed and tested within prescribed holding times?
  - Are samples properly logged in?
- Calibration
  - Are calibrations performed as required?
  - Are they properly documented in instrument log books, or as part of project data if required?
  - Do calibration results indicate a trend in instrument

performance?

- Preventive maintenance
  - Are adequate spare parts available?
  - Do specific instruments have repeated maintenance problems?
  - Is preventive maintenance performed and properly documented?
- Receipt and storage of standards, chemicals, and gases
  - Are all reagents, chemicals, and gases purchased for use in the laboratory of adequate grade for the intended use?
  - Are certifications of material compositions provided when required?
  - Are materials adequately stored to prevent degradation?
  - Are internal standards properly prepared and stored?
- Analytical Methods
  - Are the methods used appropriate for project requirements?
  - Are alternate methods approved for use?
- Data verification
  - Are data processed and reviewed as prescribed?
- Records management
  - Are the records of analyses complete and properly identified?
  - Are documents submitted to the record system in a timely manner and are they properly maintained?

Nonconformances observed by the auditor shall be reported to the laboratory management for corrective action to be taken. The QCD shall keep a log of nonconformances. The log shall document the nonconformance, date of

occurrence, reason for occurrence if known, date of corrective action, and corrective action taken.

14.2 SYSTEM AUDITS

System audits shall also be conducted by the QCD or LD. If project-specific audits are per-formed because of project requirements, the audit shall focus only on the performance of the laboratory for the project.

System audits performed by regulatory certifying agencies or clients will also be encouraged. These audits will be similar to system audits performed by ALSEV.

System audits will review operation of the laboratory and resulting documentation. These audits will be in-depth, will range in length from several hours to several days and may involve one auditor or an audit team. The purpose of the audit will be to ensure that all aspects of the Quality Assurance Manual are being implemented. Particular emphasis will be placed upon implementation of the Quality Control sample program and nonconformance log. Review of these aspects of the laboratory Quality Assurance Program should indicate trends adverse to data quality.

14.3 INTERNAL LABORATORY AUDITS

The QA Manager, with support from the Lab Director and Operations Manager, will perform an annual, documented review of the QAM to ensure that it is consistent with the most current laboratory practices. Spot-revisions may be performed in the future to account for sudden changes to laboratory practices. These spot-reviews will be included in the QAM file and will be integrated into the WAM during the annual review.

The corporate SOP for Internal Audits will be cited as the primary guidance when performing internal audits.

Internal audits will include:

- Verification of use of laboratory maintenance logbooks.
- Review of all logbooks.
- Verification that all SOPs are current and have been signed off on by the QA Manager and the Lab Director.
- Review of Personnel Qualification Records to ensure that personnel qualifications reflect current SOPs.
- Review of working standards and standard logbooks to ensure that expired standards are not in the laboratory.
- A minimum of 5 random, documented spot-checks of extraction or analytical

logbooks to ensure that expired standards were not in use prior to the internal audit.

- Verification that all current SOPs are maintained in hard copy form and that each SOP includes a document review log that will track SOP reviews and revisions.

15.0 TRAINING

All quality related activities performed by ALSEV shall be accomplished by personnel qualified on the basis of education, experience, and training.

The following definitions are relevant to the discussion of training in this section:

- Training - In-depth instruction to develop proficiency in the application of requirements, methods, and procedures. Such instruction may be internal or external classroom sessions, courses, or informal on-the-job assignments.
- Indoctrination - To instruct in fundamentals so as to provide understanding of principles involved
- Qualification (Personnel) - The characteristics or abilities gained through training or experience or both, that enable an individual to perform a required function
- Certification - The action of determining, verifying and attesting, in writing, to the qualifications of personnel or material
- Orientation - The act or process of acquainting individuals with the existing situation, environment or condition

15.1 QUALIFICATIONS

ALSEV normally expects necessary knowledge and fundamental chemical laboratory skills to have been demonstrated by formal academic training to include course work in general chemistry, qualitative analysis, quantitative analysis, and instrumental analysis.

15.2 PROFESSIONAL STAFF, TRAINING, AND QUALIFICATIONS

Laboratory staffs are composed primarily of professional personnel who are scientists. Such personnel shall be assigned duties within the capabilities of their education and experience by the Laboratory Director or designee. Qualifications of all professional personnel shall be documented by resumes which include

academic credentials, employment history, and experience. Technicians and support personnel performing a technical function are qualified through experience and this will be indicated in their resumes and training files. These personnel shall also be assigned by the Laboratory Director or designee based on their capabilities. Technicians and support personnel shall be supervised in their activities by experienced personnel until in the opinion of the Laboratory Director they are capable of independently performing their duties. This authorization to perform independently shall be documented in the personnel training files.

15.2.1 Technical Training and Certifications

An analyst hired to perform sample preparation procedures and/or analytical procedures shall receive direct instruction from a professional staff member. To become certified on a particular procedure, the analyst must pass a verbal discussion of the method. Included in the discussion will be method chemistry, sample logging, preservatives, holding times, glassware preparation, associated equipment and instrument usage, data handling and reporting, and, mostly, Quality Assurance/Quality Control requirements and interpretation. The discussion will be performed by a senior analyst or technical manager.

The analyst will also be required to demonstrate capability by performing a 4-replicate study of a Quality Control sample prior to becoming certified. The results of this study will be included in their personnel file.

Only after acceptable completion of the appropriate certifying steps shall the analyst perform the procedure without assistance or direct supervision.

Technicians or analysts who have not performed an analysis within a period of one year shall be required to re-certify before being allowed to perform the procedure again. Laboratory-specific criteria shall be set for maintaining qualifications.

15.2.2 Quality Assurance Training and Qualifications

General training in the requirements of the ALSEV Quality Assurance Program is required of all laboratory personnel. Formal training sessions and examinations will be conducted and documented within personnel training files. The training program shall address regulatory requirements as appropriate, basic Quality Control practices, responsibilities of the technical staff, responsibilities of the QCD, the reporting of nonconformances, and the performance of audits.

In addition, each laboratory analyst must become familiar with the laboratory Quality Assurance Program by reading the Quality Assurance Manual. The analyst must demonstrate a thorough knowledge of the content, rationale, and application of topics within the Quality Assurance Manual during a verbal discussion or written examination with a technical manager. Passing this

examination will demonstrate sufficient knowledge of the Quality Assurance Program to perform work in the laboratory upon training in a specific technical area.

15.3 QUALIFICATION AND TRAINING RECORDS

Each laboratory employee shall have Personnel Qualifications Record as shown in Figure 15-1. The record shall be documented with technical and quality assurance procedures for which the employee is qualified, the dates of qualification and renewal, and the approval signature. Other qualification and training documents include:

- Personnel resumes
- Record of observation on a sample preparation procedure
- Results of qualifying sample sets
- Quality assurance examinations
- Internal training class records
- Agreement to follow the ALS QAM and SOPs associated with their work

The Quality Control Director or Laboratory Director is responsible for maintaining the personnel qualifications and training records within the personnel section in the Quality/Operations records.

FIGURE 15-1

EXAMPLE - PERSONNEL QUALIFICATION RECORD

NAME: _____ HIRE DATE: _____

TITLE: _____ SUPERVISOR: _____

Document Name, Number	Qualify Date	Approval