STL SEATTLE

LABORATORY QUALITY MANUAL

for Chemical Analysis

Revision No. 16
January 8, 2003

ADDENDUM

Replace the following section in the originally distributed LQM:

17.3 Record Retention

STL Seattle maintains records associated with specific projects for the following time periods: analysis performed as part of site mitigation activities - 10 years; and, conventional analysis - 7 years. If a specific contractual requirement, project demand, or government regulation requires that records be maintained for a longer time period, project files are marked for longer retention and kept as required.

with the following section:

17.3 Record Retention

STL Seattle maintains records associated with specific projects for 7 years. If a specific contractual requirement, project demand, or government regulation requires that records be maintained for a longer time period, project files are marked for longer retention and kept as required.

The original section included an incorrect record retention time for some specific projects. The retention time for all reports was revised.

STL SEATTLE
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for Chemical Analysis

Revision No. 16
January 8, 2003

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1.0 POLICY STATEMENT

The objective of the measurement program of Severn Trent Laboratories (STL) Seattle is to provide high-quality analytical results that are accurate, reliable, and adequate for the intended purpose in a cost-effective manner. To this end, the STL Seattle personnel are dedicated to the encouragement of excellence in measurement and to provide the physical and mental environment conducive to the achievement of excellence, and are free from any commercial, financial, and other undue pressures that may adversely affect the quality of the work. To further these objectives, the quality assurance program described in the following sections has been established. This program applies to all scientific and technical work conducted, in principle and in detail, to the extent possible and feasible.

2.0 ETHICS STATEMENT

The STL Seattle ethics policy on waste, fraud, and abuse is as follows: no employee shall knowingly manipulate or falsify data. No employee shall knowingly deviate from contractual requirements agreed to by the laboratory. No employee shall knowingly deviate from the quality assurance requirements established for the laboratory, including this document. All employees shall make every effort to minimize the generation of waste during sample preparation and analysis, and will dispose of all waste following established laboratory practices. STL Seattle will make all necessary information available to the employee to perform job responsibilities according to ethical and established practices. Any violation by the employee of the above practices will result in punitive action by STL Seattle, which may include termination of the employee.

3.0 PROGRAM PURPOSE

The purpose of the STL Seattle quality assurance program is to serve as a guide to help provide analytical data that satisfy an internal commitment to produce high quality output that meet or exceed customer and regulatory requirements. This manual describes the STL Seattle quality assurance program, which controls:

- sample collection and preservation;
- sample receipt, handling, and storage;
- sample processing and analysis;
- sample disposal;
- analytical equipment use and maintenance;
- data verification;
- data reporting; and,
- data storage.

The quality of data provided by the STL Seattle quality assurance (QA) program is based on the accuracy of identification of the parameter measured and the numerical accuracy. The qualitative identification must be beyond reasonable doubt. The quantitative measurement must be made so that the limits of uncertainty can be assigned with a stated probability. Both goals are achieved by implementing the QA program described in the Laboratory Quality Manual (LQM). The QA program is designed to include quality control and quality assurance procedures. Within this manual, the following definitions are employed:

Quality Assurance (QA). The overall controls imposed upon laboratory operations to insure that all quality control activities are effective. These controls include both actions taken by personnel and the laboratory performance documentation.

Quality Control (QC). The daily specific actions taken within the laboratory to verify sample handling integrity, analytical performance, data processing, data reporting, and record maintenance.

Completeness. A measure of the amount of data obtained from a measurement process compared to the amount that was expected to be obtained under the conditions of measurement.

Representativeness. The degree to which the data accurately and precisely represent a characteristic of a population parameter, variation of a property, a process characteristic, or an operational condition.

Comparability. The confidence with which one data set can be compared to another.

3.1 Scope of Laboratory Activities

The scope of laboratory activities governed by the QA Program described in the Laboratory Quality Manual (LQM) includes the preparation and analysis of samples submitted for chemical analysis. This QA Program is designed to satisfy QA requirements for environmental laboratories, as specified in the following documents:

- Guidance on Preparation of Laboratory Quality Assurance Plans, U. S. EPA Region 10 Document Number EPA 910/9-92-032;
- Navy Installation Restoration Laboratory Quality Assurance Guide, Interim Guidance Document, Naval Facilities Engineering Service Center, February, 1996;
- Shell for Analytical Chemistry, Appendix I to EM 200-1-3, U. S. Army Corps of Engineers, February, 2001; and
- National Environmental Laboratory Accreditation Conference Standard, Chapter 5, Quality Systems, July 1, 1999.

A variety of matrices may be analyzed under this QA program, excepting foodstuffs. Chemical analysis may be for any target analytes described in a laboratory SOP. The majority of the preparation and analyses detailed in laboratory SOPs are based on published methodologies.

3.2 Requirements of the Quality Assurance Program

To support the overall objective of the STL Seattle QA Program, the following requirements must be met during routine procedures performed by the laboratory:

- an effective, on-going quality control program to measure and verify laboratory performance must be maintained;
- data requirements for precision, accuracy, and representativeness must be met;
- sufficient flexibility to allow controlled changes in routine methods to meet specific data quality requirements must be provided;
- situations which adversely affect data quality must be recognized quickly and corrective action provided;
- operational performance of the laboratory on a routine basis must be monitored and corrective action provided as needed; and,
- complete sample handling records, laboratory performance records, and analysis information in order to verify resulting data must be maintained.

3.3 STL Seattle Quality Assurance Documents

Complete documentation of STL Seattle operations requires several quality assurance documents. All QA documents must maintain the same signature level of authority, which includes all appropriate department supervisors and the QA manager, and may include project managers and clients as well. The QMP states the company's policies, LQM states

STL Seattle's policies; other documents provide supportive or supplementary information, or meet specific project requirements. The document types are described below.

3.3.1 Quality Management Plan

The QMP provides overall company policy. It discusses all aspects of quality assurance and quality control; however, it is not intended that the manual provide in-depth technical discussion. The QMP has precedence in policy matters over all other quality-related documents. The CEO, chief operating officer, vice president and director of quality assurance are required to sign and date the QMP prior to implementation.

3.3.2 Laboratory Quality Manual

The LQM provides overall local policy. It discusses all aspects of quality assurance and quality control; however, it is not intended that the manual provide in-depth technical discussion. The LQM has precedence in policy matters over all other local quality-related documents. All department supervisors, the laboratory director, operations manager, technical director, and the QA manager are required to sign and date the LQM prior to implementation.

3.3.3 Standard Operating Procedures

Standard operating procedures (SOPs) provide detailed discussion and instruction for implementing quality assurance/quality control policies and specific analytical procedures. When referenced analytical procedures have stated QA/QC requirements, the SOP meets the stated requirements. When referenced analytical procedures are revised, new SOP revisions are generated to incorporate the revisions. Whenever multiple versions of the same SOP exist, the most recent version is the default version in use. If multiple versions of the same SOP are in use simultaneously, or if the most recent version of an SOP is not used, the analyst must specify which version is used for sample analysis. Laboratory SOPs are authored by the laboratory personnel most familiar with the procedures described. The SOPs are reviewed and released by the appropriate department supervisor(s) and the QA manager, and implemented into the laboratory on the date indicated on the SOP.

3.3.4 Sampling and Analysis Plans

STL Seattle is not typically involved in the sampling phase of a project. Sampling and Analysis Plans (SAPs) will be drafted by STL Seattle whenever STL Seattle is responsible for on-site sampling activities. All details of the field activities will be described in the plan; appropriate SOPs will be referenced in the SAP.

3.3.5 Quality Assurance Project Plans

Specific contractual and regulatory demands may require implementing a project-specific quality assurance program and document. The analytical project may be part of a larger project under the direction of STL Seattle clients. In this case, the Quality Assurance Project Plans (QAP_jPs) would be developed within the client organization, with direct input and approval by the STL Seattle project manager. Data quality objectives that could require a project-specific quality assurance program may be:

- new testing methods;
- nonstandard requirements for equipment calibration and maintenance;
- nonstandard detection limits;
- specific accuracy and precision limits or statistical treatment of data; or,
- specific document and record formats or maintenance.

If a project requires a unique quality assurance program, the program will be implemented. Full documentation will be provided in the QAP_jP. The quality assurance requirements of the work will take precedence over conventional STL Seattle quality assurance practices.

3.4 Control, Distribution, and Revision of Quality Control Documents

The LQM, SAPs, SOPs, and QAP_jPs are approved and controlled documents; all four documents require the approval of the Quality Assurance (QA) Manager and the appropriate Department Supervisor(s). Approval of documents is denoted by a signature and date on the document. All Department Supervisors must sign the LQM; at least one Department Supervisor must sign an SAP, SOP, or an internal QAPjP.

SAPs require approval of the STL Seattle project manager and the client project manager, in addition to the appropriate Department Supervisors and the QA manager. Approval of documents is denoted by a signature and date on the original document.

In general, laboratory QA/QC documents are distributed as needed to all STL Seattle employees. When the document is no longer needed or the copyholder leaves STL Seattle, the document should be returned. All copies of the LQM distributed within STL Seattle are numbered for document control. The QA Manager handles distribution of the LQM, QAP_jPs, SAPs, and SOPs. Controlled copies of the laboratory LQM are distributed to all technical and technical support personnel.

The LQM and SOPs are reviewed by the author or the current technical person responsible for the procedure, and updated on an annual basis (at a minimum). Any significant procedural changes are documented in a revision as soon as the change is to be implemented; annual updates are used only to document relatively small procedural changes. “Significant” changes are changes that impact any aspect of the reported analytical results.

An SOP is distributed to all laboratory personnel who need the particular information described in the SOP. A complete and current inventory of the laboratory SOPs is maintained on the laboratory information management system (LIMS), and is accessible to all laboratory personnel. The implementation date of an SOP is the date the document is entered into the LIMS database.

The quality assurance manager maintains distribution records that allow all quality assurance documents to be revised and redistributed as necessary. Before issue, revisions require the same approvals as the original document. Revisions are issued to all copyholders as needed. The quality assurance manager maintains distribution records of all revised sections.

Copies of quality assurance documents are issued external to STL Seattle as required. The quality assurance manager is responsible for authorizing distribution of all quality assurance documents.

4.0 LABORATORY ORGANIZATION

Laboratory organization includes the description of the laboratory ownership and laboratory facility, the list of capital equipment available in the laboratory, and the organization of personnel within the laboratory.

4.1 Ownership

The laboratory is owned by Severn Trent Laboratories, Inc. (STL), a division of Severn Trent Services, Inc. of Fort Washington, Pennsylvania.

4.2 Facility Description and Capital Equipment

The STL Seattle laboratory is located at 5755 8th St East in Tacoma, Washington. The main building is 18,000 square feet with an attached volatiles laboratory that is an additional 1800 square feet. This architect-designed building was purpose–built as a laboratory with safety, efficiency and quality control in mind. There are 9 high-velocity fume hoods in use in the general and sample preparation labs, an additional one in the volatiles laboratory, and two in the waste disposal area. An extensive RO/DI water treatment system delivers ASTM type I water to all sinks and dishwashers in the sample preparation areas of the main laboratory.

The overall STL Seattle facility is divided into eight main sections. Within the laboratory approximately 3350 square feet is dedicated to general laboratory space, 1800 sq ft to volatile analyses, 2000 square feet to pesticide/PCBs, HPLC/explosives and semivolatile petroleum analyses, 1500 square feet to semivolatile organics, 380 sq ft to metals instrumentation, 300 square feet to microbiological analyses, 300 square feet to inorganics/TOX analyses, 850 square feet to sample management 4300 square feet to administrative office space, and 3200 square feet to storage and utility space. Approximately 1500 cubic feet of monitored, alarmed walk-in refrigerator space is available for storage of samples and extracts. A schematic of the laboratory is provided as Appendix A. The STL Seattle permanent capital equipment list is provided as Appendix B.

The attached volatiles laboratory is separated from the rest of the laboratory by a poured concrete curtain wall that extends through the roof membrane. It has a separate entrance and exit, with no common walkways inside the building and no shared heating, ventilation, or air conditioning systems.

4.3 Personnel Organization

This section describes general positions and quality-related responsibilities within STL Seattle. The STL Seattle organizational chart is provided in Figure 4-1. A summary of STL Seattle key personnel is provided in Table 4-2. The positions and responsibilities discussed below provide independence of judgment and integrity, and are fundamental to the quality assurance structure of the STL Seattle laboratory.

4.3.1 Quality Assurance Manager

4.3.1.1 Education, training, and experience requirements:

- minimum of bachelor of arts (BA) degree in science with a minor in chemistry (or number of credit hours in chemistry equivalent to a minor);
- training in statistics; and,
- minimum of two years experience involved in analytical procedures.

4.3.1.2 The responsibilities of the quality assurance manager include:

- overall management of quality assurance activities;
- maintenance and distribution of all quality assurance documents;
- maintenance of method performance data files;
- verification and completion of corrective actions recommended by audits and nonconformance memorandum;
- initiation and management of laboratory participation in certification programs;
- adherence to all written laboratory procedures and QA Documents; and,
- provision of client contact for all quality assurance issues.

4.3.2 Laboratory Director

4.3.2.1 Education, training, and experience requirements:

- minimum of associate of arts (AA) degree in chemistry (or number of credit hours in chemistry equivalent to an AA degree); and,
- minimum of five years experience involved in analytical procedures, personnel and financial management within an environmental laboratory.

4.3.2.2 The responsibilities of the laboratory director include:

- overall management of all financial, technical and administrative functions of the laboratory;
- work with account executives/customer service manager to establish pricing for the laboratory's services;
- management of human resources to include interviewing and hiring, on-going training and development, conducting performance reviews, and structuring compensation and benefit programs;
- evaluation of capital equipment needs of the laboratory. Negotiates with equipment vendors and makes final purchase decisions; and,
- Responsible for long range planning for the STL Seattle facility.

4.3.3 Operations Manager

4.3.3.1 Education, training, and experience requirements:

- minimum of associate of arts (AA) degree in chemistry (or number of credit hours in chemistry equivalent to an AA degree); and,
- minimum of five years experience involved in analytical procedures, personnel and financial management within an environmental laboratory.

4.3.3.2 The responsibilities of the operations manager include:

- day-to-day management of all technical and administrative functions of the laboratory;
- providing operational guidance to all technical and administrative laboratory departments; and,
- assessment of resources and capital equipment needs of the laboratory.

4.3.4 Department Supervisor

4.3.4.1 Education, training, and experience requirements:

- minimum of associate of arts (AA) degree in chemistry (or number of credit hours in chemistry equivalent to an AA degree) or, for the department supervisors who are also designated as technical directors as defined by NELAP, a minimum of a bachelors of arts (BA) degree in chemistry or related science, including 24 semester credit hours in chemistry (an AA degree and 16 semester credit hours in chemistry are required for general chemistry technical directors); and,
- minimum of two years (three years for the environmental lead program) experience involved in analytical procedures performed within the department. For technical directors, a masters or Ph.D. in a relevant discipline may be substituted for one year of experience.

4.3.4.2 The responsibilities of the department supervisor include:

- implementation and supervision of quality control procedures and the data review process; oversight of methods development and documentation of method performance;
- maintenance of quality control measures established in the laboratory;
- initiation of corrective actions recommended by audits and nonconformance memorandum; adherence to all written laboratory procedures and QA Documents;
- oversight of department records management system; and,
- arrangement of archival storage and maintenance of storage documentation.

4.3.5 Chemist/Scientist/Analyst

4.3.5.1 Education, training, and experience requirements:

- minimum of associate of arts (AA) degree in chemistry (or number of credit hours in chemistry equivalent to an AA degree); and,
- minimum of two years experience involved in analytical procedures performed within the department.

4.3.5.2 The responsibilities of the scientists, technicians, and analysts include:

- performance of established sample preparation and sample analysis procedures;
- performance of data processing and validation following SOPs;
- completion and signature of worksheets or bench sheets;
- insurance that all sample quality control information, nonconformance forms, and appropriate bench notes are included in the data collection folder;
- documentation of calibration and machine maintenance information; and,
- documentation of all quality control activities.

4.3.6 EDD Specialist

4.3.6.1 Education, training, and experience requirements:

- minimum of associate of arts (AA) degree in computer systems or science;
- familiarity with database systems and structures;
- familiarity with configuring and repairing computers with internal and external devices such as modems, CD-ROMs, and video cards;
- familiarity with computer networking systems and implementation;
- minimum 2 years experience working with Microsoft Office software, particularly Excel and Access;
- knowledge of DOS and windows operating systems; and,
- familiarity with laboratory methods and procedures.

4.3.6.2 The responsibilities of the EDD specialist include:

- convert laboratory data to client specific diskette deliverable formats;
- E-mail data report information or summaries to clients;
- design and implement database projects;
- maintain and configure computer systems in the laboratory;
- assist laboratory personnel with computer problems; and,
- administer and troubleshoot local area network.

4.3.7 Data Review Specialist

4.3.7.1 Education, training, and experience requirements:

- minimum of associate of arts (AA) degree in chemistry (or number of credit hours in chemistry equivalent to an AA degree); and,
- minimum of two years experience involved in analytical procedures.

4.3.7.2 The responsibilities of the data review specialist include:

- performance of complete data reviews on data reports;
- preparation of nonconformance memoranda regarding QC issues;
- adherence to all written laboratory procedures and QA Documents; and,
- signature and release of the data report to the project manager.

4.3.8 Customer Service/Project Managers

4.3.8.1 Education, training, and experience requirements:

- minimum of associate of arts (AA) degree in chemistry (or number of credit hours in chemistry equivalent to an AA degree); and,
- minimum of two years experience involved in analytical procedures performed within the department.

4.3.8.2 The responsibilities of the project manager include:

- adherence to all written laboratory procedures and QA Documents;
- coordination of project-specific quality assurance activities;
- performance of reviews on all project-specific sample and quality control data;
- drafting narratives for data reports when appropriate;
- assembly of client-specific data packages;
- signature and release the data report; and,
- provision of client interface.

4.3.9 Laboratory Technician

4.3.9.1 Education, training, and experience requirements:

- minimum of a high school diploma, and,
- minimum of 90 days of supervised experience and in-house training in the performance of the procedures the technician will be using. This requirement may be modified by previous laboratory experience or specific training courses completed by the technician.

4.3.9.2 The responsibilities of the laboratory technician include:

- performance of established sample preparation and sample analysis procedures;
- performance of data processing and validation following SOPs;
- completion and signature of worksheets or bench sheets;
- insurance that all sample quality control information, nonconformance forms, and appropriate bench notes are included in the data collection folder;
- documentation of calibration and machine maintenance information; and,
- documentation of all quality control activities.

4.3.10 Sample Management Specialist

4.3.10.1 Education, training, and experience requirements:

- minimum of a high school diploma, and,
- minimum of 90 days of supervised experience and in-house training in the performance of the procedures the sample custodian will be using; this requirement may be modified by previous laboratory experience or specific training courses completed by the custodian.

4.3.10.2 The responsibilities of the sample management specialist include:

- logging in of all samples received, complete Chain-of-Custody documents, and maintenance of sample log books and computer data bases;
- adherence to all written laboratory procedures and the QA Documents;
- maintenance of the sample storage facilities; and,
- issuance of nonconformance memos to document sample receipt problems.

4.3.11 Environmental Health and Safety Coordinator

4.3.11.1 Education, training, and experience requirements:

- minimum of Associate of arts (AA) degree in Chemistry (or number of credit hours in chemistry equivalent to a minor);
- minimum of two years experience involved in analytical procedures; and,
- WISHA training: accident prevention, accident investigation, and hazard communication.

4.3.11.2 The responsibilities of the environmental health and safety coordinator include:

- perform the monthly housekeeping inspection and log checklist;
- maintain OSHA recordkeeping;
- review and update the site-specific health and safety manual on an annual basis;
- document all accident/injuries in the laboratory;
- coordinate monthly exposure documentation;
- work with employees to develop and implement the appropriate environmental health and safety policies and practices;
- coordinate the quarterly safety meetings at the laboratory;
- conduct exposure monitoring when appropriate;
- gather and maintain manufacturer's MSDSs;
- ensure that proper signs and labels are provided in the laboratory, and are used when appropriate; and,
- coordinate or perform inspections of emergency equipment.

4.3.12 Waste Disposal Coordinator

4.3.12.1 Education, training, and experience requirements:

- minimum of a high school diploma, and,
- minimum of 90 days of supervised experience and in-house training in the performance of the procedures the disposal coordinator will be using; this requirement may be modified by previous laboratory experience or specific training courses completed by the coordinator.

4.3.12.2 The responsibilities of the waste disposal coordinator include:

- adherence to all written laboratory procedures and the QA Documents; and,
- ensure that a licensed waste handler handles waste generated by the laboratory;
- ensure that a certified solid waste disposal facility receives the waste generated by STL Seattle; and,
- maintenance of appropriate records to document disposal.

4.3.13 Account Executive / Business Development Manager

4.3.13.1 Education, training, and experience requirements:

- minimum of associate of arts (AA) degree in chemistry (or number of credit hours in chemistry equivalent to an AA degree);
- minimum of two years experience involved in analytical procedures; and,
- familiarity with local, state, and federal environmental laws, regulations, and requirements.

4.3.13.2 The responsibilities of the account executive include:

- communicating with various government and private clients and potential clients regarding upcoming projects and STL Seattle's services and capabilities; and,
- communicating with STL Seattle's management regarding environmental laboratory business opportunities.

4.3.14 Office Manager

4.3.14.1 Education, training, and experience requirements:

- minimum of associate of arts (AA) degree in business support or accounting-related field; and
- minimum of two years experience performing bookkeeping functions.

4.3.14.2 The responsibilities of the office manager:

- supervision and oversight of all functions related to administrative support, bookkeeping, and accounting;
- supervision or performance of all functions related to accounts payable, accounts receivable, invoicing, payroll, and cash management; and,
- preparation of in-house financial statements.

4.3.15 Administrative Assistant / Receptionist

4.3.15.1 Education, training, and experience requirements:

- minimum of a high school diploma, and,
- minimum of 90 days of supervised experience and in-house training in the performance of clerical functions to include word processing, filing and switchboard operation. This requirement may be modified by previous experience or specific training courses completed.

4.3.15.2 The responsibilities of the administrative assistant/receptionist include:

- answering phones and transferring calls to appropriate personnel, greeting walk-in customers;
- data entry and preparation of analytical test reports;
- inputs test completion information into laboratory information system (LIMS);
- photocopies, faxes and mails completed reports to clients; and,
- assists bookkeeper with accounts receivable payment entries.

4.4 Procedures Initiated in the Absence of Key Personnel

All department supervisors, the client services manager, the operations manager, quality assurance manager, IT manager, environmental health and safety coordinator, waste disposal coordinator, and the two laboratory directors are considered key personnel. Each department supervisor has an analyst within the department designated as an alternate, to perform responsibilities delegated to the department supervisor. The client service manager has designated an alternate project manager (or managers) to perform responsibilities delegated to the client service manager. The operations manager, while listed under key personnel, is an administrative management position. In the event of the absence of the operations manager, other administrative management would be consulted if necessary. The director positions and quality assurance manager are oversight; as such, most technical or quality assurance policy issues can be deferred until the return of the quality assurance manager or director. In the event that an issue must be resolved in the absence of the quality assurance manager or director and cannot be resolved by the appropriate department supervisor or the EDD specialist, the operations manager or other administrative management will be consulted. The EDD specialist is consulted in the absence of the IT manager. The environmental health and safety coordinator and waste disposal coordinator have designated a qualified alternate staff member to address environmental health and safety and waste disposal issues in their absence.

4.5 Stop Work Authority

The following positions are vested with stop work authority:

- Sample Receiving--authorized to stop work (not accept any samples) for detectable levels of radioactivity;
- Technical Department Supervisors--authorized to not release analytical data without proper reporting or associated QC, or the resolution of any issues determined at the time of peer review;

- QC Specialists/QA manager--authorized to not release analytical data without proper reporting, associated QC, departmental releases, or the resolution of any issues determined at the time of QC review;
- Project Managers--authorized to not release a report without department and QC review, resolution of any laboratory issues, or the resolution of any client issues determined prior to release of the report;
- Quality assurance manager--authorized to not release a report based on quality assurance policies/issues;
- Directors--authorized to stop work based on policy issues, or project-specific issues; and,
- Laboratory Director/Operations Manager--authorized to stop work based on administrative management issues.

Figure 4-1. STL Seattle Organizational Chart (12-2-02)

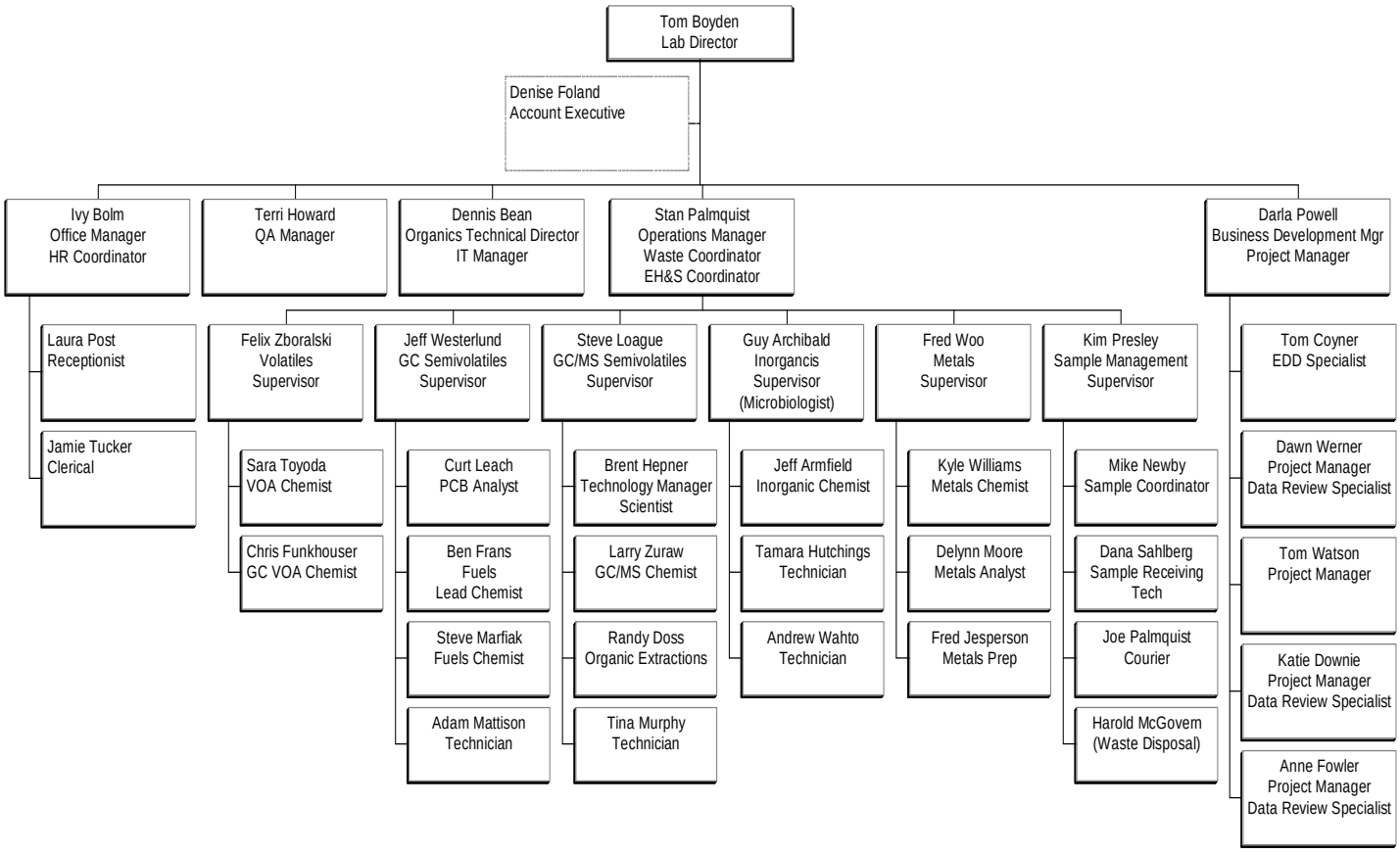


Table 4-2. STL Seattle Key Personnel

Name	Position	Education	Years Experience
Thomas Boyden	Laboratory Director	A.A. Chemistry	24
Stan Palmquist	Operations Manager Waste Disposal Coordinator Environmental Health and Safety Coordinator	B.S. Chemistry	26
Terri Howard	Quality Assurance Manager	B.S. Biology	8
Dennis Bean	IT Manager and Technical Director	M.S. Chemistry B.S. Chemistry	23
Tom Watson	Customer Service Manager	B.S. Chemistry	30
Felix Zboralski	Volatile Organics Department Supervisor	B.S. Chemistry	16
Steve Loague	Semivolatile Organics GC/MS Department Supervisor	B.A. Chemistry	13
Jeff Westerlund	Semivolatile GC and LC Department Supervisor	B.A. Chemistry	17
Fred Woo	Metals Department Supervisor	B.S. Chemistry	16
Guy Archibald	Microbiology and General Chemistry Dept. Supervisor	B.A. Biology	16
Darla Powell	Project Manager Supervisor Business Development Manager	A.A. Chemistry	18
Kim Presley	Sample Receiving Supervisor		1

5.0 TRAINING

Whether it is specialized one-on-one technical training or personal and career advancement, STL Seattle is committed to offering and promoting learning opportunities for all employees.

5.1 Specific Technologies

Specialized one-on-one technical training takes place between a qualified scientist (or qualified technician) and the trainee. The first training step is to familiarize the trainee with the specific technology. Specific technologies include the test methods, instrumentation and equipment operation and maintenance, quality control, and data processing. If use of chemicals is required by the technology, the published material safety data sheet (MSDS) for every chemical hazard is read by the trainee. The trainer's responsibility is to review the MSDS with the trainee, making sure that all potential risks are fully understood. The trainer describes the specific technology step-by-step. This segment involves interactive dialogue between the trainer and trainee. The trainee usually takes notes, and, if needed, the trainer provides supplemental information. The trainee performs the specific technology under the direct guidance of the trainer, until the trainer feels that the trainee is fully capable of using the specific technology with a minimum amount of supervision.

The trainer must critically evaluate the work of the trainee and continue to scrutinize the trainee's performance. This evaluation process includes an opportunity for the trainee to receive feedback on his or her work and make the appropriate changes recommended by the trainer. This review process continues until the trainer perceives that the trainee is fully competent at the designated task. Whenever methodologies and SOPs are revised, the trainee will undergo continued training, typically conducted by the author. This training is documented by signature record, quiz, or other appropriate means.

5.2 Outside Learning Opportunities

STL Seattle is dedicated to providing its employees with a wide variety of learning opportunities. Each employee must make himself or herself aware of the learning opportunities available around him or her. These training opportunities include any work related activities, such as: seminars; vocational courses; computer and software classes; instrument training courses; and, health and safety training.

5.3 Technical Training Requirements

5.3.1 Laboratory Documents

All employees are required to read and be familiar with laboratory documents issued to that employee. These documents include the Corporate Quality Management Plan, STL Seattle LQM, the Corporate Health and Safety Manual, STL Seattle Health and Safety Manual and the SOPs that describe laboratory procedures specific to that employee's role within the organization. The employee is required to maintain the current laboratory documents in their individual document file.

5.3.2 Proficiency Sample Analysis

Employees performing sample analysis are required to analyze proficiency (PE) samples, either as provided to the laboratory through routine program participation, or at the request of a client, or as provided by the QA/QC Department. PE samples are obtained for most of the parameters performed at the laboratory. Successful analysis of these PE samples is considered to be a demonstration of proficiency; whenever possible, the analyst most routinely performing a particular parameter should analyze the PE samples for that parameter.

5.4 Quality Assurance Training Requirements

Employees are required to attend all relevant quality assurance and project management trainings and meetings at the laboratory. These trainings and meetings are the primary mechanism used to inform employees regarding changes or additions to the QA program, as well project- or client- specific information. QA training and meetings are typically conducted by the QA manager, and are scheduled at least quarterly. The meetings are announced in a Memorandum to the employees, inviting the appropriate list of employees for the topics to be covered. A signature record documents the attendance at these trainings and meetings, and a copy of the record is maintained in the training files for each employee. Any employee not able to attend a relevant quality assurance training or meeting is then required to meet with the QA manager for individual training.

5.5 Health and Safety Training Requirements

A primary consideration in the performance of laboratory operations is the health and safety of personnel. Not only must a variety of techniques and management tasks be conducted, but they must also be accomplished in a manner that does not jeopardize the worker. STL Seattle's goal for health and safety training is to ensure laboratory employees have the required knowledge to safely perform their assigned duties. The application of standard safety procedures by trained personnel reduces the possibility of injury or exposure.

Health and Safety orientation is required for any person working in the laboratory area under any capacity. The Environmental Health and Safety Coordinator or qualified designee gives this orientation to new employees within one week of starting work. This includes:

- an introduction to the STL Corporate and STL Seattle Health and Safety Manuals;
- a tour of facilities to familiarize the employee with locations and use of emergency exits, fire extinguishers, first aid supplies, emergency spill equipment, personal protective supplies, available safety related reference information, and designated reagent and waste storage areas; and,
- an overview of emergency practices in cases of fire, organic solvent spills, corrosive agent spills, or medical emergencies.

The employee is required to read and acknowledge understanding of the STL Health and Safety Manual; the acknowledgment is on file.

Monthly health and safety training is typically conducted by the Environmental Health and Safety Coordinator. This training is required for all personnel working in analytical laboratory areas. First Aid/CPR training is recommended for all STL Seattle employees, and provided at the laboratory routinely. The Heath and Safety Manual is updated periodically, and is reviewed by each employee.

The potential of on-site work by STL Seattle requires that employees performing on-site work be knowledgeable in hazardous waste handling. Scheduled classes for 40 hours of Hazardous Waste Site Activities training are completed on an "as needed" basis for field technicians, as are the annual 8 hour refresher courses.

Continuing supervision in all areas of laboratory safety is ongoing, especially with respect to assigned work in analytical operations, established Washington Department of Labor and Industries protocols in hazardous materials handling, and STL Seattle policy decisions affecting general laboratory safety (for example, personal protective equipment use, food consumption areas, laboratory equipment security and reagent control).

5.6 Legal and Ethical Training

Initially upon hiring, and on an annual basis thereafter, all laboratory personnel must attend training to emphasize legal and ethical responsibilities, including the potential punishments and penalties for inappropriate, improper, unethical, or illegal actions.

5.7 Training Documentation

5.7.1 Individual Technical Training

Individual technical training is documented with an Analyst Qualification Form, which is completed by the Analyst (or technical person), the technical lead performing the training, and the Department Supervisor. If the training is for a specific method, a copy of a successful analysis of an "unknown", a PE sample or four IDOC (Initial Demonstration of Capability) samples must accompany the Analyst Qualification Form. In addition to the successful analysis of an "unknown", a PE sample or IDOCs, the appropriate analyst yearly DOC (Demonstration of Capability) must be present in the training file.

5.7.2 Group Training (QA, Project management, Safety)

Group training performed at STL Seattle is documented with a training record, indicating the type of training, the date of the training, and signatures of all attendees at the training session. General Laboratory and quality assurance training records are maintained by the QA manager in individual employee training files. Health and Safety training records are maintained by the health and safety officer in employee health and safety files. Employees are required to attend applicable training whenever reasonably possible.

5.7.3 SOP Training

SOP training will be documented for each employee who receives a copy of the SOP within one week of distribution. Each new revision of an SOP requires continued training documentation. All employees will document (by electronic or hardcopy signature record) that each SOP and SOP revision distributed to him/her has been read and understood.

5.7.4 Legal and Ethical Training

Each employee must document legal and ethical training by signature record. He/she must read the required documentation and acknowledge and understand the legal and ethical responsibilities as written and explained by the trainer.

5.7.5 Outside Training

Outside training, either courses or seminars are documented in the employee training file.

6.0 QUALITY ASSURANCE PROGRAM OVERVIEW

Daily activities within an analytical laboratory are directed toward the analysis of samples. However, there are many laboratory activities that precede or follow analysis that are necessary to control and verify the sample results; these activities represent the daily implementation of the quality assurance program. This section introduces these activities and provides an overview of the total system providing quality assurance within the laboratory. Figure 6-1 is a schematic of the flow of analytical procedures within the laboratory. Figure 6-2 is a schematic of the flow of data systems within the laboratory.

Figure 6-1. Laboratory Analysis Flow Chart

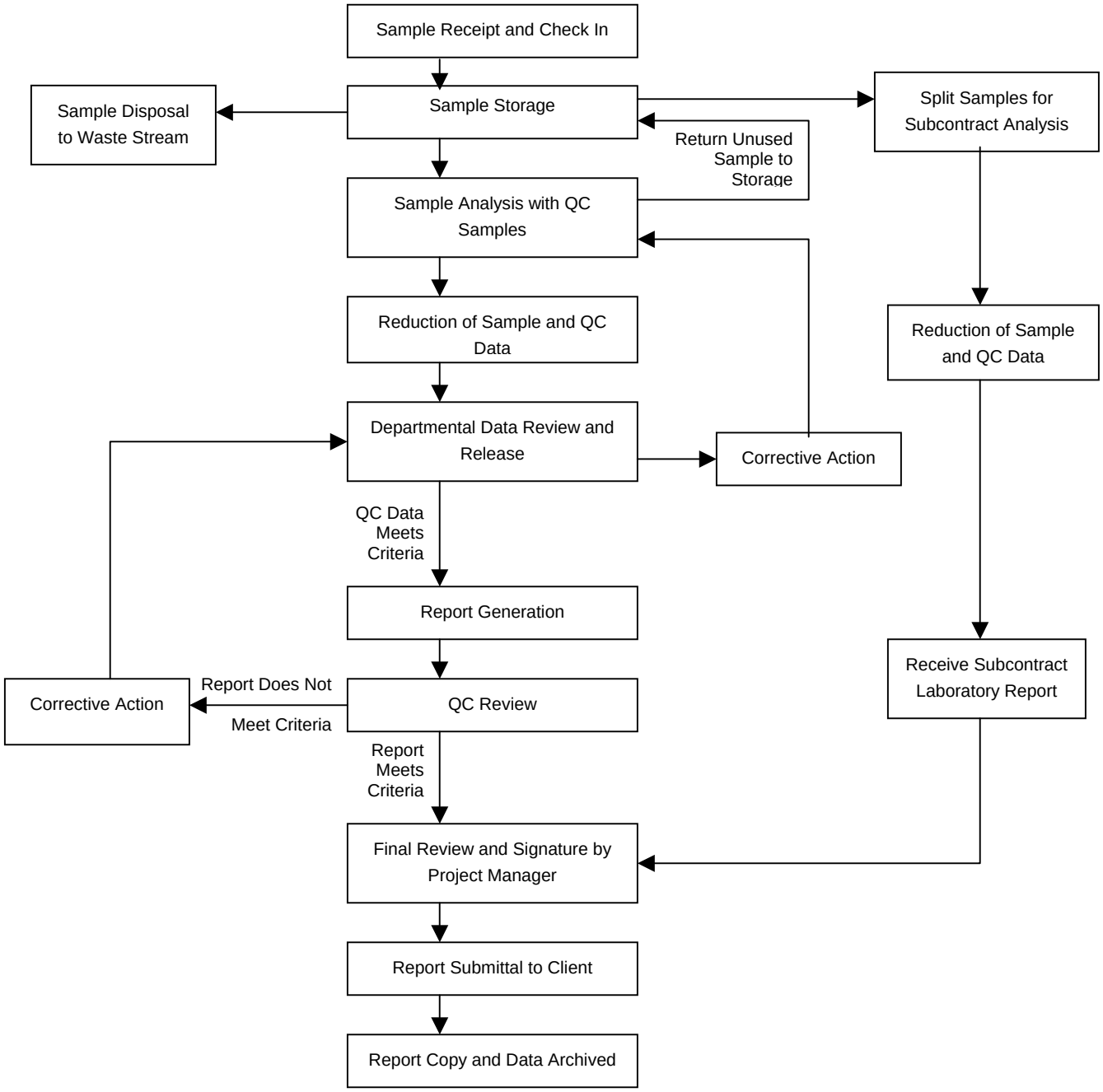
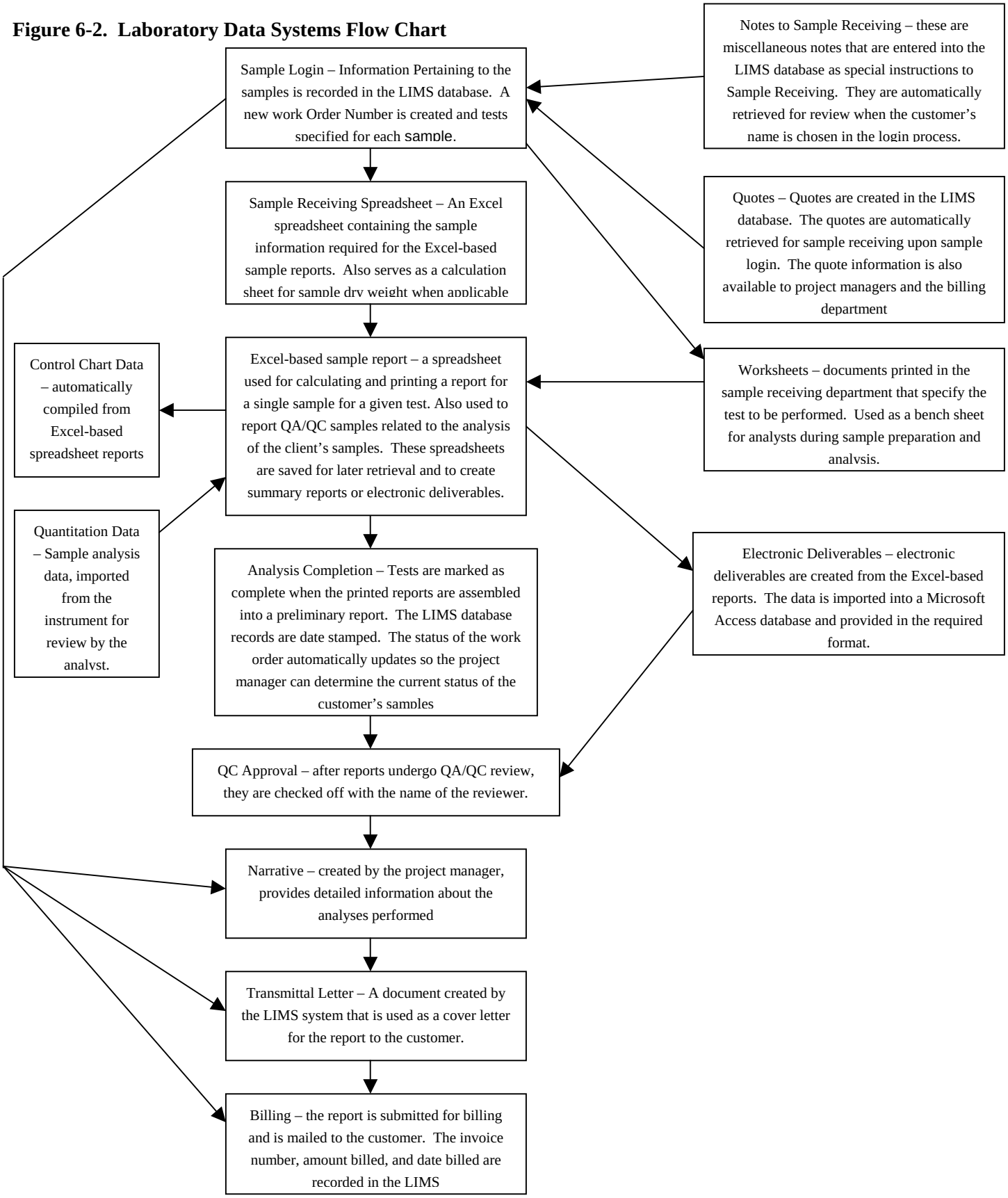


Figure 6-2. Laboratory Data Systems Flow Chart



6.1 Sample Receipt and Processing

Prior to acceptance of samples, STL Seattle must ensure that the laboratory has the appropriate facilities and resources to successfully complete the requested work. The contract review and project planning is carried out by the STL Seattle project manager, sample receiving personnel, and/or STL Seattle laboratory directors/managers. Detailed information on contract review, design control and quality planning mechanisms are included in the STL Corporate Quality Management Plan.

Upon sample receipt, the sample custodian performs the following activities:

- samples are examined for damaged containers;
- sample preservation measures are reviewed;
- Chain-of-Custody documentation is completed;
- a work order is completed;
- samples are logged in according to work order number;
- workorder numbers are assigned to sample groups and samples are individually numbered;
- samples are placed in the proper storage environment; and,
- the testing program is defined.

The sample receiving personnel fills out all internal documents according to procedures described in the appropriate SOPs, relinquishes the samples to the sample custodian, and submits the sample paperwork into the laboratory after project manager approval.

Once all analyses are completed, reviewed by the analyst, peer reviewed, and released by the department supervisor, an analytical report is generated. The report is submitted to the data review specialists for quality control review. When the quality control review is completed, the report is submitted to the project manager for final review and signature. The data review specialists are forbidden to do quality control review in lieu of peer review or department supervisor review. The data review specialists are also forbidden to do quality control review for projects were they serve as a project manager. The original report is then submitted to the client, along with copies of the custody information and any requested copies of raw data. The original custody information, raw data, and a copy of the report and invoice are archived in STL Seattle files.

The process is continuously monitored by a project manager; any interruptions or problems with the flow are handled as they arise, to insure holding times and project due dates are met.

6.2 Material and Instrument Preparation

Concurrent with analysis, the auxiliary functions described below are routinely performed to verify and maintain acceptable materials and instrument performance.

6.2.1 Material Procurement and Control

In order to maintain traceability and control materials used in the laboratory, the following procedures have been established:

- acceptable grades of reagents, solvents, gases, and water are obtained for use within the laboratory;
- the adequacy of laboratory materials is verified before use by reagent blank and method blank analysis;
- acceptable precision and accuracy of volumetric glassware used is ensured;
- proper storage and handling of reagents and solvents is observed;

- traceability is maintained through logbook documentation or appropriate QA and/or inventory files in accordance with the applicable standard operating procedure(s); and,
- established cleaning protocol for laboratory glassware and equipment are followed.

These procedures are described in STL Seattle SOP 0010, 0030 and 0525, and are issued to departments and appropriate analysts.

6.2.2 Instrument Calibration

The following are activities performed as part of the STL Seattle calibration program:

- the performance of instruments which measure physical parameters are routinely tested with suitable standards to ensure proper calibration;
- instrument response to standards of known chemical composition and concentration are determined;
- the range of an instrument's linear response is determined; and,
- the limit of detection of the instrument is determined.

Instrument calibration procedures including frequency, reference standards used, calibration acceptance criteria, and verification of calibration criteria, are described in Appendix D of this Manual.

6.2.3 Preventive Maintenance

The following are activities performed as part of the STL Seattle preventive maintenance program:

- instruments are serviced on a routine basis to maintain performance;
- a stock of instrument parts are maintained;

Instrument system maintenance is described in either dedicated SOPs, or integrated into the routine method performed with the system. In general, analysts are responsible for instrument maintenance, on a schedule appropriate for instrument or system requiring maintenance. Analysts will also assume responsibility of procurement of necessary parts and equipment for routine and non-routine maintenance or repair. Outside service can be used for maintenance, including specific maintenance contracts when appropriate.

6.3 Analytical Procedures

Sample analysis occurs as part of the "analytical procedures" performed in the laboratory. The suite of activities involved in sample analysis include:

- review of sample holding times by the analyst to verify that sample integrity has been maintained;
- review of requested method with consideration of the client data quality objectives;
- performance of analysis specified by the client, including instrument calibration and the analysis of quality control samples and standards;
- documentation of any method variance with respect to sample results;
- computation of analytical results from sample data (data reduction);
- internal review of the analytical results;
- reporting of the analytical results to the client; and,
- archiving of the analytical results.

6.4 Modifications or Non-Standard Methods

6.4.1 Routine Procedures

When routine procedures are modifications of published methodologies, the designation "modified" will appear in the title for the reported results. In the laboratory SOP, the modifications to the published method will be described. A typical example of a modification used and identified is the use of a mass spectrophotometer as a detector instead of an ECD or other GC detector for SW-846 pesticide analyses. The word "modified" designation will be used in the title of the reported results when appropriate; the SOP will also detail modifications to the referenced methodologies.

6.4.2 Client-specific or Project-Specific Modifications

When a client (or a project) has specific requirements of the laboratory, a modification of existing procedures may be necessary. Typically, the target analyte list may be amended or the Practical Quantitation Limits (PQLs) may be modified to meet project goals. The necessary modifications are discussed and defined with the appropriate technical or QA personnel, and the interactions with the client or any client documents are maintained in the project manager's client file, or the project file. The modifications are documented as appropriate in laboratory records, and are usually described in the report narrative.

6.4.3 Sample-Specific Modifications

When a set of samples requires modifications to existing procedures in order to generate acceptable analytical results, the client will be contacted and the modifications proposed by the laboratory submitted for client approval. Approval may be verbal or written, depending on the nature of the project. An example of this kind of modification would be the proposal of an alternate surrogate compound, or additional cleanup, due to problems with interferences present as part of the sample matrix.

6.5 Quality Control Procedures

Quality control procedures are developed to collect data that allows assessment of the analytical instrumentation performance, as well as method performance with respect to the specific sample group. Three steps are involved in the evaluation of sample batch or method quality control sample results:

- computation of quality control sample data;
- comparison of quality control sample data with established acceptance limits; and,
- internal review of the quality control results.

Quality control data are compared against stated acceptance levels for precision and accuracy; these levels may be inherent in the requested method, established by the client, or established by the laboratory. If the quality control data meet acceptance levels, analytical data processing begins. If the quality control data do not meet acceptance levels, corrective action is taken.

6.6 Corrective Action Procedures

If quality control data are outside criteria, the cause is identified and corrected. If the cause can be corrected or resolved in a way that does not affect the integrity of the analytical data, analytical data processing can proceed. Corrective action situations that affect the integrity of the analytical data require reanalysis of the affected samples or data flagging within the final data report. Corrective action can occur in all areas of the analytical process, from sample receipt to data reporting.

6.6.1 Control charts

Corrective action procedures for control chart data are described in the appropriate SOPs. The laboratory keeps records of all out-of-control events, the determined cause(s), and corrective action taken.

6.6.2 Data recording

All handwritten data are recorded using indelible ink and no correction fluid is used on original laboratory records. Corrections made to data are documented with a single strike out and the recorder's initials and date.

6.6.3 Data reporting

If corrections or additions to a laboratory report are necessary, they are documented in the batch file, and a revised report with a **"revised report date":** is issued to the client.

6.6.4 Client complaints

The laboratory responds to client complaints using a Client Contact Record. Resolution of the complaint is documented on the Record. The Client Contact Record, and any resulting revised documents, are kept in the batch file for the samples associated with the complaint. A copy of the complaint and resolution is provided to the QA manager or saved in the LIMS.

6.7 Data Processing and Validation

Analytical results are generated from raw data by the analyst, using procedures specific to the analytical methods, and described in the appropriate SOP. The analyst, using procedures specific to the analytical method, evaluates the data; sample data evaluation procedures for major instrument systems are provided as Appendix E. The laboratory adheres to all stated quality control requirements as published by the method being used, or modified as described in the SOP.

Once the data has been processed and evaluated by the analyst, the resulting data are reviewed and validated by an analyst other than the one performing data processing as described in SOP 0635. Validation demonstrates that the proper input parameters (such as response factors or dilutions) have been used and calculations are correct.

6.8 Data Reporting

Analytical data and quality control data are summarized in standard presentation formats, either designed by STL Seattle or supplied by the client. The data report is reviewed by the quality assurance manager or a QC specialist to verify that the report is consistent with the worksheets and other file documents, and that data meet or exceed required acceptance levels, or are qualified appropriately. Detailed procedures for data review are described in SOP 0606, 0625, and 0635. Any issues affecting the reported results are described in an analytical narrative provided with the reported results. After review and approval by the department supervisor or the project manager, the data report is issued.

6.9 Data Storage

There are several records categories prepared within STL Seattle. These include:

- workorder or report files which include a copy of the final report, analytical worksheets, nonconformance memos, Chain-of-Custody documents, workorder billing sheet, invoice, and other documents which pertain to a specific

report. The workorder files are arranged by ascending number, and may be further arranged by client. The raw data are linked to the file by the assigned report number, which appears on all worksheets;
- client files, which are arranged by client name (the active file is for the current year);
- instrument run files which include raw data, calculations and results for all samples and standards analyzed on a given instrument and day; and,
- quality assurance files, which include records demonstrating overall laboratory operation such as the master laboratory sample log-in book, extraction log books, instrument run logs, instrument performance and maintenance log books, control charts, and audit records.

Separate files are maintained for each of the records categories. However, the records management system enables cross-referencing of records by date and instrument run number so that implementation of the quality assurance program can be demonstrated.

6.10 Electronic Data System Integrity and Security

STL Seattle has adopted Sections 8.1 through 8.11 of EPA Document "2185 – Good Automated Laboratory Practices", 1995, as appropriate and applicable, for the standard for the LIMS. Data integrity and security are described in detail in SOP 0523.

Individual PCs in the laboratory that are connected to the central server are secured by a user name and password. As per standard network security doctrine, the passwords are eight to sixteen characters consisting of random numbers and characters. The passwords and usernames are supplied to individual users, and access to the central server is controlled on an individual user basis. Persistent and temporary connections to the server require the use of a password to establish the connection. Only the IT Manager and the Laboratory Director know this password. The server is located in a locked office to restrict physical access. Only the IT Manager and the Laboratory Director have keys to access the server. Dialup access to the server is disabled.

Changes to sample spreadsheets are logged to the server with the date, time, and name of the user making the change. Software is available to recall the "log" of changes made to a spreadsheet report.

7.0 MATERIAL PURCHASING AND CONTROL

The quality of reagents, solvents, gases, water, and containers used by STL Seattle must meet or exceed the purity requirements necessary for accurate analytical determinations.

Each scientist is responsible for requesting and controlling materials used in their respective analysis. Material purchasing and control duties include specifying suitable grades of materials, recording the opening date and/or lot numbers of all containers, storing materials properly, and disposing of materials when shelf life has expired.

The purchasing officer is responsible for ordering materials and verifying that the correct material has been received. Purchasing duties also include dating all chemicals with the receipt date.

7.1 Requirements for Reagents, Solvents, and Gases

Chemical reagents, solvents, and gases are available in a variety of grades and purities, ranging from technical grade to ultrapure grades. The required grade for each particular analysis is stated in the SOP for the method. Each scientist is responsible for determining the grade suitable for his or her analysis.

7.2 Requirements for Laboratory Containers and Glassware

STL Seattle routinely supplies prewashed, certified glassware and polyethylene bottles (Level I) for environmental sample collection. For microbiological analyses, pre-cleaned and pre-sterilized containers, preserved with sodium thiosulfate, are purchased; the containers have a sterility seal, which must be broken before use, and a locking device to seal the container after the sample has been collected.

Samples received in other containers will be analyzed following STL Seattle procedures; however, STL Seattle will not take responsibility for cleanliness of the container, and the container may warrant a nonconformance report, if the container may affect the quality of the analytical results.

STL Seattle laboratory glassware and equipment is thoroughly cleaned before use, following established procedures described in SOP 0010. Each lot of sample containers for microbiological analyses is tested for inhibitory or nutrient substances. Each lot of sample containers for volatile analysis is tested for low-level contamination before use.

7.3 Chemical Storage

All chemicals are stored in accordance with the manufacturer's recommendations. These recommendations may include:

- storing light-sensitive reagents in a cool, dark place;
- storing neat compounds at or below $4^{o}C \pm 2^{o}C$ (-10 to $-25^{o}C$ for certain volatile standards);
- storing flammable materials in an explosion-proof flammable storage cabinet; and,
- storing strong oxidizers away from flammable compounds.

Special storage requirements for a compound will be stated in the SOP where the chemical is used.

8.0 SAMPLE HANDLING PROCEDURES

8.1 Chain-of-Custody

Evidence of collection, shipment, laboratory receipt and laboratory custody of samples until disposal must be documented, to create an accurate written record which can be used to trace the possession and handling of the samples within the laboratory. Documentation of custody is best accomplished by means of a Chain-of-Custody Form that records 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 a person's actual possession;
- in a secured area, restricted to authorized personnel.

8.1.1 Field Custody

The field Chain-of-Custody record shall be signed by each individual who has the samples in his or her possession. The Chain-of-Custody form preparation procedure is described in the STL Seattle SOP on Sample Receipt and Login. The client may have unique Custody forms, or may use forms provided by STL Seattle.

The original field Chain-of-Custody document is kept in the batch file; a copy of the Chain-of-Custody is provided to the client at the time samples are relinquished, and again with the final report. The Chain-of-Custody document is typically kept in the permanent data file, unless the sample is returned to the client (some clients require the return of the original).

If samples are returned to the client, the original Chain-of-Custody documents are relinquished with the samples. Once the sample has been destroyed, the original Chain-of-Custody documents may be returned to the client upon request; in this case, a copy is maintained in the laboratory archives.

The laboratory does not require field Chain-of-Custody documentation for samples accepted at laboratory; custody documentation is the responsibility of the sample collector until the time the sample is received at the laboratory. Laboratory internal custody is documented elsewhere; the presence or absence of a Chain-of-Custody document is recorded in the workorder file.

8.1.2 Internal Sample Custody

Upon completion of laboratory documentation of sample receipt, the sample receiving technician relinquishes the samples to the laboratory sample custodian, who places the samples into a refrigerator. Internal custody of the samples is accomplished (typically) by logging of the sample volumes in and out of the refrigerator on the laboratory Header Form by the person removing the volume. For samples requiring “controlled” internal custody, the samples will be placed in a locked refrigerator, and formally relinquished to the analyst by the custodian. In this case, the analyst will return the unused volume to the custodian for return to the locked refrigerator. Controlled custody may be extended to digests and extracts when appropriate.

8.2 Sample Labeling

8.2.1 Sample Labeling at the Time of Receipt

Every sample should be labeled to identify:
- client name;
- site name;
- sampling date and time;
- sample number;
- sample preservation method; and,
- analyses requested.

STL Seattle provides labels to clients upon request. Labels should be filled out using black, waterproof ink. Labels should be filled out before collection to minimize handling of the sample container. Labels must be firmly affixed to the sample containers.

STL Seattle does not require that STL labels be used, or sample labels be "complete", as long as the samples can be clearly identified and the requested analytical suite determined. If this is not possible, the client is contacted, and/or a nonconformance issued.

8.2.2 Sample Labeling by the Laboratory

The laboratory will place laboratory unique numbers on the sample containers before placing them in the refrigerator. The laboratory will also assign letters to identify the specific volumes as appropriate.

8.3 Sample Preservation

Samples are accepted "as received" from the client; information on sample preservation is recorded on the sample label. Proper preservation up to the time that STL Seattle receives the samples is the responsibility of the client. Improper preservation that will affect the integrity of the sample, such as no ice in the sample cooler for a sample submitted for volatile analysis, is noted in a nonconformance memo at the time the samples are received.

Recommended sample containers and sample preservation techniques are provided to the client on request; the information made available by STL Seattle to the client is summarized in Appendix C. Preservatives may be added to the containers by the laboratory prior to the sampling effort, or provided with the containers, if requested by the client.

Water samples for metals analysis or oil and grease analyses that have not been preserved by the sampler may be preserved at the time of their arrival in the laboratory. Soil samples submitted for volatiles and nonvolatile analyses with only one container provided are sampled first for volatiles extraction and/or analysis so as to maintain the integrity of the sample. Sample preservation procedures performed by the laboratory are described in the SOP dedicated to sample preservation, or in the appropriate analytical method.

8.4 Laboratory Sample Receipt

Upon sample receipt, the sample receiving technician completes the following steps:

- confirms that the Chain-of-Custody is present, complete, has been signed by the field personnel and matches samples received;
- signs and dates the Chain-of-Custody form and attach the airbill/bill of lading to the Chain-of-Custody form;
- examines condition of all samples (sufficient volume provided, appropriate containers and labels, intact, preserved per method specification, VOA headspace), custody seals, and accompanying paper work;
- records sample condition on the Chain-of-Custody form, as applicable;
- measures and records temperature of samples received in a cooler;
- verifies that sample holding times have not been exceeded;
- confirms necessary turnaround time needed by client if representative is present;
- initiates nonconformance memos as needed;
- adds preservative if requested by a client;
- enters the sample information in the LIMS to generate a workorder;
- gives the workorder master file to the project manager for review and approval, project manager verifies ability of STL Seattle to provide needed turnaround time with laboratory personnel;
- notifies the department supervisors or other appropriate personnel of sample arrival by giving them a copy of the work order and Chain-of-Custody documentation;
- initiates the project by placing the Chain-of-Custody, correspondence, and other field documentation in a file folder and filing numerically in the active master file; and
- relinquishes the samples to the sample custodian (who places the samples into the appropriate refrigerator).

If samples are considered compromised based on initial inspection, nonconformances are documented and the client is contacted. The final report will indicate any applicable nonconformances based upon condition of samples upon receipt.

8.5 Laboratory Sample Storage

The primary considerations for sample storage are maintenance of the sample at the prescribed temperature, if required, and extracting and/or analyzing samples within the prescribed holding time for the parameters of interest.

Suspected or highly contaminated samples are not stored separately from other samples for any parameters except for volatile organic compounds; however, the suspected or highly contaminated samples will be placed in a Ziploc container before storage.

Sample volumes submitted for volatile organic compound analyses only are stored in separate refrigerators. These samples are stored in a separate volatiles refrigerator if suspected or highly contaminated. Suspected or highly

contaminated samples will be opened and prepared in a hood whenever possible. These samples are returned to the refrigerator as soon as possible, to minimize volatilization of hazardous substances, or cross contamination of other samples.

8.6 Holding Times

Holding times employed by the laboratory are described in Appendix C. Holding times are defined from the time of sample collection until extraction or analysis of the sample. Placing of samples in the proper storage environment as soon as possible is the joint responsibility of the sample receiving technician and the sample custodian. The project manager or sample custodian should notify the appropriate analyst if there are any incoming samples which must be analyzed immediately because of unique holding time requirements.

The laboratory will qualify samples analyzed outside holding times. The impact of the qualification on the end use of the data will be dependent on the specific analyte of concern, and may be addressed in the analytical narrative accompanying the analytical results.

8.7 Initiating Testing Program

Analyses are requested by specification of the required test(s) on a Chain-of-Custody form, or other information received from the client.

If the required analytical tests are not clearly specified, the sample custodian immediately notifies the project manager for definition of the testing program. The analytical program is entered onto the master analytical work order in the LIMS. All verbal communications with clients regarding adding or deleting analyses are recorded on the original Chain-of-Custody Form, or in a client contact record, as well as on all relevant documents. Client contact recordkeeping procedures are described in detail in the laboratory SOP.

The sample custodian is responsible for prioritizing work on the basis of holding times and required reporting date. Any subcontracting of samples or sample volumes is organized during the initiation of the testing program, following procedures described in the STL Corporate Quality Management Plan and STL Seattle SOP 0018.

8.8 Sample Batching

A sample batch is defined as a group of samples of similar matrix that behave similarly with respect to the procedures being employed. The number of samples in a preparation and/or analysis batch may not exceed the method specified limit (usually 20, or 10 for certain wastewater methods) as described in the associated SOP. Field QC samples (e.g., field blanks, field duplicates, trip blanks) are each counted as individual samples for the purposes of determining the number of samples in a batch.

All the samples in a batch must be processed as a unit with the same method sequence and the same lots of reagents and standards. For organic analysis, the same solvent must be used, and the same number of extractions must be performed. The same concentration and amount of surrogate must be added to all samples in the batch.

If an analytical sequence contains more than one distinct step, such as a preparation step prior to the analysis step, quality control samples required by the method for the batch must be assigned and prepared in the initial step. This group of samples is called a preparation batch, and must contain all quality control samples required by the method, including matrix spike, matrix spike duplicate, duplicate, method blank, laboratory control sample, or other QC samples as appropriate. A preparation batch must not contain more than the method specified number of field samples (usually 20, or 10 for certain wastewater methods). Laboratory QC samples processed with the preparation batch are not counted in the maximum batch size.

If the instrumental analysis of the samples in one volatiles preparation batch is not performed in a continuous sequence, the method blank from the preparation batch must be analyzed with each set of samples from the same preparation batch. If re-analysis is required (e.g., dilution analysis), it is not necessary to include the method blank in the re-analysis.

The manipulations common to each sample in a batch may be performed either simultaneously or in a continuous sequence without interruption. The applicable SOP must clearly define and document which batching approach is utilized, and the maximum number of samples permitted in a batch, as stated in the reference method(s).

Sample preparation is carried out in accordance with the applicable SOP.

8.9 Completeness, Representativeness, and Comparability

The laboratory will make every effort to provide results that are complete, representative, and comparable. Completeness for a set of samples submitted will typically mean that all samples have been analyzed, all raw data is present, all associated QC is present and any nonconformance or narrative information is included in the data file. The analyst will ensure representativeness through appropriate aliquoting of the provided volume. The project manager will ensure comparability through historical knowledge of the project or the client, or through information provided about the project.

8.10 Sample Disposal

There are several possibilities for sample disposal:

- the sample may be completely consumed during analysis;
- samples may be returned to the client or location of sampling for disposal; or,
- samples may be disposed of by STL Seattle after appropriate storage time.

In general, samples will be stored for 30 days after they are received. After the appropriate storage time the samples/extracts are disposed of with other laboratory waste, following approved Environmental Protection Agency and Washington State regulations (or other state regulations when appropriate).

Separate waste streams are treated and prepared for disposal. The laboratory has identified eleven primary waste streams: soil and debris; broken sample jars; non-PCB soils and solids; low level PCB soils and solids, organic solvents (methylene chloride, Freon, and non-halogenated solvents); vials from gas chromatographic analysis; low level PCB vials, sulfuric acid waste, mercury waste, paint and sludge, and metals digestate. Occasional disposal of secondary waste streams or non-routine waste streams is necessary, and is carried out following requirements of the designated disposal company.

Aqueous sample volumes are filtered to remove oil and grease or any sludge before release into the drain system. Aqueous pH neutralization is also performed (when appropriate). No local wastewater permit has been required, based on current practice.

Appropriate records are kept to document disposal of all samples. The waste disposal coordinator is responsible for maintaining the sample disposal records.

9.0 INSTRUMENT AND EQUIPMENT CALIBRATION

Instruments and equipment used by STL Seattle are controlled with a calibration program. The program verifies that equipment of the proper type, range, accuracy, and precision are used to provide data which meet project requirements. Two types of calibration are discussed in this section and defined below.

Operational calibration. An operational calibration is a calibration which is routinely performed to develop a standard curve. Operational calibrations are generally performed for instrument systems.

Periodic calibration. A periodic calibration is a calibration which is performed at prescribed intervals for equipment such as balances, refrigerators, and ovens. In general, equipment which can be calibrated periodically are relatively stable in performance, and provide consistent performance with only minor adjustment.

9.1 Calibration Program

The elements described below comprise the overall calibration program at STL Seattle.

9.1.1 Calibration Procedures

Written procedures are developed and followed by STL Seattle for all instruments and equipment subject to calibration. Whenever possible, recognized procedures such as those published by the American Society for Testing and Materials, the United States Environmental Protection Agency, the National Institute for Occupational Safety and Health, state-specific publications, or procedures provided by manufacturers are adopted. If established procedures are not available, a procedure is developed considering the type of equipment, stability characteristics of the equipment, required accuracy, and the effect of operational error on the quantities measured. At a minimum, the procedures include:

- specific equipment to be calibrated;
- reference standards used for calibration;
- calibration technique employed;
- acceptable performance tolerances; and,
- calibration frequency.

9.1.2 Equipment Identification

Equipment that is subject to calibration is uniquely identified so calibration records can be accurately kept. STL Seattle's equipment are each identified by a unique number or name assigned by the laboratory, the date installed, manufacturer’s name, model number, and serial number.

9.1.3 Calibration Frequency

Instruments and equipment are calibrated at prescribed intervals and/or as part of the operational use of the equipment. Frequency is based on the type of equipment, inherent stability, the manufacturer's recommendations, intended use, effect of error upon the measurement process, and prior experience. The appropriate calibration frequency is described in the use and maintenance SOP for the instrument, or in the specific analyses SOP applied to the instrument system.

9.1.4 Calibration Reference Standards

Two types of reference standards are used within STL Seattle for calibration and defined below. All documentation for reference standards are maintained in the appropriate logbook or QA file to allow for complete traceability of measurements. Laboratory logbooks must contain sufficient information to provide full traceability. Documentation

requirements for logbooks are described in SOP 0609. Documentation requirements for standards and reagents are described in SOP 0611, 0612, 0614, and 0615.

Physical Standards. Physical standards are generally those used for periodic calibration, such as weights for calibrating balances (according to SOP 0014) and certified thermometers for calibrating working thermometers and ovens (according to SOP 0024). Physical reference standards are used only for calibration and are stored (along with original certificates and outside calibration certificates, as appropriate for traceability) separately from equipment used for analyses. In general, physical reference standards are at least four to ten times as accurate as the requirements for the equipment that they are used to calibrate.

Chemical Standards. Chemical standards are generally those used for operational calibration such as Standard Reference Materials provided by the National Institute for Standards and Technology or the Environmental Protection Agency Reference Standards. Whenever possible, chemical reference standards are directly traceable to National Institute for Standards and Technology Standard Reference Materials. If Standard Reference Materials are not available, compounds of certified, high-purity are used to prepare uniquely identified calibration standards. Preparation and tracking of standards shall be documented in the appropriate logbook as specified in the applicable standard operating procedures to provide full traceability. Standards prepared in-house are validated against traceable standards prior to use.

9.1.5 Calibration Failure

Equipment that fails calibration or becomes inoperable during use is removed from service or is tagged to indicate it is out of calibration. Such equipment is repaired and satisfactorily recalibrated before reuse. Equipment failure and subsequent recalibration/corrective action are documented in the appropriate instrument maintenance log.

9.1.6 Calibration Records

Calibration records are prepared and maintained for each piece of equipment needing calibration. As appropriate, records for periodically calibrated equipment include:

- unique identification number or name of equipment and type of equipment;
- calibration frequency and acceptable tolerances;
- date calibration was performed;
- STL Seattle personnel or external agencies performing calibration;
- reference standards used for calibration;
- calibration data including linear regression line; and,
- information regarding calibration acceptance or failure and any repair of failed equipment.

Calibration records for periodically calibrated equipment are maintained in the laboratory quality assurance files. Calibration records for each piece of equipment shall be kept in a separate folder or logbook.

For operational calibration, the following is performed:

- calibration raw data are filed with instrument run files by date. Therefore, if samples from different projects are processed together, calibration data can be copied and included with each group of samples;
- calibration records are maintained in the quality assurance files by instrument and date; and,
- instrument run logs list the calibrations (both initial and continuing) and samples in the order introduced.

9.2 Periodic Calibration

Periodic calibration is performed for equipment such as balances, thermometers, and pipettes that are required in the analytical methods but which are not routinely calibrated as part of the analytical procedure. Calibration documentation will be kept as described in the "Calibration Records" section of this Manual.

9.3 Operational Calibration

Operational calibration is generally performed as part of the analytical procedure and is dependent upon the instrumentation within STL Seattle. Specific standard operating procedures and approved methods are followed when calibrating instruments. Calibration data are filed chronologically with other daily operational data.

A calibration standard is a volume of appropriate solvent spiked with concentrations of target analytes. Standard solutions are prepared which define the expected calibration range of the instrument. A standard of zero concentration may be included in the standard series. Method specific calibration procedures are used to correlate instrument response with standard concentrations. This procedure defines the linearity characteristics and the working range of the instrument.

Laboratory instrument calibrations may be performed by analyzing and evaluating initial and continuing calibration standards. Initial calibration standards define the working range of the analytical system and establish the relationship of instrument response to target analyte concentration. Initial calibrations include a minimum of two points, not including blanks or zero standards. Because instrument response is subject to change, analytical standard operating procedures typically specify continuing calibration or specific check standards to be analyzed to verify that the instrument response is within an acceptable range when compared to the initial calibration curve or to the standard true value. Continuing calibration analyte concentrations are set near the midpoint of the initial calibration range, and are prepared in the same manner as the initial calibration standards. The percent recovery, percent difference, or percent drift may be calculated and recorded on laboratory quality control result data sheets, as specified in the analytical standard operating procedures. Quality control results may be charted on control charts. Continuing calibration analyses are generally performed at a minimum frequency of every 12 hours.

10.0 PREVENTIVE MAINTENANCE

The preventive maintenance program is designed to perform an organized sequence of actions to maintain proper instrument and equipment performance and to prevent instruments and equipment from failing during use. The preventive maintenance program is intended to increase the reliability of measurements.

10.1 Implementation

Implementation of the preventive maintenance program is dependent upon the specific instruments and equipment used. The program is defined by the department supervisor with approval by the quality assurance manager and implemented by each laboratory section. The department supervisor reviews performance to verify compliance with instrument specific documentation, frequency, and maintenance to be performed as defined in the instrument or instrument maintenance SOPs.

10.2 Documentation

Preventive maintenance is documented and the records stored in the department. A separate file is maintained for each analytical instrument. The instrument files include:

- external service contracts (if applicable);
- maintenance and service records, both internal and external.

Maintenance or manufacturer's instrument manuals are available to all analysts. All maintenance performed by the analyst or an outside service is recorded in the maintenance log assigned to that instrument. The in-house consumables list is used as a basis for supply of consumables used during maintenance. Instrument maintenance procedures are documented in laboratory SOPs.

11.0 QUALITY CONTROL SAMPLE ANALYSIS AND EVALUATION

Quality control samples are samples which are routinely added to the normal laboratory sample batch or sequence to demonstrate the laboratory is operating within prescribed requirements for accuracy and precision. Quality control samples are of known content and concentration so that precision, accuracy, and cleanliness of the system can be determined and control charts can be maintained.

Quality control samples are analyzed as recommended herein unless analytical procedures specifically prescribe different quality control sample analysis. If so, the procedure is followed as stated in the standard operating procedure.

11.1 Types of Quality Control Samples

Quality Control samples are analyzed to assess contamination, determine accuracy, or determine precision of the system or of the samples being analyzed. The types of quality control samples used at STL Seattle are described below.

11.1.1 Blank Analyses

Contamination can be introduced into a sample from many sources during the process of sample collection, transport, storage, and analysis. Contamination of the sample from the laboratory or the field can be determined by analysis of the appropriate blank. The blanks used by STL Seattle to determine laboratory contamination or field contamination are defined below.

Method Blank. A method blank is a volume of appropriate matrix, reagents, and solvents, carried through the entire analytical procedure. The volume or weight of the matrix used for the method blank must be approximately equal to the sample volume processed. A method blank is performed with each batch of samples (typically 20, or 10 for certain wastewater methods). The method blank measures combined contamination from the instrument, reagents, solvents, and the all other materials involved in the sample preparation steps. The method blank is critical in distinguishing between low-level field contamination and laboratory contamination. Ideally, a method blank should not contain contaminants greater than the method detection limit for the analyte. Method blank analysis results are maintained with the corresponding analytical data.

Instrument Blank. An instrument blank is a volume of appropriate laboratory solvent(s) or reagent(s) analyzed at the start of an analytical run. The instrument blank measures instrument contamination; detectable levels of target analytes indicate that instrument maintenance must be performed prior to proceeding with the analysis.

Instrument Carryover Blank. An instrument carryover blank is a volume of laboratory reagent and/or solvent that is analyzed following the analysis of a sample containing high concentrations of target analyte. The instrument carryover blank measures carryover contamination that may occur after sample analysis.

Reagent Blank. A reagent blank is an environmental sample containing all method reagents except for a color forming reagent. A reagent blank is used in colorimetric analysis to measure potential interferences derived from the sample matrix.

Refrigerator Blank. A refrigerator blank is a volume of laboratory reagent water that is analyzed for target volatile compounds after a specified length of time in the sample refrigerator. The refrigerator blank measures the amount of cross contamination from samples stored in the refrigerator.

Source Blank. A source blank is a volume of the reagent used to prepare blank samples. The source blank measures contaminants in the laboratory reagent.

Trip Blank. A trip blank is a volume of laboratory water which is sealed in a sample container and accompanies the sample containers during transit, collection, and storage. The trip blank measures the cumulative contamination derived from the source water, sample transit, the sampling site, and sample storage. Trip blank analysis (volatile parameters) results are reported with sample results and are maintained with the corresponding laboratory records.

Site Blank. A site blank is a volume of laboratory water which is sealed in a sample container and accompanies the sample containers during transit, collection, and storage. The site blank container is opened during the sample collection process, to measure background site contaminants that will not permeate a sealed blank, in addition to the parameters described for a trip blank.

Rinsate Blank. A rinsate blank is a volume of a pure water source that has been poured into or over clean field equipment prior to sample collection. This blank should be collected between sample points unless dedicated equipment is available at each site. The rinsate blank measures cumulative contamination (all parameters except volatiles) derived from field sampling equipment, rinsate blank source water, sample transit, the sampling site, and sample storage.

11.1.2 Alternate Source Standard Analyses

Check Standards. A standard of known concentration of target analyte(s) prepared in a controlled matrix. The check standard is analyzed routinely to measure laboratory performance in the absence of matrix interferences.

External Reference Standard. Nonroutine analysis of a standard to measure laboratory performance. Usually introduced as a sample of unknown concentration, as part of the internal quality assurance program.

11.1.3 Spiked Sample Analyses.

Spiked samples are analyzed to assess the accuracy of the analytical method on the spiked sample. The types of spiked samples analyzed at STL Seattle are defined below.

Surrogate Spike. The surrogate spike is a known concentration of a non-target analyte added to each sample prior to sample preparation and instrumental analysis. The surrogate spike recovery measures the efficiency of all steps of the analytical method in recovering the non-target analytes from an environmental sample matrix. The surrogate recovery is assumed to behave identically to the target analytes.

Surrogate standard determinations are typically performed for gas chromatographic analyses. Surrogate spiking compounds are added to all samples and blanks before purging or extraction to monitor sample preparation and analysis. Recoveries must meet established acceptance criteria as stated in the standard operating procedure for the method.

Matrix Spike. The matrix spike is a known concentration of target analytes added to a sample prior to sample preparation and instrumental analysis. The matrix spike recovery measures the efficiency of all steps of the analytical method in

recovering the target analytes from the environmental sample matrix. Typically, the full list of target analytes is spiked into the sample selected for matrix spike analysis. However, for certain organic methods, i.e., 8260B and 8270C, the analyte list is extremely long, components are incompatible, or components interfere with accurate assessment. Therefore, a representative subset (minimum of 10% of the full analyte list) is chosen for the spiking solution. In these instances, a full analyte list will be spiked into a selected sample (or selected samples) on a semiannual basis to provide recovery data for all target analytes.

Samples may be selected for matrix spike analysis based on client request, or may be selected by the appropriate analyst at the time of sample preparation. Samples chosen by the analyst for matrix spike analysis shall be rotated among client samples in order to address various matrix problems.

The concentration of analytes spiked is approximately the mid range of the calibration, or as specified in the method. For organic analyses, matrix spike analyses are usually performed in duplicate (MSD). Percent recovery for each portion and relative percent difference between two recoveries are calculated and summarized on quality control result data sheets. If there is not enough sample to perform matrix spikes in duplicate, a blank spike may be performed in duplicate. The relative percent difference is charted on control charts. Matrix spike determinations are typically made at a minimum frequency of one for every preparation batch of samples processed (typically 20, or 10 for certain wastewater methods), when adequate sample is available. In the absence of sufficient sample volume for a matrix spike, a blank spike (and a blank spike duplicate) analysis must be performed.

Blank Spike. The blank spike is a known concentration of target analytes added to a blank solution prior to preparation and instrumental analysis. The blank spike recovery measures the efficiency of all steps of the analytical method in recovering the target analytes. Typically, the full list of target analytes is spiked into blank spike sample. However, for certain organic methods, i.e., 8260B and 8270C, the analyte list is extremely long, components are incompatible, or components interfere with accurate assessment. Therefore, a representative subset (minimum of 10% of the full analyte list) is chosen for the spiking solution. In these instances, a full analyte list will be spiked into blank spikes for a selected batch (or selected batches) on a semiannual basis to provide recovery data for all target analytes.

11.1.4 Laboratory Duplicate Analyses

To evaluate precision, duplicate analyses are performed. The types of duplicate analysis performed at STL Seattle are defined below.

Duplicate Sample Analysis. When required by the method two portions of a field sample are simultaneously extracted and analyzed for all target analytes. Duplicate samples are analyzed at a minimum frequency of once per sample batch (typically 5%, or 10% for certain wastewater methods). The relative percent difference (RPD) between the two results is calculated and must meet method-specified acceptance criteria. Duplicate RPD is a measure of analytical precision and sample homogeneity. Samples may be selected for duplicate analysis based on client request, or may be selected by the appropriate analyst at the time of sample preparation. Samples chosen by the analyst for duplicate analysis shall be rotated among client samples in order to address various matrix problems.

Matrix Spike Duplicate Analysis. Analysis of two additional aliquots taken from a single field sample and spiked with target analyte(s) prior to sample preparation and analysis. The RPD between the matrix spike analysis and the matrix spike duplicate analysis is a measure of analytical precision and to some extent sample homogeneity.

Blank Spike Duplicate Analysis. Analysis of two separate aliquots taken from a laboratory blank solution and spiked with target analyte(s) prior to sample preparation and analysis. The RPD between the blank spike analysis and the blank spike duplicate analysis is a measure of analytical precision.

11.1.5 Performance Evaluation Sample Testing

Performance evaluation (PE) samples are analyzed on a scheduled routine basis, as well as on a project or client-specific basis. PE samples are also analyzed when new methods are developed. PE samples are analyzed in a manner as similar as possible to routine samples. STL Seattle participates in the following PE sample analysis programs:

- ERA/APG WS
- ERA/APG WP
- ACOE
- State of California/NELAP-specific (ERA)
- NIST

STL Seattle participates in water pollution performance evaluation studies and water supply performance evaluation studies on a semi-annual basis for all accredited/certified parameters as available. Supplemental PE samples are analyzed for additional accredited parameters on a semi-annual basis. When deemed necessary by the quality assurance manager or the laboratory management, additional performance evaluation samples from commercial sources or from individual clients may also be introduced. Performance Evaluation samples are typically purchased from Analytical Products Group or Environmental Resource Associates. The data are reported to and summarized by the quality assurance manager. Data results are then evaluated and presented to laboratory management and any associated accreditation agencies for review and corrective action, if needed. Additional PE samples may be analyzed as part of corrective action. When deemed necessary, reference materials are also available for analysis.

11.1.6 Single and Double Blind Performance Evaluation Sample Testing

Double blind PE samples are submitted the STL Seattle laboratory for analysis once yearly by the Corporate QA Director. Single blind PE samples may also be submitted by the STL Seattle QA manager; the results are calculated and the results made available to the analysts and department supervisors. Results outside the method limits will be evaluated and corrective action initiated if necessary.

11.2 Routine Procedures Used To Assess Data Precision, Accuracy, and Representativeness.

The routine procedures used to assess data precision, accuracy, and representativeness used at STL Seattle are described below.

Precision. Precision is expressed as relative percent difference (RPD) or as percent difference (%D) based on duplicate analyses of a sample, a MS, or a BS. The relative percent difference is calculated as:

$$\text{Relative Percent Difference} = \left[\frac{(X_1 - X_2)}{(X_1 + X_2)/2}\right] * 100$$

where X_1 and X_2 are, respectively, the first and second values obtained for the analysis.
Percent difference is calculated as:

$$\text{Percent Difference} = \left[\frac{(X_S - C_T)}{(C_T)}\right] * 100$$

where X_S is the observed concentration of the continuing calibration sample and C_T is the true concentration of the continuing calibration sample. When not specified by method or regulation, a default criteria for RPD will be used until there are sufficient data points to establish laboratory historical mean ± 3 standard deviations using control chart results. STL Seattle default quality control acceptance level for sample precision is ± 20 % D or RPD =20, for water matrix, and ± 30% for soil and wipe matrix, as determined by duplicate analyses. It must be recognized that for analytes at concentrations of less than five times the method detection limit, it may be difficult to meet this objective.

Accuracy. Accuracy is usually expressed as percent recovery (%R), which is calculated as:

$$\text{Percent Recovery} = \left[\frac{X_S}{C_T}\right] * 100$$

where X_S is the observed concentration of the continuing calibration sample and C_T is the true concentration of the continuing calibration sample. Standard reference materials or certified quality control samples, such as are available from NIST, the Environmental Protection Agency, and various commercial sources, may also be analyzed to assess accuracy if such are available with a composition similar to the samples of interest.

When not specified by method or regulation, a default criteria for MS and BS will be used until there are sufficient data points to establish laboratory historical mean ± 3 standard deviations using control chart results. STL Seattle default quality control acceptable range for accuracy is 85 to 115% percent recovery of a calibration standard. Recoveries of matrix spike compounds are method and matrix dependent; acceptable ranges are provided in the method SOPs.

Representativeness. In order that the reported results are representative of the sample received, STL Seattle makes a reasonable effort to assure that the samples are adequately homogenized prior to sampling for analysis when appropriate. STL Seattle cannot control factors in the field that may affect sample representativeness.

11.3 Continuing Calibration Evaluation

The calculated concentration of the standard versus the actual concentration of the standard is calculated as percent recovery (%R) for each parameter. Unless otherwise specified in the method procedure, control limits are set at 15% from the expected value, or %R = 85-115%, or <15% drift. If the continuing calibration is outside control limits, a new initial calibration curve must be established.

11.4 Evaluation of Quality Control Data

STL Seattle applies acceptance criteria to all quality control data. When a sample analysis is complete, the quality control data are reviewed and evaluated by using acceptance criteria as given in the standard operating procedure or as specified by the client. This evaluation is used to validate the corresponding data set. Evaluation is based on the criteria described below. Data evaluation procedures for specific instrument systems/methodologies are detailed in Appendix E of this Manual.

11.4.1 Check Standard Evaluation

The measured concentration of the standard versus the actual concentration of the standard is calculated for each parameter. Unless otherwise specified in the method procedure, control limits are set at 15% from the expected value. If the check standard is outside control limits, values outside the acceptable ranges require investigation to determine the source of error and provide corrective action. Following problem correction, the check standard or the standard reference material is reanalyzed if possible.

11.4.2 Method Blank Evaluation

The method blank results are evaluated for background laboratory contamination. If high blank values are observed, laboratory glassware and reagents are checked for contamination and the analysis halted until the method can be brought into control. An unacceptable method blank is defined as a blank containing positive results for target analytes greater than or equal to the reporting limit for the analytes, except for common laboratory contaminants.

11.4.3 Duplicate Evaluation

Duplicate results are used to calculate precision, expressed as RPD. This data is recorded on quality control result data sheets. Control limits are method and matrix specific. Limits are determined by calculating the standard deviation of the relative percent difference of at least ten sets of duplicates. Warning limits are set at two standard deviations from zero relative percent difference. Action limits are set at three standard deviations from zero relative percent difference.

11.4.4 Matrix Spike or Blank Spike Evaluation

The observed recovery of the spiked analyte versus the actual amount spiked is used to calculate accuracy, expressed as percent recovery. The results are recorded and plotted on quality control result data sheets. The matrix spike or blank spike duplicate results are used to calculate precision as relative percent difference. Precision results are recorded and may be plotted on a control chart for each analyte. Control limits are determined as for duplicate analyses. Warning limits are set at two standard deviations from the expected value. Action limits are set at three standard deviations from the expected value.

11.4.5 Surrogate Standard Evaluation

Surrogate standard results are compared with the actual concentrations spiked into the sample matrix prior to preparation and analysis. If surrogate recovery percentages do not meet method-specified or laboratory-specified acceptance criteria, the sample is reanalyzed. Limits may be set for surrogate recovery by determining the standard deviation of the recovery from at least ten samples of the same matrix type. Warning limits are set at two standard deviations from the expected value. Action limits are set at three standard deviations from the expected value.

11.4.6 Reference Standard Evaluation

Standard reference material analyses are compared with true values and acceptable ranges. Values outside the acceptable ranges require investigation to determine the source of error and provide corrective action. Following corrective action, the check standard or standard reference material is reanalyzed if possible.

11.5 Control Charts

Control charts are prepared for routine analytical methods to document, at a minimum, the percent recoveries for blank spike or matrix spike compounds, and the relative percent difference of sample duplicate analysis or duplicate matrix spikes. Surrogates may also be charted to observe trends or set recovery limits.

Control limits are updated at least once per year. At least ten measurements are required before control limits are established. Warning limits are set at two standard deviations on either side of the expected value. Action limits are set at three standard deviations from the expected value. Control limits for continuing calibration are specified in the method, or set by the laboratory in the SOP. Generally, recovery limits are set at 15 % from the expected value. The quality assurance department maintains control charts.

11.5.1 Preparation of Control Charts

A graph is prepared with dates (or batch QC #s) on the horizontal axis and the analyte recovery results or relative percent difference percentages as the vertical axis. Horizontal lines representing the expected value, upper and lower warning levels (when appropriate), and upper and lower action levels are drawn. Quality control data are chronologically entered on the chart. Out-of-control situations are defined as any of the following:

- any one point is outside the action limits;
- any three consecutive points are outside the warning limits;
- any seven consecutive points are on the same side of the mean line; or,
- any six consecutive points exist such that each point is successively larger or smaller than the point immediately preceding it.

An out-of-control situation is brought to the attention of the responsible department supervisor. The nature of the problem is determined and corrective action is taken.

Control charts are routinely used for establishing laboratory warning and action limits. The laboratory is organized under a "batch" system, where each set of analyses are evaluated against QC requirements; any batch outside QC criteria requires response, either in the form of reanalysis or nonconformance documentation, depending on the nature of the outlier.

12.0 LABORATORY CERTIFICATIONS AND APPROVALS

The laboratory has obtained certifications and approvals from agencies and contract clients, as required or as requested. The obligations placed on the laboratory by the certifications and approvals are considered at all stages of the work relevant to the particular certification or approval. The obligations may be to simply implement the existing LQM and supporting documents, or may include additional obligations, such as PE sample analysis, routine audit participation, or project-specific quality control procedures.

12.1 Current Status of Laboratory Certifications and Approvals

The certifications and approvals currently held by STL Seattle are described in Table 12-1, including Scope of Certification or Approval, Terms of the Certification or Approval, the expiration date of the Certification or Approval, Audit status, associated PE samples, and any reciprocity applied.

Table 12-1. Current Status of Laboratory Certifications and Approvals

Agency/Client	Scope	Term	Expiration	Audit Status	PE samples
Washington State Department of Ecology	*	annual	1-31-2003	Last Audit 4/26/2001	APG/ERA
State of California NELAP	*	annual	11-30-2002	Last audit 6/4-6/2001	APG/ERA
State of Oregon ORLAP	*	annual	8-1-2003	No audit	APG/ERA
State of Alaska DEC	*	annual	3-4-2003	No audit	APG/ERA
US Army Corps of Engineers	*	biannual	12-13-2003	Last audit 9/18-20/2001	ACOE
US Navy/OHM (NFESC)	*	biannual	12-13-2003	Last audit 9/18-20/2001 (Corps)	ACOE
AFCEE/ERC	Method 524.2	Project duration	Project Completion	Last audit 1/15/2002	APG/ERA
URS (Navy CLEAN)	All parameters	Project duration	Project completion	Audit 12/16/93	APG/ERA
US Navy PWC	All parameters	Project duration	Project completion	Audit 11/9-10/98	APG/ERA

*Scope provided as Appendix G

13.0 ANALYTICAL METHODOLOGY

The references used to establish STL Seattle methodologies, the documentation provided as the methodology, the data processing included as part of the analytical methodology, and the availability and storage of the methodologies are described in the following sections.

13.1 Methodology References

Whenever possible, STL Seattle uses analytical methods from source documents published by recognized agencies. Most analytical procedures used by STL Seattle are taken from one of the following sources:

- Test Methods for Evaluating Solid Wastes, USEPA, SW-846, 3rd edition (with updates).
- Methods for Chemical Analysis of Water and Wastes, USEPA-600/4-79-020, Revised March 1983.
- Methods for Organic Chemical Analysis of Municipal and Industrial Wastewater, USEPA-600/4-82-057, Revised October 26, 1984, CFR Vol. 49, No. 209.
- Standard Methods for Analysis of Water and Wastewater, 19th edition, 1995.
- American Society for Testing and Materials, 1988- 1992.
- National Institute for Occupational Safety and Health, 3rd Edition, 1990.
- Puget Sound Estuary Program, Recommended Protocols.
- Analytical Methods for Petroleum Hydrocarbons, WDOE, Publication No. ECY 97-602, June 1997.
- Alaska DEC, Underground Storage Tanks Procedures Manual, March 1, 1999.

The laboratory is on the Government Printing Office mailing list to obtain current published updates or new methods from these references.

The exact procedure selected for a specific project is based on discussions with the client or review of the project work plan or similar document. Necessary modifications based on client request or due to matrix effects are documented in the appropriate records. Modifications to published methodology that are part of the STL Seattle procedure are documented in the SOP.

13.2 Standard Operating Procedures

Written standard operating procedures (SOPs) are maintained for all STL Seattle routine procedures and analytical methodologies. STL Seattle analytical procedures may be complete, stand-alone documents or may be umbrella documents that include the published reference procedure and merely describe specific exceptions to the documented procedure. Analytical SOP's typically include:

- scope and application (including a list of analytes and applicable matrices)
- references (method source)
- associated SOP's
- definitions
- procedure – including summary, interferences, sample handling, preservation, and holding time requirements, equipment, reagents/standards, instrument calibration, sample preparation, analysis/operation, calculations, quality control, precision and accuracy, PQLs/MRLs/MDLs, and modifications to published methods
- health and safety considerations
- nonconformance and corrective action
- record management/documentation
- waste management and pollution prevention

A current inventory of SOPs is provided in Appendix H.

13.3 Method Validation

Analytical methods employed by the laboratory are validated using the following parameters:

- an acceptable calibration curve using traceable standards;
- an acceptable method blank;
- an acceptable method detection limit (MDL) study;
- acceptable analysis of a sample surrogate spike; and,
- acceptable analyst performance of an IDC (initial demonstration of capability, minimum of four acceptable blank spike samples).

If possible, a purchased PE sample should also be analyzed to verify the ability to determine accurately the target analyte(s). Calibration curves and associated batch QC analysis will be filed in the appropriate department. The QA/QC department will file PE sample results. New method MDLs will be approved by the appropriate Department Supervisor, and will be filed in the laboratory MDL file. New method IDOCs will be filed in the analyst's individual training record. A list of laboratory method capabilities is approved and maintained by the QA manager.

Performance characteristics for published analytical methods are typically defined in the method. For procedures not requiring State or EPA approval (non-standard methods), method performance characteristics will be defined by the

appropriate Department Supervisor or QA manager, and may be based on project or client specific data quality objectives. Complete method validation will be performed as appropriate prior to analysis of samples when required by contract or client.

13.4 Data Processing and Documentation

An analyst processes data by either manual calculation of instrument calibration and sample results or by direct acquisition and processing of raw data by a computer which may then require further processing by the analyst.

Regardless of how data processing is performed, documentation must be presented to allow another analyst to completely review the work. As appropriate, the following information is present in the data package:

- sample preparation data and any further dilutions or concentrations performed;
- batch QC data;
- instrument standard data;
- instrument run logs;
- raw calibration data (Tier IV);
- raw sample and quality control sample data; and,
- calculations and reported results.

The STL Seattle analytical SOPs specify exactly what documentation is necessary for each analysis. The analyst's initials and the date appear on all supporting paperwork. Information is given on each document so that a reviewer can follow the work from one document to another. For example, instrument identification numbers appear on the raw data and reporting sheets. The final product is a data sheet on which analytical results are summarized. If a computer printout from an instrument provides an equivalent form, it can be considered the final data sheet.

13.5 Manual Data Entry

Manual entry of raw data occurs in a number of areas within the scheme of data processing. Sample identifications and associated descriptive information are entered into the LIMS manually, at the time of sample receipt. This information is used to generate laboratory worksheets and internal laboratory tracking forms. Instrument outputs that are not text files transferred to the LIMS must be transferred manually by the analyst to sample worksheets and the appropriate QC logbooks. The sample worksheets and QC logbooks are typed to generate the parts of the report not generated by the LIMS. The worksheets and the QC logbooks are designed with “boxes” or columns for data entry, to minimize the generation of incomplete worksheets or QC information during the recording process.

Manual entry of data onto a worksheet or QC logbook must be performed in blue or black ink. All corrections must be made by a single line through the error, so as not to obliterate the original record. Corrections or changes must be initialed and dated by the person making the change. No correction fluid may be used on raw data. These practices minimize confusion and allow reconstruction of the data entry process.

All data is reviewed within the department to ensure accurate reporting on the worksheets. After the project report is drafted, the data is subjected to a review, including the verification that no transcription errors have been made during the recording process.

13.6 Electronic Data Entry

Data entry into spreadsheets (as part of the laboratory LIMS) is performed for many of the instrument systems used to generate sample data. Laboratory spreadsheets include as many automated checks of the data as possible, to minimize the

number of errors possible during the manual portion of the data entry. The programs warn users of incorrect data entry, checks the data against established or reasonable limits, and provides guidance and feedback to correct the data. In addition, a summary of manual entries is generated with the data report, to allow the technical reviewer or the QC specialist to verify the manual entries during the review of the report. Potential transcription errors during the reporting of sample results is minimized by using text files for data transfer from the instrument data handling system.

13.7 Manual Integration of Chromatographic Data

Most of the data systems employed within the laboratory perform automated integration of targeted analytes. Although automated, these systems may require manual integration to correct for interfering compounds or drifting baselines. The data systems that automatically flag manual integration of peaks will place flags on the quantitation data for the sample. For data systems that do not flag the manual integration of peaks, it is the responsibility of the analyst to note the manual integration of the quantitation data. Manual integration may not be done in such a way as to distort the data, or for the express purpose of causing a QA/QC parameter to meet method criteria. Corporate policy on acceptable manual integration practices is included in STL Corporate SOP S-Q-004.

13.8 Analytical Method Files

The quality assurance manager maintains files of all analytical procedures currently or historically used by STL Seattle. These files shall contain published reference methods, written standard operating procedures (SOPs), and results of any validation or equivalency studies. Method manuals, such as Test Methods for Evaluating Solid Wastes, are also maintained to allow easy reconstruction of methods used in past projects.

13.9 Availability of Analytical Procedures

Analytical SOPs currently in use by STL Seattle are maintained as a complete set as the STL Seattle standard operating procedure manual, as well as in individual and/or departmental SOP manuals. It is the responsibility of the individual or department supervisor to ensure that the most current SOPs are being used by the technical staff. Copies of written SOPs are available from the quality assurance manager. It is the responsibility of each analyst to be familiar with the written method he or she performs and to have copies of the methods at hand for immediate reference.

14.0 LIMITS OF DETECTION AND QUANTITATION

14.1 Definitions

The terms described below are used routinely in STL Seattle communications:

Instrument Detection Limit. The instrument detection limit is defined as the minimum quantity of analyte that will yield an analytical response which can be distinguished from background noise. It is applicable to a specific instrument. The instrument detection limit is generally accepted to be the amount of analyte which produces a signal three times the standard deviation of the background signal.

Method Detection Limit. The method detection limit (MDL) relates to the analysis of an analyte by a specific method. The method detection limit is based on the variability of the instrument response to the analyte at a low level (2-5 times the estimated MDL). The procedure for calculating method detection limits is defined in 40CFR Part 136, Appendix B.

Practical Quantitation Limit. The practical quantitation limit (PQL) is defined as the lowest level that can be reliably measured during routine laboratory operating conditions. Depending upon the method, the practical quantitation limit is typically from three to five times the method detection limit. In almost all cases where a calibration curve is used for

quantitation, the PQL is typically at a concentration equivalent to the lowest non-zero standard. For methods where meters or titrators are used, the PQL is typically defined by the scale used on the meter, or the graduations used on the buret.

Method Reporting Limit. A specific limit requested by a client; the limit may be used when it is above the MDL. Method reporting limits (MRLs) may also be used for reporting in lieu of MDLs, as defined by the U. S. Army Corps of Engineers Shell for Analytical Chemistry, November 1998.

14.2 Significance and Frequency of Detection Limit Studies

Instrument detection limits are specific to a particular instrument configured for a specific analysis. Any significant change in the components of an instrument, such as a change in the type of autosampler, detector, or data handling device, or a significant change in the instrument's response, requires a new instrument detection limits study. Instrument detection limits are determined for metals (ICP, ICP-MS, CVAA) systems only.

Method detection limits are specific to a particular method in the hands of a qualified analyst. Method detection limits are updated annually for routine analyses or following a significant change in the analytical system, method, or related techniques.

Method detection limits and/or reporting limits are provided in many published methods. These are often determined using reagent water, closely controlled conditions, and specific instruments and personnel. Method detection limits determined in a normal production laboratory are often higher than those in the published method. Reporting limits and MDLs used in the laboratory are approved by the appropriate Department Supervisor. All detection limits study results are filed with the quality assurance records by analytical method or instrument and study date.

15.0 DATA VERIFICATION

Data verification includes all steps taken to ensure that reported results are representative of the samples. There are two major verification activities:

- the processing of quality control samples to demonstrate that analyses are within laboratory limits for accuracy, precision and completeness; and,
- data review to insure that calculations are correct and that data are correctly reported.

15.1 Data Review

Data validation includes data review and proofing of the final report as described below. These activities are considered to be minimum requirements. If a particular client or project requires additional review activities, they are typically described in an SOP.

15.1.1 Peer Review

A qualified analyst other than the original data processor is responsible for reviewing all data processing steps including all data input, calibration, calculations and result transcriptions to the data sheet. A qualified supervisor or data review specialist can perform peer review in lieu of a qualified analyst. If a data review specialist performs peer review, he/she is prohibited from performing the QC review for the report. During peer review, all input parameters, calibrations and transcriptions are checked. Special attention is paid to errors found during the checking process. If the data are processed by computer, all fields of manually input data are checked. Computer performance is only verified on its initial use. Each page is checked, and the data review sheet is initialed and dated by the reviewer.

15.1.2 QC Review

A data review specialist is responsible for reviewing all reports (hardcopy and electronic) generated at the laboratory. Quality control review of data reports, in general the following items are reviewed:

- Check that the data has been reviewed and released by the department.
- Check that transcription of raw data is correct, 10%.
- Check at least 10 percent of all calculations, if errors are found all calculations are checked
- Check that raw data is complete and in order reported.
- Check that the matrix units are correct, and match the sample matrix.
- Check that QC (blanks, duplicates, spikes) are present and within limits (or check flags).
- Review surrogate recoveries; make sure they are within QC limits (or check flags).
- Check that PQLs are correct.
- Check for comments or nonconformances that should be noted in the narrative.
- Check holding time for method against extraction/analysis dates.
- For Tier III, IV, or client-specific reports, check that everything is present to meet the deliverable requirement.

15.1.3 Reporting Data Outliers and Anomalies

The project manager is responsible for preparing the final data report. The project manager insures that the project is complete and that the client name, project name and client IDs are correct. The report writer checks the batch file for any corrective action memos or comments that should be included in the report. If it is necessary to flag any data or discuss anomalies or outliers with the client, the report writer includes this information by either selecting the appropriate data flags or writing an explanatory narrative.

15.2 Initial and Signature Identification

The quality assurance manager maintains a list of employees with their printed names, initials, and dates of employment so their work can be positively identified.

16.0 DATA REPORTING

Data reports are the final product of any laboratory effort. Data must be presented in a format that satisfies project requirements and presented clearly and completely in order to avoid confusion or miscommunication.

16.1 Format and Content

The format and content of a data report are dependent upon project needs, such as client or contract requirements or the need for explanatory text. The STL Seattle quality assurance program does not specify an exact report format. However, several components are required for final data presentation. The final data report is reviewed in accordance with data verification requirements of Section 14 and approved by the project manager.

As a minimum, the final report submitted to the client consists of a transmittal memo, analysis reports for each test performed, and quality control information. The format for each of these components is discussed in the following subsections.

16.1.1 Report Transmittal Memo

The transmittal memo provides a description of the work performed, including any narrative to describe or explain results. The transmittal memo information includes:

- reporting date;
- client name and address;
- date and time of sampling;
- date of sample receipt;
- number of samples received;
- identification of client project;
- any pertinent nonconformance information; and,
- signature of the project manager.

16.1.2 Analysis Results

Analysis results are presented in tabular format, and consistent significant figures and units of measurement are used. Each analysis report includes:

- data page(s) identified with laboratory name, client name, project name and/or number;
- client/field sample ID;
- date received;
- date prepared;
- date analyzed;
- specification of method reference, if any;
- parameters analyzed, results, units of measurement, and reporting limits; and
- qualifiers referenced to specific data (if required).

16.1.3 QC Results

Associated QC results are provided with the analytical results, including method blanks, duplicate analyses, and any appropriate spike or check standard analyses.

16.2 Data Transmission

Data are transmitted from the laboratory to the appropriate client, only upon approval of the project chemist or quality assurance manager.

Verbal, faxed or emailed results are preferably transmitted to the client only after normal data verification. If unverified results are transmitted, they are clearly qualified as preliminary, unverified, or subject to revision. The transmission of verbal/faxed results is documented on the master file.

16.3 Electronic Deliverables

The electronic deliverable format is client and/or project specific. Electronic deliverables are generated by the LIMS Manager, EDD Specialist, or qualified designee. Data is converted to electronic format by importing information directly from excel spreadsheets, or hand entering information from typed reports.

16.4 Client Confidentiality and Proprietary Results

Data and samples provided to STL Seattle by the client, and results obtained by STL Seattle are held in confidence, subject to any disclosure required by law or legal process. STL Seattle's reports are issued solely for the use of the person or company to whom it is addressed, and are not released to a third party without written consent from the client. More detailed information on client confidentiality procedures are provided in the STL Corporate Quality Management Plan and in STL Seattle SOP 0508, Protecting Client Confidentiality.

17.0 RECORDS MANAGEMENT

STL Seattle maintains a records management system which ensures that all records are secure and easily retrievable.

17.1 Laboratory Records

Laboratory records and data are maintained in four interrelated systems as described below.

17.1.1 Project Files

Project files contain documents that are specific to a project, such as proposals, work plans and correspondence. Tables 17-1, 17-2, and 17-3 present the categories used within the project files. It is not expected that all categories are applicable for every project.

17.1.2 Laboratory Workorder Files

Workorder files contain documents that are specific to a project/workorder. Within the batch files, files are arranged according to laboratory work order number. All information relating to a particular work order, including the Chain-of-Custody, data sheets, raw data, batch QC summaries, client communication records, invoicing information, a copy of the final hardcopy report, and a diskette copy of the electronic deliverables (if requested) as submitted to the client, are contained in the workorder file.

17.1.3 Instrument Series Files

Instrument series files contain data which are specific to a given instrument or analytical system for a single run. This includes all raw data, instrument printouts and calculation sheets for all samples and standards analyzed during that series. Instrument series files may contain data for one or more batch numbers. The instrument series files are maintained by the appropriate department supervisor until archived.

17.1.4 Quality Assurance/Laboratory Operations Files

Quality assurance files contain documents, logbooks and manuals that demonstrate overall laboratory operation or quality. Included in these files are periodic calibration and preventive maintenance records, audit records, retired logbooks, quality control data sheets, and old quality control charts. Quality assurance files may be arranged by instrument and type of document. Table 17-3 lists the laboratory performance records maintained.

Many of the laboratory operations records are in daily use, such as periodic calibration logs, and control charts. It is not intended that the records be stored daily while they are in use. However, when individual logbooks are filled, they are placed in the files. Logbooks are tracked using a Log of logbooks system, where individual numbers are assigned to each logbook, and date opened and date closed of each logbook is recorded.

TABLE 17-1. PROJECT FILE CATEGORIES

Proposal and Costing
Contract/Purchase Order
Correspondence
Statement of Work
Quality Assurance Project Plan
Project Specific Methods, Regulations, or Protocols
Project Specific Audit Records

TABLE 17-2. WORKORDER FILE CATEGORIES

Chain-of-Custody
Request for Analysis/Work order
Airbill
Phone Notes/Client Contact Record
Nonconformance Record/Corrective Action Form
Analytical Data Sheets
Raw Data
Batch QC Summary Sheets
Final Hardcopy Report
Final Electronic Deliverables
Invoice

TABLE 17-3. QUALITY ASSURANCE FILE CATEGORIES

Periodic Calibration Logs
Instrument Preventive Maintenance Records
Performance Evaluation Records (external and internal)
Certification Program Records
Retired Log Books
Control Charts
Quality Assurance/Quality Control Reports to Management
Standard Operating Procedure and Laboratory Quality Manual Distribution Records
Standard Operating Procedure and Laboratory Quality Manual Originals
Corrective Action Forms
Analytical Methods
Audit Records
Training Records

17.2 Records Control

Laboratory file maintenance is the responsibility of the data management specialist. Maintenance of project files is the responsibility of the project managers. Maintenance of instrument series files is the responsibility of the section leaders. Maintenance of the quality assurance operations files is the responsibility of the quality assurance manager.

17.3 Record Retention

STL Seattle maintains records associated with specific projects for the following time periods: analysis performed as part of site mitigation activities - 10 years; and, conventional analysis - 7 years. If a specific contractual requirement, project demand, or government regulation requires that records be maintained for a longer time period, project files are marked for longer retention and kept as required.

Space limitations require that files cycle into off-site permanent archives. When files are purged into bankers' boxes for archive, a complete inventory of the box is made. The inventories are indexed for easy retrieval. The inventories are maintained by the archiving company. STL Seattle maintains a copy of the inventory, and the data management specialist tracks the inventories.

In the event that ownership of STL Seattle changes, or the laboratory closes, STL Seattle will guarantee in writing prior to the transfer of ownership to be accountable for any analyses, data, and reports generated up to the time of legal transfer of ownership or closure. All records and analyses will be maintained at an appropriate storage facility or transferred to the new ownership, and will be retained in accordance with client agreement, for the timeframe specified above.

18.0 NONCONFORMANCE AND CORRECTIVE ACTION

18.1 Types of Nonconformance

A nonconformance is any event that is beyond the acceptable limits established for laboratory operations. Nonconformances may include (but are not limited to) the following:

- failure of an instrument to work properly (lack of sensitivity, failure to properly calibrate, failure of balance to pass check, refrigerator, freezer, or oven temperatures out of criteria);
- a continuing calibration recovery or blank spike/blank spike duplicate relative percent difference result that is out of control;
- initial calibration which does not meet linearity criteria;
- samples received for volatiles analysis with headspace;
- samples extracted or analyzed outside method holding times;
- samples received without proper paperwork or improper containers;
- insufficient sample volume;
- batch QC errors (too many samples, inadequate QC samples in the batch, QC sample failure); or,
- data recording errors, transcription errors, or failure to document.

18.2 Documentation of Nonconformance

Nonconformance events are documented using a nonconformance memorandum, which is completely filled out by the analyst, project manager, or QC person recording the event. The nonconformance memorandum details the nonconformance issue or event, describes associated information (date, associated laboratory workorder, associated samples, project manager, analyst), details any corrective action taken or recommended, and may include a detailed

narrative to accompany reporting of the nonconformance. For some nonconformance events, a second signature from the QA department is required in addition to the analyst signature.

Nonconformance memorandum forms for sample receiving and for extraction, analysis, and reporting are available; however, a client contact record may serve to document a problem and the associated corrective action. Employees identifying a problem that may affect data quality are responsible for initiating a nonconformance/corrective action memo or other record of the event.

Broken bottles, improper preservation, improper labeling, headspace, or other nonconformance detected at the time of sample receipt will initiate action; generally, the client will be contacted before work can proceed.

Many nonconformances can be corrected at the analyst/technician level; however, if the person initiating the corrective action form is not able to take corrective action, it is the responsibility of that person to inform someone who can do so. All nonconformance documentation and subsequent corrective actions are placed in a relevant workorder data file and a copy provided to the QA department. The quality assurance manager keeps a file documenting nonconformances, and summarizes the overall findings in the monthly quality assurance report.

18.3 Authority

If nonconformance events compromise reported results, QC personnel or project managers have the authority to not report the results, or to report the results with qualification. The samples may be reanalyzed by the laboratory, or the client will be contacted to obtain additional sample, or to continue “as is” if that is a feasible solution to the problem. If an analyst observes a sample nonconformance that requires a “stop work” action, the analyst will notify the project manager.

18.4 Preventative Action

Preventative action is defined as noting and correcting a problem before it happens, because of a weakness in a system, method, or procedure. Preventative actions include analysis of quality system to detect, analyze, and eliminate potential causes of nonconformances. When potential problems are identified, preventative action is initiated to effectively address the problem and alleviate the identified risk. Preventative action measures are reviewed during annual management reviews. Preventative actions are documented by the initiator, and documentation is maintained by the QA department.

19.0 INTERNAL QUALITY ASSURANCE AUDITS AND SURVEILLANCE

19.1 Routine Surveillances

Routine laboratory surveillances are performed by the quality assurance manager or qualified designee, to provide ongoing monitoring of laboratory operations. These surveillances are considered "spot checks" and can focus on one or more of the following subjects:

- sample maintenance (holding times, storage issues);
- calibration (frequency, standard sources, acceptance criteria issues. Are calibrations properly documented in instrument logbooks, on data sheets, or, if required, as part of project data? Do calibration results indicate a trend in instrument performance?);
- preventative maintenance (Are adequate spare parts available? Is preventative maintenance performed and properly documented?);

- receipt and storage of standards, chemicals, and gases (standard certification issues. Are all reagents, chemicals, and gases purchased for use in the laboratory of adequate grade for the intended use? Are materials adequately stored to prevent degradation? Are materials kept beyond stated shelf life? Are internal standards properly prepared and stored? Are internal standards kept beyond stated shelf life?);
- data validation (Are data processed and peer reviewed as prescribed?); and,
- records management (Are the analysis records complete and properly identified? Are documents submitted to the record system in a timely manner and are they properly maintained?).

Nonconformances observed during routine surveillances are reviewed by the quality assurance manager and discussed with the involved parties; recommendations may be forwarded to the department supervisors for corrective action. The quality assurance manager keeps a file documenting nonconformances, occurrence date, reason for occurrence, corrective action date, the corrective action taken and other observations or comments.

19.2 System Audits

An appropriately trained and qualified internal auditor conducts system audits. The audits are conducted once per year and provide a thorough overview of the quality assurance program and technical operations within the laboratory. The audit is external to the QA program, with reporting directly to the company officers. System audits review laboratory operation and resulting documentation, including all items reviewed during routine surveillances.

Audits by the internal auditor are performed in the following manner:

- an audit plan is prepared, reviewed and updated for every routine audit with consideration to information gained during previous audits. The audit plan defines participants, applicable documents, schedule, and scope of laboratory activities;
- based on the audit plan, a detailed checklist is prepared;
- a pre-audit meeting takes place with the QA manager to discuss the audit plan;
- performance of the audit;
- at the close of the audit, a post-audit meeting is held to discuss the audit findings; and,
- an audit summary report is prepared by the quality assurance manager to discuss details such as the audit date, the audit team members and persons contacted in the laboratory, the laboratory operations audited, a summary of findings and observations requiring corrective action and, if possible, the means for correction.

The laboratory analysts are responsible for responding to findings and observations for their area. Responses are in writing to the quality assurance manager and state the corrective action taken or the action underway. If correction can be verified through documentation, the section leader attaches corrective action documentation to the audit response. Upon receipt of the audit response, the quality assurance manager verifies corrective action completion and then closes the particular finding.

During the course of system audits, the internal auditor is cognizant of recurring nonconformances in the laboratory or trends that affect quality. Recurring nonconformances and trends are addressed in the audit report. Correcting such events may require reviewing the quality assurance program. If the inherent problem lies within the program, the program is amended through appropriate revision of quality assurance documents.

19.3 Documentation

All documentation pertaining to each system and technical operations audit is maintained in a dated folder in the "Audit" category of the quality assurance files. The routine surveillance log is also maintained in the "Audit" section within the

quality assurance files. All quality assurance records are open to all employees. All records are also available for client review on the premises of STL Seattle.

19.4 Authority

If surveillance or audit findings compromise the quality of sample results, the internal auditor and quality assurance manager have the authority to stop the reporting of results, or to qualify any results associated with the finding. The samples may also be reanalyzed by the laboratory, or the client contacted to obtain additional sample for analysis.

20.0 QUALITY ASSURANCE REPORTS TO MANAGEMENT

The quality assurance manager is responsible for preparing various reports to the laboratory officers indicating the effectiveness of the quality assurance program.

20.1 Audit Reporting

Audit reports generated from the annual system and technical operations audits are prepared and distributed as per Section 19 of this manual.

20.2 Monthly Quality Assurance/Quality Control Report

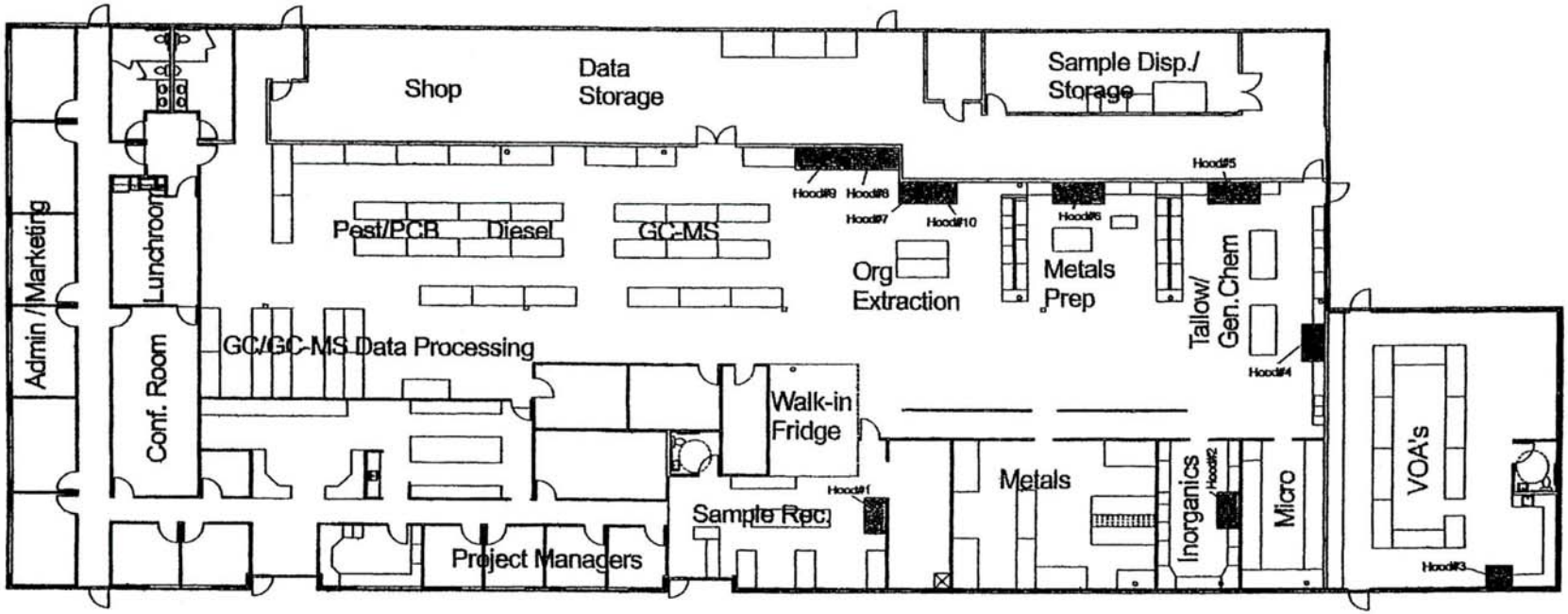
The STL Seattle quality assurance manager prepares a monthly quality assurance/quality control summary. This report is submitted to laboratory department supervisors, laboratory general and operations managers, and the STL Corporate QA manager at the beginning of the following month. The report includes, but is not limited to, the following sections:

- Audits and Routine Surveillances - including auditing party or individual, dates, reason for audit, and reference to summary findings.
- Nonconformances/Holding time violations - summary of nonconformances and associated corrective action.
- Revised reports/client complaints.
- Certification/Accreditation/scope changes
- Performance Evaluation/Proficiency Testing Samples - including certifying agency, expiration date, and approved parameters.
- Standard Operation Procedures - a summary of SOP status.
- Internal issues – improvements, regulatory compliance issues, general concerns, interactions with Corporate QA.
- Goals - a discussion of future plans for new standard operating procedures, quality assurance plan revisions, etc.

20.3 Management Review of the Quality Assurance Program

Review of the quality assurance program is ongoing. At any time, a department supervisor may present recommended changes to the quality assurance manager. Documented management review is conducted annually at a minimum for each department. Typically, the management review is accomplished through monthly quality assurance reporting, goal setting, and annual LQM review. Management reviews consider the suitability and effectiveness of the quality assurance program, review laboratory audits and corrective actions, evaluate laboratory operations as they pertain to the department. Suggestions for changes and/or improvements and preventative action measures are documented. The STL Corporate Quality Management Plan and STL Seattle's management review SOP provide further guidance to department supervisors on this topic. During system audits, the quality assurance program is discussed. The audit report documents recommendations made by either the department supervisor or the audit team for revision.

APPENDIX A
STL Seattle Laboratory Schematic


Shop
Data Storage
Sample Disp./ Storage
Hood#9
Hood#8
Hood#7
Hood#10
Hood#6
Hood#5
Pest/PCB
Diesel
GC-MS
Org Extraction
Metals Prep
Tallow/ Gen.Chem
Hood#4
Admin /Marketing
Lunchroom
Conf. Room
GC/GC-MS Data Processing
Walk-in Fridge
Hood#1
Sample Rec.
Project Managers
Metals
Inorganics
Hood#2
Micro
VOA's
Hood#3

APPENDIX B
STL Seattle
Capital Equipment Inventory

STL SEATTLE CAPITAL EQUIPMENT INVENTORY

Equipment or Instrument System	Instrument ID	Serial Number	Date of Purchase
Semivolatile Organics:			
(4) Finnigan MAT Magnum GC/MS/DS System	SEA009	004122	August, 2002
Varian 3400 GC; Varian SPI Injector	SEA012	000273	August, 1994
Electron Impact or Chemical Ionization	SEA010	003294	January, 1992
CTC A200S Autosampler	SEA011	003624	August, 2002
Pentium Data System			
NIST mass spectral library			
Finnigan MAT Model ITS40 GC/MS/DS System	SEA008	003281	December, 1998
Varian 3400 GC; ATAS Large Volume Injector			
Electron Impact or Chemical Ionization			
CTC A200S Autosampler			
Pentium Data System			
NIST mass spectral library			
Finnigan MAT Polaris Q GC/MS/DS System	SEA031	110029	July, 2000
Thermoquest Trace GC; ATAS Large Volume Injector			
Electron Impact or Chemical Ionization			
Thermoquest 2000 Autosampler			
Pentium Data System			
NIST mass spectral library			
Waters 717 Plus GPC Cleanup System	SEA030	M98719656R	July, 1999
Dual Wavelength Absorption Detector			
Waters 746 Integrator System			
Volatile Organics:			
(2) Finnigan MAT Model ITS40 GC/MS/DS System	SEA005	IS00262	January, 1992
Varian 3400 GC	SEA004	IS003775	Upgraded March, 1999
Tekmar LSC 3000 Automatic Purge and Trap Concentrator			
Electron Impact or Chemical Ionization			
Varian Archon 51 position Autosampler for water & soil samples			
Pentium Data System			
NBS75K.1 Mass Spectral Library			
Hewlett Packard HP5973N-6890 Plus GC-FID/MS/DS System	SEA002	US01160155	August, 2000
Hewlett Packard 6890 GC			
FID/Electron Impact Quadrupole (Dual Detectors)			
Tekmar 3000 Purge and Trap Concentrator			
Archon 51 Position Autosampler for water and soil samples			
Pentium III with Hewlett Packard ChemStation data system			
NIST Mass Spectral Library			
Hewlett Packard HP5973N-6890 Plus GC/MS/DS System	SEA001	US10452041	January, 2002
Hewlett Packard 6890 GC			
FID/Electron Impact Quadrupole (Dual Detectors)			
Tekmar 3000 Purge and Trap Concentrator			
Archon 51 Position Autosampler for water and soil samples			
Pentium III with Hewlett Packard ChemStation data system			
NBA75K.1 Mass Spectral Library			

Equipment or Instrument System	Instrument ID	Serial Number	Date of Purchase
Pesticides/PCBs:			
Varian 3400 GC Electron capture detector CTC A200S autosampler HP Chemstation Data Collection Software	SEA017	5528	October, 1990
(2) Varian 3400 GC Dual electron capture detectors CTS200 Autosampler HP Chemstation Data Collection software	SEA018 SEA020	3284 8606	May, 1991 September, 1992
Varian 3400 GC Dual electron capture detectors CTS200 Autosampler ATAS Large Volume Injector HP Chemstation Data Collection software	SEA019	13725	May, 1991
Explosives/PAHs:			
(2) Hewlett-Packard Model 1100 Modular HPLC Systems Quaternary HPLC Gradient Pump HP 1100 Autosampler HP 1100 Photodiode Array UV Detector HP ChemStation 8.3 Data Station (one station for both instrument	SEA021 SEA022	DE61800818 DE90604676	July, 1996 June, 1999
Volatile Fuels:			
Varian 3410 GC Tekmar LSC 3000 Purge and Trap Concentrator Tekmar 7000 Headspace Autosampler Cryogenics cooling and Tekmar Refrigerated Circulating Bath Photoionization detector/flame ionization detector HP Chemstation Chromatography Data Station	SEA007	8072	May, 2002
Varian 3400 GC Tekmar LSC 3000 Purge and Trap Concentrator Archon 51 Position Autosampler for water and soil samples Cryogenics cooling and Tekmar Refrigerated Circulating Bath Photoionization detector/flame ionization detector HP Chemstation Chromatography Data Station	SEA006	4088	May, 1992 Upgrade March, 1998
Hewlett Packard HP5973N-6890 Plus GC/MS/DS System Hewlett Packard 6890 GC FID/Electron Impact Quadrupole (Dual Detectors) Tekmar 3000 Purge and Trap Concentrator Tekmar ALS 2050 Automatic Vial Sampler Pentium III with Hewlett Packard ChemStation data system NBA75K.1 Mass Spectral Library	SEA003	US1853427	August, 2002

Equipment or Instrument System	Instrument ID	Serial Number	Date of Purchase
Semivolatile Fuels:			
(2) Hewlett-Packard 6890 GC Dual column/Dual Flame Ionization Detectors Dual HP 7683 /6890 Series autosamplers HP MS ChemStation Chromatography Data Station	SEA013 SEA015	DE00004014 US00022909	September, 1997 August, 1998
(2) Hewlett-Packard 5890 GC Dual column/Dual Flame Ionization Detectors Dual HP 7683 Series autosamplers HP MS ChemStation Chromatography Data Station	SEA016 SEA014	3022A29157 3108A33945	March, 1991 January, 1999
Metals:			
Perkin Elmer DV3200 Simultaneous Inductively Coupled Plasma Emission Spectrophotometer PE AS91Autosampler/NT Software	SEA027	069N9042002	June, 1999
Perkin Elmer Elan 6100 Sequential multi-element Inductively Coupled Plasma Mass Spectrometer PE AS91Autosampler/NT Software	SEA026	0579905	April, 1999
Leeman Labs PS200 Automated Mercury Analyzer Double beam photometer with PS Series autosampler PS Series software	SEA028	1010	June, 1991
Leeman Labs Hydra AA Automated Mercury Analyzer Double beam photometer with PS Series autosampler Leeman WinHg 1.4 software	SEA029	HA-2032	September, 2002
CEM MDS 2000 Laboratory Microwave With Temperature and Pressure Control			November, 1997
CEM Mars 5 Laboratory Microwave With Temperature and Pressure Control			May, 1999
General Chemistry:			
Dionex Anion Chromatograph System DX 450 System/Eluent Degas Module Autosampler Pentium Computer	SEA025	14609	March, 1993
Alpkem RFA 300 Rapid Flow Analyzer with dual distillation head and chemistry cartridges for cyanide and phenols	SEA024	1951	January, 1991
Alpkem/OI Analytical Flow Solution 3000 RFA Rapid Flow Analyzer with chemistry cartridges for ammonia, total phosphate and TKN	SEA023	8181604046	November, 1998

Equipment or Instrument System	Date of Purchase
General Chemistry, Continued:	
Mettler DL12 Automatic Titrator	October, 1992
(2) Dohrman DX-20A/B Total Organic Halide Analyzer AD-3 Adsorption Module	May, 1987 May, 1993
Dohrman DC-190 High Temperature Total Organic Carbon Analyzer	March, 1991
Aqua Media Reverse Osmosis-Deionizing Water Treatment System 300 gallon storage tank and circulation pump to deliver ASTM Type I water to 11 lab sinks and 2 dishwashers	January, 1991
(2) Barnstead Model D4741 ultrapure water systems For removal of trace levels of volatile organic contaminants	February, 1988 May, 1991
Milton Roy Spectronic 401 Spectrophotometer Single beam, visible range, microprocessor controlled	November, 1992
Orion pH Meter Model SA720	February, 1990
Orion Dissolved Oxygen Meter Model 862A	February, 2000
Hach COD Reactor Block, Model 16500-10	February, 1990
(2) CPI International Mod Block Digestor	July, 1999 February, 2000
Labconco Block Digestor	August, 1999
VWR Turbidity Meter 34100-787	February, 1997
Fisher Scientific Solid State Ultrasonic FS-14 Sonicator	
(3) Vibracell Sonicators	July, 1989 January, 1990 October, 1990
(2) Fisher Scientific FS220 Heated Sonicator Baths	December, 1999 January, 2000
Organomation Associates, Inc. Nevap 112 Nitrogen Evaporator	July, 1999
(3) Sartorius Analytical Balance	February, 1991 February, 1992
Mettler AE 160 Analytical Balance	November, 1984

Mettler AT200 Analytical Balance	December, 1991
Equipment or Instrument System	**Date of Purchase**
General Chemistry, Continued:	
Mettler AT261 Delta Range Analytical Balance	June, 1998
Mettler AG204 Analytical Balance	April, 1996
Mettler PB3002 Top Loading Balance	September, 1992
Mettler BB2400 Top Loading Balance	July, 1995
Denver Instruments XL-410 Top Loading Balance	March, 1992
Sartorius 3806MP Top Loading Balance	June, 1995
OHAUS E3000D Top Loading Balance	
Setaflash Tester	March, 1990
PMCC Flash Tester	January, 2000
Labconco Rapidstill II Kjeldahl System Distilling Unit	September, 1990
Lachat BD-46 Block Digestor	November, 1992
Midi-Distiller Andrews Glass Company Model 110-10R Cyanide Distillation System	July, 1993
Parr Oxygen Bomb Calorimeter	January, 1990
Orion Model 162A Conductivity/Salinity Meter	February, 2000
Fisher Scientific Model 307 BOD Incubator	June, 1995
Shaker Table, 16 funnel capacity	July, 1992
(3) TCLP Tumblers	February, 1991
Thermolyne Muffle Furnace Model 62700	December, 1996
International Centrifuge	April, 1996
Clay-Adams Safety Head Centrifuge	June, 1999
Sonall RC3B Refrigerated Centrifuge	
Tecator Soxtec System HT 1043 Extraction Unit	
Lovibond Tintometer	
Labconco Flask Scrubber Dishwasher	January, 2000

Equipment or Instrument System	Date of Purchase
General Chemistry, Continued:	
Ludlum Geiger Counter Model 12 Count Rate Meter Model 44-7 Probe Detector	May, 1993
Microbiology:	
Milton Roy Spec 20, Single Beam/Variable Range	October, 1987
Quebec Darkfield Colony Counter	June, 1993
Zeiss Standard Light Microscope	January, 1997
Market Forge Sterilmatic Autoclave	June, 1993
Fisher Scientific Isotemp Incubator	June, 1999
Equatherm Coliform Bath	June, 1999

APPENDIX C
STL Seattle
Analytical Capabilities

ANALYTICAL CAPABILITIES

GENERAL CHEMISTRY

Parameter	Method
Alkalinity, as $CaCO_3$	EPA 310.1
Anion Scan (F,Cl,Br,NO_2,NO_3,PO_4,SO_4)	EPA 300.0
Bicarbonate, Carbonate	SM 2320B
Biochemical Oxygen Demand	EPA 405.1
Chemical Oxygen Demand	EPA 410.1/410.2
Chloride	EPA 300.0
Chlorine, residual	EPA 330.5
Color	EPA 110.2/SM 2120B
Corrosivity (Alk,TDS,Ca)	SM 2330
Cyanide, total	EPA 335.3/9012A/9013
Cyanide, amenable to chlorination	EPA 335.1/ 9012A/9013
Cyanide, weak & dissociable	SM 4500 CN I
Fluoride	EPA 300.0
Hardness, as $CaCO_3$	EPA 130.2/SM 2340B
Nitrogen	
- Ammonia	EPA 350.1/350.2
- Kjeldahl	EPA 351.3/351.2
- Nitrate + nitrite	EPA 300.0
- Nitrate	EPA 300.0
- Nitrite	EPA 300.0
Oil & grease (hexane extractable material)	EPA 1664
TPH (silica gel treated hexane extractable material)	EPA 1664
Oil & grease, polar & non-polar	EPA 1664
Oxygen, dissolved	EPA 360.1
pH	EPA 150.1/9040B/9045C
Phenols, total	EPA 420.2/9065
Phenols, total (low level detection)	SM 5530C
Phosphate, ortho	EPA 300.0
Phosphorus, total	EPA 365.1
Salinity	SM2520B
Solids, Total (TS)	EPA 160.3
Solids, Total Dissolved (TDS)	EPA 160.1/SM 2540C
Solids, Total Suspended (TSS)	EPA 160.2
Solids, Total Volatile (TVS)	EPA 160.4
Solids, Settleable	EPA 160.5/SM 2540F
Specific conductance	EPA 120.1
Sulfate	EPA 300.0
Sulfide (colorimetric-low level)	EPA 376.2
Sulfite	EPA 377.1
Surfactants (MBAS)	EPA 425.1
Total Organic Carbon (TOC)	EPA 415.1/9060/PSEP
Total Halogens (TX)	EPA 9076
Turbidity	EPA 180.1

ANALYTICAL CAPABILITIES

TRACE METALS

Parameter	Method
ICP Metals	EPA 200.7/6010B
ICP/MS Metals	EPA 200.8/6020
Mercury, Cold Vapor AA	EPA 245.2/7470A/7471A
Chromium, Hexavalent	EPA 218.4/200.7 EPA 7195/6010B SM 3500-Cr D

ORGANICS

Parameter	Method	Instrumentation
Halogenated Volatile Organics	EPA 624/8260B	GC-MS
Aromatic Volatile Organics/BTEX	EPA 602/8021B/8260B	GC or GC-MS
Pentachlorophenol	EPA 604/8040A-ECD	GC
Chlorinated Pesticides	EPA 608/8081A	GC
Chlorinated Pesticides and PCB's	EPA 608/8081A/8082	GC
PCBs in water	EPA 608/8082	GC
PCBs in soil	EPA 8082	GC
PCBs in wipes	STL Seattle	GC
PCBs in waste oil	EPA 8082	GC
PCBs in transformer oil	EPA 600/4-81-045	GC
Alcohols	EPA 8015B Mod	GC
Glycols	EPA 8015B Mod	GC
Explosives	EPA 8330	HPLC
Formaldehyde	EPA 8315A	HPLC
Volatile Organics	EPA 524.2/624/8260B	GC-MS
Semivolatile Organics	EPA 625/8270C	GC-MS
Tributyl Tin	Krone	GC-MS
Pentachlorophenol	EPA 625/8270C	GC-MS
Polynuclear Aromatic Hydrocarbons	EPA 625/8270C	GC-MS
Phenols	EPA 625/8270C	GC-MS
Organophosphorous Pesticides	EPA 8141A Mod	GC-MS
Chlorophenoxy Herbicides	EPA 8151A Mod	GC-MS

ANALYTICAL CAPABILITIES

RCRA HAZARDOUS WASTE CHARACTERIZATION

Parameter	Method
Ignitability (Flash)	EPA 1010/1020A
Corrosivity (pH)	EPA 9040B/9045C
Reactive cyanide	SW-846 7.3.3.2
Reactive sulfides	SW-846 7.3.4.1
Cyanide, total & amenable	EPA 9012A/9013
Sulfides, acid-soluble	EPA 9030B
Sulfate	EPA 9035
Phenolics	EPA 9066
Oil & grease	EPA 9070
Chloride	EPA 9250
Total organic carbon (TOC)	EPA 9060
Total halogens (TX)	EPA 9076
F-Listed Solvent Scan	
Volatiles	EPA 8260B
Semivolatiles	EPA 8270C
Complete F-List	EPA 8260B & 8270C

TOXICITY CHARACTERISTIC LEACHING PROCEDURE (TCLP) and SYNTHETIC PRECIPITATION LEACHING PROCEDURE (SPLP)

Parameter	EPA Method
TCLP Extraction (non-volatile)	EPA 1311
TCLP Zero headspace extraction	EPA 1311
SPLP Extraction (non-volatile)	EPA 1312
SPLP Zero headspace extraction	EPA 1312
Metals	EPA 6010B/7470A
Chlorinated pesticides	EPA 8081A
Chlorinated herbicides	EPA 8151A
Volatile organics	EPA 8260B
Semivolatile organics	EPA 8270C

CALIFORNIA WASTE EXTRACTION TEST (WET)

Parameter	Method
Extraction (non-volatile)	California Code of Regulations, Title 22

ANALYTICAL CAPABILITIES

PUGET SOUND DREDGED DISPOSAL ANALYSIS (PSDDA)

Parameter	Method
Total Solids	PSEP
Total Volatile Solids	PSEP
Total Organic Carbon	PSEP
Oil & Grease	PSEP
Total Sulfides	PSEP
BOD	PSEP
COD	PSEP
Metals (Sb,As,Cd,Cu,Pb,Hg,Ni,Ag,Zn)	EPA 6010B/6020/7471A
Volatile Organics	EPA 8260B
Semivolatile Organics	EPA 8270C
Organochlorine Pesticides and PCBs	EPA 8081A/8082
Tributyl Tin	Krone

WASHINGTON STATE DOE TOXICS CLEANUP PROGRAM

Parameter	Method
Qualitative Hydrocarbon ID	NWTPH-HCID
Gasoline Range Organics	NWTPH-Gx
Diesel Range Organics	NWTPH-Dx
BTEX by GC/PID	EPA 602/8021B
BTEX by GC/MS	EPA 624/8260B
Gasoline Range Organics with BTEX	NWTPH-Gx/EPA 8021B/8260B
TCLP Lead	EPA 1311/6010B
TCLP Benzene	EPA 1311/8021B
Interim TPH Policy Methods	EPH

OTHER UNDERGROUND FUEL TANK ANALYSES

Parameter	Method
Total Petroleum Fuel Hydrocarbons Scan	EPA 3550B/8015B Mod
Total Petroleum Hydrocarbons as Gasoline	EPA 5030B/8015B Mod
Total Petroleum Hydrocarbons as Diesel	EPA 3550B/8015B Mod
Alcohols by GC – FID	EPA 8015B Mod
Glycols by GC – FID	EPA 8015B Mod
Gasoline Range Organics	ADEC AK101
Diesel Range Organics	ADEC AK102
Residual Range Organics	ADEC AK103

ANALYTICAL CAPABILITIES

PETROLEUM ANALYSIS

Parameter	Method
Ash	ASTM D482
Benzene in gasoline	ASTM D3606
Bottom sediment & water (BS&W)	ASTM D96
BTU (heat value)	ASTM D240
Chlorine (Total halogens)	Coulometric
Flash point, PMCC	ASTM D93
Gravity	ASTM D1250
Metals by ICP	EPA 6010B
Sulfur	ASTM D3120

DRINKING WATER ANALYSES

Parameter	Method
Complete Inorganics	Various
Volatile Organic Compounds (VOCs)	EPA 524.2

MICROBIOLOGY

Parameter	Method
Total Coliform (Presence/Absence)	SM 9223B
Total Coliform MF	SM 9222B
Fecal Coliform MF	SM 9222D
E. Coli	SM 9222
Total Coliform MMO-MUG	SM 9223B
Total Coliform MPN	SM 9221B
Fecal Coliform MPN	SM 9221E
Fecal Strep	SM 9230C
Heterotrophic Plate Count	SM 9215B
Total Microbial Count	SM 9216
Iron Bacteria / Enumeration	SM 9240B
Sulfur Bacteria / Enumeration	SM 9240C
Salmonella (Presence / Absence)	SM 9260C
Salmonella (Most Probable Number)	SM 9260D

APPENDIX D
Recommended Sample containers and Holding Times

Liquid Sample Volume, Container, and Preservation Recommendations

Parameter	Volume	Container	Preservation, Liquid
Acidity	100 mls	250 ml HDPE	Cool 4°C
Alkalinity	100 mls	250 ml HDPE	Cool 4°C
Ammonia	500 mls	1L HDPE	Cool 4°C, H_2SO_4 < 2.0
Biochemical Oxygen Demand	1 liter	2 1L HDPE	Cool 4°C
Bromide	50 mls	125 ml HDPE	None required
Biochemical Oxygen Demand (Carb)	1 liter	2 1L HDPE	Cool 4°C
Chemical Oxygen Demand	50 mls	125ml HDPE	Cool 4°C, H_2SO_4 < 2.0
Chloride	50 mls	125 ml HDPE	None required
Chlorine (total residual)	200 mls	500 ml HDPE	None required
Color	50 mls	125 ml HDPE	Cool 4°C
Cyanide (total & amenable)	500 mls	1 L HDPE	NaOH to pH12.0,.6g asc
Fluoride	50 mls	125 ml HDPE	None required
Hardness	100 mls	250 ml HDPE	HNO_3<2.0 or H_2SO_4 <2.0
Hydrogen ion (pH)	25 mls	125 ml HDPE	None required
Kjeldahl and organic nitrogen	500 mls	1L HDPE	Cool 4°C, H_2SO_4 < 2.0
Chromium VI	100 mls	250 ml HDPE	Cool 4°C
Mercury	100 mls	250 ml HDPE	HNO_3 <2.0
Metals (except Cr VI & Hg)	200 mls	500 ml HDPE	HNO_3 <2.0
Nitrate	50 mls	125 ml HDPE	Cool 4°C
Nitrate-Nitrite	50 mls	125 mls HDPE	Cool 4°C, H_2SO_4 < 2.0
Nitrite	50 mls	125 mls HDPE	Cool 4°C
Oil & Grease/TPH	1 liter	2 1L BR	Cool 4°C, H_2SO_4 < 2.0
Organic Carbon	25 mls	125 ml HDPE	Cool 4°C,HCL/H_2SO_4 < 2.0
Orthophosphate	50 mls	125 ml HDPE	Filter immed./ Cool 4°C
Oxygen, dissolved	300 mls	300 ml BOD	None required
Winkler D.O.	300 mls	300 BOD	Fix onsite/store dark
Phenolics	500 mls	1L BR	Cool 4°C, H_2SO_4 < 2.0
Phosphorus (Elemental)	50 mls	1L BR	Cool 4°C
Phosphorus (Total)	50 mls	125 ml HDPE	Cool 4°C, H_2SO_4 < 2.0
Residue (Total)	100 mls	1L HDPE	Cool 4°C
Residue (Filterable)	100 mls	1L HDPE	Cool 4°C
Residue (Non-filterable)	100 mls	1L HDPE	Cool 4°C
Residue (Settleable)	1 liter	1L HDPE	Cool 4°C
Residue (Volatile)	100 mls	1L HDPE	Cool 4°C
Silica	50 mls	125 ml HDPE	Cool 4°C
Specific Conductance	100 mls	250 ml HDPE	Cool 4°C
Sulfate	50 mls	125 ml HDPE	Cool 4°C
Sulfide	500 mls	1 L HDPE	ZnAc plus NaOH to pH > 9

Liquid Sample Volume, Container, and Preservation Recommendations

Parameter	Volume	Container	Preservation
Sulfite	50 mls	125 ml HDPE	None required
Surfactants	250 mls	500 ml HDPE	Cool 4°C
Temperature	1 liter	2 1L HDPE	None required
Turbidity	100 mls	250 ml HDPE	Cool 4°C
Purgeable Halocarbons	40 mls	3-40 ml Glass V	Cool 4°C
Purgeable Aromatic Hydrocarbons	40 mls	3-40 ml Glass V	Cool 4°C, HCL<2
Acrolein & Acrylonitrile	40 mls	3-40 ml Glass V	Cool 4°C, pH 4.5
Phenols	125 ml	2-125 ml BR	Cool 4°C, 4 ^{o}C
Benzidines	125 ml	2-125 ml BR	Cool 4°C, 4 ^{o}C
Nitrosamines	125 ml	2-125 ml BR	Cool 4°C, dark
PCB's	125 ml	2-125 ml BR	Cool 4°C
Nitroaromatics & Isophorone	125 ml	2-125 ml BR	Cool 4°C, dark
Polynuclear aromatic hydrocarbons, low level	1 liter	1L BR	Cool 4°C, dark
Haloethers	125 ml	2-125 ml BR	Cool 4°C
Chlorinated Hydrocarbons	125 ml	2-125 ml BR	Cool 4 ^{o}C
Chlorinated Herbicides	125 ml	2-125 ml BR	Cool 4 ^{o}C
Dioxins & Furans	1 liter	2-1L BR?	Cool 4°C
TX Total Halogens	250 mls	1L BR	Cool 4°C, H_2SO_4 < 2
Pesticides, Chlorinated	125 ml	2-125 ml BR	Cool 4°C
Radiological Test Gross Alpha	1 liter	2 1L HDPE	HNO_3 <2
Beta	1 liter	2 1L HDPE	HNO_3 <2
Radium (Total)	1 liter	2 1L HDPE	HNO_3 <2
Coliform, Fecal & Total	100 mls	120 ml HDPE	008% $NA_2S_2O_3$, 4 ^{o}C
Fecal Streptococci	100 mls	250 ml HDPE	008% $NA_2S_2O_3$, 4 ^{o}C
Nonhalogenated Volatile Organics	40 mls	3-40 ml Glass Vial	Cool 4°C
Volatile Organics	40 mls	3-40 ml Glass Vial	Cool 4°C
Semivolatile Organics	125 ml	2-125 ml BR	Cool 4°C

HDPE High- Density Polyethylene Bottles
BR- Boston Round
AJ- Amber Jug

Soil Sample Volume, Container, and Preservation Recommendations

Parameter	Volume	Container	Preservation
Chloride	10 g	4 oz CWM	Cool 4°C
Cyanide (total & amenable)	10 g	4 oz CWM	Cool 4°C
Hydrogen ion (pH)	100 g	4 oz CWM	Cool 4°C
Chromium VI	10 g	8 oz CWM	Cool 4°C
Mercury	10 g	8 oz CWM	Cool 4°C
Metals (except Cr VI & Hg)	10 g	8 oz CWM	Cool 4°C
Nitrate	10 g	8 oz CWM	Cool 4°C
Nitrate-Nitrite	10 g	8 oz CWM	Cool 4°C
Nitrite	10 g	8 oz CWM	Cool 4°C
Organic Carbon	10 g	4 oz CWM	Cool 4°C
Phenolics	10 g	8 oz CWM	Cool 4°C
Specific Conductance	100 g	8 oz CWM	Cool 4°C
Sulfate	10 g	4 oz CWM	Cool 4°C
Sulfide	100 g	8 oz CWM	Cool 4°C
Purgeable Halocarbons	5 g	4 oz CWM	Cool 4°C
Purgeable Aromatic Hydrocarbons	5 g	4 oz CWM	Cool 4°C
Acrolein & Acrylonitrile	5 g	4 oz CWM	Cool 4°C
Phenols	10 g	8 oz CWM	Cool 4°C
Benzidines	10 g	8 oz CWM	Cool 4°C
Phthalate Esters	10 g	8 oz CWM	Cool 4°C
Nitrosamines	10 g	8 oz CWM	Cool 4°C
PCB's	10 g	8 oz CWM	Cool 4°C
Nitroaromatics & Isophorone	10 g	8 oz CWM	Cool 4°C
Polynuclear aromatic hydrocarbons	10 g	8 oz CWM	Cool 4°C
Haloethers	10 g	8 oz CWM	Cool 4°C
Chlorinated Hydrocarbons	10 g	8 oz CWM	Cool 4°C
Chlorinated Herbicides	10 g	8 oz CWM	Cool 4°C
Dioxins & Furans	10 g	8 oz CWM	Cool 4°C
TX Total Halogens	10 g	8 oz CWM	Cool 4°C
Pesticides, Chlorinated	10 g	8 oz CWM	Cool 4°C
Radiological Test Gross Alpha	100 g	8 oz CWM	Cool 4°C
Beta	100 g	8 oz CWM	Cool 4°C
Radium (Total)	100 g	8 oz CWM	Cool 4°C
Coliform, Fecal & Total	--	8 oz CWM	Cool 4°C
Nonhalogenated Volatile Organics	5 g	4 oz CWM	Cool 4°C
Volatile Organics	5 g	4 oz CWM	Cool 4°C
Semivolatile Organics	10 g	16 oz CWM	Cool 4°C
TCLP sample	100 g	16 oz CWM	Cool 4°C
Hazardous Waste Characterization	200 g	8 oz CWM	Cool 4°C

CWM- Clear Wide Mouth

Laboratory Holding Times

Parameter	Holding Time, Extraction	Holding Time, Analysis
Acidity	--	14 days
Alkalinity	--	14 days
Ammonia	--	28 days
Biochemical Oxygen Demand	--	48 hours
Bromide	--	28 days
Chemical Oxygen Demand	--	28 days
Chloride	--	28 days
Chlorine (total residual)	--	immediately
Color	--	48 hours
Cyanide (total & amenable)	--	14 days
Fluoride	--	28 days
Hardness	--	6 months
Hydrogen ion (pH)	--	immediately
Kjeldahl and organic nitrogen	--	28 days
Chromium VI	--	24 hours
Mercury	--	28 days
Metals (except Chromium VI & Hg)	--	6 months
Nitrate	--	48 hours
Nitrate-Nitrite	--	28 days
Nitrite	--	48 hours
Oil & Grease/TPH	--	28 days
Organic Carbon	--	28 days
Orthophosphate	--	48 hours
Oxygen, dissolved	--	immediately
Winkler D.O.	--	8 hours
Phenolics	--	28 days
Phosphorus (Total Dissolved)	--	24 hours
Phosphorus (Total)	--	28 days
Residue (Total)	--	7 days
Residue (Filterable)	--	7 days
Residue (Non-filterable)	--	7 days
Residue (Settleable)	--	48 hours
Residue (Volatile)	--	7 days
Silica	--	28 days
Specific Conductance	--	28 days
Sulfate	--	28 days
Sulfide	--	7 days
Sulfite	--	immediately
Surfactants	--	48 hours
Temperature	--	immediately
Turbidity	--	48 hours
Purgeable Halocarbons	--	14 days
Purgeable Aromatic Hydrocarbons	--	14 days
Acrolein & Acrylonitrile	--	14 days
Phenols	7 days (water) / 14 days (soil)	40 days
Benzidines	7 days (water) / 14 days (soil)	40 days

Laboratory Holding Times (continued)

Parameter	Holding Time, Extraction	Holding Time, Analysis
Phthalate Esters	7 days (water) / 14 days (soil)	40 days
Nitrosamines	7 days (water) / 14 days (soil)	40 days
PCB's	7 days (water) / 14 days (soil)	40 days
Nitroaromatics & Isophorone	7 days (water) / 14 days (soil)	40 days
Polynuclear aromatic hydrocarbons	7 days (water) / 14 days (soil)	40 days
Haloethers	7 days (water) / 14 days (soil)	40 days
Chlorinated Hydrocarbons	7 days (water) / 14 days (soil)	40 days
Chlorinated Herbicides	7 days (water) / 14 days (soil)	40 days
Dioxins & Furans	7 days (water) / 14 days (soil)	40 days
TX Total Halogens	--	28 days
Pesticides, Chlorinated	7 days (water) / 14 days (soil)	40 days
Radiological Test Gross Alpha	--	6 months
Beta	--	6 months
Radium (Total)	--	6 months
Coliform, Fecal & Total	--	6 hours
Fecal Streptococci	--	6 hours
Nonhalogenated Volatile Organics	--	14 days
Volatile Organics	--	14 days
Semivolatile Organics	7 days (water) / 14 days (soil)	40 days
TCLP sample, volatile (ZHE)	14 days	14 days
TCLP sample, semivolatile organic	14 days to leach / 7 days to extract	40 days
TCLP sample, metals	180 days (28 days for mercury)	180 days (28 days for mercury)
Hazardous Waste Characterization	--	14 days

APPENDIX E
STL Seattle
Instrument Calibration Program

STL SEATTLE INSTRUMENT CALIBRATION PROGRAM

Instrument System: GC/MS (Volatile Organics, 8260/624)

Initial Calibration Procedure. Five standards (0.4, 1.0, 2.0, 5.0 and 10.0 ug/L for ITS40 and HP5973N, and 10, 20, 50, 100, 200, and 5000 (ketones only) ug/L for the Incos system) are purged by autosampler; the sequence of injection is lowest concentration standard to highest concentration standard. Each standard solution contains internal standards and surrogate at 50 ug/L (2.5 for the ITS40). A response factor (RF) is calculated for each target analyte at each concentration. Method 8260: A relative standard deviation (RSD) is calculated based on the relative response factors (RRF) from each target analyte. All calculations are based on the average RRF for RSD $\leq$ 15; if the RSD > 15, the default of a higher order regression analysis is used. Linear regression is used if the correlation coefficient is greater than 0.990. For compounds that do not meet criteria, a quadratic fit is employed. Optionally if the mean of all RSDs over the entire calibration range for all target analytes is $\leq$ 15%, the average response factors is employed for all target analytes. Method 624: RSDs must be $\leq$ 35%. Separate calibration curves are generated for waters/medium soils and low soils.

Continuing Calibration Procedure. A single point calibration standard containing each target analyte, 50 ug/L (2.5 for the ITS40) of each surrogate compound, and 50 ug/L (1.0 for the ITS40) of each internal standard is purged by autosampler. A response factor is calculated for each target analyte, and compared to the average relative response factor from the initial calibration.

Frequency of Calibration. An initial calibration is performed whenever a major instrument change occurs, or whenever the continuing calibration fails to meet acceptance criteria. Continuing calibration standards are analyzed at a minimum frequency of every 12 hours or at the beginning of an analytical sequence.

Reference Standards. Calibration standards are prepared from the following vendors: UltraScientific; AccuStandard; Chem Service; EM Science; Restek; Cresent Chemical; Aldrich; Supelco, and Sigma. Internal standards and surrogate standards added to the calibration standards are made from neat solutions. The LCS standard is purchased from a source independent of the initial calibration standards.

Calibration Acceptance Criteria. Method 8260: All SPCC compounds must meet minimum RF criteria for initial calibration. All CCC compounds must meet the RPD criteria of $\leq$ 30% for initial calibration. For the continuing calibration, all SPCC compounds must meet minimum RF requirements. All CCC compounds must have %D of $\leq$ 20%. Method 624: %RSD $\leq$ 35%.

Calibration Verification. A second-source standard is analyzed with every analytical batch; the recovery of analytes in the standard must be within performance-based limits.

Instrument System: GC/MS (Volatile Organics, 524)

Initial Calibration Procedure. Five standards (0.4, 1.0, 2.0, 5.0 and 10 ug/L for ITS40, all target analytes) are purged by autosampler; the sequence of injection is lowest concentration standard to highest concentration standard. Each standard solution contains internal standards and surrogate at 2.5 ug/L. A response factor (RF) is calculated for each target analyte at each concentration. A relative standard deviation (RSD) is calculated based on the relative response factors (RRF) from each target analyte. All calculations are based on the average RRF for RSD < 20; if the RSD > 20, a high order regression analysis is used. Linear regression is used if the correlation coefficient is greater than 0.99. For compounds that do not meet criteria, a quadratic fit is employed.

Continuing Calibration Procedure. A standard containing 1.0 ug/L of each target analyte, 2.5 ug/L of each surrogate compound, and 2.5 ug/L of each internal standard is purged by autosampler. A response factor is calculated for each target analyte, and compared to the average relative response factor from the initial calibration.

STL SEATTLE INSTRUMENT CALIBRATION PROGRAM

Frequency of Calibration. An initial calibration is performed whenever a major instrument change occurs, or whenever the continuing calibration fails to meet acceptance criteria. Continuing calibration standards are analyzed at a minimum frequency of every 12 hours.

Reference Standards. Calibration standards are prepared from the following vendors: UltraScientific; AccuStandard; Chem Service; EM Science; Restek; Cresent Chemical; Aldrich; Supelco, and Sigma.

Calibration Acceptance Criteria. All compounds must have %D of $\leq$ 30%.

Calibration Verification. Laboratory control sample (LCS) and a laboratory fortified blank (LFB) analyses are performed with each analytical batch; the LCS is prepared from alternate source standards from the calibration standards, and the 0.5 ug/L LFB is prepared from the same stock standards used for ICAL standards. If recovery of any target analytes fails QC criteria for the LCS, the LCS standard is reanalyzed; if any target compounds fail both analyses, corrective action is taken.

Instrument System: GC/MS (Semivolatiles)

Initial Calibration Procedures. Six standards (typically 2.5, 1.0, 0.75, 0.5, 0.25, 0.1 [and 0.01 for PAHs only]) mg/L, all target analytes) are injected by autosampler. Each standard solution contains internal standards corresponding to 1.0 mg/L in the extract. Each standard contains surrogate compounds at the same concentration as the target analytes. A response factor (RF) is calculated for each target analyte at each concentration. A relative standard deviation (RSD) is calculated based on the relative response factors (RRF) from each target analyte. An average relative response factor may be calculated for each target analyte, or optionally a linear or quadratic regression may be calculated.

Continuing Calibration Procedures. A single-point continuing calibration standard containing each target analyte, surrogate compound, and each internal standard is injected by autosampler. A response factor is calculated for each target analyte, and compared to the average relative response factor from the initial calibration. Alternatively, the calculated value is compared to the true value for each target analyte if a calibration curve is used for quantitation.

Frequency of Calibration. An initial calibration is performed whenever a major instrument change occurs, or whenever the continuing calibration fails to meet acceptance criteria. Continuing calibration standards are analyzed at a minimum frequency of every 12 hours.

Reference Standards. Calibration standards are prepared from Supelco (or equivalent) standard solutions containing all target analytes at 2000 mg/L. Internal standards added to the calibration standards are obtained from Supelco (or equivalent) Internal Standard Mix containing all internal standards at 2000 mg/L, diluted to 100 mg/L. Surrogate standards added to the calibration standards are obtained from Supelco (or equivalent).

Calibration Acceptance Criteria. Initial calibration acceptance criteria is dependent on the method performed; generally, a RSD of 15% or less for specific target analytes is required if the average response factor is used for quantitation. If the RSD for any given analyte(s) is greater than 15%, a linear or quadratic regression may be used. The r or r^2 must be $\geq$ 0.99. All relative response factors for CCCs must have a %RSD of $\leq$ 30%. All SPCC compounds must meet the minimum response factors specified in the reference method. The continuing calibration acceptance criteria are dependent on the method performed; generally, a percent difference (%D) of 20% between the RF for the continuing calibration and the average relative response factor from the initial calibration is required for CCCs. If a linear or quadratic regression is used, the percent drift for CCCs must be $\leq$ 20%. For all target analytes, the minimum RF is dependent on the method; however, an RF of 0.05 is the lowest RF accepted for SPCCs.

Calibration Verification. The ICAL is verified by a second-source standard; continuing calibration limits are applied to the recoveries.

STL SEATTLE INSTRUMENT CALIBRATION PROGRAM

Instrument System: GC/MS (Pesticides/Herbicides)

Initial Calibration Procedures. Six standards (typically 0.01, 0.05, 0.1, 0.5, 1.0, 2.0 mg/L, all target analytes) are injected by autosampler; the sequence of injection is highest concentration standard to lowest concentration standard. Each standard solution contains internal standards at 1.0 mg/L. Each standard contains surrogate compounds at the same concentration as the target analytes. A response factor (RF) is calculated for each target analyte at each concentration. A relative standard deviation (RSD) is calculated based on the relative response factors (RRF) from each target analyte. An average relative response factor may be calculated for each target analyte, or a linear or quadratic regression may be calculated.

Continuing Calibration Procedures. A single-point continuing calibration standard containing each target analyte, each surrogate compound, and each internal standard is injected by autosampler. A response factor is calculated for each target analyte, and compared to the average relative response factor from the initial calibration.

Frequency of Calibration. An initial calibration is performed whenever a major instrument change occurs, or whenever the continuing calibration fails to meet acceptance criteria. Continuing calibration standards are analyzed at a minimum frequency of every 12 hours.

Reference Standards. Calibration standards are prepared from AccuStandard Mixtures. Internal standards and surrogate standards added to the calibration standards are obtained from Chem Services as custom mixtures.

Calibration Acceptance Criteria. Initial calibration acceptance criteria is dependent on the method performed; generally, a RSD of 15% or less for specific target analytes is required if the average response factor is used for quantitation. If the RSD for any given analyte(s) is greater than 15%, a linear or quadratic regression may be used. The r or r^2 must be $\geq$ 0.99. The continuing calibration acceptance criteria are dependent on the method performed; generally, a percent difference (%D) of 20% between the RF for the continuing calibration and the average relative response factor from the initial calibration is required when an average response factor is used for quantitation. If a linear or quadratic regression is used, the percent drift must be $\leq$ 20%.

Calibration Verification. The ICAL is verified by a second-source standard; performance-based limits are applied to the recoveries.

Instrument System: GC/ECD (PCBs/oils)

Initial Calibration Procedures. Five Standards (Aroclor 1242/1260 mixture) are used to generate a calibration curve at concentrations of 0.010, 0.050, 0.10, 0.25, 0.50 mg/L. Single point calibrations are performed for Aroclors 1221/1254, 1248, 1232, and 1016 at concentrations of 0.10 mg/L. Aroclor 1221 is calibrated and quantitated based on three peak areas. Aroclor 1016, 1232, 1242, 1248, 1254, and 1260 are calibrated and quantitated using five peak areas. The calculated concentrations from the integrated areas are averaged to determine the reported result. The correlation coefficient is calculated for Aroclors 1242 and 1260.

Continuing Calibration Procedures. A continuing calibration verification standard consisting of Aroclor 1242/1260 is analyzed at a frequency of once for every 10 analytical runs.

Frequency of Calibration. An initial calibration is performed whenever a major instrument change occurs, or whenever the continuing calibration fails to meet acceptance criteria. Continuing calibration standards are analyzed at a minimum frequency of after every ten samples.

Reference Standards. Supelco AroclorT (or equivalent) standards are used for calibration standards. A Restek (or equivalent) reference standard is used as the second source check standard.

STL SEATTLE INSTRUMENT CALIBRATION PROGRAM

Calibration Acceptance Criteria. The correlation coefficient from the initial calibration curve must be ≥ 0.995, or the %RSD must be ≤ 20%. Continuing calibration standard calculated result must be within 15% of the true value. The Restek check standard must agree within 15% of the true value.

Calibration Verification. A Restek reference check standard is analyzed immediately following the initial calibration. The calculated result for the standard must agree within 15% of the true value.

Instrument System: GC/ECD/ECD, GC/ECD (Pesticides and PCBs)

Initial Calibration Procedures. Six standards of chlorinated pesticides (typically 1.0, 2.0, 5.0, 10, 20, and 50 ug/L, all target analytes) are injected by autosampler; the sequence of injection is lowest concentration standard to highest concentration standard. Each pesticide standard contains surrogate compounds at five times the concentration of the target analytes. Five standards of a polychlorinated biphenyl Aroclor 1242/1260 mixture (10, 50, 100, 250, and 500 ug/L) are injected singly by autosampler; the sequence of injection is lowest concentration standard to highest concentration standard. Each polychlorinated biphenyl compound (PCB) standard contains a surrogate compound at 20 ug/L. For chlorinated pesticides, a curve is generated from the standard areas for each target analyte. For PCBs, five curves are generated for five specific peaks within the PCB response pattern. One standard at a concentration of 100 ug/L is also analyzed for each of the other common PCB mixtures; if any of these PCB mixtures are identified in the samples, the single point calibration is used for quantitation. One standard of chlordane is analyzed; if chlordane is identified in the samples, a six point calibration (10, 50, 100, 250, 500, and 1000 ug/L) is performed for chlordane. One standard of toxaphene is analyzed; if toxaphene is identified in the samples, a five point calibration (100, 200, 400, 600, and 800 ug/L) is performed for toxaphene.

Continuing Calibration Procedures. A chlorinated pesticide standard containing each single-peak response target analyte and 20 ug/L of each surrogate compound is injected by autosampler. A PCB standard containing 100 ug/L of a PCB and 20 ug/L of surrogate is injected by autosampler.

Frequency of Calibration. An initial calibration is performed whenever a major instrument change occurs, or whenever the continuing calibration fails to meet acceptance criteria. Continuing calibration standards are analyzed at a minimum frequency of after every ten samples.

Reference Standards Calibration standards for chlorinated pesticides are prepared Supelco (or equivalent) CLP Pesticide Mixtures. Surrogate standards added to the chlorinated pesticide calibration standards are prepared from Supelco Pesticide Surrogate Spike Mixture. PCB standards are prepared from Supelco Aroclor mixtures (1016, 1221, 1232, 1242, 1248, 1254, and 1260).

Calibration Acceptance Criteria. Initial calibration acceptance criteria is a curve with a minimum correlation coefficient of 0.995 or an RSD of ≤ 20%, for chlorinated pesticides and PCBs. The continuing calibration acceptance criteria is a percent difference (%D) of 15% between the calculated concentration of the continuing calibration standard and the true value of the standard. For PCBs, the true values calculated for each peak of the pattern response should also agree within 15% of each other. A continuing calibration failing criteria may be re-analyzed, or a new continuing calibration standard may be analyzed, or finally, a new initial calibration may be performed.

Calibration Verification. A second source calibration verification standard is analyzed after every initial calibration. The current second source is Restek.

STL SEATTLE INSTRUMENT CALIBRATION PROGRAM

Instrument System: GC/PID/FID (8021/602/Gasoline)

Initial Calibration Procedure. Five standards (minimum) are injected singly for volatile aromatics and for gasoline by autosampler from lowest concentration to highest concentration. A calibration curve is generated using a minimum of 5 standards; a minimum correlation coefficient of 0.99 is required for volatile aromatics, and a minimum of 0.990 is required for gasoline. NWTPH-Gx requires all initial calibration standard calculated results to be within 15% of the true value.

Continuing Calibration Procedure. One continuing calibration standard is injected singly by autosampler, at a concentration within the linear range containing gasoline and volatile aromatic compounds.

Frequency of Calibration. An initial calibration is performed whenever a major instrument change occurs, or whenever the continuing calibration fails to meet acceptance criteria. Continuing calibration standards are analyzed at a minimum frequency of every 12 hours of instrument operation and/or at the end of each analytical run. Second source calibration verification standards may be analyzed at the beginning of each analysis batch, and may be rotated with the continuing calibration standard.

Reference Standards. Initial and continuing calibration standards for volatile aromatics compounds are purchased. Gasoline standards are prepared from neat composites or neat individual volumes of local gasolines, or purchased.

Calibration Acceptance Criteria. Initial calibration curves for volatile aromatics (8021) must meet a minimum correlation coefficient of 0.990; alternatively, the calculated RSD may be $\leq$20%, and then the curve is assumed to pass through the origin. Initial calibration curves for volatile aromatics (602) must meet RSD criteria of $\leq$10%. Initial calibration curves for gasoline must meet a minimum correlation coefficient of 0.990. NWTPH-Gx requires all initial calibration standard calculated results to be within 15% of the true value. Continuing calibration standards and external calibration check standards must have a calculated concentration within 15% of the actual concentration for Method 8021 and gasoline (within 20% for NWTPH-Gx, within 25% for AK101), and within 10% for Method 602.

Calibration Verification. At the beginning of each analysis batch or every 24 hours, a second source calibration verification standard for volatile aromatics and gasoline is analyzed.

Instrument System: GC/FID (Semivolatile Fuels)

Initial Calibration Procedures. A minimum of five standards containing diesel and motor oil(25, 50, 100, 250, 500, 1000, 2,500 and 5,000 mg/L) are injected singly by autosampler; the sequence of injection is lowest concentration standard to highest concentration standard. Calibration curves are generated for diesel and motor oil. Immediately following the initial calibration, external calibration check standards for diesel and motor oil are analyzed. A minimum of five concentrations of surrogate standard (2.0, 4.0, 10, 20, 40 and 100 mg/L) are injected singly by autosampler; a calibration curve is generated for the surrogate.

Continuing Calibration Procedure. One of each type of standard (gasoline, diesel, and/or motor oil) is injected singly by autosampler, at a concentration within the linear range.

Frequency of Calibration. An initial calibration is performed whenever a major instrument change occurs, or whenever the continuing calibration fails to meet acceptance criteria. Also, poor surrogate recoveries in method blank samples may prompt instrument maintenance and a new initial calibration. Continuing calibration standards are analyzed at a minimum frequency of every 10 samples. External calibration check standards are analyzed at a minimum frequency of every 24 hours.

Reference Standards. The diesel fuel used is Diesel fuel #2, and is obtained from local sources. Oil range calibration is performed with Motor Oil.

STL SEATTLE INSTRUMENT CALIBRATION PROGRAM

Calibration Acceptance Criteria. Initial standard and surrogate calibration curves must meet a minimum correlation coefficient of 0.990, or response factors must have an RSD of $\leq$ 20%. Continuing calibration standards and external calibration check standards must have a calculated concentration within 15% (25% for Alaska methods) of the actual standard concentration. If the continuing calibration standard does not meet criteria, a fresh standard may be prepared and analyzed. If this standard fails to meet criteria, appropriate instrument maintenance is performed, and a new initial calibration curve is generated.

Calibration Verification. Immediately following the initial calibration, and at the beginning of each analysis batch or every 24 hours, external calibration check standards for gasoline and diesel are analyzed.

Instrument System: ICP, simultaneous and sequential

Initial Calibration Procedures. One instrument blank and three standards containing all analytes of interest are analyzed for initial calibration (analyte-specific concentrations). Standards are analyzed from the lowest concentration to highest concentration standard.; three replicates, three readings at each replicate, of each standard are analyzed and the results averaged. A calibration curve is generated using the blank and the average value for each of the three standards.

Continuing Calibration Procedures. A continuing calibration standard containing a mid-range concentration of each analyte is analyzed after 10 samples, or once per batch. The calculated concentration is compared to the actual concentration of the standard analytes.

Frequency of Calibration. An initial calibration is performed daily. The continuing calibration standard is analyzed after every 10 samples are analyzed, or once per batch. An interelement correction standard is analyzed at the beginning and end of each analytical sequence to ensure that the instrument is compensating for interferences.

Reference Standards. CPI A and AB (interference check), Leeman Labs Multielement Blends (or equivalent), and second source (outside) check standards.

Calibration Acceptance Criteria. Initial calibration acceptance criteria is a curve with a minimum correlation coefficient of 0.995. The agreement between the replicate injections of each standard must be a relative standard deviation of less than or equal to 25. The continuing calibration acceptance criteria is a percent difference (%D) of 10% (5% for samples analyzed for NPDES) between the calculated concentration of the continuing calibration standard and the true value of the standard. If criteria is not met, the standard is rerun, or a "curve update" is performed. An "update" is a linear adjustment of the curve using the highest standard. The external calibration check must agree within 10% (5% for samples analyzed by method 200.7) of the true value.

Calibration Verification. Immediately following the initial calibration, and at the beginning of each analysis batch or every 24 hours, an external calibration check standard is analyzed.

Instrument System: Cold Vapor Atomic Absorption Spectrophotometer, Mercury Analysis

Initial Calibration Procedure. An instrument blank and five standards (0.1, 2.0, 5.0, 10.0, and 20.0 ug/L) are injected in triplicate by an autosampler. The injection order is blank, 0.1 ug/L, 2.0 ug/L, 5.0 ug/L, 10 ug/L, and finally the 20 ug/L standard. An average value for each standard and the instrument blank is calculated by the instrument; the average instrument response is used to generate the calibration curve.

Continuing Calibration Procedure. A continuing calibration standard at 5.0 ug/L is injected singly by an autosampler, immediately followed by an instrument blank.

STL SEATTLE INSTRUMENT CALIBRATION PROGRAM

Frequency of Calibration. Initial calibrations are performed daily, or whenever the continuing calibration fails to meet acceptance criteria. Continuing calibration standards are analyzed after every 10 samples, immediately following an instrument blank.

Reference Standards. A CPI mercury standard at a concentration of 100 mg/L (or equivalent) is used to prepare the initial and continuing calibration standards. An EM Sciences standard at 100 mg/L (or equivalent second source) is used to prepare the daily check standards.

Calibration Acceptance Criteria. The initial calibration curve must generate a minimum correlation coefficient of 0.995. The continuing calibration standard must have a calculated concentration within 15% of the true standard value. If the continuing calibration standard fails acceptance criteria, it may be re-analyzed.

Calibration Verification. Immediately following the initial calibration, and at the beginning of each analysis batch or every 24 hours, an external calibration check standard is analyzed.

Instrument System: Instrument System: ICP-MS

Initial Calibration Procedures. One instrument blank and five standards containing all analytes of interest are analyzed for initial calibration (analyte-specific concentrations). Standards are analyzed from the lowest concentration to highest concentration standard.; three replicates, three readings at each replicate, of each standard are analyzed and the results averaged. A calibration curve is generated using the blank and the average value for each of the five standards.

Continuing Calibration Procedures. A continuing calibration standard containing a mid-range concentration of each analyte is analyzed after 10 samples, or once per batch. The calculated concentration is compared to the actual concentration of the standard analytes.

Frequency of Calibration. An initial calibration is performed daily. The continuing calibration standard is analyzed after every 10 samples are analyzed, or once per batch.

Reference Standards. Plasma Chem Standards, Leeman Labs Multielement Blends (or equivalent), and CPI CHK7 and CHK19 (outside check standards), or equivalent.

Calibration Acceptance Criteria. Initial calibration acceptance criteria is a curve with a minimum correlation coefficient of 0.995. The agreement between the replicate injections of each standard must be a relative standard deviation of less than or equal to 25. The continuing calibration acceptance criteria is a percent difference (%D) of 10% between the calculated concentration of the continuing calibration standard and the true value of the standard. If criteria is not met, the standard is rerun.

Calibration Verification. Immediately following the initial calibration, and at the beginning of each analysis batch or every 24 hours, an external calibration check standard is analyzed. The standard must agree within 10% of the true value.

Instrument System: IC

Initial Calibration Procedures. One instrument blank and six standards containing all analytes of interest are injected singly by autosampler (analyte-specific concentrations). Standards are analyzed from the lowest concentration to highest concentration standard. A calibration curve is generated using the blank and the value for each of the six standards.

STL SEATTLE INSTRUMENT CALIBRATION PROGRAM

Continuing Calibration Procedures. A continuing calibration standard is analyzed containing a mid-range concentration of each analyte. The calculated concentration is compared to the actual concentration of the standard analytes.

Frequency of Calibration. An initial calibration check is performed daily. The continuing calibration standard is analyzed after every 10 samples are analyzed, or once per batch.

Reference Standards. A mixed standard is used to prepare the initial and continuing calibration standard. An ERA custom standard is used for the outside check standard.

Calibration Acceptance Criteria. Initial calibration acceptance criteria is a curve with a minimum correlation coefficient of 0.995. The continuing calibration acceptance criteria is a percent difference (%D) of 10% between the calculated concentration of the continuing calibration standard and the true value of the standard. If criteria is not met, the standard is rerun. The outside check standard must agree within 10% of the true value.

Calibration Verification. Immediately following the initial calibration, and at the beginning of each analysis batch or every 24 hours, an outside check standard is analyzed.

Instrument System: RFA

Initial Calibration Procedures. An instrument blank and a minimum of four standards (standard concentrations are analyte specific) are analyzed at the beginning of an analytical sequence. The analysis order of the standards at the beginning of the sequence is highest concentration standard to lowest concentration standard.

Continuing Calibration Procedures. One standard at the approximate mid-range (concentration is analyte specific) of the standard curve is analyzed.

Frequency of Calibration. The analytical sequence between the two calibration runs may not exceed 12 hours of operating time. Continuing calibration standards are analyzed after every 10 samples. An outside check standard is analyzed following the first calibrating sequence.

Reference Standards. Individual analyte solutions are prepared as primary standards from reagent grade materials. The calibration check standard is prepared from APG or ERA Setpoint Laboratory Standards.

Calibration Acceptance Criteria. The initial calibration curve must have a correlation coefficient of at least 0.995. The initial individual calibrating standards are compared against the true value; each must agree within 10%. If the lowest level standard does not meet acceptance criteria of within 10% of the true value, but the correlation coefficient is greater than 0.995 and there are no samples with response at the low level of that standard, the curve is still valid for sample quantitation.

Calibration Verification. Following the initial calibrating sequence, a reference check standard is evaluated; the calculated standard concentration must agree within 10% of the true value of the standard. The continuing calibration standard must agree within 10% of the true value of the standard, or all subsequent samples must be reanalyzed.

Instrument System: HPLC

Initial Calibration Procedures. An instrument blank and at least five standards containing all analytes of interest at appropriate concentrations are injected singly by autosampler for initial calibration. Standards are analyzed from lowest to highest concentration. A calibration curve is generated using the obtained standard values.

STL SEATTLE INSTRUMENT CALIBRATION PROGRAM

Continuing Calibration Procedures. A continuing calibration standard containing a mid-range concentration of each analyte is analyzed after 10 samples, or once per batch. The calculated concentration is compared to the actual concentration of the standard analytes.

Frequency of Calibration. An initial calibration is performed whenever a major instrument change occurs, or whenever the continuing calibration fails to meet acceptance criteria. Continuing calibration standards are analyzed at various concentrations within the instrument calibration range.

Reference Standards. A Supelco (or equivalent) custom standard is used to prepare the initial and continuing calibration standard. A Restek mixed standard is used for the outside check standard.

Calibration Acceptance Criteria. Initial calibration acceptance criteria is a curve with a minimum correlation coefficient of 0.995 or an RSD of $\leq$ 20%. The continuing calibration acceptance criteria is $\leq$ 15 percent difference between the calculated concentration of the continuing calibration standard and the true value of the standard. If criteria are not met, the standard is rerun. The outside check standard must agree within 15% of the true value.

Calibration Verification. An outside check standard is analyzed immediately following the initial calibration.

Instrument System: Turbidimeter

Initial Calibration Procedure. One instrument blank and a minimum of three standards are analyzed.

Continuing Calibration Procedure. None.

Frequency of Calibration. An initial calibration is performed for each batch of samples analyzed.

Reference Standards. Calibrating and reference standards are purchased from Advanced Polymer Systems, Inc.

Calibration Acceptance Criteria. None (the meter is set with the calibrating standard).

Calibration Verification. The outside check standard must be within 10% of the true value.

Instrument System: Spectrophotometer

Initial Calibration Procedure. One instrument blank and a minimum of three standards (or as specified in the referenced analytical method) are analyzed at the appropriate wavelength.

Continuing Calibration Procedure. None.

Frequency of Calibration. An initial calibration is performed whenever samples are analyzed.

Reference Standards. Calibrating standards are purchased from Milton Roy.

Calibration Acceptance Criteria. None (the meter is set with the calibrating standard).

Calibration Verification. Annual calibration and standardization is performed by a qualified calibration laboratory.

STL SEATTLE INSTRUMENT CALIBRATION PROGRAM

Instrument System: Ion-specific Meter (pH)

Initial Calibration Procedure. Two calibration buffers are used to set the upper and lower pH values; pH 7.0 buffer is also set during the calibration, following manufacture's procedure for calibration.

Continuing Calibration Procedure. None.

Frequency of Calibration. An initial calibration is performed for each batch.

Reference Standards. Purchased as standardized buffer solutions.

Calibration Acceptance Criteria. None (the meter is set with the calibrating standard).

Calibration Verification. An outside check standard must be within 0.50 pH units of the true value. An annual calibration check is performed by a qualified outside calibration laboratory.

APPENDIX F
STL Seattle
Sample Data Evaluation Procedures

STL SEATTLE SAMPLE DATA EVALUATION PROCEDURES

Instrument System: GC/MS (8260, 624, 524)

- Surrogate compound percent recoveries are calculated and compared to the acceptable limits specified for the method and matrix.
- Batch QC, which is performed at a five percent frequency (minimum), is evaluated to determine acceptability. The matrix spike/matrix spike duplicate or blank spike/blank spike duplicate results are compared to method and matrix specific QC limits. For TCLP leachate, a matrix spike and a sample duplicate are evaluated.
- Method blanks are examined for analytes that have concentrations above the PQL (or 5x the PQL for EPA designated common laboratory solvents). For Method 524.2, the method blanks are examined for analytes that have concentrations above 0.5 ug/L.
- For Method 524.2, the LFB and the LCS are evaluated against method criteria.
- For Method 624, the LCS and the LCSD are evaluated against method criteria.
- Samples are examined for analytes with concentrations that exceed the instrument calibration range. If the sample has been diluted based on previous analysis or screening results that indicate a high level of contamination, a target analyte should be within the upper half of the initial calibration range. This may not be possible, however, for samples that contain high concentrations of non-targeted compounds.
- The relative retention time of a quantitated analyte that has closely eluting targeted or non-targeted isomers is checked to assure its identity.
- The mass spectrum of each quantitated target analyte is evaluated against a known reference spectrum of the compound according to standard EPA rules.
- The reported value for each analyte is flagged with any applicable QC qualifiers.
- The calculated results for the sample are peer-reviewed at a frequency of at least 10 percent. Units and reporting limits are also verified.

Instrument System: GC/MS (8270, 625)

- The surrogate standard percent recoveries are calculated and compared to the acceptable limits specified for the method and matrix.
- Batch QC, which is performed at a five percent frequency (minimum) is evaluated to determine acceptability. The matrix spike/matrix spike duplicate or blank spike/blank spike duplicate results are compared to method and matrix specific QC limits.
- Method blanks are examined for analytes that have concentrations above the PQL or MDL (or 5x the PQL for EPA designated phthalate esters).
- Samples are examined for analytes with concentrations that exceed the instrument calibration range. If the sample has been diluted based on previous analysis or screening results that indicate a high level of contamination, a target analyte should be within the upper half of the initial calibration range. This may not be possible, however, for samples that contain high concentrations of non-targeted compounds, or high concentrations of multiple target analytes.
- The relative retention time of a quantitated analyte that has closely eluting targeted or non-targeted isomers is checked to assure its identity.
- The mass spectrum of each quantitated target analyte is evaluated against a known reference spectrum of the compound according to standard EPA rules.
- The reported value for each analyte is flagged with any applicable QC qualifiers.
- The calculated results for the sample are peer-reviewed at a frequency of at least 10 percent. Units and reporting limits are also verified.

STL SEATTLE SAMPLE DATA EVALUATION PROCEDURES

Instrument System: GC/MS (8141, 8151)

- The surrogate standard percent recoveries are calculated and compared to the acceptable limits specified for the method and matrix.
- Batch QC, which is performed at a five percent frequency (minimum), is evaluated to determine acceptability. The matrix spike/matrix spike duplicate or blank spike/blank spike duplicate results are compared to method and matrix specific QC limits.
- Method blanks are examined for analytes that have concentrations above the PQL or MDL.
- Samples are examined for analytes with concentrations that exceed the instrument calibration range. If the sample has been diluted based on previous analysis or screening results that indicate a high level of contamination, a target analyte should be within the upper half of the initial calibration range. This may not be possible, however, for samples that contain high concentrations of non-targeted compounds.
- The relative retention time of a quantitated analyte that has closely eluting targeted or non-targeted isomers is checked to assure its identity.
- The mass spectrum of each quantitated target analyte is evaluated against a known reference spectrum of the compound according to standard EPA rules.
- The reported value for each analyte is flagged with any applicable QA/QC qualifiers.
- The calculated results for the sample are peer-reviewed at a frequency of at least 10 percent. Units and reporting limits are also verified.

Instrument System: GC/ECD (600/4, 608, 8081, 8082)

- The surrogate standard percent recoveries are calculated and compared to the acceptable limits specified for the method and matrix.
- Peak patterns and retention times are evaluated by the analyst to determine the presence of Aroclors based on an established multicomponent library.
- Batch QC, which is performed at a minimum frequency of five percent (ten percent for Method 608) is evaluated to determine acceptability. The matrix spike/matrix spike duplicate or blank spike/blank spike duplicate results are compared to method and matrix specific QC limits.
- Method blanks are examined for detectable levels of target analytes.
- Samples are examined for analytes with concentrations that exceed the instrument calibration range. If the sample has been diluted based on previous analysis or screening results that indicate a high level of contamination, a target analyte should be within the upper half of the initial calibration range. This may not be possible, however, for samples that contain high concentrations of non-targeted compounds.
- The reported value for each analyte is flagged with any applicable QC qualifiers.
- The calculated results for the sample are peer-reviewed at a frequency of at least 10 percent. Units and reporting limits are also verified.

Instrument System: GC/ECD/ECD (8081, 8082, 608)

- The surrogate standard percent recoveries are calculated and compared to the acceptable limits specified for the method and matrix.
- Peak patterns and retention times are evaluated for each column (typically RTX-CLP1 and RTX-CLP2) by the analyst to determine the presence of pesticides and/or Aroclors based on an established single component and multicomponent library. Confirmation of the presence of an analyte must be accomplished by detection on both analytical columns in order to be reported as present in the sample. If a single component analyte is present at a sufficiently high level, further confirmation of the presence of the analyte may be accomplished by analyzing the sample by GC/MS.

- Batch QC, which is performed at a minimum frequency of five percent (ten percent for Method 608) is evaluated to determine acceptability. The matrix spike/matrix spike duplicate or blank spike/blank spike duplicate results are compared to method and matrix specific QC limits.
- Method blanks are examined for detectable levels of target analytes.
- Samples are examined for analytes with concentrations that exceed the instrument calibration range. If the sample has been diluted based on previous analysis or screening results that indicate a high level of contamination, a target analyte should be within the upper half of the initial calibration range. This may not be possible, however, for samples that contain high concentrations of non-targeted compounds.
- The reported value for each analyte is flagged with any applicable QC qualifiers.
- The calculated results for the sample are peer-reviewed at a frequency of at least 10 percent. Units and reporting limits are also verified.

Instrument System: GC/PID/FID (8021, 602, Gasoline)

- The surrogate standard percent recoveries are calculated and compared to the acceptable limits specified for the method and matrix.
- Peak patterns and relative retention times are evaluated by the analyst to determine the presence of target analytes based on an established single component and multicomponent library. If a single component analyte is present at a sufficiently high level, further confirmation of the presence of the analyte may be accomplished by analyzing the sample by GC/MS.
- Batch QC, which is performed at a minimum frequency of five percent (ten percent for Method 602) is evaluated to determine acceptability. The matrix spike/matrix spike duplicate or blank spike/blank spike duplicate results are compared to method and matrix specific QC limits. Duplicates are analyzed and evaluated with each NWTPH-Gx batch for fuels parameters at a minimum frequency of 10%. Quality control check standards are evaluated for acceptable recoveries, based on the limits provided by the manufacturer.
- Method blanks are examined for detectable levels of target analytes.
- Samples are examined for analytes with concentrations that exceed the instrument calibration range. If the sample has been diluted based on previous analysis or screening results that indicate a high level of contamination, a target analyte should be within the upper half of the initial calibration range. This may not be possible, however, for samples that contain high concentrations of non-targeted compounds.
- The reported value for each analyte is flagged with any applicable QC qualifiers.
- The calculated results for the sample are peer-reviewed at a frequency of at least 10 percent. Units and reporting limits are also verified.

Instrument System: GC/FID (Diesel, Petroleum Oils)

- The surrogate standard percent recoveries are calculated and compared to the acceptable limits specified for the method and matrix.
- Peak patterns and retention times are evaluated by the analyst to determine the presence of target analytes based on an established multicomponent library.
- Batch QC, which is performed at a frequency of five percent (minimum) is evaluated to determine acceptability. The matrix spike/matrix spike duplicate or blank spike/blank spike duplicate results are compared to method and/or laboratory established matrix specific QC limits. Duplicates are analyzed and evaluated with each batch for fuels parameters at a minimum frequency of 10%. Quality control check standards are evaluated for acceptable recoveries, based on the method-specified QC limits.
- Method blanks are examined for detectable levels of target analytes.

STL SEATTLE SAMPLE DATA EVALUATION PROCEDURES

- Samples are examined for analytes with concentrations that exceed the instrument calibration range. If the sample has been diluted based on previous analysis or screening results that indicate a high level of contamination, a target analyte should be within the upper half of the initial calibration range. This may not be possible, however, for samples that contain high concentrations of non-targeted compounds.
- The reported value for each analyte is flagged with any applicable QC qualifiers.
- The calculated results for the sample are peer-reviewed at a frequency of at least 10 percent. Units and reporting limits are also verified.

Instrument System: ICP, Simultaneous and Sequential/ICP-MS

- If matrix interferences are suspected for any element, the sample scan for that element is reviewed by the analyst prior to reporting results.
- The concentrations of the target elements are reviewed to determine if concentrations exceed the instrument linear range.
- Batch QC, which is performed at a minimum frequency of five percent (10% for Method 200.7 and 200.8) is evaluated to determine acceptability. The matrix spike or blank spike and duplicate results are compared to method and matrix specific QC limits. Quality control check standards are evaluated for acceptable recoveries, based on the method-specified QC limits.
- Method blanks are examined for the presence of target elements above the reporting limit.
- The reported value for each element is flagged with any applicable QC qualifiers.
- The calculated results for the sample are peer-reviewed at a frequency of at least 10 percent. Units and reporting limits are also verified.

Instrument System: CVAA (Mercury)

- The concentrations of the target elements are reviewed to determine if concentrations exceed the instrument calibration range.
- Batch QC, which is performed at a minimum frequency of five percent is evaluated to determine acceptability. The matrix spike or blank spike and duplicate results are compared to method and matrix specific QC limits. Quality control check standards are evaluated for acceptable recoveries, based on the method-specified QC limits.
- Method blanks are examined for the presence of target elements above the reporting limit.
- The reported value for each element is flagged with any applicable QC qualifiers.
- The calculated results for the sample are peer-reviewed at a frequency of at least 10 percent. Units and reporting limits are also verified.

Instrument System: IC (Anions)

- Peak retention times are evaluated by the analyst to determine the presence of target analytes based on the established method. Chromatographic peaks are evaluated for signs of matrix interferences or poor integration.
- Batch QC, which is performed at a minimum frequency of ten percent for spikes and five percent for duplicates and method blanks is evaluated to determine acceptability. The matrix spike or blank spike and duplicate results are compared to method and matrix specific QC limits. Quality control check standards are evaluated for acceptable recoveries, based on the method-specified QC limits.
- Method blanks are examined for detectable levels of target analytes.
- Samples are examined for analytes with concentrations that exceed the instrument calibration range.
- The reported value for each analyte is flagged with any applicable QC qualifiers.
- The calculated results for the sample are peer-reviewed at a frequency of at least 10 percent. Units and reporting limits are also verified.

STL SEATTLE SAMPLE DATA EVALUATION PROCEDURES

Instrument System: RFA

- Instrument response is evaluated for signs of matrix interferences or poor integration.
- Batch QC, which is performed at a minimum frequency of ten percent is evaluated to determine acceptability. The matrix spike or blank spike and duplicate results are compared to method and matrix specific QC limits. Quality control check standards are evaluated for acceptable recoveries, based on the method-specified QC limits.
- Method blanks are examined for detectable levels of target analytes.
- Samples are examined for analytes with concentrations that exceed the instrument calibration range.
- The reported value for each analyte is flagged with any applicable QC qualifiers.
- The calculated results for the sample are peer-reviewed at a frequency of at least 10 percent. Units and reporting limits are also verified.

Instrument System: TX/TOX

- Two instrument readings are acquired for each sample. These results are examined to determine if the standard deviation for the two readings is within acceptable limits.
- The sample concentration is reviewed to determine if concentrations exceed the instrument calibration range.
- Batch QC, which is performed at a frequency of five percent (minimum) is evaluated to determine acceptability. Duplicate results are compared to method and matrix specific QC limits.
- Method blanks are examined for the presence of target elements above the reporting limit.
- The reported value for each sample is flagged with any applicable QC qualifiers.
- The calculated results for the sample are peer-reviewed at a frequency of at least 10 percent. Units and reporting limits are also verified.

Instrument System: TOC

- Two instrument readings are acquired for each sample. These results are examined to determine if the standard deviation for the two readings is within acceptable limits.
- The sample concentration is reviewed to determine if concentrations exceed the instrument calibration range.
- Batch QC, which is performed at a frequency of five percent (minimum) is evaluated to determine acceptability. Matrix spike and/or duplicate results are compared to method and matrix specific QC limits.
- Method blanks are examined for the presence of target elements above the reporting limit.
- The reported value for each sample is flagged with any applicable QC qualifiers.
- The calculated results for the sample are peer-reviewed at a frequency of at least 10 percent. Units and reporting limits are also verified.

Instrument System: HPLC

- The surrogate standard percent recoveries are calculated and compared to the acceptable limits specified for the method and matrix.
- Peak shape and retention times are evaluated by the analyst to determine the presence of target analytes. Confirmation of the analyte is made by either dual detector confirmation, PDA spectral confirmation, or secondary column analysis.
- Batch QC, which is performed at a frequency of five percent (minimum) is evaluated to determine acceptability. The matrix spike/matrix spike duplicate or blank spike/blank spike duplicate results are compared to method and matrix specific QC limits.
- Method blanks are examined for detectable levels of target analytes.

STL SEATTLE SAMPLE DATA EVALUATION PROCEDURES

- Samples are examined for analytes with concentrations that exceed the instrument calibration range. If the sample has been diluted based on previous analysis or screening results that indicate a high level of contamination, a target analyte should be within the upper half of the initial calibration range.
- The reported value for each analyte is flagged with any applicable QC qualifiers.
- The calculated results for the sample are peer-reviewed at a frequency of at least 10 percent. Units and reporting limits are also verified.

APPENDIX G
STL Seattle Data Qualifiers

STL SEATTLE DATA QUALIFIERS AND ABBREVIATIONS

B1: This analyte was detected in the associated method blank. The analyte concentration was determined not to be significantly higher than the associated method blank (less than ten times the concentration reported in the blank).

B2: This analyte was detected in the associated method blank. The analyte concentration in the sample was determined to be significantly higher than the method blank (greater than ten times the concentration reported in the blank).

C1: Second column confirmation was performed. The relative percent difference value (RPD) between the results on the two columns was evaluated and determined to be $\leq$ 40%.

C2: Second column confirmation was performed. The RPD between the results on the two columns was evaluated and determined to be > 40%. The higher result was reported unless anomalies were noted.

M: GC/MS confirmation was performed. The result derived from the original analysis was reported.

D: The reported result for this analyte was calculated based on a secondary dilution factor.

E: The concentration of this analyte exceeded the instrument calibration range and should be considered an estimated quantity.

J: The analyte was analyzed for and positively identified, but the associated numerical value is an estimated quantity.

MCL: Maximum Contaminant Level

MDL: Method Detection Limit

N: See analytical narrative.

ND: Not Detected

PQL: Practical Quantitation Limit

X1: Contaminant does not appear to be "typical" product. Elution pattern suggests it may be _____ .

X2: Contaminant does not appear to be "typical" product.

X3: Identification and quantitation of the analyte or surrogate was complicated by matrix interference.

X4: RPD for duplicates was outside advisory QC limits. The sample was re-analyzed with similar results. The sample matrix may be nonhomogeneous.

X4a: RPD for duplicates outside advisory QC limits due to analyte concentration near the method practical quantitation limit/detection limit.

X5: Matrix spike recovery was not determined due to the required dilution.

X6: Recovery and/or RPD values for matrix spike(/matrix spike duplicate) outside advisory QC limits. Sample was re-analyzed with similar results.

X7: Recovery and/or RPD values for matrix spike(/matrix spike duplicate) outside advisory QC limits. Matrix interference may be indicated based on acceptable blank spike recovery and/or RPD.

X7a: Recovery and/or RPD values for this spiked analyte outside advisory QC limits due to high concentration of the analyte in the original sample.

X8: Surrogate recovery was not determined due to the required dilution.

X9: Surrogate recovery outside advisory QC limits due to matrix interference.

APPENDIX H
STL Seattle
Certifications/Scopes of Accreditation

The State of Washington Department of Ecology

This is to certify that

STL Seattle
Tacoma, WA

has complied with provisions set forth in Chapter 173-50 WAC and is hereby recognized by the Department of Ecology as an ACCREDITED LABORATORY for the analytical parameters listed on the accompanying Scope of Accreditation. This certificate is effective February 1, 2002, and shall expire January 31, 2003.

Witnessed under my hand on January 28, 2002.

Perry F. Brake, Chemist
Lab Accreditation Unit Supervisor

Lab Accreditation Number
C027

Scope of Accreditation

STL Seattle

Tacoma, WA

is accredited by the State of Washington Department of Ecology to perform analyses for the parameters listed below using the analytical methods indicated. This Scope of Accreditation may apply to any of the following matrix types: non-potable water, drinking water, solid and chemical materials, and air and emissions. Accreditation for all parameters is final unless indicated otherwise in a note. Accreditation is for the latest version of a method unless otherwise specified in a note. EPA refers to the U.S. Environmental Protection Agency. SM refers to American Public Health Association's publication, Standard Methods for the Examination of Water and Wastewater, 18th, 19th or 20th Edition, unless otherwise noted. ASTM stands for the American Society for Testing and Materials. PSEP stands for Puget Sound Estuary Program. Other references are detailed in the notes section.

Matrix Type/Parameter Name	Reference	Method Number	Notes
Drinking Water			
Alkalinity, Total	SM	2320 B	
Chloride	EPA	300.0	
Chlorine Residual, Free	SM	4500-Cl G	
Color	SM	2120 B	
Cyanide, Total	EPA	335.4	
Fluoride	EPA	300.0	
Hardness, Total (as CaCO3)	SM	2340 B	
Nitrate	EPA	300.0	
Nitrite	EPA	300.0	
Orthophosphate	EPA	300.0	
pH	EPA	150.1	
Solids, Total Dissolved	SM	2540 C	
Specific Conductance	SM	2510 B	
Sulfate	EPA	300.0	
Turbidity	EPA	180.1	
Aluminum	EPA	200.7	
Antimony	EPA	200.8	
Arsenic	EPA	200.8	

Matrix Type/Parameter Name	Reference	Method Number	Notes
Barium	EPA	200.7	
Barium	EPA	200.8	
Beryllium	EPA	200.7	
Beryllium	EPA	200.8	
Boron	EPA	200.7	
Cadmium	EPA	200.8	
Chromium	EPA	200.7	
Chromium	EPA	200.8	
Copper	EPA	200.7	
Copper	EPA	200.8	
Hardness, Total (as CaCO3)	EPA	200.7	
Iron	EPA	200.7	
Lead	EPA	200.8	
Manganese	EPA	200.7	10
Mercury	EPA	245.2	8
Molybdenum	EPA	200.7	
Nickel	EPA	200.7	
Nickel	EPA	200.8	
Silica	EPA	200.7	
Silver	EPA	200.7	
Silver	EPA	200.8	
Sodium	EPA	200.7	10
Coliforms/E. coli Density (MPN)	SM 18	9221 C	
E. coli (NA MUG)	SM 20	9222 G(1b)	
E. coli (EC MUG)	SM 20	9221 F	
Fecal Coliforms (m-FC)	SM 18	9222 D	
Heterotrophic Plate Count	SM	9215 B	
Total Coliforms	SM	9221 B	
Total Coliforms (Endo type)	SM 18	9222 B(6a)	
Total Coliforms (Endo type)	SM 18	9222 B(6b)	

Matrix Type/Parameter Name	Reference	Method Number	Notes
Vinyl Chloride	EPA	524.2	
Purgeable Organics	EPA	524.2	

Non-potable Water

Acidity	EPA	305.1	
Alkalinity, Total	EPA	310.1	
Ammonia	EPA	350.1	
Anionic Surfactants	SM	5540 C	
Biochemical Oxygen Demand, BOD/CBOD	EPA	405.1	
Bromide	EPA	300.0	
Chemical Oxygen Demand (COD)	EPA	410.1	
Chloride	EPA	300.0	
Chlorine Residual, Total	EPA	330.5	
Color	EPA	110.2	
Cyanide, Total	EPA	335.3	
Dissolved Oxygen	EPA	360.1	
Fluoride	EPA	300.0	
Fluoride	EPA	340.2	
Hardness, Total (as CaCO3)	EPA	130.2	
Hexane Extractable Material	EPA	1664	10
Nitrate	EPA	300.0	
Nitrate + Nitrite	EPA	300.0	
Nitrite	EPA	300.0	
Nitrogen, Total Kjeldahl	EPA	351.2	
Nitrogen, Total Kjeldahl	EPA	351.3	
Oil & Grease	EPA	413.1	
Oil & Grease	EPA	413.2	
Orthophosphate	EPA	300.0	
pH	EPA	150.1	
Phenolics, Total Recoverable	EPA	420.1	

Matrix Type/Parameter Name	Reference	Method Number	Notes
Phenolics, Total Recoverable	EPA	420.2	
Phosphorus, Total	EPA	365.1	
Phosphorus, Total Persulfate	SM	4500-P E	
Salinity	SM	2520 B	
Solids, Total	EPA	160.3	
Solids, Total Dissolved	EPA	160.1	
Solids, Total Suspended	EPA	160.2	
Solids, Total Volatile	EPA	160.4	
Specific Conductance	EPA	120.1	
Sulfate	EPA	300.0	
Sulfide	EPA	376.1	
Sulfide	EPA	376.2	
Sulfite	EPA	377.1	
Total Organic Carbon	EPA	415.1	
Total Petroleum Hydrocarbons	EPA	418.1	
Turbidity	EPA	180.1	
Aluminum	EPA	200.7	
Aluminum	EPA	200.8	
Antimony	EPA	200.7	
Antimony	EPA	200.8	
Arsenic	EPA	200.7	
Arsenic	EPA	200.8	
Arsenic	EPA	206.2	
Barium	EPA	200.7	
Barium	EPA	200.8	
Beryllium	EPA	200.7	
Beryllium	EPA	200.8	
Cadmium	EPA	200.7	
Cadmium	EPA	200.8	
Calcium	EPA	200.7	

Matrix Type/Parameter Name	Reference	Method Number	Notes
Chromium	EPA	200.7	
Chromium	EPA	200.8	
Chromium, Hexavalent	SM	3500-Cr B	
Cobalt	EPA	200.7	
Cobalt	EPA	200.8	
Copper	EPA	200.7	
Copper	EPA	200.8	
Iron	EPA	200.7	
Iron	EPA	200.8	
Lead	EPA	200.7	
Lead	EPA	200.8	
Lead	EPA	239.2	
Magnesium	EPA	200.7	
Manganese	EPA	200.7	10
Manganese	EPA	200.8	
Mercury	EPA	245.2	8
Molybdenum	EPA	200.7	
Molybdenum	EPA	200.8	
Nickel	EPA	200.7	
Nickel	EPA	200.8	
Potassium	EPA	200.7	
Selenium	EPA	200.7	
Selenium	EPA	200.8	
Silica	EPA	200.7	
Silver	EPA	200.7	
Silver	EPA	200.8	
Sodium	EPA	200.7	10
Strontium	EPA	200.7	
Strontium	EPA	200.8	
Thallium	EPA	200.7	

Matrix Type/Parameter Name	Reference	Method Number	Notes
Thallium	EPA	200.8	
Tin	EPA	200.7	
Titanium	EPA	200.7	
Titanium	EPA	200.8	
Vanadium	EPA	200.7	
Vanadium	EPA	200.8	10
Zinc	EPA	200.7	
Zinc	EPA	200.8	
E. coli	SM	9213 D	
E. coli (EC MUG)	SM 20	9221 F	
Fecal Coliforms	SM	9221 E	
Fecal Coliforms (m-FC)	SM 18	9222 D	
Fecal Strep/Enterococci	SM	9230 C	
Total Coliforms	SM	9221 B	
Chlorinated Herbicides	EPA	615	
Organochlorine Pesticides	EPA	608	
Organophosphorus Pesticides	EPA	614	1
Phenols	EPA	604	6
Polychlorinated Biphenyls	EPA	608	11
Total Pet Hydrocarbons - Diesel	WDOE	NWTPH-Dx	3
Total Pet Hydrocarbons - Gasoline	WDOE	NWTPH-Gx	3
Volatile Aromatics	EPA	602	
BNA Extr (Semivolatile) Organics	EPA	625	
Organotins	SASI	0346.1	4
Volatile Organic Compounds	EPA	624	5

Solid and Chemical Materials

Aluminum	EPA	6010	
Aluminum	EPA	6020	
Antimony	EPA	6010	

Matrix Type/Parameter Name	Reference	Method Number	Notes
Antimony	EPA	6020	
Arsenic	EPA	6010	
Arsenic	EPA	6020	
Arsenic	EPA	7060	
Barium	EPA	6010	
Barium	EPA	6020	
Beryllium	EPA	6010	
Beryllium	EPA	6020	
Cadmium	EPA	6010	
Cadmium	EPA	6020	
Calcium	EPA	6010	
Chromium	EPA	6010	
Chromium	EPA	6020	
Chromium, Hexavalent	EPA	6010	
Cobalt	EPA	6010	
Cobalt	EPA	6020	
Copper	EPA	6010	
Copper	EPA	6020	
Iron	EPA	6010	
Iron	EPA	6020	
Lead	EPA	6010	
Lead	EPA	6020	
Lead	EPA	7421	
Magnesium	EPA	6010	
Manganese	EPA	6010	10
Manganese	EPA	6020	
Mercury	EPA	7470	
Mercury	EPA	7471	
Molybdenum	EPA	6010	
Molybdenum	EPA	6020	

Matrix Type/Parameter Name	Reference	Method Number	Notes
Nickel	EPA	6010	
Nickel	EPA	6020	
Potassium	EPA	6010	
Selenium	EPA	6010	
Selenium	EPA	6020	
Silica	EPA	6010	
Silver	EPA	6010	
Silver	EPA	6020	
Sodium	EPA	6010	10
Strontium	EPA	6010	
Strontium	EPA	6020	
Thallium	EPA	6010	
Thallium	EPA	6020	
Tin	EPA	6010	
Titanium	EPA	6010	
Titanium	EPA	6020	
Vanadium	EPA	6010	
Vanadium	EPA	6020	10
Zinc	EPA	6010	
Zinc	EPA	6020	
Chlorinated Herbicides	EPA	8151	
Glycols	EPA	8015	9
Nitroaromatics & Nitramines	EPA	8330	2
Organochlorine Pesticides	EPA	8081	
Organophosphorus Pesticides	EPA	8141	1
Polychlorinated Biphenyls	EPA	8082	11
Volatile Aromatics	EPA	8021	
BNA Extr (Semivolatile) Organics	EPA	8270	
Volatile Organic Compounds	EPA	8260	5

Matrix Type/Parameter Name	Reference	Method Number	Notes

Accredited Parameter Note Detail

(1) Modified to use an ion trap MS detector instead of the method specified detector. (2) Method has been modified to use a solid phase cartridge and elution with acetonitrile to extract the target compounds. (3) Washington Department of Ecology Analytical Methods for Petroleum Hydrocarbons, Publication Number ECY 97-602, June 1997. (4) Procedure is an Ion Trap method for determination of tetra-, tri-, di-, and monobutyltin in sediments and pore water. (5) Method modified to use tuning criteria required by EPA CLP. (6) Pentachlorophenol is the only target analyte and diazomethane is used for derivativization. (7) For sediments, modifications are: 30-minute sonication at elevated temperature with a heated ultrasonic bath; use of 40-mL Surlyn coated vials; and extraction of 10 grams of sample with an initial solvent volume of 20 mL instead of extraction of 30 grams of sample with an initial solvent volume of 60 mL. (8) Principal Modifications are that 50 mL of sample is digested using a Hot Bloc digestion block as a heat source. (9) Method modified to determine glycols according to Sound Analytical Laboratory SOP 0341-2. (10) Provisional pending an acceptable performance evaluation result (WAC173-50-110). (11) When acid cleanup is not necessary, lab runs according to EPA 8081 protocol.

11/19/02

Authentication Signature

Perry Brake -- Section Manager, Washington State Department of Ecology -- Lab Accreditation Section

STATE OF ALASKA

DEPARTMENT OF
ENVIRONMENTAL CONSERVATION
CONTAMINATED SITES PROGRAM

LABORATORY APPROVAL

LABORATORY: SEVERN TRENT LABORATORIES, INC.- SEATTLE
5755 8TH STREET EAST
TACOMA, WASHINGTON 98424

APPROVAL NUMBER: UST-022 EXPIRES: MARCH 4, 2003

APPROVED FOR THE ANALYSIS OF:

AROMATIC/ALIPHATIC SEPARATION FUEL METHODS (AK101-3AA;) IN WATERS AND SOLIDS;
GASOLINE RANGE ORGANICS (AK101) IN WATERS AND IN SOLIDS
DIESEL RANGE ORGANICS (AK102) IN WATERS AND IN SOLIDS; RESIDUAL RANGE ORGANICS (AK103) IN SOLIDS
BTEX (AK101/8021B/8260B) IN WATERS AND (AK101/8260B) IN SOLIDS;
PAHS (8270C) IN WATERS AND IN SOLIDS; VCSS (8260B) IN WATERS AND IN SOLIDS;
PCBS (8082) IN WATER AND SOLIDS;
AS, BA, CD, CR, NI, PB, AND V (6010B & 6020) IN WATERS AND IN SOLIDS

Sara Rairick
SARA RAIRICK
CS LAB APPROVAL OFFICER

Alan L Love
ALAN LOVE, PH. D.
APPROVAL AUTHORITY

STATE OF ALASKA
DEPARTMENT OF ENVIRONMENTAL CONSERVATION
DIVISION OF ENVIRONMENTAL HEALTH
STATE CHEMISTRY LABORATORY
http://www.state.ak.us/dec/

TONY KNOWLES, GOVERNOR

TELEPHONE: (907) 790-2169
FAX: (907) 790-2451
10107 BENTWOOD PLACE
JUNEAU, AK 99801-8552

4 April 2002

Lila Transue
Severn Trent Laboratories, Inc.
5755 8th Street East
Tacoma, WA 98424

Re: **2002** ADEC Contaminated Sites Lab Approval **UST-022**

Dear Ms. Transue,

Thank you for your continued interest in the State of Alaska Contaminated Sites Laboratory Approval. Based on a review of the materials received, and of those on file, Severn Trent Laboratories, Inc.in Tacoma, WA (STL - Seattle) is approved as detailed below to do work under the June 25, 1999 revision of AS 18 AAC 78.

Severn Trent Laboratories, Inc.in Tacoma, WA (STL - Seattle) is granted ***Full Approval*** to perform the following analyses for Alaska contaminated sites projects including UST/LUST:

GRO (AK101, AK101AA) in *waters* and *solids*
DRO (AK102, AK102AA) in *waters* and *solids*
RRO (AK103) in *solids*
RRO (AK103AA) in *waters* and *solids*
BTEX (EPA 8021B, 8260B, AK101) in *waters*
BTEX (EPA 8260B, AK101) in *solids*
PAHs (EPA 8270C) in *waters* and *solids*
VCSs (EPA 8260B) in *waters* and *solids*
PCBs (EPA 8082) in *waters* and *solids*
As (EPA 6010B, 6020) in *waters and solids*
Ba (EPA 6010B, 6020) in *waters and solids*
Cd (EPA 6010B, 6020) in *waters and solids*
Cr (EPA 6010B, 6020) in *waters and solids*
Ni (EPA 6010B, 6020) in *waters and solids*
Pb (EPA 6010B, 6020) in *waters and solids*
V (EPA 6010B, 6020) in *waters and solids*

Please remember your expiration date is **March 4, 2003**.

Your window for renewal next year is <u>December 4, 2002 to February 4, 2003.</u>

Ms. Transue
Page 2
4 April 2002

We must receive your application, fees, acceptable performance evaluation results, and the latest revision of your quality assurance manual during this window. You may download a copy of the application from the following site:
http://www.state.ak.us/dec/deh/laboratories/UST.htm

Your laboratory identifying number remains **UST-022**. Please remember to include this number in ALL correspondence concerning your Alaska UST/LUST approval and on all data transmittals.

In order to assure timely handling please address all correspondence to the attention of '**CS lab approval program**'.

Thank you for your patience and co-operation. If you have any questions, please contact the Alaska Department of Environmental Conservation's State Chemistry Laboratory at (907)790-2169 or you may reach our approval officer at the following email address Sara_Rairick@EnvirCon.state.ak.us.

Respectfully,

Alan Love

Alan Love, Ph.D.
Approval Authority

Sara Rairick

Sara Rairick
CS Lab Approval Officer

SAR/sar (g:\share\accred\corres\ust022\2002ap.doc)

cc: reading file
laboratory file
enc.: CS Approval Certificate

STATE OF CALIFORNIA
DEPARTMENT OF HEALTH SERVICES

NATIONAL ENVIRONMENTAL LABORATORY ACCREDITATION PROGRAM

ACCREDITATION

Is hereby granted to

STL SEATTLE

5755 8th STREET EAST

TACOMA, WA 98424

Scope of accreditation is limited to the
"NELAP Accredited Fields of Testing"
which accompanies this Certificate.

Continued accredited status depends on successful
ongoing participation in the program.

This Certificate is granted in accordance with provisions of
Section 100825, et seq. of the Health and Safety Code.

Certificate No: **01170CA**
Expiration Date: **11/30/2003**
Effective Date: **11/30/2002**

Berkeley, California
subject to forfeiture or revocation.

George C. Kulasingam, Ph.D.
Program Chief
Environmental Laboratory Accreditation Program

CALIFORNIA DEPARTMENT OF HEALTH SERVICES
ENVIRONMENTAL LABORATORY ACCREDITATION PROGRAM
NELAP Accredited Fields of Testing

STL SEATTLE
5755 8th STREET EAST
TACOMA, WA 98424

Lab Phone (253) 922-2310

Certificate No: 01170CA Renew Date: 11/30/2003

Field of Testing: 108 - Inorganic Chemistry of Wastewater

108.020	001	EPA 120.1	Conductivity
108.040	001	EPA 130.2	Hardness
108.050	001	EPA 150.1	pH
108.060	001	EPA 160.1	Residue, Filterable
108.070	001	EPA 160.2	Residue, Non-filterable
108.080	001	EPA 160.3	Residue, Total
108.090	001	EPA 160.4	Residue, Volatile
108.100	001	EPA 160.5	Residue, Settleable
108.110	001	EPA 180.1	Turbidity
108.120	001	EPA 300.0	Bromide
108.120	002	EPA 300.0	Chloride
108.120	003	EPA 300.0	Fluoride
108.120	004	EPA 300.0	Nitrate
108.120	005	EPA 300.0	Nitrite
108.120	006	EPA 300.0	Nitrate-nitrite, Total
108.120	007	EPA 300.0	Phosphate, Ortho
108.120	008	EPA 300.0	Sulfate
108.140	001	EPA 310.1	Alkalinity
108.180	001	EPA 335.1	Cyanide, amenable
108.182	001	EPA 335.3	Cyanide, Total
108.200	001	EPA 350.1	Ammonia
108.211	001	EPA 351.2	Kjeldahl Nitrogen
108.250	001	EPA 360.1	Dissolved Oxygen
108.261	001	EPA 365.1	Phosphorus, Total
108.291	001	EPA 376.2	Sulfide
108.310	001	EPA 405.1	Biochemical Oxygen Demand
108.320	001	EPA 410.1	Chemical Oxygen Demand
108.321	001	EPA 410.2	Chemical Oxygen Demand
108.340	001	EPA 415.1	Total Organic Carbon
108.360	001	EPA 420.1	Phenols, Total
108.370	001	EPA 425.1	Surfactants
108.380	001	EPA 1664	Oil and Grease

Field of Testing: 109 - Toxic Chemical Elements of Wastewater

109.010	001	EPA 200.7	Aluminum
109.010	002	EPA 200.7	Antimony
109.010	003	EPA 200.7	Arsenic
109.010	004	EPA 200.7	Barium
109.010	005	EPA 200.7	Beryllium
109.010	006	EPA 200.7	Boron
109.010	007	EPA 200.7	Cadmium
109.010	008	EPA 200.7	Calcium
109.010	009	EPA 200.7	Chromium

As of 01/06/2003, this list supersedes all previous lists for this certificate number.
Customers: Please verify the current accreditation standing with the State.

109.010	010	EPA 200.7	Cobalt
109.010	011	EPA 200.7	Copper
109.010	012	EPA 200.7	Iron
109.010	013	EPA 200.7	Lead
109.010	014	EPA 200.7	Magnesium
109.010	015	EPA 200.7	Manganese
109.010	016	EPA 200.7	Molybdenum
109.010	017	EPA 200.7	Nickel
109.010	018	EPA 200.7	Potassium
109.010	019	EPA 200.7	Selenium
109.010	020	EPA 200.7	Silica
109.010	021	EPA 200.7	Silver
109.010	022	EPA 200.7	Sodium
109.010	023	EPA 200.7	Thallium
109.010	024	EPA 200.7	Tin
109.010	026	EPA 200.7	Vanadium
109.010	027	EPA 200.7	Zinc
109.020	002	EPA 200.8	Antimony
109.020	003	EPA 200.8	Arsenic
109.020	004	EPA 200.8	Barium
109.020	005	EPA 200.8	Beryllium
109.020	006	EPA 200.8	Cadmium
109.020	007	EPA 200.8	Chromium
109.020	008	EPA 200.8	Cobalt
109.020	009	EPA 200.8	Copper
109.020	010	EPA 200.8	Lead
109.020	011	EPA 200.8	Manganese
109.020	012	EPA 200.8	Molybdenum
109.020	013	EPA 200.8	Nickel
109.020	014	EPA 200.8	Selenium
109.020	015	EPA 200.8	Silver
109.020	016	EPA 200.8	Thallium
109.020	017	EPA 200.8	Vanadium
109.020	018	EPA 200.8	Zinc
109.103	001	EPA 218.4	Chromium (VI)
109.191	001	EPA 245.2	Mercury
109.811	001	SM3500-Cr D	Chromium (VI)

Field of Testing: 110 - Volatile Organic Chemistry of Wastewater

110.020	001	EPA 602	Benzene
110.020	002	EPA 602	Chlorobenzene
110.020	003	EPA 602	1,2-Dichlorobenzene
110.020	004	EPA 602	1,3-Dichlorobenzene
110.020	005	EPA 602	1,4-Dichlorobenzene
110.020	006	EPA 602	Ethylbenzene
110.020	007	EPA 602	Toluene
110.040	001	EPA 624	Benzene
110.040	002	EPA 624	Bromodichloromethane
110.040	003	EPA 624	Bromoform
110.040	004	EPA 624	Bromomethane
110.040	005	EPA 624	Carbon Tetrachloride
110.040	006	EPA 624	Chlorobenzene

110.040	007	EPA 624	Chloroethane
110.040	008	EPA 624	2-Chloroethyl Vinyl Ether
110.040	009	EPA 624	Chloroform
110.040	010	EPA 624	Chloromethane
110.040	011	EPA 624	Dibromochloromethane
110.040	012	EPA 624	1,2-Dichlorobenzene
110.040	013	EPA 624	1,3-Dichlorobenzene
110.040	014	EPA 624	1,4-Dichlorobenzene
110.040	015	EPA 624	1,1-Dichloroethane
110.040	017	EPA 624	1,1-Dichloroethene
110.040	018	EPA 624	trans-1,2-Dichloroethene
110.040	019	EPA 624	1,2-Dichloropropane
110.040	020	EPA 624	cis-1,3-Dichloropropene
110.040	021	EPA 624	trans-1,3-Dichloropropene
110.040	022	EPA 624	Ethylbenzene
110.040	023	EPA 624	Methylene Chloride
110.040	024	EPA 624	1,1,2,2-Tetrachloroethane
110.040	025	EPA 624	Tetrachloroethene
110.040	026	EPA 624	Toluene
110.040	027	EPA 624	1,1,1-Trichloroethane
110.040	028	EPA 624	1,1,2-Trichloroethane
110.040	029	EPA 624	Trichloroethene
110.040	030	EPA 624	Trichlorofluoromethane
110.040	031	EPA 624	Vinyl Chloride

Field of Testing: 111 - Semi-volatile Organic Chemistry of Wastewater

111.100	001	EPA 625	Acenaphthene
111.100	003	EPA 625	Anthracene
111.100	004	EPA 625	Benzidine
111.100	005	EPA 625	Benz(a)anthracene
111.100	006	EPA 625	Benzo(b)fluoranthene
111.100	007	EPA 625	Benzo(k)fluoranthene
111.100	008	EPA 625	Benzo(g,h,i)perylene
111.100	009	EPA 625	Benzo(a)pyrene
111.100	010	EPA 625	Benzyl Butyl Phthalate
111.100	011	EPA 625	Bis(2-chloroethoxy)methane
111.100	012	EPA 625	Bis(2-chloroethyl) Ether
111.100	013	EPA 625	Bis(2-chloroisopropyl) Ether
111.100	014	EPA 625	Bis(2-ethylhexyl) Phthalate
111.100	015	EPA 625	4-Bromophenyl Phenyl Ether
111.100	016	EPA 625	4-Chloro-3-methylphenol
111.100	017	EPA 625	2-Chloronaphthalene
111.100	018	EPA 625	2-Chlorophenol
111.100	019	EPA 625	4-Chlorophenyl Phenyl Ether
111.100	020	EPA 625	Chrysene
111.100	021	EPA 625	Dibenz(a,h)anthracene
111.100	022	EPA 625	1,2-Dichlorobenzene
111.100	023	EPA 625	1,3-Dichlorobenzene
111.100	024	EPA 625	1,4-Dichlorobenzene
111.100	025	EPA 625	3,3'-Dichlorobenzidine
111.100	026	EPA 625	2,4-Dichlorophenol
111.100	027	EPA 625	Diethyl Phthalate

111.100	028	EPA 625	2,4-Dimethylphenol
111.100	029	EPA 625	Dimethyl Phthalate
111.100	030	EPA 625	Di-n-butyl phthalate
111.100	031	EPA 625	Di-n-octyl phthalate
111.100	032	EPA 625	2,4-Dinitrophenol
111.100	033	EPA 625	2,4-Dinitrotoluene
111.100	034	EPA 625	2,6-Dinitrotoluene
111.100	035	EPA 625	Fluoranthene
111.100	036	EPA 625	Fluorene
111.100	037	EPA 625	Hexachlorobenzene
111.100	038	EPA 625	Hexachlorobutadiene
111.100	039	EPA 625	Hexachlorocyclopentadiene
111.100	040	EPA 625	Hexachloroethane
111.100	041	EPA 625	Indeno(1,2,3-c,d)pyrene
111.100	042	EPA 625	Isophorone
111.100	043	EPA 625	2-Methyl-4,6-dinitrophenol
111.100	044	EPA 625	Naphthalene
111.100	045	EPA 625	Nitrobenzene
111.100	046	EPA 625	2-Nitrophenol
111.100	047	EPA 625	4-Nitrophenol
111.100	048	EPA 625	N-nitrosodimethylamine
111.100	049	EPA 625	N-nitrosodi-n-propylamine
111.100	050	EPA 625	N-nitrosodiphenylamine
111.100	051	EPA 625	Pentachlorophenol
111.100	052	EPA 625	Phenanthrene
111.100	053	EPA 625	Phenol
111.100	054	EPA 625	Pyrene
111.100	055	EPA 625	1,2,4-Trichlorobenzene
111.170	001	EPA 608	Aldrin
111.170	002	EPA 608	a-BHC
111.170	003	EPA 608	b-BHC
111.170	004	EPA 608	d-BHC
111.170	005	EPA 608	g-BHC (Lindane)
111.170	006	EPA 608	Chlordane
111.170	007	EPA 608	4,4'-DDD
111.170	008	EPA 608	4,4'-DDE
111.170	009	EPA 608	4,4'-DDT
111.170	010	EPA 608	Dieldrin
111.170	011	EPA 608	Endosulfan I
111.170	012	EPA 608	Endosulfan II
111.170	013	EPA 608	Endosulfan Sulfate
111.170	014	EPA 608	Endrin
111.170	015	EPA 608	Endrin Aldehyde
111.170	016	EPA 608	Heptachlor
111.170	017	EPA 608	Heptachlor Epoxide
111.170	018	EPA 608	Toxaphene
111.170	019	EPA 608	PCB-1016
111.170	020	EPA 608	PCB-1221
111.170	021	EPA 608	PCB-1232
111.170	022	EPA 608	PCB-1242
111.170	023	EPA 608	PCB-1248
111.170	024	EPA 608	PCB-1254

111.170	025	EPA 608	PCB-1260

Field of Testing: 114 - Inorganic Chemistry of Hazardous Waste

114.010	001	EPA 6010B	Antimony
114.010	002	EPA 6010B	Arsenic
114.010	003	EPA 6010B	Barium
114.010	004	EPA 6010B	Beryllium
114.010	005	EPA 6010B	Cadmium
114.010	006	EPA 6010B	Chromium
114.010	007	EPA 6010B	Cobalt
114.010	008	EPA 6010B	Copper
114.010	009	EPA 6010B	Lead
114.010	010	EPA 6010B	Molybdenum
114.010	011	EPA 6010B	Nickel
114.010	012	EPA 6010B	Selenium
114.010	013	EPA 6010B	Silver
114.010	014	EPA 6010B	Thallium
114.010	015	EPA 6010B	Vanadium
114.010	016	EPA 6010B	Zinc
114.020	001	EPA 6020	Antimony
114.020	002	EPA 6020	Arsenic
114.020	003	EPA 6020	Barium
114.020	004	EPA 6020	Beryllium
114.020	005	EPA 6020	Cadmium
114.020	006	EPA 6020	Chromium
114.020	007	EPA 6020	Cobalt
114.020	008	EPA 6020	Copper
114.020	009	EPA 6020	Lead
114.020	010	EPA 6020	Molybdenum
114.020	011	EPA 6020	Nickel
114.020	012	EPA 6020	Selenium
114.020	013	EPA 6020	Silver
114.020	014	EPA 6020	Thallium
114.020	015	EPA 6020	Vanadium
114.020	016	EPA 6020	Zinc
114.140	001	EPA 7470A	Mercury
114.141	001	EPA 7471A	Mercury
114.221	001	EPA 9012A	Cyanide, Total
114.240	001	EPA 9040	pH
114.241	001	EPA 9045	pH
114.250	001	EPA 9056	Fluoride

Field of Testing: 115 - Extraction Test of Hazardous Waste

115.020	001	EPA 1311	Toxicity Characteristic Leaching Procedure (TCLP)
115.030	001	CCR Chapter11, Article 5, Appendix II	Waste Extraction Test (WET)

Field of Testing: 116 - Volatile Organic Chemistry of Hazardous Waste

116.020	011	EPA 8015B	Ethylene Glycol
116.030	001	EPA 8015B	Gasoline-range Organics
116.040	002	EPA 8021B	Benzene
116.040	011	EPA 8021B	Chlorobenzene
116.040	023	EPA 8021B	1,2-Dichlorobenzene
116.040	024	EPA 8021B	1,3-Dichlorobenzene

116.040	025	EPA 8021B	1,4-Dichlorobenzene
116.040	039	EPA 8021B	Ethylbenzene
116.040	041	EPA 8021B	Methyl tert-butyl Ether (MTBE)
116.040	047	EPA 8021B	Toluene
116.040	056	EPA 8021B	Xylenes, Total
116.080	001	EPA 8260B	Acetone
116.080	002	EPA 8260B	Acetonitrile
116.080	003	EPA 8260B	Acrolein
116.080	004	EPA 8260B	Acrylonitrile
116.080	007	EPA 8260B	Benzene
116.080	008	EPA 8260B	Benzyl Chloride
116.080	010	EPA 8260B	Bromochloromethane
116.080	011	EPA 8260B	Bromodichloromethane
116.080	012	EPA 8260B	Bromoform
116.080	013	EPA 8260B	Bromomethane
116.080	014	EPA 8260B	n-Butyl Alcohol
116.080	015	EPA 8260B	Carbon Disulfide
116.080	016	EPA 8260B	Carbon Tetrachloride
116.080	018	EPA 8260B	Chlorobenzene
116.080	019	EPA 8260B	Chloroethane
116.080	020	EPA 8260B	2-Chloroethyl Vinyl Ether
116.080	021	EPA 8260B	Chloroform
116.080	022	EPA 8260B	Chloromethane
116.080	026	EPA 8260B	Dibromochloromethane
116.080	028	EPA 8260B	1,2-Dibromoethane
116.080	030	EPA 8260B	Dibromomethane
116.080	031	EPA 8260B	1,2-Dichlorobenzene
116.080	032	EPA 8260B	1,3-Dichlorobenzene
116.080	033	EPA 8260B	1,4-Dichlorobenzene
116.080	034	EPA 8260B	cis-1,4-Dichloro-2-butene
116.080	035	EPA 8260B	trans-1,4-Dichloro-2-butene
116.080	036	EPA 8260B	Dichlorodifluoromethane
116.080	037	EPA 8260B	1,1-Dichloroethane
116.080	038	EPA 8260B	1,2-Dichloroethane
116.080	039	EPA 8260B	1,1-Dichloroethene
116.080	040	EPA 8260B	trans-1,2-Dichloroethene
116.080	041	EPA 8260B	cis-1,2-Dichloroethene
116.080	042	EPA 8260B	1,2-Dichloropropane
116.080	043	EPA 8260B	1,3-Dichloropropane
116.080	044	EPA 8260B	2,2-Dichloropropane
116.080	045	EPA 8260B	1,1-Dichloropropene
116.080	046	EPA 8260B	cis-1,3-Dichloropropene
116.080	047	EPA 8260B	trans-1,3-Dichloropropene
116.080	050	EPA 8260B	1,4-Dioxane
116.080	052	EPA 8260B	Ethyl Acetate
116.080	053	EPA 8260B	Ethylbenzene
116.080	056	EPA 8260B	Hexachlorobutadiene
116.080	057	EPA 8260B	Hexachloroethane
116.080	058	EPA 8260B	2-Hexanone (MBK)
116.080	059	EPA 8260B	Iodomethane
116.080	060	EPA 8260B	Isobutyl Alcohol
116.080	064	EPA 8260B	Methyl tert-butyl Ether (MTBE)

As of 01/06/2003, this list supersedes all previous lists for this certificate number.
Customers: Please verify the current accreditation standing with the State.

116.080	065	EPA 8260B	Methylene Chloride
116.080	066	EPA 8260B	Methyl Ethyl Ketone
116.080	068	EPA 8260B	4-Methyl-2-pentanone (MIBK)
116.080	069	EPA 8260B	Naphthalene
116.080	081	EPA 8260B	1,1,1,2-Tetrachloroethane
116.080	082	EPA 8260B	1,1,2,2-Tetrachloroethane
116.080	083	EPA 8260B	Tetrachloroethene
116.080	084	EPA 8260B	Toluene
116.080	086	EPA 8260B	1,2,3-Trichlorobenzene
116.080	087	EPA 8260B	1,2,4-Trichlorobenzene
116.080	089	EPA 8260B	1,1,2-Trichloroethane
116.080	090	EPA 8260B	Trichloroethene
116.080	091	EPA 8260B	Trichlorofluoromethane
116.080	092	EPA 8260B	1,2,3-Trichloropropane
116.080	093	EPA 8260B	Vinyl Acetate
116.080	094	EPA 8260B	Vinyl Chloride
116.080	095	EPA 8260B	Xylenes, Total

Field of Testing: 117 - Semi-volatile Organic Chemistry of Hazardous Waste

117.010	001	EPA 8015B	Diesel-range Total Petroleum Hydrocarbons
117.110	001	EPA 8270C	Acenaphthene
117.110	007	EPA 8270C	Aniline
117.110	008	EPA 8270C	Anthracene
117.110	010	EPA 8270C	Benzidine
117.110	011	EPA 8270C	Benz(a)anthracene
117.110	012	EPA 8270C	Benzo(b)fluoranthene
117.110	013	EPA 8270C	Benzo(k)fluoranthene
117.110	014	EPA 8270C	Benzo(g,h,i)perylene
117.110	015	EPA 8270C	Benzo(a)pyrene
117.110	016	EPA 8270C	Benzoic Acid
117.110	018	EPA 8270C	Benzyl Alcohol
117.110	019	EPA 8270C	Benzyl Butyl Phthalate
117.110	020	EPA 8270C	Bis(2-chloroethoxy)methane
117.110	021	EPA 8270C	Bis(2-chloroethyl) Ether
117.110	022	EPA 8270C	Bis(2-chloroisopropyl) Ether
117.110	023	EPA 8270C	Bis(2-ethylhexyl) Phthalate
117.110	024	EPA 8270C	4-Bromophenyl Phenyl Ether
117.110	025	EPA 8270C	Carbazole
117.110	026	EPA 8270C	4-Chloroaniline
117.110	027	EPA 8270C	4-Chloro-3-methylphenol
117.110	029	EPA 8270C	2-Chloronaphthalene
117.110	030	EPA 8270C	2-Chlorophenol
117.110	031	EPA 8270C	4-Chlorophenyl Phenyl Ether
117.110	032	EPA 8270C	Chrysene
117.110	036	EPA 8270C	Dibenz(a,h)anthracene
117.110	037	EPA 8270C	Dibenzofuran
117.110	039	EPA 8270C	1,2-Dichlorobenzene
117.110	040	EPA 8270C	1,3-Dichlorobenzene
117.110	041	EPA 8270C	1,4-Dichlorobenzene
117.110	042	EPA 8270C	3,3'-Dichlorobenzidine
117.110	043	EPA 8270C	2,4-Dichlorophenol
117.110	045	EPA 8270C	Diethyl Phthalate

117.110	054	EPA 8270C	Dimethyl Phthalate
117.110	055	EPA 8270C	Di-n-butyl phthalate
117.110	056	EPA 8270C	Di-n-octyl phthalate
117.110	060	EPA 8270C	2,4-Dinitrophenol
117.110	061	EPA 8270C	2,4-Dinitrotoluene
117.110	062	EPA 8270C	2,6-Dinitrotoluene
117.110	067	EPA 8270C	Fluoranthene
117.110	068	EPA 8270C	Fluorene
117.110	069	EPA 8270C	Hexachlorobenzene
117.110	070	EPA 8270C	Hexachlorobutadiene
117.110	071	EPA 8270C	Hexachlorocyclopentadiene
117.110	072	EPA 8270C	Hexachloroethane
117.110	075	EPA 8270C	Indeno(1,2,3-c,d)pyrene
117.110	076	EPA 8270C	Isophorone
117.110	080	EPA 8270C	2-Methyl-4,6-dinitrophenol
117.110	083	EPA 8270C	2-Methylnaphthalene
117.110	084	EPA 8270C	2-Methylphenol
117.110	085	EPA 8270C	3-Methylphenol
117.110	086	EPA 8270C	4-Methylphenol
117.110	087	EPA 8270C	Naphthalene
117.110	092	EPA 8270C	2-Nitroanilne
117.110	093	EPA 8270C	3-Nitroaniline
117.110	094	EPA 8270C	4-Nitroaniline
117.110	095	EPA 8270C	Nitrobenzene
117.110	096	EPA 8270C	2-Nitrophenol
117.110	097	EPA 8270C	4-Nitrophenol
117.110	100	EPA 8270C	N-nitrosodimethylamine
117.110	101	EPA 8270C	N-nitrosodi-n-propylamine
117.110	102	EPA 8270C	N-nitrosodiphenylamine
117.110	110	EPA 8270C	Pentachlorophenol
117.110	112	EPA 8270C	Phenanthrene
117.110	113	EPA 8270C	Phenol
117.110	119	EPA 8270C	Pyrene
117.110	120	EPA 8270C	Pyridine
117.110	125	EPA 8270C	2,3,4,6-Tetrachlorophenol
117.110	129	EPA 8270C	1,2,4-Trichlorobenzene
117.110	130	EPA 8270C	2,4,5-Trichlorophenol
117.110	131	EPA 8270C	2,4,6-Trichlorophenol
117.150	005	EPA 8315A	Formaldehyde
117.210	001	EPA 8081A	Aldrin
117.210	002	EPA 8081A	a-BHC
117.210	003	EPA 8081A	b-BHC
117.210	004	EPA 8081A	d-BHC
117.210	005	EPA 8081A	g-BHC (Lindane)
117.210	007	EPA 8081A	a-Chlordane
117.210	008	EPA 8081A	g-Chlordane
117.210	009	EPA 8081A	Chlordane (tech.)
117.210	013	EPA 8081A	4,4'-DDD
117.210	014	EPA 8081A	4,4'-DDE
117.210	015	EPA 8081A	4,4'-DDT
117.210	020	EPA 8081A	Dieldrin
117.210	021	EPA 8081A	Endosulfan I

117.210	022	EPA 8081A	Endosulfan II
117.210	023	EPA 8081A	Endosulfan Sulfate
117.210	024	EPA 8081A	Endrin
117.210	025	EPA 8081A	Endrin Aldehyde
117.210	026	EPA 8081A	Endrin Ketone
117.210	027	EPA 8081A	Heptachlor
117.210	028	EPA 8081A	Heptachlor Epoxide
117.210	033	EPA 8081A	Methoxychlor
117.210	039	EPA 8081A	Toxaphene
117.220	001	EPA 8082	PCB-1016
117.220	002	EPA 8082	PCB-1221
117.220	003	EPA 8082	PCB-1232
117.220	004	EPA 8082	PCB-1242
117.220	005	EPA 8082	PCB-1248
117.220	006	EPA 8082	PCB-1254
117.220	007	EPA 8082	PCB-1260

Field of Testing: 120 - Physical Properties of Hazardous Waste

120.010	001	EPA 1010	Ignitability
120.020	001	EPA 1020A	Ignitability
120.040	001	Section 7.3 SW-846	Reactive Cyanide
120.050	001	Section 7.3 SW-846	Reactive Sulfide
120.070	001	EPA 9040B	Corrosivity - pH Determination
120.080	001	EPA 9045C	Corrosivity - pH Determination

OREGON

ENVIRONMENTAL LABORATORY ACCREDITATION PROGRAM

Severn Trent Laboratories - Seattle

ID # ORELAP - WA200002

5755 - 8th Street East
Tacoma, WA 98424

IS GRANTED APPROVAL BY ORELAP, UNDER THE 1999 NELAC STANDARDS, TO PERFORM ANALYSES ON ENVIRONMENTAL SAMPLES UNDER PROGRAMS AS LISTED BELOW:

Solid and Hazardous Waste (RCRA)

Water/Waste Water (CWA)

AND AS RECORDED IN THE LIST OF APPROVED ANALYTES, METHODS, ANALYTIC TECHNIQUES, AND FIELDS OF TESTING ISSUED CONCURRENTLY WITH THIS CERTIFICATE AND REVISED AS NECESSARY.

ACCREDITED STATUS DEPENDS ON SUCCESSFUL ONGOING PARTICIPATION IN THE PROGRAM AND CONTINUED COMPLIANCE WITH THE STANDARDS.

CUSTOMERS ARE URGED TO VERIFY THE LABORATORY'S CURRENT ACCREDITATION STATUS IN OREGON.

Irene E. Ronning, Ph.D.
ORELAP Administrator
1717 SW 10th
Portland, OR 97201

ISSUE DATE: August 02, 2002
EXPIRATION DATE: August 01, 2003

Certificate No: 1026155508

Oregon

Environmental Laboratory Accreditation Program

Department of Agriculture, Laboratory Division
Department of Environmental Quality, Laboratory Division
Department of Human Services, Health Division

Public Health Laboratory
1717 SW 10th Avenue
Portland, OR 97201
(503) 229-5505
FAX (503) 229-5682
TTY (503) 731-4031

Accredited Fields of Testing

Severn Trent Laboratories - Seattle 5755 8th Street East Tacoma, WA 98424		ID No. WA200002 Ph: (253) 922-2310
Certificate No. 1026155508	Expiration Date: August 01, 2003	Primary AA: California
Fields of Testing Date of Issue: August 2, 2002		

Inorganic Chemistry of Waste Water

Program	Method	Analyte
CWA	200.7	Aluminum
CWA	200.7	Antimony
CWA	200.7	Arsenic
CWA	200.7	Barium
CWA	200.7	Beryllium
CWA	200.7	Boron
CWA	200.7	Cadmium
CWA	200.7	Calcium
CWA	200.7	Chromium
CWA	218.4 3500-Cr D	Chromium, hexavalent
CWA	200.7	Cobalt
CWA	200.7	Copper
CWA	200.7	Iron
CWA	200.7	Lead
CWA	200.7	Magnesium
CWA	200.7	Manganese
CWA	245.2	Mercury

As of August 2, 2002, this list supersedes all previous lists for this certificate.
Customers: Please verify the current accreditation standing with the State.

Severn Trent Laboratories - Seattle
ID No. WA200002
Certificate No. 1026155508
Fields of testing Issued: 08/02/02

Program	Method	Analyte
CWA	200.7	Molybdenum
CWA	200.7	Nickel
CWA	200.7	Potassium
CWA	200.7	Selenium
CWA	200.7	Silver
CWA	200.7	Sodium
CWA	200.7	Thallium
CWA	200.7	Tin
CWA	200.7	Titanium
CWA	200.7	Vanadium
CWA	200.7	Zinc
CWA	350.1	Ammonia
CWA		
CWA	335.1	Cyanide, Amenable
CWA	335.3	Cyanide, Total
CWA	340.2	Fluoride
CWA	351.2	Nitrogen (TKN)
CWA	365.1	Orthophosphate
CWA	360.1	Dissolved Oxygen
CWA	376.2	Sulfide
CWA	310.1	Alkalinity
CWA	405.1	BOD
CWA	410.1 410.2	COD
CWA	120.1	Conductivity
CWA	130.2	Hardness
CWA	1664	Oil and Grease
CWA	150.1	pH
CWA	420.1	Phenols, Total
CWA	160.5	Settleable solids
CWA	425.1	Surfactants
CWA	415.1	TOC
CWA	160.1	Total Dissolved Solids

As of August 2, 2002, this list supersedes all previous lists for this certificate.
Customers: Please verify the current accreditation standing with the State.

Program	Method	Analyte
CWA	160.2	Total Suspended Solids
CWA	160.3	Total Solids
CWA	160.4	Total Volatile Solids
CWA	180.1	Turbidity

Organic Chemistry of Waste Water

Program	Method	Analyte
CWA	602 624	Benzene
CWA	624	Bromodichloromethane
CWA	624	Bromoform
CWA	624	Bromomethane
CWA	624	Carbon Tetrachloride
CWA	602 624	Chlorobenzene
CWA	624	Chloroethane
CWA	624	2-Chloroethyl Vinyl Ether
CWA	624	Chloroform
CWA	624	Chloromethane
CWA	624	Dibromochloromethane
CWA	602 624	1,2-Dichlorobenzene
CWA	602 624	1,3-Dichlorobenzene
CWA	602 624	1,4-Dichlorobenzene
CWA	624	1,1-Dichloroethane
CWA	624	1,1-Dichloroethylene
CWA	624	trans-1,2-Dichloroethylene
CWA	624	1,2-Dichloropropane
CWA	624	cis-1,3-Dichloropropylene
CWA	624	trans-1,3-Dichloropropylene
CWA	602 624	Ethylbenzene
CWA	624	Methylene Chloride

As of August 2, 2002, this list supersedes all previous lists for this certificate.
Customers: Please verify the current accreditation standing with the State.

Program	Method	Analyte
CWA	624	1,1,2,2-Tetrachoroethane
CWA	624	Tetrachloroethylene
CWA	602 624	Toluene
CWA	624	1,1,1-Trichloroethane
CWA	624	1,1,2-Trichloroethane
CWA	624	Trichloroethylene
CWA	624	Trichlorofluoromethane
CWA	624	Vinyl Chloride
CWA	625	Acenaphthene
CWA	625	Anthracene
CWA	625	Benzidine
CWA	625	Benzo[a]anthracene
CWA	625	Benzo[a]pyrene
CWA	625	Benzo[b]fluoranthene
CWA	625	Benzo[g,h,i]perylene
CWA	625	Benzo[k]fluoranthene
CWA	625	4-Bromophenyl-phenylether
CWA	625	Butylbenzylphthalate
CWA	625	bis(2-Chloroethoxy)methane
CWA	625	bis(2-Chloroethyl)ether
CWA	625	bis(2-Chloroisopropyl)ether
CWA	625	4-Chloro-3-methylphenol
CWA	625	2-Chloronaphthalene
CWA	625	2-Chlorophenol
CWA	625	4-Chlorophenyl-phenylether
CWA	625	Chrysene
CWA	625	Dibenz[a,h]athracene
CWA	625	1,2-Dichlorobenzene
CWA	625	1,3-Dichlorobenzene
CWA	625	1,4-Dichlorobenzene
CWA	625	3,3'-Dichlorobenzidine
CWA	625	2,4-Dichlorophenol

As of August 2, 2002, this list supersedes all previous lists for this certificate.
Customers: Please verify the current accreditation standing with the State.

Program	Method	Analyte
CWA	625	Diethylphthalate
CWA	625	2,4-Dimethylphenol
CWA	625	Dimethylphthalate
CWA	625	2,4-Dinitrophenol
CWA	625	2,4-Dinitrotoluene
CWA	625	2,6-Dinitrotoluene
CWA	625	Di-n-butylphthalate
CWA	625	Di-n-octylphthalate
CWA	625	bis (2-Ethylhexyl) phthalate
CWA	625	Fluoranthene
CWA	625	Fluorene
CWA	625	Hexachlorobenzene
CWA	625	Hexachlorobutadiene
CWA	625	Hexachlorocyclopentadiene
CWA	625	Hexachloroethane
CWA	625	Indeno[1,2,3-cd]pyrene
CWA	625	Isophorone
CWA	625	2-Methy-4,6-dinitrophenol
CWA	625	Naphthalene
CWA	625	Nitrobenzene
CWA	625	2-Nitrophenol
CWA	625	4-Nitrophenol
CWA	625	N-Nitrosodimethylamine
CWA	625	n-Nitroso-di-n-propylamine
CWA	625	n-Nitrosodiphenylamine
CWA	625	Pentachlorophenol
CWA	625	Phenanthrene
CWA	625	Phenol
CWA	625	Pyrene
CWA	625	1,2,4-Trichlorobenzene
CWA	625	2,4,6-Trichlorophenol
CWA	608	Aldrin
CWA	608	alpha-BHC

As of August 2, 2002, this list supersedes all previous lists for this certificate.
Customers: Please verify the current accreditation standing with the State.

Program	Method	Analyte
CWA	608	beta-BHC
CWA	608	delta-BHC
CWA	608	gamma-BHC (Lindane)
CWA	608	Chlordane
CWA	608	4,4'-DDD
CWA	608	4,4'-DDE
CWA	608	4,4'-DDT
CWA	608	Dieldrin
CWA	608	Endodulfan I
CWA	608	Endosulfan II
CWA	608	Endosufan Sulfate
CWA	608	Endrin
CWA	608	Endrin aldehyde
CWA	608	Heptachlor
CWA	608	Heptaclor epoxide
CWA	608	Toxaphene
CWA	608	PCB-1016
CWA	608	PCB-1221
CWA	608	PCB-1232
CWA	608	PCB-1242
CWA	608	PCB-1248
CWA	608	PCB-1254
CWA	608	PCB-1260

Inorganic Chemistry of Hazardous Waste

Program	Method	Analyte
RCRA	6010 B 6020	Antimony
RCRA	6010 B 6020	Arsenic
RCRA	6010 B 6020	Barium
RCRA	6010 B 6020	Beryllium

As of August 2, 2002, this list supersedes all previous lists for this certificate.
Customers: Please verify the current accreditation standing with the State.

Program	Method	Analyte
RCRA	6010 B 6020	Cadmium
RCRA	6010 B 6020	Chromium
RCRA	6010 B 6020	Cobalt
RCRA	6010 B 6020	Copper
RCRA	6010 B 6020	Lead
RCRA	7470 A	Mercury in Liquid Waste
RCRA	7471 A	Mercury in Sediment
RCRA	6010 B 6020	Molybdenum
RCRA	6010 B 6020	Nickel
RCRA	6010 B	Potassium
RCRA	6010 B 6020	Selenium
RCRA	6010 B 6020	Silver
RCRA	6010 B 6020	Thallium
RCRA	6010 B 6020	Vanadium
RCRA	6010 B 6020	Zinc
RCRA	1010 1020 A	Ignitability (Pensky-Martens)
RCRA	9012 A	Cyanide, total
RCRA	9040 B	Corrosivity (pH)
RCRA	9045 C	pH (Soil and Waste)

Organic Chemistry of Hazardous Waste

Program	Method	Analyte
RCRA	8015 B	Ethylene glycol
RCRA	8015 B	Diesal range organics
RCRA	8015 B	Gasoline range organics
RCRA	8260 B	Acetone

As of August 2, 2002, this list supersedes all previous lists for this certificate.
Customers: Please verify the current accreditation standing with the State.

Program	Method	Analyte
RCRA	8260 B	Acetonitrile
RCRA	8260 B	Acrolein
RCRA	8260 B	Acrylonitrile
RCRA	8021 B 8260 B	Benzene
RCRA	8260 B	Benzyl chloride
RCRA	8260 B	Bromochloromethane
RCRA	8260 B	Bromodichloromethane
RCRA	8260 B	Bromoform
RCRA	8260 B	Bromomethane
RCRA	8260 B	n-Butyl alcohol
RCRA	8260 B	Carbon Disulfide
RCRA	8260 B	Carbon Tetrachloride
RCRA	8021 B 8260 B	Chlorobenzene
RCRA	8260 B	Chloroethane
RCRA	8260 B	2-Chloroethyl Vinyl Ether
RCRA	8260 B	Chloroform
RCRA	8260 B	Chloromethane
RCRA	8260 B	Dibromochloromethane
RCRA	8260 B	1,2-Dibromoethane
RCRA	8260 B	Dibromomethane
RCRA	8021 B 8260 B	1,2-Dichlorobenzene
RCRA	8021 B 8260 B	1,3-Dichlorobenzene
RCRA	8021 B 8260 B	1,4-Dichlorobenzene
RCRA	8260 B	cis-1,4-Dichloro-2-butene
RCRA	8260 B	trans-1,4-Dichloro-2-butene
RCRA	8260 B	Dichlorodifluoromethane
RCRA	8260 B	1,1-Dichloroethane
RCRA	8260 B	1,2-Dichloroethane
RCRA	8260 B	1,1-Dichloroethylene
RCRA	8260 B	cis-1,2-Dichloroethylene

As of August 2, 2002, this list supersedes all previous lists for this certificate.
Customers: Please verify the current accreditation standing with the State.

Program	Method	Analyte
RCRA	8260 B	trans-1,2-Dichloroethylene
RCRA	8260 B	1,2-Dichloropropane
RCRA	8260 B	1,3-Dichloropropane
RCRA	8260 B	2,2-Dichloropropane
RCRA	8260 B	1,1-Dichloropropylene
RCRA	8260 B	cis-1,3-Dichloropropylene
RCRA	8260 B	trans-1,3-Dichloropropylene
RCRA	8260 B	1,4-Dioxane
RCRA	8260 B	Ethyl acetate
RCRA	8021 B 8260 B	Ethylbenzene
RCRA	8260 B	Hexachlorobutadiene
RCRA	8260 B	Hexachloroethane
RCRA	8260 B	2-Hexanone
RCRA	8260 B	Iodomethane
RCRA	8260 B	Isobutyl alcohol
RCRA	8260 B	Methylene Chloride
RCRA	8021 B 8260 B	Methyl tert-butyl ether (MTBE)
RCRA	8260 B	Methyl ethyl ketone (MEK)
RCRA	8260 B	Methyl-2-penranone (MIBK)
RCRA	8260 B	Napthalene
RCRA	8260 B	1,1,1,2-Tetrachloroethane
RCRA	8260 B	1,1,2,2-Tetrachloroethane
RCRA	8260 B	Tetrachloroethylene
RCRA	8021 B 8260 B	Toluene
RCRA	8260 B	1,2,3-Trichlorobenzene
RCRA	8260 B	1,2,4-Trichlorobenzene
RCRA	8260 B	1,1,2-Trichloroethane
RCRA	8260 B	Trichloroethylene
RCRA	8260 B	Trichorofluoromethane
RCRA	8260 B	1,2,3-Trichloropropane
RCRA	8260 B	Vinyl Acetate

As of August 2, 2002, this list supersedes all previous lists for this certificate.
Customers: Please verify the current accreditation standing with the State.

Program	Method	Analyte
RCRA	8260 B	Vinyl Chloride
RCRA	8021 B 8260 B	Xylenes, total
RCRA	8270 C	Acenaphthene
RCRA	8270 C	Aniline
RCRA	8270 C	Anthracene
RCRA	8270 C	Benzidine
RCRA	8270 C	Benzyl Alcohol
RCRA	8270 C	Benzo[a]anthracene
RCRA	8270 C	Benzo[b]fluoranthene
RCRA	8270 C	Benzo[k]fluoranthene
RCRA	8270 C	Benzo[g,h,i]perylene
RCRA	8270 C	Benzo[a]pyrene
RCRA	8270 C	Benzoic Acid
RCRA	8270 C	4-Bromophenyl-phenylether
RCRA	8270 C	Butylbenzylphthalate
RCRA	8270 C	Carbazole
RCRA	8270 C	4-Chloroaniline
RCRA	8270 C	bis(2-Chloroethoxy)methane
RCRA	8270 C	bis(2-Cloroethyl)ether
RCRA	8270 C	bis(2-chloroisopropyl)ether
RCRA	8270 C	2-Chloronaphthalene
RCRA	8270 C	2-Chlorophenol
RCRA	8270 C	4-Chloro-3-methylphenol
RCRA	8270 C	4-Chlorophenyl-phenylether
RCRA	8270 C	Chrysene
RCRA	8270 C	Dibenzo[a,h]anthracene
RCRA	8270 C	Dibenzofuran
RCRA	8270 C	Di-n-butylphthalate
RCRA	8270 C	1,2-Dichlorobenzene
RCRA	8270 C	1,3-Dichlorobenzene
RCRA	8270 C	1,4-Dichlorobenzene
RCRA	8270 C	3-3'-Dichlorobenzidine

As of August 2, 2002, this list supersedes all previous lists for this certificate.
Customers: Please verify the current accreditation standing with the State.

Program	Method	Analyte
RCRA	8270 C	2,4-Dichlorophenol
RCRA	8270 C	Diethylphthalate
RCRA	8270 C	Dimethylphthalate
RCRA	8270 C	2,4-Dintrophenol
RCRA	8270 C	2,4-Dinitrotoluene
RCRA	8270 C	2,6-Dinitrotoluene
RCRA	8270 C	Di-n-octylphthalate
RCRA	8270 C	bis(2-Ethylhexyl)phthalate
RCRA	8270 C	Fluoranthene
RCRA	8270 C	Fluorene
RCRA	8270 C	Hexachlorobenzene
RCRA	8270 C	Hexachlorobutadiene
RCRA	8270 C	Hexachlorocyclopentadiene
RCRA	8270 C	Hexachloroethane
RCRA	8270 C	Ideno[1,2,3-c,d]pyrene
RCRA	8270 C	Isophorone
RCRA	8270 C	2-Methyl-4,6-dinitrophenol
RCRA	8270 C	2-Methylnaphthalene
RCRA	8270 C	2-Methylphenol
RCRA	8270 C	3-Methylphenol
RCRA	8270 C	4-Methylphenol
RCRA	8270 C	Naphthalene
RCRA	8270 C	2-Nitroaniline
RCRA	8270 C	3-Nitroaniline
RCRA	8270 C	4-Nitroaniline
RCRA	8270 C	Nitrobenzene
RCRA	8270 C	2-Nitrophenol
RCRA	8270 C	4-Nitrophenol
RCRA	8270 C	N-Nitrosodimethylamine
RCRA	8270 C	n-Nitroso-di-n-propylamine
RCRA	8270 C	n-Nitrosodiphenylamine
RCRA	8270 C	Pentachlorophenol
RCRA	8270 C	Phenanthrene

As of August 2, 2002, this list supersedes all previous lists for this certificate.
Customers: Please verify the current accreditation standing with the State.

Program	Method	Analyte
RCRA	8270 C	Phenol
RCRA	8270 C	Pyrene
RCRA	8270 C	Pyridine
RCRA	8270 C	2,3,4,6-Tetrachlorophenol
RCRA	8270 C	1,2,4-Trichlorobenzene
RCRA	8270 C	2,4,5-Trichlorophenol
RCRA	8270 C	2,4,6-Trichlorophenol
RCRA	8315 A	Formaldehyde
RCRA	8081 A	Aldrin
RCRA	8081 A	alpha-BHC
RCRA	8081 A	beta-BHC
RCRA	8081 A	delta-BHC
RCRA	8081 A	gamma-BHC (Lindane)
RCRA	8081 A	alpha-Chlordane
RCRA	8081 A	gamma-Chlordane
RCRA	8081 A	Chlordane, technical
RCRA	8081 A	4,4'-DDD
RCRA	8081 A	4,4'-DDE
RCRA	8081 A	4,4'-DDT
RCRA	8081 A	Dieldrin
RCRA	8081 A	Endrin
RCRA	8081 A	Endrin aldehyde
RCRA	8081 A	Endrin ketone
RCRA	8081 A	Endosulfan I
RCRA	8081 A	Endosulfan II
RCRA	8081 A	Endosulfan sulfate
RCRA	8081 A	Heptachlor
RCRA	8081 A	Heptachlor epoxide
RCRA	8081 A	Methoxychlor
RCRA	8081 A	Toxaphene
RCRA	8082	PCB-1016
RCRA	8082	PCB-1221
RCRA	8082	PCB-1232

As of August 2, 2002, this list supersedes all previous lists for this certificate.
Customers: Please verify the current accreditation standing with the State.

Severn Trent Laboratories - Seattle
ID No. WA200002
Certificate No. 1026155508
Fields of testing Issued: 08/02/02

Program	Method	Analyte
RCRA	8082	PCB-1242
RCRA	8082	PCB-1248
RCRA	8082	PCB-1254
RCRA	8082	PCB-1260

As of August 2, 2002, this list supersedes all previous lists for this certificate.
Customers: Please verify the current accreditation standing with the State.

DEPARTMENT OF THE ARMY
CORPS OF ENGINEERS
HTRW CENTER OF EXPERTISE
12565 WEST CENTER ROAD
OMAHA, NEBRASKA 68144-3869

REPLY TO
ATTENTION OF:

December 13, 2001

Hazardous, Toxic and Radioactive Waste
Center of Expertise

STL Seattle
ATTN: Lila Transue
5755 8th Street East
Tacoma, WA 98424

Gentlemen:

This correspondence addresses the recent evaluation of STL Seattle (formerly Sound Analytical, Inc.) of Tacoma, WA by the U.S. Army Corps of Engineers (USACE) for chemical analysis in support of the USACE Hazardous, Toxic and Radioactive Waste Program.

Your laboratory is now validated for the parameters listed below:

METHOD	PARAMETERS	MATRIX(1)
300.0	Anions(4)	Water(2)
8021B	BTEX	Water(2)
8021B	BTEX	Solids
9010B/9012A	Cyanide	Water(2)
9013/9012A	Cyanide	Solids
8330	Explosives	Water(2)
8330	Explosives	Solids(2)
8151A	Herbicides	Water(2)
8151A	Herbicides	Solids
8081A	Organochlorine Pesticides	Water(2)
8081A	Organochlorine Pesticides	Solids
8082	Polychlorinated Biphenyls	Water(2)
8082	Polychlorinated Biphenyls	Solids(2)
8270C-SIM	Polynuclear Aromatic Hydrocarbons	Water(2)
8270C-SIM	Polynuclear Aromatic Hydrocarbons	Solids
8270C	Semivolatile Organics	Water(2)
8270C	Semivolatile Organics	Solids(2)

6010B/7000A	TAL Metals[3]	Water[2]
6010B/7000A	TAL Metals[3]	Solids[2]
6020	TAL Metals[6]	Water[2]
6020	TAL Metals[6]	Solids[2]
9060	Total Organic Carbon	Water[2]
Mod 8015	TPH - DRO/GRO/RRO[5]	Water
Mod 8015	TPH - DRO/GRO/RRO[5]	Solids
8260B	Volatile Organics	Water[2]
8260B	Volatile Organics	Solids

Remarks:

1) 'Solids' includes soils, sediments, and solid waste.

2) The laboratory has successfully analyzed a performance evaluation sample for this method/matrix.

3) TAL Metals: Aluminum, antimony, arsenic, barium, beryllium, cadmium, calcium, chromium, cobalt, copper, iron, lead, magnesium, manganese, mercury, nickel, potassium, selenium, silver, sodium, thallium, vanadium, and zinc.

4) Anions: Chloride, fluoride, sulfate, nitrate, nitrite, and ortho-phosphate.

5) Approval for this parameter is based on review of SOPs only.

6) TAL Metals except for calcium, iron, mercury, potassium, magnesium and sodium.

Enclosed for your information is a copy of the Laboratory Inspection and Evaluation Report. Your laboratory has responded to the deficiencies as noted in the report. No further responses are necessary.

Based on the successful analysis of the performance evaluation samples, the results of the laboratory inspection, and your Corrective Action Report, your laboratory will be validated for sample analysis by the methods listed above. The period of validation is 24 months and expires on December 13, 2003.

The USACE reserves the right to conduct additional laboratory inspections or to suspend validation status for any or all of the listed parameters if deemed necessary. It should be noted that your laboratory may not subcontract USACE analytical work to any other laboratory location without the approval of this office. This laboratory validation does not guarantee the delivery of any analytical samples from a USACE Contracting Officer Representative.

Any questions or comments can be directed to Richard Kissinger at (402) 697-2569. General questions regarding laboratory validation may be directed to the Laboratory Validation Coordinator at (402) 697-2574.

Sincerely,

Marcia C. Davies

Marcia C. Davies, Ph.D.
Director, USACE Hazardous,
Toxic and Radioactive Waste
Center of Expertise

Enclosure

DEPARTMENT OF THE NAVY

NAVAL FACILITIES ENGINEERING SERVICE CENTER
1100 23RD AVE
PORT HUENEME CA 93043-4370

IN REPLY REFER TO:

NFESC 413
January 25, 2002

Ms. Lila Transue
Quality Assurance Director
Severn Trent Laboratories – Seattle
5755 8th Street East
Tacoma, WA 98424

Dear Ms. Transue,

This correspondence addresses the status of Severn Trent Laboratories (STL) – Seattle of Tacoma, WA in the Navy Installation Restoration (IR) Quality Assurance (QA) Program as administered by the Naval Facilities Engineering Service Center (NFESC).

Your laboratory is accepted to perform sample analysis for the methods listed in Table 1. The period of acceptance expires on December 13, 2003. This acceptance does not guarantee the delivery of any analytical samples. Acceptance is facility specific and can not be transferred to an affiliated or subcontract laboratory.

Acceptance is based on the latest assessment executed by the United States Army Corps of Engineers Hazardous, Toxic and Radioactive Waste (USACE-HTRW) Omaha, Nebraska. The period of acceptance corresponds with the date established by USACE-HTRW. The Army's assessment included an onsite inspection performed on September 18-20 2001, and the processing of proficiency testing (PT) samples.

The Navy reserves the right to conduct additional laboratory assessments or to suspend or revoke acceptance status for any or all of the listed parameters if deemed necessary.

Table 1

METHOD	PARAMETER	MATRIX
300.0	Anions: Chloride, fluoride, sulfate, nitrate, nitrite, and ortho-phosphate	Water(1)
8021B	BTEX	Water(1) /Solid
9010B/9012A	Cyanide	Water(1)
9013/9012A	Cyanide	Solid
8330	Explosives	Water(1)/Solid(1)
8151A	Herbicides	Water(1)/Solid
8081A	Organochlorine Pesticides	Water(1)/Solid
8082	Polychlorinated Biphenyls	Water(1)/Solid(1)

8270C-SIM	Polynuclear Aromatic Hydrocarbons	Water[1]/Solid
8270C	Semivolatile Organics	Water[1]/Solid[1]
6010B/7000A	TAL Metals: Aluminum, antimony, arsenic, barium, beryllium, cadmium, calcium, chromium, cobalt, copper, iron, lead, magnesium, manganese, mercury, nickel, potassium, selenium, silver, sodium, thallium, vanadium, and zinc	Water[1]/Solid[1]
6020	TAL Metals except for calcium, iron, mercury, potassium, magnesium and sodium	Water[1]/Solid[1]
9060	Total Organic Carbon	Water[1]
Mod 8015B	TPH - DRO/GRO/RRO	Water/Solid
8260B	Volatile Organics	Water[1]/Solid

Acceptance for use for parameters not identified on the table will be determined by Navy project personnel.

The laboratory should notify NFESC if there are parameters not presented on Table 1 that the laboratory expects to run on a routine basis in support of Navy installation restoration projects. In these circumstances the laboratory's capability to run the tests will be reviewed and the table will be modified accordingly.

Questions concerning the information provided should be directed to the NFESC IR QA Program coordinator, Ms. Patricia Moreno at (805) 982-1659, or via email at morenop@nfesc.navy.mil.

Sincerely,

Rebecca L. Biggs (for)

Douglas A. Zillmer
Supervisor, Consultation/Information
Management Branch

[1] The laboratory successfully processed a PT sample sent by USACE for this parameter/matrix.

APPENDIX I
STL Seattle
Inventory of Standard Operating Procedures

List of Available SOP's

SOP Number	Revision Number	SOP Title	Author	Revision Date	Document Name
0001	11	Sample Receipt and Log-in	Sherrill Roy	5/24/2002	0001_11.pdf
0002	7	Internal Sample Transfer and Chain of Custody	Sherrill Roy	11/2/2001	0002_7.pdf
0003	8	Sample Data Processing	Sherrill Roy	4/9/2002	0003_8.pdf
0004	8	Preparation of Trip Blanks	Felix Zboralski	9/25/2002	0004_8.pdf
0005	7	Sample Storage and Security	Sherrill Roy	11/2/2001	0005_7.pdf
0006	7	Sample Container Preservation	Sherrill Roy	4/9/2002	0006_7.pdf
0008	7	Bottle Certification for Low Level Metals	Stan Palmquist	6/12/2002	0008_7.pdf
0009	0	Maintenance of the Reverse Osmosis System	Guy Archibald	9/17/2002	0009_0.pdf
0010	4	Use and Maintenance of Laboratory Glassware	John Clawson	4/9/2002	0010_4.pdf
0012	8	Use and Maintenance of Laboratory Refrigerators and Freezers	Terri Howard	4/12/2002	0012_8.pdf
0013	7	Use and Maintenance of Laboratory Ovens and Incubators	Dawn Werner	4/12/2002	0013_7.pdf
0014	9	Use and Maintenance of Laboratory Balances	Adam Mattison	11/27/2002	0014_9.pdf
0016	5	Use and Maintenance of Eppendorf Pipettes	Stan Palmquist	4/11/2002	0016_5.pdf
0017	4	Use and Maintenance of Water Incubators	Guy Archibald	4/5/2002	0017_4.pdf
0018	8	Subcontracting Samples	Lila Transue	1/17/2002	0018_8.pdf
0019	5	Use and Maintenance of the CEM MDS 2000 Microwave	Stan Palmquist	9/16/2002	0019_5.pdf
0020	0	Use and Maintenance of the Mars 5 Microwave	MN	4/3/2002	0020_0.pdf
0024	8	Use, Calibration, and Maintenance of Laboratory Thermometers	DW/TH	10/4/2001	0024_8.pdf
0026	4	Sample Extract, Digest, and Filtrate Storage and Security	Terri Howard	8/19/2002	0026_4.pdf
0027	4	Use and Maintenance of the Laboratory Water Bath	Stan Palmquist	9/20/2002	0027_4.pdf
0028	4	Subsampling of Solid Samples	Steve Loague	4/9/2002	0028_4.pdf
0029	7	Sample Handling Procedures for Drinking Water Samples	Sherrill Roy	4/9/2002	0029_7.pdf
0030	6	Verification of Quality of Materials used in the Laboratory	Guy Archibald	4/5/2002	0030_6.pdf
0031	3	Use and Maintenance of the Spectrophotometers	Jeff Armfield	4/11/2002	0031_3.pdf
0032	6	STL Seattle Sample Documentation	Sherrill Roy	4/9/2002	0032_6.pdf
0034	4	Use and Maintenance of the Autoclave	GA	4/5/2002	0034_4.pdf
0035	3	Sample Preservation and Filtration	MN	4/11/2002	0035_3.pdf
0036	6	Laboratory Waste Management and Disposal	John Clawson	4/9/2002	0036_6.pdf

List of Available SOP's

SOP Number	Revision Number	SOP Title	Author	Revision Date	Document Name
0038	5	Verification of Sample Preservation	Sherrill Roy	4/9/2002	0038_5.pdf
0101	5	Alkalinity Analysis	Jeff Armfield	2/8/2002	0101_5.pdf
0102	6	5-Day Biochemical Oxygen Demand (BOD)	Janie McAninch	1/25/2002	0102_6.pdf
0103	6	Analysis of Chemical Oxygen Demand, Low-Level	Janie McAninch	1/25/2002	0103_6.pdf
0104	6	Analysis of Chemical Oxygen Demand, High-Level	Janie McAninch	1/25/2002	0104_6.pdf
0106	2	Total and Amenable Cyanide, EPA Method 335.1, 335.3 Modified	Matthew Scott	2/8/2002	0106_2.pdf
0109	6	Hardness Analysis	Janie McAninch	8/16/2002	0109_6.pdf
0110	2	Analysis of Chemical Oxygen Demand, Saline Waters	Janie McAninch	1/25/2002	0110_2.pdf
0111	4	Analysis of N-Ammonia, EPA Method 350.1	Matthew Scott	2/8/2002	0111_4.pdf
0112	4	Total Kjeldahl Nitrogen, Macro Digestion, EPA Method 351.3	GA/MS	2/8/2002	0112_4.pdf
0113	4	Total Kjeldahl Nitrogen, Micro Block Digestion, EPA Method 351.2	Matthew Scott	2/8/2002	0113_4.pdf
0115	2	Ammonia Nitrogen, Macro Digestion, EPA Method 350.2	Guy Archibald	1/30/2002	0115_2.pdf
0118	3	Use and Maintenance of the Dohrman DX-20B Total Organic Halide Analyzer	Curt Leach	5/17/2002	0118_3.pdf
0120	5	Manual Determination of Phenols by	Jeff Armfield	2/13/2002	0120_5.pdf
0121	4	N-Hexane Extractable Material and Silica Gel Treated N-Hexane Extractable Material, USEPA Method 1664 with Solid Phase	Jeff Armfield	2/13/2002	0121_4.pdf
0122	8	Determination of pH/Corrosivity in Liquid Samples, EPA Methods 150.1 / 9040B	Janie McAninch	1/25/2002	0122_8.pdf
0124	4	Analysis of Total Phosphorus	Matthew Scott	2/8/2002	0124_4.pdf
0125	4	Determination of Total Residue	GA	1/30/2002	0125_4.pdf
0126	7	Determination of Total Dissolved Solids (Filterable Residue)	Janie McAninch	1/25/2002	0126_7.pdf
0127	6	Determination of Total Suspended Solids (Non-filterable Residue)	Janie McAninch	1/25/2002	0127_6.pdf
0128	4	Determination of Total Volatile Solids (Residue, Volatile)	Guy Archibald	1/30/2002	0128_4.pdf
0129	5	Analysis of Conductivity, EPA Methods 9050A and 120.1, Standard Method 2510B	Jeff Armfield	2/13/2002	0129_5.pdf
0133	9	Analysis of Turbidity	Guy Archibald	8/16/2002	0133_9.pdf
0134	3	Determination of Corrosivity by Method 9045C	Janie McAninch	1/25/2002	0134_3.pdf
0138	3	Determination of Corrosivity by Method 9041A	Janie McAninch	1/25/2002	0138_3.pdf

List of Available SOP's

SOP Number	Revision Number	SOP Title	Author	Revision Date	Document Name
0140	2	Dissolved Oxygen	Janie McAninch	1/25/2002	0140_2.pdf
0147	8	Ignitability, EPA Method 1010	GA	1/30/2002	0147_8.pdf
0148	1	Acid-Soluble Sulfide, EPA Method	Jeff Armfield	10/18/2002	0148_1.pdf
0149	5	Reactivity	Matthew Scott	2/8/2002	0149_5.pdf
0150	3	Total and Amenable Cyanide, Method 9012A/9013 Modified	Matthew Scott	2/8/2002	0150_3.pdf
0154	8	Ignitibility, EPA Method 1020A	Guy Archibald	1/30/2002	0154_8.pdf
0155	1	Heat of Combustion	Guy Archibald	11/19/2002	0155_1.pdf
0157	6	Determination of Total Organic Carbon	CL	2/13/2002	0157_6.pdf
0158	7	Total Halogens, EPA Method 9076	Curt Leach	2/8/2002	0158_7.pdf
0159	3	Maintenance of the Dohrman DC-190 High Temperature Total Organic Carbon Analyzer	Curt Leach	5/17/2002	0159_3.pdf
0160	8	Determination of Sample Dry Weight/Total Percent Solids	GA	4/9/2002	0160_8.pdf
0161	10	Determination of Anions by Ion	John Clawson	1/30/2002	0161_10.pdf
0163	1	Residual Chlorine Analysis	Guy Archibald	1/30/2002	0163_1.pdf
0164	7	Sulfide Analysis, EPA Method 376.2 modified	Jeff Armfield	2/13/2002	0164_7.pdf
0166	4	Analysis of Color by Visual Comparison	GA	2/13/2002	0166_4.pdf
0167	1	Methylene Blue Active Substances (MBAS) Analysis	Jeff Armfield	2/13/2002	0167_1.pdf
0171	6	Paint Filter Liquids Test	Jeff Armfield	2/13/2002	0171_6.pdf
0174	6	Total Sulfur Analysis	Jeff Armfield	2/13/2002	0174_6.pdf
0175	4	Hexavalent Chromium, Colorimetric Method	Jeff Armfield	2/8/2002	0175_4.pdf
0176	3	Preventative and Routine Maintenance of Dionex Ion Chromatograph	John Clawson	4/9/2002	0176_3.pdf
0178	2	Use and Maintenance of the Alpkem RFA	Mike Newby	4/11/2002	0178_2.pdf
0179	5	Hexavalent Chromium, Sample Preparation by Coprecipitation	Mike Newby	4/10/2002	0179_5.pdf
0180	5	Salinity Measurement by Electrical Conductivity	Jeff Armfield	2/13/2002	0180_5.pdf
0181	6	Settleable Matter (Method 160.5) or Settleable Solids (SM 2540F)	GA	1/30/2002	0181_6.pdf
0200	10	Trace Metals Analysis by ICP	Stan Palmquist	11/15/2002	0200_10.pdf
0202	10	Mercury Analysis by CVAA	Delynn Moore	4/10/2002	0202_10.pdf
0204	3	Acid Digestion of Sediments, Sludges, and	SP	1/22/2002	0204_3.pdf
0205	9	Water Digestion Procedure for Metal Analysis	SP	1/22/2002	0205_9.pdf

List of Available SOP's

SOP Number	Revision Number	SOP Title	Author	Revision Date	Document Name
0206	16	Microwave Assisted Acid Digestion of Sediments, Sludges, and Soils	SP	1/22/2002	0206_16.pdf
0208	6	Acid Digestion of Oil	SPP / FJ	8/16/2002	0208_6.pdf
0209	8	Acid Digestion of Wipes or Air Filters	SP	1/22/2002	0209_8.pdf
0210	4	Toxicity Characteristic Leaching Procedure, EPA Method 1311	Mike Newby	4/3/2002	0210_4.pdf
0212	4	Use and Maintenance of the Perkin Elmer Elan 6100 ICP-MS	Fred Woo	6/3/2002	0212_4.pdf
0213	8	Acid Leaching of Earthenware	Stan Palmquist	8/16/2002	0213_8.pdf
0214	9	Acid Digestion of Paint Films or Chips: In-House Methodology	SPP / FJ	8/16/2002	0214_9.pdf
0216	3	PS200 Automated Mercury Analyzer	Delynn Moore	1/22/2002	0216_3.pdf
0217	12a	Inductively Coupled Plasma-Mass Spectrometry (ICP-MS)	SP / FW	4/11/2002	0217_12a.pdf
0221	6	TCLP Digestion Procedure for ICP Metal Analysis	Stan Palmquist	8/16/2002	0221_6.pdf
0222	4	Waste Extraction Test (WET) Procedures	Stan Palmquist	1/31/2002	0222_4.pdf
0225	3	Synthetic Precipitation Leaching Procedure, EPA Method 1312	Mike Newby	4/3/2002	0225_3.pdf
0230	1	Maintenance of the Perkin Elmer 3200DV Simultaneous ICP	Stan Palmquist	4/11/2002	0230_1.pdf
0232	3	Mercury Analysis by CVAA, Reduced Volume Procedure	Delynn Moore	4/10/2002	0232_3.pdf
0300	6	Separatory Funnel Liquid-Liquid Extraction of TCLP Leachate for Method 8270 Analysis	Steve Loague	5/28/2002	0300_6.pdf
0301	5	Liquid-Liquid Extraction, EPA Method 3510C	Steve Loague	5/24/2002	0301_5.pdf
0303	2	Extraction of Marine Sediments and Tissue for Semivolatile Analysis	Jeff Westerlund	5/28/2002	0303_2.pdf
0308	10	Preparation and Dual Column Analysis of Chlorinated Pesticides and PCBs	Jeff Westerlund	11/5/2002	0308_10.pdf
0309	3	Organophosphorus Compounds Analysis by GC/MS, Method 8141 Modified	BH	4/16/2002	0309_3.pdf
0310	3	Chlorinated Herbicides Analysis by GC/MS, Method 8151A	BH	10/3/2001	0310_3.pdf
0312	6	Method 8260 Modified: Volatile Organic Compound Analysis by GC/Finnigan Mat ITS-40 MS or Agilent 5973 Network Mass Selective Detector	FZ	1/9/2002	0312_6.pdf
0313	7	Semivolatile Organic Compound (Base/Neutrals and Acids) Analysis by GC/MS,	BH	1/18/2002	0313_7.pdf

List of Available SOP's

SOP Number	Revision Number	SOP Title	Author	Revision Date	Document Name
0314	0	1,2-Dibromoethane (EDB) and 1,2-Dibromo-3-Chloropropane (DBCP) in Water by Method 504.1	Jeff Westerlund	10/11/2002	0314_0.pdf
0316	5	Purgeable Aromatics, Method 602	Chris Funkhouser	11/12/2002	0316_5.pdf
0322	4	Pentachlorophenol by GC/ECD, Modified Method 604	Jeff Westerlund	10/7/2002	0322_4.pdf
0325	3	Instrument Maintenance for Semivolatile Ion Trap GC/MS Analysis Systems	Brent Hepner	4/16/2002	0325_3.pdf
0326	2	Hydrocarbon Identification Method for Soil and Water by NWTPH-HCID Modified	Robert Frans	2/15/2002	0326_2.pdf
0327	2	Instrument Maintenance for GC/MS Analysis System	Felix Zboralski	5/29/2002	0327_2.pdf
0328	6	Extract Screening for GC/MS by GC/FID	Felix Zboralski	5/29/2002	0328_6.pdf
0329	3	Gaseous Hydrocarbons in Water by GC Headspace Equilibrium Technique	Robert Frans	9/17/2002	0329_3.pdf
0334	5	High Temperature Sonication Extraction Procedure, EPA Method 3550B Modified	Steve Loague	11/26/2002	0334_5.pdf
0335	4	Petroleum Fuel Hydrocarbons by EPA SW-846 Method 8015B Modified	Robert Frans	2/15/2002	0335_4.pdf
0336	6	Volatile Aromatic Hydrocarbons by USEPA Method 8021B Modified	Sara Toyoda	1/25/2002	0336_6.pdf
0337	2	Volatile Petroleum Products Method for Soil and Water by NWTPH-Gx Modified	Chris Funkhouser	11/12/2002	0337_2.pdf
0338	6	Method 524.2 Volatile Organic Compound Analysis	FZ	2/22/2002	0338_6.pdf
0339	4	Semivolatile Petroleum Products Method for Soil and Water by NWTPH-Dx	Robert Frans	2/20/2002	0339_4.pdf
0340	3	Semivolatile Organic Compound (Base/Neutrals and Acids) Analysis by GC/MS,	Steve Loague	12/30/02	0340_3.pdf
0341	4	Glycol Analysis by Method 8015B Modified	Robert Frans	11/18/2002	0341_4.pdf
0342	3	Gel Permeation Chromatography Extract Clean-up Procedure	Brent Hepner	5/24/2002	0342_3.pdf
0343	3	Alcohol Analysis by Method 8015B Modified	Robert Frans	11/18/2002	0343_3.pdf
0344	2	Semivolatile Organic Standard Solution Preparation	BH	5/28/2002	0344_2.pdf
0346	2	Puget Sound Estuary Protocol Method for Analysis of Organotin Compounds	BH	5/10/2001	0346_2.pdf
0349	6	Extractable Fuels Screening by GC/FID	Robert Frans	9/25/2002	0349_6.pdf
0351	8	Preparation and Analysis of PCBs in Water, Soil, Wipes, and Waste Oil	JW	1/24/2002	0351_8.pdf
0352	4	Florisil Clean-up Procedure	JW	5/28/2002	0352_4.pdf

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SOP Number	Revision Number	SOP Title	Author	Revision Date	Document Name
0353	4	Extract Clean-up Procedure using Mercury	JW	3/28/2002	0353_4.pdf
0355	2	AK102 Method for Determination of Diesel Range Organics In Water, Reduced Sample Volume Extraction	Robert Frans	9/25/2002	0355_2.pdf
0359	8	Nitroaromatic and Nitroamine Compound Analysis by HPLC, Modified Method 8330	Jeff Westerlund	9/17/2002	0359_8.pdf
0361	2	WSDOE Method for Determination of Extractable Petroleum Hydrocarbons Fractions Method	Robert Frans	5/17/2002	0361_2.pdf
0362	7	AK 101 Method for Determination of Gasoline Range Organics	Chris Funkhouser	11/12/2002	0362_7.pdf
0363	6	AK102 Method for Determination of Diesel Range Organics	Robert Frans	11/19/2002	0363_6.pdf
0364	4	Silica Gel Clean-up Procedure	JW	5/28/2002	0364_4.pdf
0366	6	AK103 Method for Determination of Residual Range Organics	Robert Frans	11/18/2002	0366_6.pdf
0367	3	Soxhlet Extraction, EPA Method 3540C	Brent Hepner	2/13/2002	0367_3.pdf
0371	3	Formaldehyde by HPLC, EPA Method 8315A	Jeff Westerlund	3/28/2002	0371_3.pdf
0375	2	Picric Acid Analysis by HPLC, Modified Method 8330	Jeff Westerlund	5/28/2002	0375_2.pdf
0376	2	BTEX and Gasoline Range Organics by GC/MS, 8260B Modified	Felix Zboralski	9/26/2002	0376_2.pdf
0377	4	Volatile Petroleum Products Method for Soil and Water by USEPA Method 8015B Modified	Felix Zboralski	9/26/2002	0377_4.pdf
0380	5	Preparation and Analysis of Organochlorine Pesticides and PCBs by Method 608	Jeff Westerlund	9/17/2002	0380_5.pdf
0381	3	Method 624 Volatile Organic Compound Analysis by GC/MS using the Finnigan ITS-40 or Agilent 5973 Network Mass Selective Detector	Felix Zboralski	1/9/2002	0381_3.pdf
0383	0	Extract Clean-up Procedure using Sulfuric Acid	JW	4/29/1997	0383_0.pdf
0385	2	Maintenance of Tekmar LSC 2050 System	Felix Zboralski	5/29/2002	0385_2.pdf
0386	3	Maintenance of Varian 3400 GC with PID and FID	Felix Zboralski	5/29/2002	0386_3.pdf
0387	3	Maintenance of Varian 3300/3400 and HP 5890/6890 GCs with FIDs	Ben Frans	4/9/2002	0387_3.pdf
0389	3	Maintenance of Varian 3400/3600 GCs with ECDs	Jeff Westerlund	4/10/2002	0389_3.pdf
0390	3	Maintenance of Hewlett Packard Model 1100 HPLC	Jeff Westerlund	3/28/2002	0390_3.pdf
0409	5	ECD Leak Test and Maintenance	JW	4/10/2002	0409_5.pdf
0500	8	Preparation, Approval, Review, Revision, and Distribution of SOPs	Lila Transue	5/30/2002	0500_8.pdf
0503	3	Laboratory Information Management System - Spreadsheet Reporting	DB	5/29/2002	0503_3.pdf

List of Available SOP's

SOP Number	Revision Number	SOP Title	Author	Revision Date	Document Name
0504	8	Client Contact Recordkeeping	Terri Howard	8/19/2002	0504_8.pdf
0506	8	Archiving Reports and Report File	DW	6/5/2002	0506_8.pdf
0507	3	Facility Security	Tom Boyden	5/17/2002	0507_3.pdf
0508	4	Protecting Client Confidentiality	Terri Howard	8/19/2002	0508_4.pdf
0511	5	Project Management	Darla Powell	11/12/2002	0511_5.pdf
0512	3	Laboratory Documentation and Forms	LT	5/30/2002	0512_3.pdf
0513	6	Data Reporting for Drinking Water Analyses	GA	5/29/2002	0513_6.pdf
0514	3	Laboratory Procedures for Obtaining Client or Accrediting Agency Approval for Non-Standard or Modified Methods	Lila Transue	5/30/2002	0514_3.pdf
0520	1	File Server Restoration / Disaster Recovery	Dennis Bean	2/26/2001	0520_1.pdf
0521	1	Electronic Data Archiving Procedures	Dennis Bean	2/26/2001	0521_1.pdf
0522	2	Laboratory Information Management System and Excel-Based Reporting Software Documentation and Approval of Changes	Dennis Bean	2/26/2001	0522_2.pdf
0523	1	Laboratory Data Integrity and Security	Dennis Bean	5/29/2002	0523_1.pdf
0525	3	Chemical Inventory Tracking System	Guy Archibald	5/29/2002	0525_3.pdf
0600	6	Quality Control Charting and Establishing Method Warning and Action Limits	Lila Transue	4/16/2002	0600_6.pdf
0601	2	Quality Assurance Audit Procedures	Lila Transue	5/30/2002	0601_2.pdf
0602	3	Method Detection Limit Studies	Terri Howard	8/20/2002	0602_3.pdf
0604	1	Managerial Review Procedures	Terri Howard	8/16/2002	0604_1.pdf
0605	5	Archiving Logbooks	DW	6/5/2002	0605_5.pdf
0606	4	QA/QC Review of Data Reports	Lila Transue	4/16/2002	0606_4.pdf
0607	3	Deliverable Assembly	LT	5/30/2002	0607_3.pdf
0608	5	Employee Technical Training Procedures	Lila Transue	1/17/2002	0608_5.pdf
0609	2	Use and Maintenance of Laboratory Logbooks	Lila Transue	5/30/2002	0609_2.pdf
0610	5	Laboratory Corrective Action Procedures	Terri Howard	8/15/2002	0610_5.pdf
0611	6	Organic Standard and Reagent Solution Recordkeeping	BH	5/28/2002	0611_6.pdf
0612	4	Volatile Organic Reagent and Standard Solution Recordkeeping	Felix Zboralski	5/29/2002	0612_4.pdf
0614	4	Reagent and Standard Solution Recordkeeping for Metals	Fred Woo	6/6/2002	0614_4.pdf
0615	4	Reagent and Standard Solution Recordkeeping for General Chemistry	Jeff Armfield	5/29/2002	0615_4.pdf
0616	4	Storage Blank Handling and Analysis	FZ	5/29/2002	0616_4.pdf

List of Available SOP's

SOP Number	Revision Number	SOP Title	Author	Revision Date	Document Name
0617	5	Demonstration of Capability for Analytical Methods	Lila Transue	5/30/2002	0617_5.pdf
0618	3	Laboratory Information Management System - Spreadsheet Template Validation	DB	2/26/2001	0618_3.pdf
0625	2	Data Deliverables Review for US Army Corps of Engineers Projects	Lila Transue	4/16/2002	0625_2.pdf
0630	2	New Employee Technical Training	Lila Transue	5/30/2002	0630_2.pdf
0635	1	Procedure for Review of Analytical Data Using the Peer Review Worksheet	Lila Transue	5/30/2002	0635_1.pdf
0800	6	Preparation of Buffered Dilution Water	GA	4/5/2002	0800_6.pdf
0801	6	Heterotrophic Plate Count	GA	4/9/2002	0801_6.pdf
0802	7	Total Coliforms by Membrane Filter Technique	GA	4/9/2002	0802_7.pdf
0803	6	Fecal Coliform Analysis by the Membrane Filter Technique	GA	4/9/2002	0803_6.pdf
0805	5	QC Procedures for Bacteriological Reagent Water	GA	4/9/2002	0805_5.pdf
0808	6	Laboratory Sterile and Aseptic Techniques	GA	4/9/2002	0808_6.pdf
0809	5	Multiple Tube Fermentation for Coliform	GA	4/5/2002	0809_5.pdf
0811	2	Coliform Analysis of Sludge and Sewage	Guy Archibald	8/16/2002	0811_2.pdf
0812	3	Membrane Filtration for Fecal Streptococcus and Enterococci	Guy Archibald	8/16/2002	0812_3.pdf
0817	0	Salmonella by Most Probable Number	Guy Archibald	9/17/2002	0817_0.pdf

APPENDIX J
STL Seattle
Glossary of Terms

STL Seattle Glossary of Terms

Acceptance Criteria: specified limits placed on characteristics of an item, process, or service defined in requirement documents. (ASQC)

Accreditation: the process by which an agency or organization evaluates and recognizes a laboratory as meeting certain predetermined qualifications or standards, thereby accrediting the laboratory. In the context of the National Environmental Laboratory Accreditation Program (NELAP), this process is a voluntary one. (NELAC)

Accuracy: the degree of agreement between an observed value and an accepted reference value, or true value. Accuracy includes a combination of random error (precision) and systematic error (bias) components which are due to sampling and analytical operations; a data quality indicator.
(QAMS)

Analyst: the designated individual who performs the "hands-on" analytical methods and associated techniques and who is the one responsible for applying required laboratory practices and other pertinent quality controls to meet the required level of quality. (NELAC)

Audit: a systematic evaluation to determine the conformance to quantitative and qualitative specifications of some operational function or activity. (EPA-QAD)

Batch: environmental samples that are prepared and/or analyzed together with the same process and personnel, using the same lot(s) of reagents. A **preparation batch** is composed of up to 20 environmental samples (or other method-specified number of samples) of similar matrix, meeting the above-mentioned criteria and with a maximum time between the start of processing of the first and last sample in the batch to be 24 hours. An **analytical batch** is composed of prepared environmental samples (extracts, digestates or concentrates), which are analyzed together as a group. An analytical batch can include prepared samples originating from various environmental matrices and can exceed 20 samples, if allowed by the reference method. (NELAC Quality Systems Committee)

Blank: a sample that has not been exposed to the analyzed sample stream in order to monitor contamination during sampling, transport, storage, preparation, and/or analysis. The blank is subjected to the usual analytical and measurement process to establish a zero baseline or background value and is sometimes used to adjust or correct routine analytical results. (ASQC)

Blind Sample: a sub-sample for analysis with a composition known to the submitter. The analyst/laboratory may know the identity of the sample but not its composition. It is used to test the analyst's or laboratory's proficiency in the execution of the measurement process. (NELAC)

Calibration: to determine, by measurement or comparison with a standard, the correct value of each scale reading on a meter, instrument, or other device. The levels of the applied calibration standard should bracket the range of planned or expected sample measurements. (NELAC)

Calibration Curve: the graphical relationship between the known values, such as concentrations, of a series of calibration standards and their instrument response. (NELAC)

Calibration Method: a defined technical procedure for performing a calibration. (NELAC)

Calibration Standard: a substance or reference material used to calibrate an instrument. (QAMS)

Certification: The process of testing and evaluation against specifications designed to document, verify, and recognize the competence of a person, organization, or other entity to perform a function or service.

Certified Reference Material (CRM): a reference material one or more of whose property values are certified by a technically valid procedure, accompanied by or traceable to a certificate or other documentation which is issued by a certifying body. (ISO Guide 30 - 2.2)

Chain of Custody: an unbroken trail of accountability that ensures the physical security of samples and includes the signatures of all who handle the samples. (NELAC)[5.12.4]

Check Standard: A standard prepared independently of the calibration standards and analyzed exactly like the samples. Results are used to estimate analytical precision and indicate presence of bias due to the calibration of the analytical system.

Confirmation: verification of the identity of a component through the use of an approach with a different scientific principle from the original method. These may include, but are not limited to:
Second column confirmation
Alternate wavelength
Derivatization
Mass spectral interpretation
Alternative detectors or
Additional cleanup procedures.
(NELAC)

Comparability: A measure of the confidence with which one data set or method can be compared to another.

Completeness: A measure of the amount of valid data obtained from a measurement system compared to the amount that was expected to be obtained under correct, normal conditions.

Conformance: an affirmative indication or judgment that a product or service has met the requirements of the relevant specifications, contract, or regulation; also the state of meeting the requirements. (ANSI/ASQC E4-1994)

Corrective Action: the action taken to eliminate the causes of an existing nonconformity, defect or other undesirable situation that may affect data quality in order to preclude recurrence wherever possible. (ISO 8402)

Data Quality Objectives (DQOs): The qualitative and quantitative statements derived from the DQO Process that clarify study's technical and quality objectives, define the appropriate type of data, and specify tolerable levels of potential decision errors that will be used as the basis for establishing the quality and quantity of data needed to support decisions.

DQO Process: A systematic strategic planning tool based on the scientific method that identifies and defines the type, quality, and quantity of data needed to satisfy a specified use. DQOs are the qualitative and quantitative outputs from the DQO process.

Data Reduction: the process of transforming raw data by arithmetic or statistical calculations, standard curves, concentration factors, etc., and collating them into a more useable form. (EPA-QAD)

Deficiency: an unauthorized deviation from acceptable procedures or practices, or a defect in an item. (ASQC)

Demonstration of Capability: a procedure to establish the ability of the analyst to generate acceptable accuracy. (NELAC)

Detection Limit: the lowest concentration or amount of the target analyte that can be determined to be different from zero by a single measurement at a stated degree of confidence. See Method Detection Limit. (NELAC)

Document Control: The policies and procedures used to ensure that documents (and revisions thereto) are proposed, reviewed for accuracy, approved for release by authorized personnel, distributed, archived, stored, and retrieved properly, and controlled to ensure use of the correct version at the location where the prescribed activity is performed. (ASQC)

Duplicate Analyses: the analyses or measurements of the variable of interest performed identically on two sub-samples of the same sample. The results from duplicate analyses are used to evaluate analytical or measurement precision but not the precision of sampling, preservation or storage internal to the laboratory. (EPA-QAD)

Equipment (Rinsate) Blank: a sample of analyte-free media that has been used to rinse common sampling equipment to check effectiveness of decontamination procedures. (NELAC)

Field Blank: blank prepared in the field by filling a clean container with pure de-ionized water and appropriate preservative, if any, for the specific sampling activity being undertaken. Field blanks provide information about contaminants that may be introduced during sample collection, storage, and transport. (EPA OSWER)

Finding: An assessment conclusion that identifies a condition having a significant effect on an item or activity. An assessment finding may be positive, but is typically a deficiency, and is normally accompanied by specific examples of the observed condition.

Grade: The category or rank given to entities having the same functional use but different requirements for quality.

Guidance: A suggested practice that is not mandatory in programs intended to comply with a standard.

Hazardous Waste: Any waste material that satisfies the definition of hazardous waste given in 40CFR 261, "Identification and Listing of Hazardous Waste."

Holding Times (Maximum Allowable Holding Times): the maximum times that samples may be held prior to preparation and/or analysis and still be considered valid or not compromised. While exceeding holding time does not necessarily negate the veracity of analytical results, it may cause the qualification of data not meeting the method-specified acceptance criteria by the end data user. (40 CFR Part 136)

Internal Standard: a known amount of standard added to a test portion of a prepared sample as a reference for evaluating and controlling the precision and bias of the applied analytical method. (NELAC)

Instrument Blank: a clean sample (e.g., distilled water) processed through the instrumental steps of the measurement process; used to determine instrument contamination. (EPA-QAD)

Laboratory: a defined facility performing environmental analyses in a controlled and scientific manner. (NELAC)

Laboratory Control Sample (however named, such as laboratory fortified blank, blank spike, or QC check sample): a sample matrix, free from the analytes of interest, spiked with verified known amounts of analytes from a source independent of the calibration standards or a material containing known and verified amounts of analytes. It is generally used to establish intra-laboratory or analyst specific precision and bias or to assess the performance of all or a portion of the measurement system. (NELAC)

Laboratory Duplicate: aliquots of a sample taken from the same container under laboratory conditions and processed and analyzed independently. (NELAC)

Limit of Detection (LOD): the lowest concentration level that can be determined by a single analysis and with a defined level of confidence to be statistically different from a blank. (Analytical Chemistry, 55, p.2217, December 1983, modified) See also Method Detection Limit.

Matrix: the component or substrate that contains the analyte of interest. For purposes of batch and QC requirement determinations, the following matrix distinctions shall be used:
Aqueous: any aqueous sample excluded from the definition of Drinking Water matrix or Saline/Estuarine source. Includes surface water, groundwater, effluents, and TCLP or other extracts.
Drinking Water: any aqueous sample that has been designated a potable or potential potable water source.
Saline/Estuarine: any aqueous sample from an ocean or estuary, or other salt water source such as the Great Salt Lake.
Non-aqueous Liquid: any organic liquid with <15% settleable solids.
Biological Tissue: any sample of a biological origin such as fish tissue, shellfish, or plant material. Such samples shall be grouped according to origin.
Solids: includes soils, sediments, sludges and other matrices with >15% settleable solids.
Chemical Waste: a product or by-product of an industrial process that results in a matrix not previously defined.
Air: whole gas or vapor samples including those contained in flexible or rigid wall containers and the extracted concentrated analytes of interest from a gas or vapor that are collected with a sorbant tube, impinger solution, filter, or other device. (NELAC)

Matrix Spike (spiked sample or fortified sample): a sample prepared by adding a known mass of target analyte to a specified amount of matrix sample for which an independent estimate of target analyte concentration is available. Matrix spikes are used, for example, to determine the effect of the matrix on a method's recovery efficiency. (QAMS)

Matrix Spike Duplicate (spiked sample or fortified sample duplicate): a second replicate matrix spike prepared in the laboratory and analyzed to obtain a measure of the precision of the recovery for each analyte. (QAMS)

May: denotes permitted action, but not required action. (NELAC)

Mean: The sum of all the values of a set of measurements divided by the number of values in the set; a measure of central tendency.

Method: A body of procedures and techniques for performing an activity (e.g., sampling, chemical analysis, quantification), systematically presented in the order in which they are to be executed.

Method Blank: a sample of a matrix similar to the batch of associated samples (when available) that is free from the analytes of interest, which is processed simultaneously with and under the same conditions as samples through all steps of the analytical procedures, and (ideally) in which no target analytes or interferences are present at concentrations that impact the analytical results for sample analyses. (NELAC)

Method Detection Limit: the minimum concentration of a substance (an analyte) that can be measured and reported with 99% confidence that the analyte concentration is greater than zero and is determined from analysis of a sample in a given matrix containing the analyte. (40 CFR Part 136, Appendix B)

Must: denotes a requirement that must be met. (Random House College Dictionary)

National Institute of Standards and Technology (NIST): an agency of the US Department of Commerce's Technology Administration that is working with EPA, States, NELAC, and other public and commercial entities to establish a system under which private sector companies and interested States can be accredited by NIST to provide NIST-traceable proficiency testing (PT) to those laboratories testing drinking water and wastewater. (NIST)

National Environmental Laboratory Accreditation Conference (NELAC): a voluntary organization of State and Federal environmental officials and interest groups purposed primarily to establish mutually acceptable standards for accrediting environmental laboratories. A subset of NELAP. (NELAC)

National Environmental Laboratory Accreditation Program (NELAP): the overall National Environmental Laboratory Accreditation Program of which NELAC is a part. (NELAC)

Nonconformance: A deficiency in a characteristic, documentation, or procedure that renders the quality of an item or activity unacceptable or indeterminate; non-fulfillment of a specified requirement.

Observation: An assessment conclusion that identifies a condition (either positive or negative) that does not represent a significant impact on an item or activity. An observation may identify a condition that has not yet caused a degradation of quality.

Outlier: An extreme observation that is shown to have a low probability of belonging to a specified data population.

Parameter: A quantity, usually unknown, such as a mean or a standard deviation characterizing a population.

Peer Review: A documented critical review of work conducted by qualified individuals who are independent of those who performed the work, but collectively equivalent in technical expertise to those who performed the original work. Peer reviews are conducted to ensure that activities are technically adequate, competently performed, properly documented, and satisfy established technical and quality requirements.

Performance Based Measurement System (PBMS): a set of processes wherein the data quality needs, mandates or limitations of a program or project are specified and serve as criteria for selecting appropriate test methods to meet those needs in a cost-effective manner. (NELAC)

Performance Evaluation (PE): A type of audit in which the quantitative data generated in a measurement system are obtained independently and compared with routinely obtained data to evaluate the proficiency of an analyst or laboratory.

Practical Quantitation Limit (PQL): the minimum level, concentration, or quantity of a target variable (e.g., target analyte) that can be quantified with the confidence level required by the data user. (NELAC)

Precision: the degree to which a set of observations or measurements of the same property, obtained under similar conditions, conform to themselves; a data quality indicator. Precision is usually expressed as standard deviation, variance or range, in either absolute or relative terms. (NELAC)

Preservation: refrigeration and/or reagents added at the time of sample collection (or later) to maintain the chemical and/or biological integrity of the sample. (NELAC)

Procedure: A specified way to perform an activity.

Process: A set of interrelated resources and activities that transforms inputs into outputs. Examples of processes include analysis, design, data collection, operation, fabrication, and calculation.

Proficiency Testing: a means of evaluating a laboratory's performance under controlled conditions relative to a given set of criteria through analysis of unknown samples provided by an external source. (NELAC)[2.1]

Proficiency Testing Program: the aggregate of providing rigorously controlled and standardized environmental samples to a laboratory for analysis, reporting of results, statistical evaluation of the results and the collective demographics and results summary of all participating laboratories. (NELAC)

Proficiency Test Sample (PT): a sample, the composition of which is unknown to the analyst and is provided to test whether the analyst/laboratory can produce analytical results within specified acceptance criteria. (QAMS)

Protocol: a detailed written procedure for field and/or laboratory operation (e.g., sampling, analysis) which must be strictly followed. (EPA-QAD)

Qualifier: A flag associated with one or more data points that provides information on the usability of the data.

Quality Assurance (QA): an integrated system of activities involving planning, implementation, quality control, quality assessment, reporting and quality improvement to ensure that a product, process, item, or service meets defined standards of quality with a stated level of confidence. (QAMS)

Quality Assurance [Project] Plan (QAPP): A formal document describing the detailed QA, quality control, and other technical activities and procedures that must be implemented to ensure that the results of the work performed for the project will satisfy the stated performance criteria.

Quality Control: the overall system of technical activities whose purpose is to measure and control the quality of a product or service so that it meets the needs of users. (QAMS)

Quality Control Sample: an uncontaminated sample matrix spiked with known amounts of analytes from a source independent from the calibration standards. It is generally used to establish intra-laboratory or analyst specific precision and bias or to assess the performance of all or a portion of the measurement system. (EPA-QAD)

Quality Assurance Manual: a document stating the management policies, objectives, principles, organizational structure and authority, responsibilities, accountability, and implementation of an agency, organization, or laboratory, to ensure the quality of its product and the utility of its product to its users. (NELAC)

Quality System: a structured and documented management system describing the policies, objectives, principles, organizational authority, responsibilities, accountability, and implementation plan of an organization for ensuring quality in its work processes, products (items), and services. The quality system provides the framework for planning, implementing, and assessing work performed by the organization and for carrying out required QA and QC. (ANSI/ASQC E-41994)

Range: the difference between the minimum and the maximum of a set of values. (EPA-QAD)

Raw Data: any original factual information from a measurement activity or study recorded in a laboratory notebook, worksheets, records, memoranda, notes, or exact copies thereof that are necessary for the reconstruction and evaluation of the report of the activity or study. Raw data may include photography, microfilm or microfiche copies, computer printouts, magnetic media, including dictated observations, and recorded data from automated instruments. If exact copies of raw data have been prepared (e.g., tapes which have been transcribed verbatim, data and verified accurate by signature), the exact copy or exact transcript may be submitted. (EPA-QAD)

Reagent Blank (method reagent blank): a sample consisting of reagent(s), without the target analyte or sample matrix, introduced into the analytical procedure at the appropriate point and carried through all subsequent steps to determine the contribution of the reagents and of the involved analytical steps. (QAMS)

Reagent Water (Pure): shall be water (defined by national or international standard) in which no target analytes or interferences are detected as required by the analytical method. (NELAC)

Reciprocity: the mutual agreement of two or more parties (i.e., States) to accept each other's findings regarding the ability of environmental testing laboratories in meeting the required standards. (NELAC)[1.5.3]

Record: A document that furnishes objective evidence of items or activities, and have typically been verified and authenticated as technically complete and correct. Records may include raw data, quality documents, and other laboratory articles that may be stored on paper, electronic, or other permanent formats.

Record Retention: The systematic collection, indexing and storing of documented information under secure conditions. (EPA-QAD)

Recovery: The act of determining whether or not the methodology sufficiently measures all of the analyte contained in a sample.

Reference Material: a material or substance one or more properties of which are sufficiently well established to be used for the calibration of an apparatus, the assessment of a measurement method, or for assigning values to materials. (ISO Guide 30-2.1)

Reference Method: a method of known and documented accuracy and precision issued by an organization recognized as competent to do so. (NELAC)

Reference Standard: a standard, generally of the highest metrological quality available at a given location, from which measurements made at that location are derived. (VIM-6.08)

Repeatability: The degree of agreement between independent test results produced by the same analyst, using the same test method and equipment on random aliquots of the same sample within a short time period.

Replicate Analyses: the measurements of the variable of interest performed identically on two or more sub-samples of the same sample within a short time interval. (NELAC)

Reporting Limit: The lowest concentration or amount of the target analyte required to be reported from a data collection project. Reporting limits are generally greater than detection limits and are usually not associated with a probability level.

Representativeness: A measure of the degree to which data accurately and precisely represent a characteristic of a population, a parameter variation at a sampling point, a process condition, or an environmental condition.

Reproducibility: The precision, usually expressed as variance that measures the variability among the results of measurement of the same sample at different laboratories.

Requirement: denotes a mandatory specification; often designated by the term “shall”. (NELAC)

Resource Conservation and Recovery Act (RCRA): the enabling legislation under 42 USC 321 *et seq.* (1976), that gives EPA the authority to control hazardous waste from the “cradle-to-grave”, including its generation, transportation, treatment, storage, and disposal. (NELAC)

Safe Drinking Water Act (SDWA): the enabling legislation, 42 USC 300f *et seq.* (1974), (Public Law 93-523), that requires the EPA to protect the quality of drinking water in the U.S. by setting maximum allowable contaminant levels, monitoring, and enforcing violations. (NELAC)

Sample Duplicate: two samples taken from and representative of the same population and carried through all steps of the sampling and analytical procedures in an identical manner. Duplicate samples are used to assess variance of the total method including sampling and analysis. (EPA-QAD)

Sensitivity: the capability of a method or instrument to discriminate between measurement responses representing different levels (e.g., concentrations) of a variable of interest. (NELAC)

Shall: denotes a requirement that is mandatory whenever the criterion for conformance with the specification requires that there be no deviation. This does not prohibit the use of alternative approaches or methods for implementing the specification so long as the requirement is fulfilled. (ANSI)

Should: denotes a guideline or recommendation whenever noncompliance with the specification is permissible. (ANSI)

Specification: A document stating requirements and referring to or including drawings or other relevant documents. Specifications should indicate the means and criteria for determining conformance.

Spike: a known mass of target analyte added to a blank sample or sub-sample; used to determine recovery efficiency or for other quality control purposes. (NELAC)

Standard Operating Procedures (SOPs): a written document which details the method of an operation, analysis or action whose techniques and procedures are thoroughly prescribed and which is accepted as the method for performing certain routine or repetitive tasks. (QAMS)

Standardized Reference Material (SRM): a certified reference material produced by the U.S. National Institute of Standards and Technology or other equivalent organization and characterized for absolute content, independent of analytical method. (EPA-QAD)

Surrogate: a substance with properties that mimic the analyte of interest. It is unlikely to be found in environment samples and is added to them for quality control purposes. (QAMS)

Surveillance: Continual or frequent monitoring and verification of the status of an entity or process and the analysis of records to ensure that specified requirements are being fulfilled.

Systems Audit (also Technical Systems Audit): a thorough, systematic, qualitative on-site assessment of the facilities, equipment, personnel, training, procedures, record keeping, data validation, data management, and reporting aspects of a total measurement system.
(EPA-QAD)

Technical Director: individual(s) who has overall responsibility for the technical operation of the environmental testing laboratory, or a department within the environmental testing laboratory. (NELAC)

Test: a technical operation that consists of the determination of one or more characteristics or performance of a given product, material, equipment, organism, physical phenomenon, process or service according to a specified procedure. The result of a test is normally recorded in a document sometimes called a test report or a test certificate. (ISO/IEC Guide 2-12.1, amended)

Test Method: an adoption of a scientific technique for a specific measurement problem, as documented in a laboratory SOP. (NELAC)

Traceability: The ability to trace the history, application, or location of an entity by means of recorded identifications. In the calibration sense, traceability is the property of a result of a measurement whereby it can be related to appropriate standards, generally international or national standards, basic physical constants or properties, or reference materials through an unbroken chain of comparisons. In a data collection sense, it relates calculations and data generated throughout the project back to the requirements for the quality of the project.

Trip Blank: A clean sample of a matrix that is taken to the sampling site and transported to the laboratory for analysis without having been exposed to sampling procedures.

United States Environmental Protection Agency (EPA): the federal governmental agency with responsibility for protecting public health and safeguarding and improving the natural environment (i.e., the air, water, and land) upon which human life depends. (US-EPA)

Validation: Confirmation or substantiating by examination and provision of objective evidence that the particular requirements for a specific intended use (i.e., performance criteria) have been fulfilled. In design and development, validation concerns the process of examining a product or result to determine conformance to user needs.

Verification: confirmation by examination and provision of evidence that specified requirements have been met. In design and development, verification concerns the process of examining a result of a given activity to determine conformance to the stated requirements for that activity. *NOTE: Per NELAC, in connection with the management of measuring equipment, verification provides a means for checking that the deviations between values indicated by a measuring instrument and corresponding known values of a measured quantity are consistently smaller than the maximum allowable error defined in a standard, regulation or specification peculiar to the management of the measuring equipment. The result of verification leads to a decision either to restore in service, to perform adjustment, to repair, to downgrade, or to declare obsolete. In all cases, it is required that a written trace of the verification performed shall be kept on the measuring instrument's individual record.*

Work Cell: a well-defined group of analysts that together perform the method analysis. The members of the group and their specific functions within the work cell must be fully documented. (NELAC)

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