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Section 1
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QUALITY ASSURANCE MANUAL

Columbia Analytical Services, Inc.

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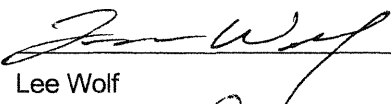
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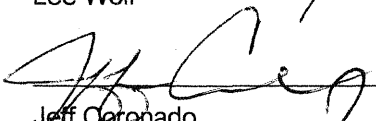
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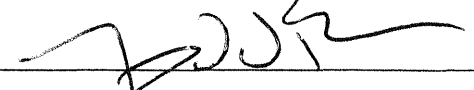
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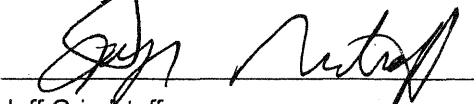
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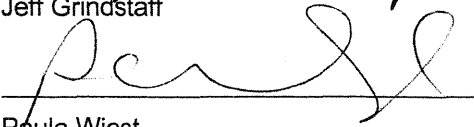
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3.0 INTRODUCTION AND COMPANY QUALITY ASSURANCE POLICY

Columbia Analytical Services, Inc. (CAS) is an employee-owned professional analytical services laboratory which performs chemical and microbiological analyses on a wide variety of sample matrices, including drinking water, groundwater, surface water, wastewater, soil, sludge, sediment, tissue, industrial and hazardous waste, and other material.

It is a policy at CAS that there will be sufficient Quality Assurance (QA) activities conducted in the laboratory to ensure that all analytical data generated and processed will be scientifically sound, legally defensible, of known and documented quality, and will accurately reflect the material being tested. This goal is achieved by ensuring that adequate Quality Control (QC) procedures are used throughout the monitoring process, and by establishing a means to assess performance of these Quality Control and other QA activities. Policies and procedures are established in order to meet the quality objectives of clients, accrediting authorities, and certifying organizations. The Quality System is established to meet the requirements of the National Environmental Laboratory Accreditation Conference (NELAC).

CAS maintains control of analytical results by adhering to written standard operating procedures (SOPs) and by observing sample custody requirements. All analytical results are calculated and reported in units consistent with project specifications to allow comparability of data.

We recognize that quality assurance requires a commitment to quality by everyone in the organization - individually, within each operating unit, and throughout the entire laboratory.

CAS is a network of laboratories. In addition to the Kelso, WA facility, to which this manual is applicable, CAS also operates laboratories in California, Florida, New York, Arizona, and Texas.

The information in this document has been organized according to the format described in *EPA Requirements for Quality Management Plans*, EPA QA/R-2, USEPA, 2001; and *EPA Requirements for Quality Assurance Project Plans*, EPA QA/R-5, USEPA, 2001.

4.0 PROGRAM DESCRIPTION

The purpose of the QA program at CAS is to ensure that our clients are provided with analytical data that is scientifically sound, legally defensible, and of known and documented quality. The concept of Quality Assurance can be extended, and is expressed in the mission statement of CAS:

"The mission of Columbia Analytical Services, Inc., is to provide high quality, cost-effective, and timely professional testing services to our customers. We recognize that our success as a company is based on our ability to maintain customer satisfaction. To do this requires constant attention to customer needs, maintenance of state-of-the-art testing capabilities and successful management of our most important asset - our people - in a way that encourages professional growth, personal development and company commitment."

In support of this mission, our QA program addresses all aspects of laboratory operations, including laboratory organization and personnel, standard operating procedures, sample management, sample and quality control data, calibration practices, standards traceability data, equipment maintenance records, method proficiency data (such as method detection limit studies and control charts), document control/storage and staff training records.

4.1 Facilities and Equipment

CAS features over 25,000 square feet of laboratory and administrative workspace. The laboratory has been designed and constructed to provide safeguards against cross-contamination of samples and is arranged according to work function, which enhances the efficiency of analytical operations. The ventilation system has been specially designed to meet the needs of the analyses performed in each work space. Also, CAS minimizes laboratory contamination sources by employing janitorial and maintenance staff to ensure that good housekeeping and facilities maintenance are performed. In addition, the segregated laboratory areas are designed for safe and efficient handling of a variety of sample types. These specialized areas (and access restrictions) include:

- Shipping and Receiving/Purchasing
- Sample Management Office
 - Controlled-access sample storage areas
- Inorganic/Metals Sample Preparation Laboratories (2)
- Inorganic/Metals "clean room" sample preparation laboratory
- ICP-AES Laboratory

- ICP-MS Laboratory
- AA Laboratory
- Water Chemistry & General Chemistry Laboratories
- Semi-volatile Organics Sample Preparation Laboratories (3)
- Gas Chromatography Laboratory
- Gas Chromatography/Mass Spectrometry Laboratory
- Petroleum Hydrocarbon Laboratory
- Semi-volatile Organics Drinking Water Laboratory
- Volatile Organics Laboratory
 - Separate sample preparation laboratory
 - Access by semi-volatile sample preparation staff only after removing lab coat and solvent-contaminated gloves, etc.
- Microbiology Laboratory
- Laboratory Deionized Water System
- Laboratory Management, Client Service, Report Generation and Administration
- Data Archival, Data Review and support functions areas
- Information Technology (IT) and LIMS

In addition, the designated areas for sample receiving, refrigerated sample storage, dedicated sample container preparation and shipping provide for the efficient and safe handling of a variety of sample types. Figure 4-1 shows the facility floor plan. The laboratory is equipped with state-of-the-art analytical and administrative support equipment. The equipment and instrumentation are appropriate for the procedures in use. Appendix C lists the major equipment, illustrating the laboratory's overall capabilities and depth.

4.2 Technical Elements of the Quality Assurance Program

The Quality Assurance Program provides a platform on which technical operations are based. The program provides laboratory organization, procedures, and policies by which the laboratory operates. The necessary certifications and approvals administered by external agencies are maintained. This includes method approvals and audit administration. In addition, internal audits are performed to assess compliance with policies and procedures. Standard Operating Procedures (SOPs) are maintained for technical and administrative functions. A document control system is used for SOPs, as well as laboratory notebooks, and this QA Manual. A list of QA Program documents is provided in Appendix A.

Acceptable calibration procedures are defined in the SOP for each test procedure. Calibration procedures for other laboratory equipment (balances, thermometers, etc.) are also defined. Quality Control (QC) procedures are used to monitor the testing performed. Each analytical procedure has associated QC requirements to be achieved in order to demonstrate data quality. The use of method detection limit studies, control charting, and preventative maintenance procedures further ensure the quality of data produced. Proficiency Testing (PT) samples are used as an external

means of monitoring the quality and proficiency of the laboratory. PT samples are obtained from qualified vendors and are performed on a regular basis. In addition to method proficiency, documentation of analyst training is performed to ensure proficiency and competency of laboratory analysts and technicians. Sample handling and custody procedures are defined in SOPs. Procedures are also in place to monitor the sample storage areas. The technical elements of the QA program are discussed in further detail in later sections of this QA manual.

4.3 Operational Assessments

There are a number of methods used to assess the laboratory and its daily operations. In addition to the routine quality control (QC) measurements to measure quality, the senior laboratory management examines a number of other indicators to assess the overall ability of the laboratory to successfully perform analyses for its clients. On-time performance, report quality, training, and Quality Assurance are a few of the items that are used to assess performance from an external perspective. A frequent, routine assessment must also be made of the laboratory's facilities and resources in anticipation of accepting an additional or increased workload.

CAS utilizes a number of different methods to ensure that adequate resources are available in anticipation of the demand for service. Regularly scheduled senior staff meetings, tracking of outstanding proposals and an accurate, current synopsis of incoming work all assist the senior staff in properly allocating resources to achieve the required results. All Requests for Proposal (RFP) documents are reviewed by the Project Chemist and appropriate managerial staff to identify any project specific requirements that differ from the standard practices of the laboratory. Any requirements that cannot be met are noted and communicated to the client, as well as requesting the client to provide any project specific Quality Assurance Plans (QAPP's) if available. A weekly status meeting is also conducted with the laboratory staff by the Client Services Manager to inform the staff of the status of incoming work, future projects, or project requirements.

4.4 Document Control

Procedures for control and maintenance of documents are described in the *SOP for Document Control (ADM-DOC_CTRL)*. The procedures described in the SOP include distribution, tracking, filing, and copyrighting of CAS controlled documents. The requirements of the SOP apply to all standards preparation logbooks, instrument maintenance logbooks, run logbooks, standard operating procedures (SOPs), quality assurance manuals (QAMs), quality assurance project plans (QAPPs), safety manuals (SFM), and other controlled CAS documents.

Each controlled copy of a controlled document will be released only after a document control number is assigned and the recipient is recorded on a document distribution

list. Filing and distribution is performed by the Quality Assurance Manager, or designee, and ensure that only the most current version of the document is distributed and in use. A document control number is assigned to logbooks. Completed logbooks that are no longer in use are archived in a master logbook file.

CAS maintains a records system that ensures all laboratory records (including raw data, reports, and supporting records) are retained and available. The archiving system is described in the *SOP for Data Archiving (ADM-ARCH)*.

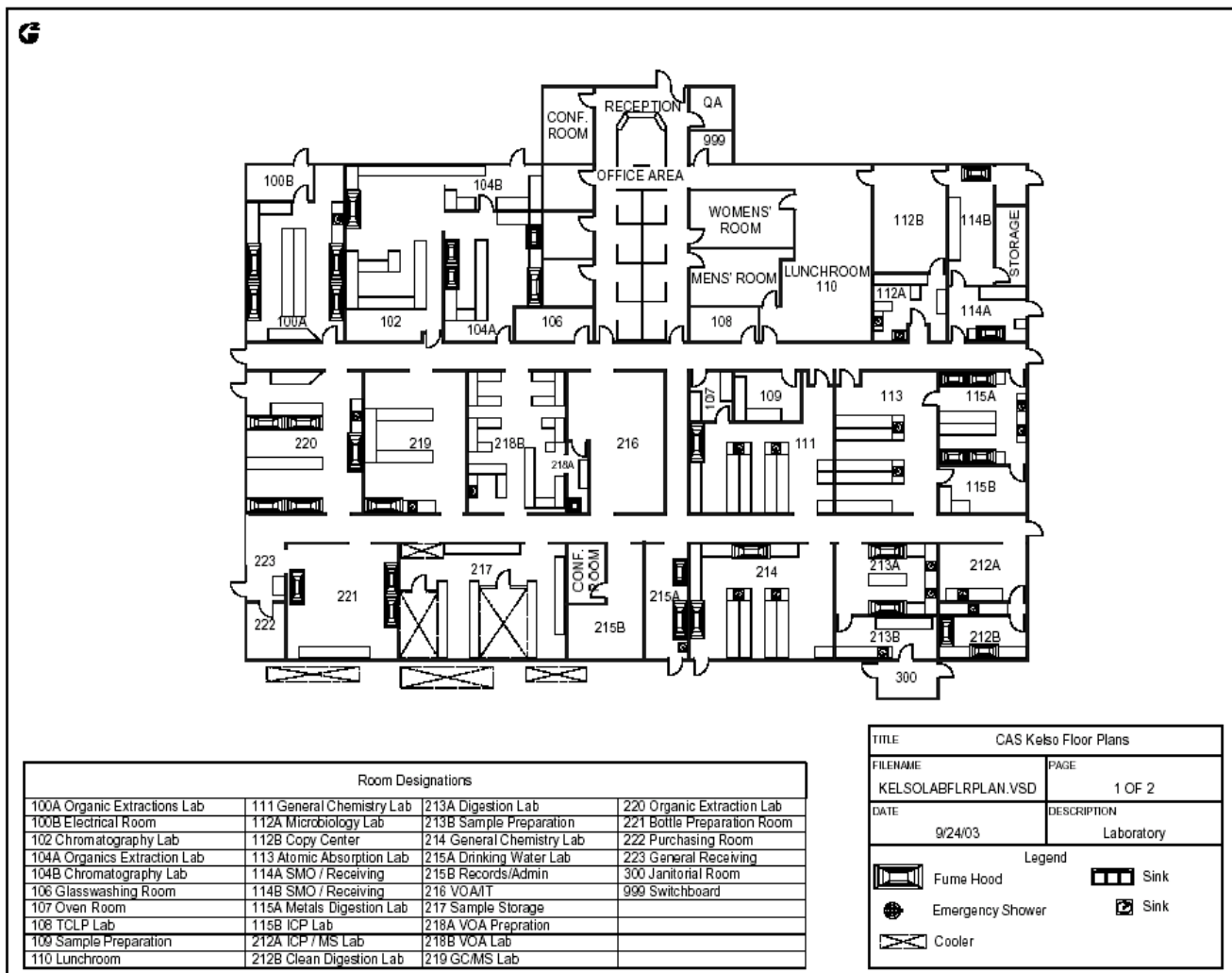
4.5 Subcontracting

Analytical services are subcontracted when CAS/Kelso needs to balance workload or when the requested analyses are not performed by CAS/Kelso. Subcontracting is only done with the knowledge and approval of the client. Subcontracting to another CAS laboratory is preferred over external-laboratory subcontracting. Further, subcontracting is done using capable and qualified laboratories. Established procedures are used to qualify external subcontract laboratories. These procedures are described in the *SOP for Qualification of Subcontract Laboratories (ADM-SUBLAB)*. The Quality Assurance Director is responsible for qualifying and oversight of subcontract laboratories.

4.6 Procurement

The quality level of reagents and materials (grade, traceability, etc.) required is specified in analytical SOPs. Department supervisors ensure that the proper materials are purchased. Inspection and verification of material ordered is performed at the time of receipt by receiving personnel. The receiving staff labels the material with the date received. Expiration dates are assigned (by the laboratory user) as appropriate for the material. Storage conditions and expiration dates are specified in the analytical SOP. The procedures for purchasing and procurement are described in the *SOP for Purchasing Through CAS Purchasing Agent (SOP ADM-PUR)*. Also, refer to section 10.18 for a discussion of reference materials.

Figure 4-1
CAS/Kelso Laboratory Floor Plan



5.0 PROFESSIONAL CONDUCT AND ETHICAL PRACTICES

One of the most important aspects of the success of CAS as a company is the emphasis placed on the integrity of the data that are provided and the services that are performed. To promote product quality, CAS requires certain standards of conduct and ethical performance among our employees. The following examples of documented CAS policy are representative of these standards, and are not intended to be limiting or all-inclusive:

- Under no circumstances is the willful act of fraudulent manipulation of analytical data condoned. Such acts are to be reported immediately to senior management for appropriate corrective action. Unless specifically required in writing by a client, alteration, deviation or omission of written contractual requirements is not permitted. Such changes must be in writing and approved by senior management.
- Falsification of data in any form will not be tolerated. While much analytical data is subject to professional judgment and interpretation, outright falsification, whenever observed or discovered, will be documented, and appropriate remedies and punitive measures will be taken toward those individuals responsible. Employee discipline is progressive in its severity and each situation is handled individually in that the discipline is designed to fit the circumstances. Potential disciplinary actions may include a verbal warning, written warning, a second written notice (more severe and more strongly worded than a warning), suspension without pay, demotion, or termination.
- It is the responsibility of all CAS employees to safeguard sensitive company and client information. The nature of our business and the economic well being of our company and of our clients is dependent upon protecting and maintaining proprietary company/client information. All information, data, and reports (except that in the public domain) collected or assembled on behalf of a client is treated as confidential. No information may be given to third parties without the consent of the client. Unauthorized release of confidential information about the company or its clients is taken very seriously and is subject to formal disciplinary action.

As a condition of employment, all employees are required to sign and adhere to the requirements set forth in the *CAS Confidentiality and Conflicts of Interest Employee Agreement* and the *CAS Commitment to Excellence in Data Quality Policy*. All employees receive in-house ethics training (*Assuring Ethical Practices in the Laboratory*) and are periodically reminded of their data quality and ethical conduct responsibilities.

CAS makes every attempt to ensure that employees are free from any commercial, financial, or other undue pressures that might affect their quality of work. Related policies and

responsibilities are described in the CAS Employee Handbook. This includes the CAS Ombudsman Program, the CAS Open Door Policy, and the use of flexible work hours. Operational assessments are regularly made to ensure that project planning is performed and that adequate resources are available during anticipated periods of increased workloads (Section 4.3). Procedures for subcontracting work are established, and within the CAS laboratory network additional capacity is typically available for subcontracting, if necessary.

6.0 PROJECT ORGANIZATION AND RESPONSIBILITIES

The CAS/Kelso staff, consisting of approximately 110 employees, includes chemists, technicians and support personnel. They represent diverse educational backgrounds and experience, and provide the comprehensive skills that the laboratory requires. During seasonal workload increases, additional temporary employees may be hired to perform specific tasks.

CAS is committed to providing an environment that encourages excellence. Everyone within CAS shares responsibility for maintaining and improving the quality of our analytical services. The responsibilities of key personnel within the laboratory are described below. Table 6-1 lists the CAS/Kelso personnel assigned to these key positions. Managerial staff members are provided the authority and resources needed to perform their duties. An organizational chart of the laboratory, as well as the resumes of these key personnel, can be found in Appendix B.

- The role of the **Laboratory Director** is to provide technical, operational, and administrative leadership through planning, allocation and management of personnel and equipment resources. The Laboratory Director provides leadership and support for the QA program and is responsible for overall laboratory efficiency and the financial performance of the Kelso facility. The Laboratory Director has the authority to stop work in response to quality problems. The Laboratory Director also provides resources for implementation of the QA program, reviews and approves this QA Manual, reviews and approves standard operating procedures (SOPs), and provides support for business development by identifying and developing new markets through continuing support of the management of existing client activities.
- The responsibility of the **Quality Assurance Manager (QAM)** is to oversee implementation of the quality program and to coordinate overall QA activities within the laboratory. The QAM works with individual laboratory production units to establish effective quality control and assessment plans. The QAM has the authority to stop work in response to quality problems. The QAM is responsible for maintaining the QA Manual and performing an annual review/revision of it; reviewing and approving SOPs and coordinating the annual review of each SOP; maintaining QA records such as metrological records, archived logbooks, PT sample results, etc.; document control; oversight of QC practices; conducting PT sample studies; approving nonconformity and corrective action reports; reviewing data; maintaining the laboratory's certifications and approvals; performing internal QA audits; preparing QA activity reports; etc. The QAM reports directly to the Laboratory Director. The QAM also interacts with the CAS Quality Assurance Director, who is responsible for the CAS laboratory-wide QA program. It is important to note that when evaluating data, the QAM does so in an objective manner and free of outside, or managerial, influence.

The Quality Assurance Director is responsible for the overall QA program at all the CAS laboratories. The QA Director is responsible for performing an annual on-site audit at each CAS laboratory and preparing a written report; maintaining a data base of information about state certifications and accreditation programs; writing laboratory-wide SOPs; maintaining a data base of CAS-approved subcontract laboratories; providing assistance to the laboratory QA staff and laboratory managers; preparing a quarterly QA activity report; etc.

- In the case of absence of the Laboratory Director or QA Manager, deputies are assigned to act in that role. Default deputies for these positions are the Client Services Manager or Organics Department Manager (for the Laboratory Director) and the QA Director or Laboratory Director (for the QA manager).
- The **Environmental Health and Safety Officer** (EH&S) is responsible for the administration of the laboratory health and safety policies. This includes the formulation and implementation of safety policies, the supervision of new-employee safety training, the review of accidents, incidents and prevention plans, the monitoring of hazardous waste disposal and the conducting of departmental safety inspections. The EH&S officer is also designated as the Chemical Hygiene Officer. The EH&S Officer has a dotted-line reporting responsibility to CAS' EH&S Director.
- The **Client Services and Sample Management Office Manager** is responsible for the Client Services Department (customer services/project chemists, and Electronic Data Deliverables group) and the sample management office/bottle preparation sections. The Client Services Department provides a complete interface with clients from initial project specification to final deliverables. The sample management office handles all the activities associated with receiving, storage, and disposal of samples. The Client Services Manager has the authority to stop subcontractor work in response to quality problems.
- The **Project Chemist** is a senior-level scientist assigned to each client to act as a technical liaison between the client and the laboratory. The project chemist is responsible for ensuring that the analyses performed by the laboratory meet all project, contract, and regulatory-specific requirements. This entails coordinating with the CAS laboratory and administrative staff to ensure that client-specific needs are understood, and that the services CAS provides are properly executed and satisfy the requirements of the client.
- The Analytical Laboratory is divided into operational units based upon specific disciplines. Each department is responsible for establishing, maintaining and documenting a quality control program based upon the unique requirements within the department.. Each **Department Manager and Supervisor** has the responsibility to ensure that quality control functions are carried out as planned, and to guarantee the production of high quality data. Department managers and bench-level supervisors have the responsibility to monitor the day-to-day operations to ensure that productivity and data quality objectives are met. Each department manager has the authority to stop work in response to quality problems in their area. Each analyst in the laboratory has the responsibility to carry out testing according to prescribed methods, standard operating procedures and quality control guidelines particular to the laboratory in which he/she is working.

- The **Sample Management Office** plays a key role in the laboratory QA program by maintaining documentation for all samples received by the laboratory, and by assisting in the archival of all laboratory results. The sample management office staff is also responsible for the proper disposal of samples after analysis.
- **Information Technology** (IT) staff are responsible for the administration of the Laboratory Information Management System (LIMS) and other necessary support services. Other functions of the IT staff include laboratory network maintenance, IT systems development and implementation, education of analytical staff in the use of scientific software, Electronic Data Deliverable (EDD) generation, and data back-up, archival and integrity operations.

Table 6-1
Summary of Technical Experience and Qualifications

Personnel	Years of Experience	Project Role
Jeff Christian, B.S.	25	Laboratory Director
Lee Wolf, B.S.	18	Quality Assurance Manager
Lynda Huckestein, B.S.	15	Client Services Manager Sample Management Office Manager
Jeff Coronado, B.S.	14	Inorganics Department Manager
Todd Poyfair, B.S.	12	Gas Chromatography and Petroleum Hydrocarbons Department Manager
Jeff Grindstaff, B.S.	15	Volatiles and Semivolatiles GC/MS Department Manager
Jim Smith, B.S.	16	Organics Drinking Water Department Manager
Eileen Arnold, B.A.	22	Environmental Health and Safety Officer
Paul Gowan, B.A.	17	Technical Information Specialist
Lawrence Jacoby, Ph.D.	31	CAS Quality Assurance Director
Gary Ward, M.S.	28	CAS Information Technology Director CAS Chief Quality Officer
Steve Vincent, B.S.	28	CAS President

7.0 INFORMATION MANAGEMENT

The generation, compilation, reporting, and archiving of electronic data is a critical component of laboratory operations. In order to generate data of known and acceptable quality, the quality assurance systems and quality control practices for electronic data systems must be complete and comprehensive and in keeping with the overall quality assurance objectives of the organization. CAS management provides the tools and resources to implement electronic data systems and establishes information technology standards and policies. Appendix C lists major automated data processing equipment.

7.1 Software Quality Assurance Plan

CAS has defined practices for assuring the quality of the computer software used throughout all laboratory operations to generate, compile, report, and store electronic data. These practices are described in the CAS Software Quality Assurance Plan (SQAP). The purpose of the SQAP is to describe the policies and practices for the procurement, configuration management, development, validation and verification, data security, maintenance, and use of computer software. The policies and practices described in the plan apply to purchased computer software as well as to internally developed computer software. A key component of configuration management plan are policies for controlling the software version that is in use in the laboratory.

7.2 IT Support

The local CAS Information Technology (IT) department is established to provide technical support for all computing systems. The IT department staff continually monitor the performance and output of operating systems. The IT department oversees routine system maintenance and data backups to ensure the integrity of all electronic data. A software inventory is maintained. Additional IT responsibilities are described in the SQAP.

In addition to the local IT department, CAS corporate IT provides support for network-wide systems. CAS-Kelso also has personnel assigned to information management duties such as development and implementation of reporting systems; data acquisition, and Electronic Data Deliverable generation.

7.3 Information Management Systems

CAS has various systems in place to address specific data management needs. The CAS Laboratory Information Management System (LIMS) is used to manage sample information and invoicing. Access is controlled by password. This is a Unix-based network system, operating in an Oracle[®] database environment. This system is used to establish and define sample identification, analysis specifications, and provide a means of sample tracking. This system is used during sample login to generate the internal Service Request. The Service Request provides a summary of client information, sample information, required analyses, work instructions, deliverable requirements and other necessary information provided on the chain of custody. The LIMS also is the basis for valuable sample tracking mechanisms used throughout the laboratory. Laboratory analysts generate worklists from the LIMS and the barcoding system used for internal chain of custody (Section 8) interfaces with this system.

Where possible, instrument data acquired locally is immediately moved to a server (Microsoft Windows2000[®] local area network) dedicated to this function. This provides a reliable, easily maintained, high-volume acquisition and storage system for electronic data files. With password entry, users may access the system from many available computer stations, improving efficiency and flexibility. Another server is dedicated to data reporting, EDD generation, and administrative functions. Access to these systems is controlled by password. A standardized EDI (electronic data interchange) format is used as a reporting platform, providing functionality and flexibility for end users. With a common standardized communication platform, the EDI provides data reporting in a variety of hardcopy and electronic deliverable formats.

7.4 Backup and Security

CAS laboratory data is either acquired directly to the centralized acquisition server or acquired locally and then transferred to the server. All data is eventually moved to the centralized data acquisition server for reporting and archiving. Differential backups are performed on all file server information once per day, Sunday through Thursday. Full backups are performed on Friday and Saturday nights. Tapes are physically stored in a locked media cabinet within a locked, temperature controlled computer room.

Access to sample information and data is on a need-to-know basis. Access is restricted to the person's areas of responsibility. Passwords are required on all systems. No direct external, non-CAS access is allowed to any of our network systems.

The external e-mail system and Internet access is set up via a single gateway to discourage unauthorized entry. CAS uses a closed system for company e-mail. Files, such as electronic deliverables, are sent through the external e-mail system only via a

trusted agent. The external messaging system operates through a single secure gateway. All attachments sent in and out of the gateway are subject to a virus scan. Because the Internet is not regulated, we use a limited access approach to provide a firewall for added security. Virus screening is performed every week on all network systems.

8.0 SAMPLE MANAGEMENT

8.1 Sampling and Sample Preservation

The quality of analytical results is highly dependent upon the quality of the procedures used to collect, preserve and store samples. CAS recommends that clients follow sampling guidelines described in 40 CFR 136, 40 CFR 141, USEPA SW-846, and state-specific sampling guidelines, if applicable. Sampling factors that must be taken into account to insure accurate, defensible analytical results include:

- Amount of sample taken
- Type of container used
- Type of sample preservation
- Sample storage time
- Proper custodial documentation

CAS uses the sample preservation, container, and holding-time recommendations published in a number of documents. The primary documents of reference are: USEPA SW-846, Third Edition and Updates I, II, IIA, IIB, III for hazardous waste samples, and USEPA 600/4-79-020, 600/4-91-010, 600/4-82-057, 600/R-93/100, 600/4-88-039, 600/R-94-111, and Supplements; and *Standard Methods for the Examination of Water and Wastewater* for water and wastewater samples. The complete citation for each of these references can be found in Section 18.0 of this document. The container, preservation and holding time information for these references is summarized in Table 8-1 for soil, water, and drinking water. The current EPA CLP Statement of Work should be referred to for container, preservation and holding time information for CLP procedures. Where allowed by the project sampling and analytical protocols (such as Puget Sound Protocols) the holding time for sediment, soil, and tissue samples may be extended for a defined period when stored frozen at -20°C.

CAS routinely provides sample containers with appropriate preservatives for our clients. The containers are purchased as "precleaned" to a level 1 status, and conform to the requirements for analytical samples established by the USEPA. Certificates of analysis for the sampling containers are available to clients if requested. Reagent water used for sampling blanks (trip blanks, etc.) and chemical preservation reagents are tested by the laboratory to ensure that they are free of interferences and documented. Our sample kits typically consist of foam-lined, precleaned shipping coolers, (cleaned inside and out with appropriate cleaner, rinsed thoroughly and air-dried), specially prepared and labeled sample containers individually wrapped in protective material, (VOC vials are placed in a specially made, foam holder), chain-of-

custody (COC) forms, and custody seals. Container labels and custody seals are provided for each container. Figure 8-1 shows the chain-of-custody form routinely used at CAS and included with sample kits. For large sample container shipments, the containers may be shipped in their original boxes. Such shipments will consist of several boxes of labeled sample containers and sufficient materials (bubble wrap, COC forms, custody seals, shipping coolers, etc.) to allow the sampling personnel to process the sample containers and return them to CAS. The proper preservative is added to the sample containers prior to shipment, unless otherwise instructed by the client.

If any returning shipping cooler exhibits an odor or other abnormality after receipt and subsequent decontamination by laboratory personnel, a second, more vigorous decontamination process is employed. Containers exhibiting an odor or abnormality after the second decontamination process are promptly and properly discarded. CAS keeps client-specific shipping requirements on file and utilizes major transportation carriers to guarantee that sample shipping requirements (same-day, overnight, etc.) are met. CAS also provides courier service that makes regularly scheduled trips to the Greater Portland, Oregon Metropolitan area.

When CAS ships environmental samples to other laboratories for analysis each sample bottle is wrapped in protective material and placed in a plastic bag (preferably Ziploc®) to avoid any possible cross-contamination of samples during shipping. The sample management office (SMO) follows formalized procedures for maintaining the chain of custody of the sample(s) (*SOP for Chain of Custody for Sample Transfer between Laboratories* [SOP ADM-COC]), proper packaging and shipment, specification of proper methodology, etc. Blue or gel ice is the only temperature preservative used by CAS, unless otherwise specified by the client or receiving laboratory.

8.2 Sample Receipt and Handling

Standard Operating Procedures are established for the receiving of samples into the laboratory. These procedures ensure that samples are received and properly logged into the laboratory, and that all associated documentation, including chain of custody forms, is complete and consistent with the samples received. Complete documentation of all sample storage is maintained in order to preserve the integrity of the samples.

Once samples are delivered to the CAS sample management office (SMO), a Cooler Receipt and Preservation Check Form (CRF - See Figure 8-2 for an example) is used to assess the shipping cooler and its contents as received by the laboratory personnel. Verification of sample integrity includes the following activities:

- Assessment of custody seal presence/absence, location and signature;
- Temperature of sample containers upon receipt;
- Chain of custody documents properly used (entries in ink, signature present, etc.);
- Sample containers checked for integrity (broken, leaking, etc.);
- Sample is clearly marked and dated (bottle labels complete with required information);
- Appropriate containers (size, type) are received for the requested analyses;
- The minimum amount of sample material is provided for the analysis.
- Sample container labels and/or tags agree with chain of custody entries (identification, required analyses, etc.);
- Assessment of proper sample preservation (if inadequate, corrective action is employed); and
- VOC containers are inspected for the presence/absence of bubbles. (Assessment of proper preservation of VOC containers is performed by lab personnel).

Samples are logged into a Laboratory Information Management System (LIMS). Any anomalies or discrepancies observed during the initial assessment are recorded on the CRF and COC documents. Potential problems with a sample shipment are addressed by contacting the client and discussing the pertinent issues. When the Project Chemist and client have reached a satisfactory resolution, the login process may continue and analysis may begin. During the login process, each sample is given a unique laboratory code and a service request form is generated. The LIMS generates a Service Request that contains client information, sample descriptions, sample matrix information, required analyses, sample collection dates, analysis due dates and other pertinent information. The service request is reviewed by the appropriate Project Chemist for accuracy, completeness, and consistency of requested analyses and for client project objectives.

Samples are kept refrigerated until they undergo analysis, unless otherwise specified. CAS stores samples in various refrigerators or freezers, depending on the type of analysis and the matrix of the sample. CAS has five walk-in refrigerators which house the majority of sample containers received at the laboratory. In addition to the walk-in refrigerators, there are three additional refrigerators, including dedicated refrigerated storage of VOC samples. These refrigerators are segregated by matrix type (soil or water) and method of analysis. The dedicated storage areas for VOC samples are monitored using storage blanks, as described in the *SOP for VOA Storage Blanks (VOC-BLAN)*. CAS also has six sub-zero freezers capable of storing samples at -20° C; these are primarily used for tissue and sediment samples requiring specialized storage conditions. The temperature of each sample storage unit used at CAS is monitored daily and the data recorded in a bound logbook. Continuous-graph temperature recorders have also been placed in the walk-in refrigerators to provide a permanent record of the storage conditions to which samples are exposed.

CAS adheres to the method-prescribed or project-specified holding times for all analyses. In order to comply with holding time requirements, the sampling date and time are entered into the LIMS system at the time of sample receipt and login. Each analyst then monitors holding times by obtaining analysis-specific worklists (typically daily, or more often) from the LIMS. These worklists provide holding time information on all samples for the analysis, calculated from the sample date and the holding time requirement. In order to report adherence to holding time requirements, the date analyzed is printed or written on the analytical raw data. For analyses with holding time prescribed in hours, the time analyzed is also recorded.

Unless other arrangements have been made in advance, upon completion of all analyses and submittal of the final report, aqueous samples and sample extracts are retained at ambient temperature for 30 days, soil samples are retained at ambient temperature for 60 days, and tissue samples are retained frozen for 3 months. Upon expiration of these time limits, the samples are either returned to the client or disposed of according to approved disposal practices. All samples are characterized according to hazardous/non-hazardous waste criteria and are segregated accordingly. All hazardous waste samples are disposed of according to formal procedures outlined in the *CAS Environmental Health and Safety Manual*. All waste produced at the laboratory, including the laboratory's own various hazardous waste streams, is treated in accordance with applicable local and Federal laws. Documentation is maintained for each sample from initial receipt through final disposal. This ensures that an accurate history of the sample from "cradle to grave" is generated.

8.3 Sample Custody

Sample custody transfer at the time of sample receipt is documented using chain-of-custody (COC) forms accompanying the samples. During sample receipt, it is also noted if custody seals were present. This is described in the *SOP for Sample Receiving (SMO-GEN)*. Figure 8-1 is a copy of the chain-of-custody form routinely used at CAS.

Facility security and access is important in maintaining the integrity of samples received at CAS/Kelso. Access to the laboratory facility is limited by use of locked exterior doors with a coded entry, except for the reception area and sample receiving doors, which are manned during business hours and locked at all other times. In addition, the sample storage area within the laboratory is a controlled access area with locked doors with a coded entry. The CAS facility is equipped with an alarm system and CAS employs a private security firm to provide nighttime and weekend security.

A barcoding system is used to document internal sample custody. Each person removing or returning samples from/to sample storage while performing analysis is required to document this custody transfer. The system uniquely identifies the sample container and provides an electronic record of the custody of each sample. For sample extracts and digestates the analyst documents custody of the sample extract or

digestate by signing on the benchsheet, or custody record, that they have accepted custody. The procedures are described in the *SOP for Sample Tracking and Internal Chain of Custody (SMO-SCOC)*.

8.4 Project Setup

The analytical method(s) to be used for sample analysis are chosen based on the COC information and project requirements. Unless specified otherwise, the most recent versions of reference methods are used. LIMS codes are chosen to identify the analysis method used for analysis. The Project Chemist ensures that the correct methods are selected for analysis, deliverable requirements are identified, and due dates are specified on the LIMS generated Service Request. To communicate and specify project-specific requirements, a Tier V form (Figure 8-3) is used and accompanies the service request form.

Table 8-1
Sample Preservation and Holding Times

DETERMINATION	MATRIX ^b	CONTAINER ^c	PRESERVATION	MAXIMUM HOLDING TIME
Bacterial Tests				
Coliform, Colilert	W, DW	P, Bottle or Bag	Cool, 4°C, 0.008% Na ₂ S ₂ O ₃ ^d	6-24 hours ^e
Coliform, Fecal and Total	W, DW	P,G	Cool, 4°C, 0.008% Na ₂ S ₂ O ₃ ^d	6-24 hours ^e
Fecal Streptococci	W	P,G	Cool, 4°C, 0.008% Na ₂ S ₂ O ₃ ^d	6-24 hours ^e
Inorganic Tests				
Acidity	W	P,G	Cool, 4°C	14 days
Alkalinity	W, DW	P,G	Cool, 4°C	14 days
Ammonia	W, DW	P,G	Cool, 4°C, H ₂ SO ₄ to pH<2	28 days
Biochemical Oxygen Demand (BOD)	W	P,G	Cool, 4°C	48 hours
Bromate	W, DW	P,G	50mg/L EDA, cool to 4°C	28 days
Bromide	W, DW	P,G	None Required	28 days
Chemical Oxygen Demand (COD)	W	P,G	Cool, 4°C, H ₂ SO ₄ to pH<2	28 days
Chloride	W, DW	P,G	None Required	28 days
Chlorine, Total Residual	W, DW	P,G	None Required	24 hours
Chlorite	W, DW	P,G	50mg/L EDA, cool to 4°C	14 days
Chlorophyll-A	W	G Amber	Cool, 4°C	Analyze immediately
Color	W, DW	P,G	Cool, 4°C	48 hours
Cyanide, Total and Amenable to Chlorination	W, DW	P,G	Cool, 4°C, NaOH to pH>12, plus 0.6 g Ascorbic Acid	14 days
Cyanide, Weak Acid Dissociable	W	P,G	Cool, 4°C, NaOH to pH >12	14 days
Ferrous Iron	W, DW	G Amber	Cool, 4°C	24 hours
Fluoride	W, DW	P,G	None Required	28 days
Hardness	W, DW	P,G	HNO ₃ to pH<2	6 months
Hydrogen Ion (pH)	W, DW	P,G	None Required	24 hours
Kjeldahl and Organic Nitrogen	W	P,G	Cool, 4°C, H ₂ SO ₄ to pH<2	28 days
Nitrate	W, DW	P,G	Cool, 4°C	48 hours
Nitrate	W, DW	P,G	Cool, 4°C	14 days
Nitrate-Nitrite	W, DW	P,G	Cool, 4°C, H ₂ SO ₄ to pH<2	28 days
Nitrite	W, DW	P,G	Cool, 4°C	48 hours
Orthophosphate	W, DW	P,G	Filter Immediately, Cool, 4°C	48 hours
Oxygen, Dissolved (Probe)	W, DW	G, Bottle and Top	None Required	Analyze immediately
Oxygen, Dissolved (Winkler)	W, DW	G, Bottle and Top	Fix on Site and Store in Dark	8 hours
Perchlorate	W, DW	P,G	Protect from temperature extremes	28 days
Phenolics, Total	W	G Only	Cool, 4°C, H ₂ SO ₄ to pH<2	28 days

Table 8-1 (continued)
Sample Preservation and Holding Times

DETERMINATION	MATRIX ^b	CONTAINER ^c	PRESERVATION	MAXIMUM HOLDING TIME
Phosphorus, Elemental	W	G Only	Cool, 4°C	48 hours
Phosphorus, Total	W	P,G	Cool, 4°C, H ₂ SO ₄ to pH<2	28 days
Residue, Total	W	P,G	Cool, 4°C	7 days
Residue, Filterable (TDS)	W	P,G	Cool, 4°C	7 days
Residue, Nonfilterable (TSS)	W	P,G	Cool, 4°C	7 days
Residue, Settleable	W	P,G	Cool, 4°C	48 hours
Residue, Volatile	W	P,G	Cool, 4°C	7 days
Silica	W	P Only	Cool, 4°C	28 days
Specific Conductance	W, DW	P,G	Cool, 4°C	28 days
Sulfate	W, DW	P,G	Cool, 4°C	28 days
Sulfide	W	P,G	Cool, 4°C, Add Zinc Acetate plus Sodium Hydroxide to pH>9	7 days
Sulfite	W	P,G	None Required	24 hours
Surfactants (MBAS)	W	P,G	Cool, 4°C	48 hours
Tannin and Lignin	W	P,G	Cool, 4°C	28 days
Temperature	W	P,G	None Required	Analyze immediately
Turbidity	W, DW	P,G	Cool, 4°C	48 hours
Metals				
Metals, except CrVI and Mercury	W, DW	P,G	HNO ₃ to pH<2	6 months
	S	G, Teflon-Lined Cap	Cool, 4°C	6 months
Chromium VI	W	P,G	Cool, 4°C	24 hours
Mercury	W	P,G	HNO ₃ to pH<2	28 days
	S	P,G	Cool, 4°C	28 days
Organic Tests				
Oil and Grease, Hexane Extractable Material (EPA 1664)	W	G, Teflon-Lined Cap	Cool, 4°C, H ₂ SO ₄ to pH<2	28 days
Organic Carbon, Total (TOC)	W	P,G	Cool, 4°C, H ₂ SO ₄ to pH<2	28 days
Organic Halogens, Total (TOX)	W	G, Teflon-Lined Cap	Cool, 4°C, H ₂ SO ₄ to pH<2, No headspace	28 days
Organic Halogens, Adsorbable (AOX)	W	G, Teflon-Lined Cap	Cool, 4°C, HNO ₃ to pH<2	6 months
Petroleum Hydrocarbons, Total	W	G, Teflon-Lined Cap	Cool, 4°C, HCl or H ₂ SO ₄ to pH<2	7 days until extraction; 40 days after extraction
	S	G, Teflon-Lined Cap	Cool, 4°C	14 days until extraction; 40 days after extraction

Table 8-1 (continued)
Sample Preservation and Holding Times

DETERMINATION	MATRIX ^b	CONTAINER ^c	PRESERVATION	MAXIMUM HOLDING TIME
Volatile Organics				
Petroleum Hydrocarbons, Volatile (Gasoline-Range Organics)	W	G, Teflon-Lined Septum Cap	Cool, 4°C, HCl to pH<2 No Headspace	14 days
	S	G, Teflon-Lined Cap	Cool, 4°C Minimize Headspace	14 days
Purgeable Halocarbons	W	G, Teflon-Lined Septum Cap, No Headspace	No Residual Chlorine Present: HCl to pH<2, Cool, 4°C, No Headspace Residual Chlorine Present: 10% Na ₂ S ₂ O ₃ , HCl to pH<2, Cool, 4°C	14 days
	S	G, Teflon-Lined Cap	Cool, 4°C, Minimize Headspace	14 days
	S	Method 5035	Encore, Freeze at -20°C Methanol, Cool, 4°C Sodium Bisulfate Cool, 4°C	7 days 48 hrs to prepare from Encore, 14 days after preparation. 48 hrs to prepare from Encore, 14 days after preparation.
Purgeable Aromatic Hydrocarbons (including BTEX and MTBE)	W	G, Teflon-Lined Septum Cap, No Headspace	No Residual Chlorine Present: HCl to pH<2, Cool, 4°C, No Headspace Residual Chlorine Present: 10% Na ₂ S ₂ O ₃ , HCl to pH<2, Cool 4°C	14 days
	S	G, Teflon-Lined Cap	Cool, 4°C, Minimize Headspace	14 days
	S	Method 5035	Encore, Freeze at -20°C Methanol, Cool, 4°C Sodium Bisulfate Cool, 4°C	7 days 48 hrs to prepare from Encore, 14 days after preparation. 48 hrs to prepare from Encore, 14 days after preparation.
Acrolein, Acrylonitrile, Acetonitrile	W	G, Teflon-Lined Septum Cap	Adjust pH to 4-5, Cool, 4°C, No Headspace	14 days
EDB and DBCP	W,S	G, Teflon-Lined Cap	Cool, 4°C, 3 mg Na ₂ S ₂ O ₃ , No Headspace	28 days

Table 8-1 (continued)
Sample Preservation and Holding Times

DETERMINATION	MATRIX ^b	CONTAINER ^c	PRESERVATION	MAXIMUM HOLDING TIME
Semivolatile Organics				
Petroleum Hydrocarbons, Extractable (Diesel-Range Organics)	W,S	G, Teflon-Lined Cap	Cool, 4°C	7 days until extraction; ^f 40 days after extraction
Alcohols and Glycols	W,S	G, Teflon-Lined Cap	Cool, 4°C ^g	7 days until extraction; ^f 40 days after extraction
Phenols	W,S	G, Teflon-Lined Cap	Cool, 4°C ^g	7 days until extraction; ^f 40 days after extraction
Phthalate Esters	W,S	G, Teflon-Lined Cap	Cool, 4°C ^g	7 days until extraction; ^f 40 days after extraction
Nitrosamines	W,S	G, Teflon-Lined Cap	Cool, 4°C, Store in Dark ^g	7 days until extraction; ^f 40 days after extraction
Organochlorine Pesticides and PCBs	W,S	G, Teflon-Lined Cap	Cool, 4°C	7 days until extraction; ^f 40 days after extraction
Nitroaromatics and Cyclic Ketones	W,S	G, Teflon-Lined Cap	Cool, 4°C, Store in Dark ^g	7 days until extraction; ^f 40 days after extraction
Polynuclear Aromatic Hydrocarbons	W,S	G, Teflon-Lined Cap	Cool, 4°C, Store in Dark ^g	7 days until extraction; ^f 40 days after extraction
Haloethers	W,S	G, Teflon-Lined Cap	Cool, 4°C ^g	7 days until extraction; ^f 40 days after extraction
Chlorinated Hydrocarbons	W,S	G, Teflon-Lined Cap	Cool, 4°C ^g	7 days until extraction; ^f 40 days after extraction
Organophosphorus Pesticides	W,S	G, Teflon-Lined Cap	Cool, 4°C ^g	7 days until extraction; ^f 40 days after extraction
Nitrogen- and Phosphorus-Containing Pesticides	W,S	G, Teflon-Lined Cap	Cool, 4°C ^g	7 days until extraction; ^f 40 days after extraction

Table 8-1 (continued)
Sample Preservation and Holding Times

DETERMINATION	MATRIX ^b	CONTAINER ^c	PRESERVATION	MAXIMUM HOLDING TIME
Chlorinated Herbicides	W,S	G, Teflon-Lined Cap	Cool, 4°C ^g	7 days until extraction; ^f 40 days after extraction
Chlorinated Phenolics	W	G, Teflon-Lined Cap	H ₂ SO ₄ to pH<2, Cool, 4°C ^g	30 days until extraction; 30 days after extraction
Resin and Fatty Acids	W	G, Teflon-Lined Cap	NaOH to pH ≥10, Cool, 4°C ^g	30 days until extraction; 30 days after extraction
Drinking Water Organics				
Purgeable Organics	DW	G, Teflon-Lined Septum Cap,	Ascorbic Acid, HCl to pH≤2, Cool, 4°C, No Headspace	14 days
EDB, DBCP, and TCP	DW	G, Teflon-Lined Septum Cap	Cool, 4°C, 3 mg Na ₂ S ₂ O ₃ , No Headspace	14 days
Carbamates, Carbamoyloximes	DW	G, Amber, Teflon-Lined Cap	1.8 mL monochloroacetic acid to pH<3; 80 mg/L Na ₂ S ₂ O ₃ if Res.Cl.; Cool, 4°C	28 days
Chlorinated Herbicides	DW	G, Amber, Teflon-Lined Cap	If Res.Cl, 2mg/40mL NaS; Cool, <6°C	14 days until extraction; 21 days after extraction
Chlorinated Pesticides	DW	G, Amber, Teflon-Lined Cap	50 mg/L NaS, HCl to pH≤ 2; Cool, 4°C	14 days until extraction; 30 days after extraction
Diquat and Paraquat	DW	G, Amber, Teflon-Lined Cap	100 mg/L Na ₂ S ₂ O ₃ if Res.Cl., Cool, 4°C,	7days until extraction; 21 days after extraction
Endothall	DW	G, Amber, Teflon-Lined Cap	Cool, 4°C	7 days until extraction; 14 days after extraction
Glyphosate	DW	G, Amber, Teflon-Lined Cap	100 mg/L Na ₂ S ₂ O ₃ , Cool, 4°C	14 days
Haloacetic Acids	DW	G, Amber, Teflon-Lined Cap	100 mg/L NH ₄ Cl, Cool, 4°C	14 days until extraction; 7 days after extraction
Semivolatile Organics	DW	G, Amber, Teflon-Lined Cap	50 mg/L NaS, HCl to pH≤ 2; Cool, 4°C	14 days until extraction; 30 days after extraction

Table 8-1 (continued)
Sample Preservation and Holding Times

DETERMINATION	MATRIX ^b	CONTAINER ^c	PRESERVATION	MAXIMUM HOLDING TIME
Toxicity Characteristic Leaching Procedure (TCLP)				
Mercury	HW	P,G	Sample: Cool, 4°C TCLP extract: HNO ₃ to pH<2	28 days until extraction; 28 days after extraction
Metals, except Mercury	HW	P,G	Sample: Cool, 4°C TCLP extract: HNO ₃ to pH<2	180 days until extraction; 180 days after extraction
Volatile Organics	HW	G, Teflon-Lined Cap	Sample: Cool, 4°C Minimize Headspace TCLP extract: Cool, 4°C, HCl to pH<2, No Headspace	14 days until extraction; 14 days after extraction
Semivolatile Organics	HW	G, Teflon-Lined Cap	Sample: Cool, 4°C, Store in Dark ^g TCLP extract: Cool, 4°C, Store in Dark ^g	14 days until TCLP ext'n; 7 days until extraction; 40 days after extraction
Organochlorine Pesticides	HW	G, Teflon-Lined Cap	Sample: Cool, 4°C TCLP extract: Cool, 4°C	14 days until TCLP ext'n; 7 days until extraction; 40 days after extraction
Chlorinated Herbicides	HW	G, Teflon-Lined Cap	Sample: Cool, 4°C TCLP extract: Cool, 4°C	14 days until TCLP ext'n; 7 days until extraction; 40 days after extraction

a See Section 18.0 for sources of holding time information.

b DW = Drinking Water, W = Water; S = Soil or Sediment; HW = Hazardous Waste

c P = Polyethylene; G = Glass

d For chlorinated water samples

e The recommended maximum holding time is variable, and is dependent upon the geographical proximity of sample source to the laboratory.

f Fourteen days until extraction for soil, sediment, and sludge samples.

g If the water sample contains residual chlorine, 10% sodium thiosulfate is used to dechlorinate.

Figure 8-2

**Columbia Analytical Services Inc.
Cooler Receipt And Preservation Form**

Project/Client _____ Work Order K23 _____

Cooler received on _____ and opened on _____ by _____

1. Were custody seals on outside of cooler? Y N
If yes, how many and where? _____
2. Were seals intact and signature & date correct? Y N
3. Is the shipper's airbill available and filed? If no, record airbill number: _____ Y N
4. COC # _____
Temperature of cooler(s) upon receipt: _____
Temperature Blank: _____
5. Were custody papers properly filled out (ink, signed, etc.)? Y N
6. Type of packing material present _____
7. Did all bottles arrive in good condition (unbroken)? Y N
8. Were all bottle labels complete (*i.e.* analysis, preservation, etc.)? Y N
9. Did all bottle labels and tags agree with custody papers? Y N
10. Were the correct types of bottles used for the tests indicated? Y N
11. Were all of the preserved bottles received at the lab with the appropriate pH? Y N
12. Were VOA vials checked for absence of air bubbles, and if present, noted below? Y N
13. Did the bottles originate from CAS/K or a branch laboratory? Y N
14. Are CWA Microbiology samples received with > ½ the 24 hr. hold time remaining from collection? Y N
15. Was CI2/Res negative? Y N

Explain any discrepancies: _____

RESOLUTION: _____

Samples that required preservation or received out of temperature:

Sample ID	Reagent	Volume	Lot Number	Bottle Type	Rec'd out of Temperature	Initials

Figure 8-3 Tier V Form

Client :

Project Chemist :

Project Name :

Service Request :

Project Number :

SMO LimsTemplate ID :

Project Description :

QAPP/SOW Information :

Reporting

Tier Level :

PDF:

Report to :

In result field use :

EDD :

Flagging Requirements :

Other Requirements :

Sample Considerations

Sample Limitations :

Sample Prep/Analysis :

Non-Standard Holdtimes :

Historical Data :

Comments :

9.0 QUALITY CONTROL OBJECTIVES (PRECISION, ACCURACY, AND MDLS)

A primary focus of Columbia Analytical Services Quality Assurance (QA) Program is to ensure the accuracy, precision and comparability of all analytical results. Prior to using a procedure for the analysis of field samples, acceptable method performance is established by performing demonstration of capability analyses and performance characteristics are established by performing method detection limit studies and assessing accuracy and precision according to the reference method. CAS has established Quality Control (QC) objectives for precision and accuracy that are used to determine the acceptability of the data that is generated in its laboratories. These QC limits are either specified in the methodology or are statistically derived based on the laboratory's actual historical data obtained from the various QC measurements for each analytical method. The Quality Control objectives are defined below and the numeric values are shown in Appendix D.

9.1 Demonstration of Capability

Where required by mandatory test method, regulation, or accreditation protocols, a demonstration of capability (DOC) is made prior to using any test method. This demonstration is made following regulatory, accreditation, or method specified procedures. In general, this demonstration does not test the performance of the method in real world samples, but in the applicable clean matrix free of target analytes and interferences.

A quality control reference material or quality control sample is obtained. The analyte(s) is (are) diluted in a volume of clean matrix (for analytes which do not lend themselves to spiking, e.g., TSS, the demonstration of capability may be performed using quality control samples). Where specified, the method-required concentration levels are used. Four aliquots are prepared and analyzed according to the test procedure. The mean recovery and standard deviations are calculated and compared to the corresponding acceptance criteria for precision and accuracy in the test method or laboratory-generated acceptance criteria (if there are not established mandatory criteria). All parameters must meet the acceptance criteria. Where spike levels are not specified, actual Laboratory Control Sample results or MDL study results may be used to meet this requirement, provided acceptance criteria is met.

9.2 Accuracy

Accuracy is a measure of the closeness of an individual measurement (or an average of multiple measurements) to the true or expected value. Accuracy is determined by calculating the mean value of results from ongoing analyses of laboratory-fortified blanks,

standard reference materials, and standard solutions. In addition, laboratory-fortified (i.e. matrix-spiked) samples are also measured; this indicates the accuracy or bias in the actual sample matrix. Accuracy is expressed as percent recovery (% REC.) of the measured value, relative to the true or expected value. If a measurement process produces results whose mean is not the true or expected value, the process is said to be biased. Bias is the systematic error either inherent in a method of analysis (e.g., extraction efficiencies) or caused by an artifact of the measurement system (e.g., contamination). CAS utilizes several quality control measures to eliminate analytical bias, including systematic analysis of method blanks, laboratory control samples and independent calibration verification standards. Because bias can be positive or negative, and because several types of bias can occur simultaneously, only the net, or total, bias can be evaluated in a measurement.

9.3 Precision

Precision is the ability of an analytical method or instrument to reproduce its own measurement. It is a measure of the variability, or random error, in sampling, sample handling and in laboratory analysis. The American Society of Testing and Materials (ASTM) recognizes two levels of precision: repeatability - the random error associated with measurements made by a single test operator on identical aliquots of test material in a given laboratory, with the same apparatus, under constant operating conditions, and reproducibility - the random error associated with measurements made by different test operators, in different laboratories, using the same method but different equipment to analyze identical samples of test material.

"Within-batch" precision is measured using replicate sample or QC analyses and is expressed as the relative percent difference (RPD) between the measurements. The "batch-to-batch" precision is determined from the variance observed in the analysis of standard solutions or laboratory control samples from multiple analytical batches.

9.4 Control Limits

The acceptance limits for accuracy and precision originate from two different sources: For analyses having enough QC data, control limits are calculated at the 99% confidence limits. For analyses not having enough QC data, or where the method is prescriptive, control limits are taken from the method on which the procedure is based. If the method does not have control limits stated in it, then control limits are assigned method-default or reasonable values. New control limits are generated periodically. After review of the data by the Quality Assurance Manager, the new acceptance criteria replace the previous criteria and data is assessed using the new values. These control limits are updated when new statistical limits are generated for the appropriate surrogate, laboratory control sample, and matrix spike compounds (typically once a year) or when method prescribed limits change.

The acceptance limits for accuracy and precision for selected analytes are shown in the table in Appendix D. For accuracy limits, the values listed are for laboratory control samples unless otherwise indicated. For inorganics, the precision limit values listed are for laboratory duplicates. For organics, the precision limit values listed are for duplicate laboratory control samples or duplicate matrix spike analyses.

9.5 Representativeness

Representativeness is the degree to which the field sample represents the overall sample site or material. This can be extended to the sample itself, in that representativeness is the degree to which the subsample that is analyzed represents the entire field sample submitted for analysis. CAS has sample handling procedures to ensure that the sample used for analysis is representative of the entire sample. These include the *SOP for Sample Preparation, Compositing, and Subsampling*, the *SOP for Solid Sample Preparation*, and the *SOP for Tissue Sample Preparation*. Further, analytical SOPs specify appropriate sample handling and sample sizes to further ensure the sample aliquot that is analyzed is representative in entire sample.

9.6 Completeness

Completeness is a measure of the amount of valid data that is obtained, compared to the amount that is expected. For the purposes of this plan, completeness is calculated by dividing the number of samples having valid data by the total number of samples in the project, expressed as a percentage. The CAS objective for completeness is 100%.

9.7 Comparability

Comparability expresses the confidence with which one data set can be compared to another. To ensure comparability, standard operating procedures are used for the preservation, handling, and analysis of all samples. Data is reported in units specified by the customer.

9.8 Method Detection Limits and Method Reporting Limits

Method Detection Limits (MDL) for analytical methods routinely performed at CAS/Kelso are determined annually, thus may change slightly from year to year. The MDLs are determined by following the *SOP for the Determination of Method Detection Limits*, which is based on the procedure in 40 CFR Part 136, Appendix B. The Method Reporting Limits (MRLs) used at CAS are the routinely reported lower limits of quantitation. These MRLs are the levels to which CAS routinely reports results in order to minimize false positive or false negative results. The MRLs take into account day-to-day fluctuations in instrument sensitivity as well as other factors. Analyses are calibrated to the MRL, or lower. The MRL is typically two to ten times the MDL.

10.0 QUALITY CONTROL PROCEDURES

The specific types, frequencies, and processes for quality control sample analysis are described in detail in method-specific standard operating procedures. These sample types and frequencies have been adopted for each method and a definition of each type of QC sample is provided below. In addition, a number of other quality control processes that may impact analytical results are also described below.

10.1 Standard Operating Procedures (SOPs) and Laboratory Notebooks.

CAS maintains a database of SOPs for use in both technical and administrative functions. SOPs are written following the format and content requirements described in the *SOP for Preparation of Standard Operating Procedures* (SOP No. ADM-SOP). Each SOP has been reviewed and approved by a minimum of two managers (the Laboratory Director and/or Department Manager and the Quality Assurance Manager). All SOPs undergo a documented annual review to make sure current practices are described. The QA Manager maintains a comprehensive list of current SOPs. The document control process ensures that only the most currently prepared version of an SOP is being used for guidance and instruction. The QA Manual, QAPPs, SOPs, standards preparation logbooks, maintenance logbooks, et al., are controlled documents. The procedures for document control are described in the *SOP for Document Control* (SOP No. ADM-DOC_CTRL). In addition to SOPs, each laboratory department maintains a current file, accessible to all laboratory staff, of the promulgated methodology used to perform analyses. Laboratory notebook entries have been standardized following the guidelines in the *Making Entries into Logbooks and onto Benchsheets* SOP (SOP No. ADM-DATANTRY). The entries made into laboratory notebooks are reviewed and approved by the appropriate supervisor at a regular interval (e.g., weekly, monthly, etc.).

10.2 Deviation from Standard Operating Procedures

When a customer requests a modification to an SOP (such as a change in reporting limit, addition or deletion of target analyte(s), etc.), the project chemist handling that project must discuss the proposed deviation with the department manager in charge of the analysis and obtain their approval to accept the project. The project chemist is responsible for documenting the approved or allowed deviation from the standard operating procedure by placing a detailed description of the deviation attached to the quotation or in the project file and also providing an appropriate comment on the service request when the samples are received.

For circumstances when a deviation or departure from company policies or procedures involving any non-technical function is found necessary, approval must be obtained from the appropriate supervisor, manager, the laboratory director, or other level of authority. Frequent departure from policy is not encouraged. However, if frequent departure from any policy is noted, the laboratory director will address the possible need for a change in policy.

10.3 Modified Procedures

CAS strives to perform published methods as described in the referenced documents. If there is a material deviation from the published method, the method is cited as a "Modified" method in the analytical report. Modifications to the published methods are listed in the standard operating procedure. Standard operating procedures are available to analysts and are also available to our clients for review, especially those for "Modified" methods. Client approval is obtained for the use of "Modified" methods prior to the performance of the analysis.

10.4 Analytical Batch

The basic unit for analytical quality control is the analytical batch. The definition that CAS has adopted for the analytical batch is listed below. The overriding principle for describing an analytical batch is that all the samples in a batch, both field samples and quality control samples, are to be handled exactly the same way, and all of the data from each analysis is to be manipulated in exactly the same manner.

The minimum requirements of an analytical batch are:

- 1) The number of (field) samples in a batch is not to exceed 20.
- 2) All (field) samples in a batch are of the same matrix.
- 3) The QC samples to be processed with the (field) samples include:
 - a) Method Blank (a.k.a. Laboratory Reagent Blank)
Function: Determination of laboratory contamination.
 - b) Laboratory Control Sample (a.k.a. Laboratory Fortified Blank)
Function: Assessment of method performance
 - c) Matrix Spiked (field) Sample (a.k.a. Laboratory Fortified Sample Matrix)
Function: Assessment of matrix problems

NOTE: A sample identified as a field blank, an equipment blank, or a trip blank is not to be matrix spiked.

d) Duplicate Matrix Spiked (field) Sample or Duplicate (field) Sample (a.k.a. Laboratory Duplicate)

Function: Assessment of batch precision

NOTE: A sample identified as a field blank, an equipment blank, or a trip blank is not to be duplicated.

- 4) A single lot of reagents is used to process the batch of samples.
- 5) Each operation within the analysis is performed by a single analyst, technician, chemist, or by a team of analysts/technicians/chemists.
- 6) The time frame is not to exceed a 24-hour period. "Open batches" extending over more than one 24 hour period are not allowed.
- 7) (Field) samples are assigned to batches commencing at the time that sample processing begins. For example: for analysis of metals, sample processing begins when the samples are digested. For analysis of organic constituents, it begins when the samples are extracted.
- 8) The QC samples are to be analyzed in conjunction with the associated field samples prepared with them. However, for tests which have a separate sample preparation step that defines a batch (digestion, extraction, etc.), the QC samples in the batch do not require analysis each time a field sample within the preparation batch is analyzed (multiple instrument sequences to analyze all field samples in the batch need not include re-analyses of the QC samples).
- 9) The batch is to be assigned a unique identification number that can be used to correlate the QC samples with the field samples.
- 10) Batch QC refers to the QC samples that are analyzed in a batch of (field) samples.
- 11) Specific project, program, or method SOP requirements may be exceptions. If project, program, or method SOP requirements are more stringent than these laboratory minimum requirements, then the project, program, or method SOP requirements will take precedence. However, if the project, program, or method SOP requirements are less stringent than these laboratory minimum requirements, these laboratory minimum requirements will take precedence.

10.5 Method Blank (a.k.a. Laboratory Reagent Blank)

The method blank is either analyte-free water or analyte-free soil (when available), subjected to the entire analytical process. When analyte-free soil is not available,

anhydrous sodium sulfate, organic-free sand, or an acceptable substitute may be used instead. The method blank is analyzed to demonstrate that the analytical system itself is not contaminated with the analyte(s) being measured. The method blank results should be below the Method Reporting Limit (MRL) or, if required for DoD projects, below half of the MRL for the analyte(s) being tested. Otherwise, corrective action must be taken. A method blank is included with the analysis of every sample preparation batch, every 20 samples, or as stated in the method, whichever is more frequent.

10.6 Calibration Blanks

For some methods, calibration blanks are prepared along with calibration standards in order to create a calibration curve. Calibration blanks are free of the analyte of interest and, where applicable, provide the zero point of the calibration curve.

10.7 Continuing Calibration Blanks

Continuing calibration blanks (CCBs) are solutions of either analyte-free water, reagent, or solvent that are analyzed in order to verify the system is contamination-free when CCV standards are analyzed. The frequency of CCB analysis is either once every ten samples or as indicated in the method, whichever is greater.

10.8 Calibration Standards

Calibration standards are solutions of known concentration prepared from primary standard solutions that are, in turn, prepared from stock standard materials. Calibration standards are used to calibrate the instrument response with respect to analyte concentration. Standards are analyzed in accordance with the requirements stated in the particular method being used.

10.9 Initial (or Independent) Calibration Verification Standards

Initial (or independent) calibration verification standards (ICVs) are standards that are analyzed *after* calibration with newly prepared standard(s) but *prior to* sample analysis, in order to verify the validity of the standards used in the calibration. Once it is determined that there is no systematic error in preparation of the calibration standard(s), they are considered valid standards and may be used for subsequent calibrations (as expiration dates and methods allow). The ICV standards are prepared from materials obtained from a source independent of that used for preparing the calibration standards. ICVs are also analyzed in accordance with method-specific requirements.

10.10 Continuing Calibration Verification Standards

Continuing calibration verification standards (CCVs) are midrange standards that are analyzed in order to verify that the calibration of the analytical system is still acceptable. The frequency of CCV analysis is either once every ten samples, or as indicated in the method.

10.11 Internal Standards

Internal standards consist of known amounts of specific compounds that are added to each sample following sample preparation or extraction. Internal standards are generally used for GC/MS and ICP-MS procedures to correct sample results that have been affected by changes in instrument conditions or changes caused by certain matrix effects. The integrated area of the internal standard compared to the continuing calibration check standard should vary by no more than the limits specified in each method.

10.12 Surrogates

Surrogates are organic compounds which are similar in chemical composition and chromatographic behavior to the analytes of interest, but which are not normally found in environmental samples. Depending on the analytical method, one or more of these compounds is added to method blanks, calibration and check standards, and samples (including duplicates, matrix spike samples, duplicate matrix spike samples and laboratory control samples) prior to extraction and analysis in order to monitor the method performance on each sample. The percent recovery is calculated for each surrogate, and the recovery is a measurement of the overall method performance. The acceptance criteria for these various analytes are listed in Appendix D, along with other data quality capabilities.

10.13 Matrix Spikes (a.k.a. Laboratory Fortified Sample Matrix)

Matrix spiked samples are aliquots of samples to which a known amount of the target analyte (or analytes) has been added. The samples are then prepared and analyzed in the same analytical batch, and in exactly the same manner as are routine samples. The stock solutions used for spiking the sample(s) are purchased and prepared independently of calibration standards. The spike recovery measures the effects of interferences caused by the sample matrix and reflects the accuracy of the method for the particular matrix in question. Spike recoveries are calculated as follows:

$$\text{Recovery (\%)} = (S - A) \times 100 \div T$$

Where: S = The observed concentration of analyte in the spiked sample,
A = The analyte concentration in the original sample, and
T = The theoretical concentration of analyte added to the spiked sample.

For the appropriate methods, matrix spiked samples are prepared and analyzed at a minimum frequency of one spiked sample (and one duplicate spiked sample, if appropriate) per twenty samples.

10.14 Laboratory Duplicates and Duplicate Matrix Spikes

Duplicates are additional replicates of samples that are subjected to the same preparation and analytical scheme as the original sample. Depending on the method of analysis, either a duplicate analysis (and/or a matrix spiked sample) or a matrix spiked sample and duplicate matrix spiked sample (MS/DMS) are analyzed. The relative percent difference between duplicate analyses or between an MS and DMS is a measure of the precision for a given method and analytical batch. The relative percent difference (RPD) for these analyses is calculated as follows:

$$\text{Relative Percent Difference (RPD)} = (S1 - S2) \times 100 \div S_{ave}$$

Where S1 and S2 = The observed concentrations of analyte in the sample and its duplicate, or in the matrix spike and its duplicate matrix spike, and

S_{ave} = The average of observed analyte concentrations in the sample and its duplicate, or in the matrix spike and its duplicate matrix spike.

Depending on the method of analysis, either duplicates (and/or matrix spikes) or MS/DMS analyses are performed at a minimum frequency of one set per 20 samples.

10.15 Laboratory Control Samples (a.k.a. Laboratory Fortified Blanks or Quality Control Samples)

The laboratory control sample (LCS) is an aliquot of analyte-free water or analyte-free soil (or anhydrous sodium sulfate or equivalent) to which known amounts of the method analyte(s) is(are) added. A standard reference material (SRM) of known matrix type, containing certified amounts of target analytes, may also be used as an LCS. The LCS sample is prepared and analyzed in the same analytical batch, and in exactly the same

manner, as the other routine samples. Stock solutions used for LCSs are purchased or prepared independently of calibration standards. The percent recovery (% REC.) of the target analytes in the LCS assists in determining whether the methodology is in control and whether the laboratory is capable of making accurate and precise measurements at the required reporting limit. Comparison of batch-to-batch LCS analyses enables the laboratory to evaluate batch-to-batch precision and accuracy. Acceptance criteria for LCS analyses are obtained through the use of control charts. An LCS is prepared and analyzed at a minimum frequency of one LCS per 20 samples, with every analytical batch or as stated in the method, whichever is more frequent.

If an insufficient quantity of sample is available to perform a laboratory duplicate or duplicate matrix spikes, duplicate LCSs will be prepared and analyzed.

10.16 Interference Check Samples

An interference check sample (ICS) is a solution containing both interfering and analyte elements of known concentration that can be analyzed to verify background and interelement correction factors in metals analyses. The ICS is prepared to contain known concentrations of interfering elements that will provide an adequate test of the correction factors. The ICS is spiked with the elements of interest at concentrations of approximately ten times the instrument detection limits. The ICS is analyzed at the beginning and end of an analytical run or every eight hours, whichever is more frequent, and the results must be within $\pm 20\%$ of the true values.

10.17 Post Digestion Spikes

Post digestion spikes are samples prepared for metals analyses that have an analyte spike added to determine if matrix effects may be a factor in the results. The spike addition should produce a method-specified minimum concentration above the instrument detection limit. A post digestion spike is analyzed with each batch of samples and recovery criteria are specified for each method.

10.18 Source and Preparation of Standard Reference Materials

All analytical measurements generated at CAS are performed using materials and/or processes that are traceable to a reference material. Metrology equipment (analytical balances, thermometers, etc.) is calibrated using reference materials traceable to the National Institute of Standards and Technology (NIST). These primary reference materials are themselves recertified on an annual basis. All sampling containers provided to the client by the laboratory are purchased as precleaned (Level 1) containers, with certificates of analysis available for each bottle type. This information is provided to the client when requested.

Consumable reference materials routinely purchased by the laboratories (e.g., analytical standards) are purchased from nationally recognized, reputable vendors. All vendors have fulfilled the requirements for ISO 9001 certification and/or are accredited by A₂LA. CAS relies on a primary vendor for the majority of its analytical supplies. In addition, consumable primary stock standards are obtained from certified commercial sources or from sources referenced in a specific method. Supelco, Ultra Scientific, AccuStandard, Chem Services, Inc., Aldrich Chemical Co., Baker, Spex, E. M. Science, etc. are examples of the vendors used by CAS. All reference materials that are received at CAS are recorded by the technical staff in the appropriate logbook(s) and are stored under conditions that provide maximum protection against deterioration and contamination. The logbook entry includes such information as an assigned logbook identification code, the source of the material (i.e. vendor identification), solvent (if applicable) and concentration of analyte(s), reference to the certificate of analysis and an assigned expiration date. In addition, the date that the standard is received in the laboratory is marked on the container. When the reference material is used for the first time, the date of usage and the initials of the analyst are also recorded on the container.

Stock solutions and/or calibration standard solutions are prepared fresh as often as necessary according to their stability. After preparation, all standard solutions are properly labeled as to analyte concentration, solvent, date, preparer, and expiration date; these entries are also recorded in the appropriate notebook(s) following the *SOP for Making Entries into Logbooks and onto Benchsheets* (SOP No. ADM-DATANTRY). Prior to introduction into the analytical system/process, all reference materials are verified with a second, independent source of the material (see section 10.9 above). Once the reference material has been verified to be accurate, it may then be used for instrument calibration and subsequent quantitative purposes. In addition, the independent source of reference material is also used to check the calibration standards for signs of deterioration.

10.19 Control Charting

The generation of control charts is routinely performed at CAS. Surrogate, Matrix Spike and LCS recoveries are all monitored and charted. In addition, the laboratory also monitors the Relative Percent Difference (RPD) measurement of precision. Control charts are available to each individual laboratory unit to monitor the data generated in its facility using control charts that have been programmed to identify various trends in the analytical results. If trends in the data are perceived, various means of corrective action may then be employed in order to prevent future problems with the analytical system(s). Finally, data quality reports using control charts are generated for specific clients and projects pursuant to contract requirements. The control charting procedure is described in the *SOP for Control Charting Quality Control Data* (ADM-CHRT).

10.20 Glassware Washing

Glassware washing and maintenance play a crucial role in the daily operation of a laboratory. The glassware used at CAS undergoes a rigorous cleansing procedure prior to every usage. A number of SOPs have been generated that outline the various procedures used at CAS; each is specific to the end-use of the equipment as well as to the overall analytical requirements of the project. In addition, other equipment that may be routinely used at the laboratory is also cleaned following instructions in the appropriate SOP.

11.0 CALIBRATION PROCEDURES AND FREQUENCY

All equipment and instruments used at CAS are operated, maintained and calibrated according to the manufacturer's guidelines and recommendations, as well as to criteria set forth in the applicable analytical methodology. Operation and calibration are performed by personnel who have been properly trained in these procedures. Documentation of calibration information is maintained in appropriate reference files. Brief descriptions of the calibration procedures for our major laboratory equipment and instruments are described below. Records are maintained to provide traceability of reference materials.

Any item of the equipment which has been subjected to overloading or mishandling, or has been shown by verification or otherwise to be defective; is taken out of service until it has been repaired. The equipment is placed back in service only after verifying by calibration that the equipment performs satisfactorily. An evaluation of the effect of this defect on previous calibrations or tests is made and documented appropriately.

Calibration verification is performed according to in the applicable analytical methodology. Calibration verification procedures and criteria are listed in laboratory Standard Operating Procedures. Documentation of calibration verification is maintained in appropriate reference files. For NELAP accredited methods, the concentration of calibration verification standards are varied within the calibration range periodically.

11.1 Temperature Control Devices

Temperatures are monitored and recorded for all of the temperature-regulating support equipment such as sample refrigerators, freezers, and standards refrigerators. Bound record books are kept which contain daily-recorded temperatures, identification and location of equipment, acceptance criteria and the initials of the technician who performed the checks. The procedure for performing these measurements is provided in the *SOP for Support Equipment Monitoring and Calibration (SOP ADM-SEMC)*. The SOP also includes the use of acceptance criteria and correction factors.

Where the operating temperature is specified as a test condition (such as ovens, incubators, evaporators) the temperature is recorded on the raw data. All thermometers are identified according to serial number, and the calibration of these thermometers is checked annually against a National Institute of Standards and Technology (NIST) certified thermometer. The NIST thermometer is recertified by a professional metrology organization on an annual basis.

11.2 Analytical Balances

Analytical balances are serviced on a semi-annual basis by a professional metrology organization. New certificates of calibration for each balance are issued to the laboratory on a semi-annual basis. The calibration of each analytical balance is checked daily with three class S or S-1 weights, which assess the accuracy of the balance at low, mid-level and high levels within the working range. The weights are recertified using NIST traceable standards by a professional metrology organization on an annual basis.

As needed, the balances are recalibrated using the manufacturers recommended operating procedures. Bound record books are kept which contain the recorded measurements, identification and location of equipment, acceptance criteria and the initials of the technician who performed the checks. The procedure for performing these measurements and use of acceptance criteria is described in the SOP ADM-SEMC.

11.3 Water Purification System

The water purification system used at CAS is designed to produce deionized water of 18 megohms resistivity or better, meeting specifications for Type I water, as described in *Standard Methods for the Examination of Water and Wastewater (SM1080)*. The system is monitored continuously with an on-line meter, which is recorded daily in a bound record book. Deionizers are rotated and replaced when the first unit in the series produces water of 0.5 megohms, which is monitored by a light on the unit. The status of the deionizers is also checked (resistivity reading and light status) and recorded daily in a bound record book. Activated carbon filters are also in series with the demineralizers to produce "organic-free" water. Finally, the water is checked at a point downstream of the original source - typically a spigot in one of the laboratory operating units. This information is also recorded on a weekly basis.

11.4 Inductively Coupled Plasma-Atomic Emission Spectrograph (ICP-AES)

Each emission line on the ICP is calibrated daily against a blank and against standards. Analyses of calibration standards, initial and continuing calibration verification standards, and inter-element interference check samples are carried out as specified in the EPA CLP Statement of Work for Inorganic Analysis, SOW No ILM04.0.

11.5 Inductively Coupled Plasma-Mass Spectrometer (ICP-MS)

Each element of interest is calibrated for using a blank and a single standard. Prior to calibration, a short-term stability check is performed on the system. Following calibration, an independent check standard is analyzed, and a continuing calibration verification standard (CCV) is analyzed with every ten samples.

11.6 Atomic Absorption Spectrophotometers (AAS)

These instruments are calibrated daily using a minimum of four standards and a blank. Calibration is validated using reference standards, and is verified at a minimum frequency of once every ten samples. Initial calibration points cannot be “dropped” from the resulting calibration curve.

11.7 GC/MS Systems

All GC/MS instruments are calibrated at a minimum of five different concentration levels for the analytes of interest (unless specified otherwise) using procedures outlined in Standard Operating Procedures and/or appropriate USEPA method citations. All reference materials used for this function are vendor-certified standards. Calibration verification is performed at method-specified intervals following the procedures in the SOP and reference method. Compounds selected as system performance check compounds (SPCCs) must show a method-specified response factor in order for the calibration to be considered valid. Calibration check compounds (CCCs) must also meet method specifications for percent difference from the multipoint calibration. For isotope dilution procedures, the internal standard response(s) and labeled compound recovery must meet method criteria. Method-specific instrument tuning is regularly checked using bromofluorobenzene (BFB) for volatile organic chemical (VOC) analysis, or decafluorotriphenylphosphine (DFTPP) for semi-volatile analysis. Mass spectral peaks for the tuning compounds must conform both in mass numbers and in relative intensity criteria before analyses can proceed. Calibration policies for organics chromatographic analyses are described in the *SOP for Calibration of Instruments for Organics Chromatographic Analyses (SOP SOC-CAL)*.

11.8 Gas Chromatographs and High Performance Liquid Chromatographs

Calibration and standardization follow SOP guidelines and/or appropriate USEPA method citations. All GC and HPLC instruments are calibrated at a minimum of five different concentration levels for the analytes of interest (unless specified otherwise). The lowest standard is equivalent to the method reporting limit; additional standards define the working range of the GC or LC detector. Results are used to establish response factors (or calibration curves) and retention-time windows for each analyte. Calibration is verified at a minimum frequency of once every ten samples, unless otherwise specified by the reference method. *SOP for Calibration of Instruments for Organics Chromatographic Analyses (SOP SOC-CAL)*.

11.9 UV-Visible Spectrophotometer (manual colorimetric analyses)

Routine calibrations for colorimetric and turbidimetric analyses involve generating a 5-point calibration curve including a blank. Initial calibration points cannot be “dropped” from the resulting calibration curve. Correlation coefficients must meet method or SOP specifications before analysis can proceed. Independent calibration verification standards (ICVs) are analyzed with each batch of samples. Continuing calibration is verified at a minimum frequency of once every ten samples. Typical UV-Visible spectrophotometric methods at CAS include total phenolics, phosphates, surfactants and tannin-lignin.

11.10 Flow Injection Analyzer (automated colorimetric analysis)

A minimum of three standards and a blank are used to calibrate the instrument for cyanide analysis. A blank and (minimum of) five standards are used to calibrate the instrument for all other automated chemistries. Initial calibration points cannot be “dropped” from the resulting calibration curve. Standard CAS acceptance limits are used to evaluate the calibration curve prior to sample analysis.

11.11 Ion Chromatographs

Calibration of the ion chromatograph (IC) involves generating a 5-point calibration curve. Initial calibration points cannot be “dropped” from the resulting calibration curve. A correlation coefficient of ≥ 0.995 for the curve is required before analysis can proceed. Quality Control (QC) samples that are routinely analyzed include blanks and laboratory control samples. The target analytes typically determined by the IC include nitrate, nitrite, chloride, fluoride, sulfate and bromide. Calibration verification is performed at method-specified intervals following the procedures in the SOP and reference method.

11.12 Turbidimeter

Calibration of the turbidimeter requires analysis of three Nephelometric Turbidity Unit (NTU) formazin standards. Quality Control samples that are routinely analyzed include blanks, Analytical Products Group® QC samples (or equivalent) and duplicates.

11.13 Ion-selective electrode

Two standards are used to calibrate the electrodes before analysis. The slope of the curve must be within acceptance limits before analysis can proceed. Quality Control samples that are routinely analyzed include blanks, LCSs and duplicates.

11.14 Pipets

The calibration of pipets and autopipettors used to make critical-volume measurements is verified following the *SOP for Checking Pipet Calibration*. Both accuracy and precision verifications are performed, at intervals applicable to the pipet and use. The results of all calibration verifications are recorded in bound logbooks.

11.15 Other Instruments

Calibration for the total organic carbon (TOC), total organic halogen (TOX), and other instruments is performed following manufacturer's recommendations and applicable SOPs.

12.0 DATA REDUCTION, VALIDATION, AND REPORTING

CAS reports the analytical data produced in its laboratories to the client via the certified analytical report (CAR). This report includes a transmittal letter, a case narrative, client project information, specific test results, quality control data, chain of custody information, and any other project-specific support documentation. The following procedures describe our data reduction, validation and reporting procedures.

12.1 Data Reduction and Review

Results are generated by the analyst who performs the analysis and works up the data. All data is initially reviewed and processed by analysts using appropriate methods (e.g., chromatographic software, instrument printouts, hand calculation, etc.). Equations used for calculation of results are found in the applicable analytical SOPs. The resulting data set is either manually entered (e.g., titrimetric or microbiological data) into an electronic report form or is electronically transferred into the report from the software used to process the original data set (e.g., chromatographic software). Once the complete data set has been transferred into the proper electronic report form(s), it is then printed. The resulting hardcopy version of the electronic report is then reviewed by the analyst for accuracy. Once the primary analyst has checked the data for accuracy and acceptability, the hardcopy version of the data is forwarded to the supervisor or second qualified analyst, who reviews the data for errors. Where calculations are not performed a validated software system, the reviewer rechecks a minimum of 10% of the calculations. When the entire data set has been found to be acceptable, a final copy of the report is printed and signed by the laboratory supervisor, departmental manager or senior laboratory staff. The entire data package is then placed into the appropriate service request file, and an electronic copy of the final data package is forwarded to the appropriate personnel for archival. Data review procedures are described in the *SOP for Laboratory Data Review Process*.

Policies and procedures for manual editing of data are established. The analyst making the change must initial and date the edited data entry, without obliteration of the original entry. The policies and procedures are described in the *SOP for Making Entries Into Logbooks and Onto Benchsheets* (SOP ADM-DATANTRY).

Policies and procedures for electronic manual integration of chromatographic data are established. The analyst performing the integration must document the integration change by printing both the "before" and "after" integrations and including them in the raw data records. The policies and procedures are described in the *SOP for Manual Integration of Chromatographic Peaks* (SOP ADM-INT).

12.2 Confirmation Analysis

12.2.1 Gas Chromatographic and Liquid Chromatographic Analyses

For gas chromatographic (GC) and liquid chromatographic (LC) analyses, all positive results are confirmed by a second column, a second detector, a second wavelength (HPLC/UV), or by GC/MS analysis, unless exempted by one of the following situations:

- The analyte of interest produces a chromatogram containing multiple peaks exhibiting a characteristic pattern, which matches appropriate standards. This includes polychlorinated biphenyls and hydrocarbon fuels (e.g., gasoline and diesel).
- The sample is analyzed for benzene, toluene, ethylbenzene, xylenes, and naphthalene (BTEXN), and the sample is found, by a separate analysis, to contain gasoline. In a sample containing no gasoline, the presence of BTEXN compounds will be confirmed.
- The sample meets all of the following requirements:
 1. All samples (liquid or solid) come from the same source (e.g., groundwater samples from the same well) for continuous monitoring. Samples of the same matrix from the same site, but from different sources (e.g., different sampling locations) are not exempt.
 2. All analytes have been previously analyzed in sample(s) from the same source (within the last year), identified and confirmed by a second column or by GC/MS. The chromatogram is largely unchanged from the one for which confirmation was carried out. The documents indicating previous confirmation must be available for review.

12.2.2 Confirmation Data

Confirmation data will be provided as specified in the method. Identification criteria for GC, LC or GC/MS methods are summarized below:

- GC and LC Methods
 1. The analyte must fall within plus or minus three times the standard deviation (established for the analyte/column) of the retention time of the daily midpoint standard in order to be qualitatively identified. The retention-time windows will be established and documented, as specified in the appropriate Standard Operating Procedure (SOP).

2. When sample results are confirmed by two dissimilar columns or detectors, the agreement between quantitative results must be evaluated. The relative percent difference between the two results is calculated and evaluated against SOP and/or method criteria.
- GC/MS Methods - Two criteria are used to verify identification:
 1. Elution of the analyte in the sample will occur at the same relative retention time (RRT) as that of the analyte in the standard.
 2. The mass spectrum of the analyte in the sample must, in the opinion of a qualified analyst or the department manager, correspond to the spectrum of the analyte in the standard or the current GC/MS reference library.

12.3 Data Review and Validation

The integrity of the data generated in the laboratory is assessed through the evaluation of the results of the analysis of method blanks, laboratory control samples, sample duplicates, matrix spiked samples, QC samples, trip blanks, et al. The numerical criteria for evaluation of these QC samples are listed within each method-specific Standard Operating Procedure. These various QC sample analyses are evaluated using the flow diagrams found in Figures 12-1 through 12-9. Other validation measures of the data include a check of the linearity of the calibration curve, an accuracy check of the QC standards and a check of the system sensitivity. Data transcriptions and calculations are also reviewed.

12.4 Data Reporting

When an analyst determines that a data package has met the data quality objectives (and/or any client-specific data quality objectives) of the method and has qualified any anomalies in a clear, acceptable fashion, the data package is reviewed by a trained chemist. Prior to release of the report to the client, the project chemist reviews and approves the entire report for completeness and to ensure that any and all client-specified objectives were successfully achieved. The original raw data, along with a copy of the final report, is filed in project files by service request number for archiving. CAS maintains control of analytical results by adhering to standard operating procedures and by observing sample custody requirements. All data are calculated and reported in units consistent with project specifications, to enable easy comparison of data from report to report.

To the extent possible, samples shall be reported only if all quality control measures are acceptable. If a quality control measure is found to be out of control, and the data is to be reported, all samples associated with the failed quality control measure shall be reported with the appropriate data qualifier(s). The *SOP for Data Reporting and*

Report Generation addresses the flagging and qualification of data. The CAS-defined data qualifiers, state-specific data qualifiers, or project-defined data qualifiers are used depending on project requirements. A case narrative may be written by the project chemist to explain any unusual problems with a specific analysis or sample, etc.

For subcontracted analyses, the Project Chemist verifies that the report received from the subcontractor is complete. Verification includes checking that the correct analyses were performed, the analyses were performed for each sample as requested, a report is provided for each analysis, and the report is signed. The Project Chemist accepts the report if all verification items are complete. Acceptance is demonstrated by forwarding the report to the CAS client.

12.5 Documentation

CAS maintains a records system which ensures that all laboratory records of analysis data retained and available. Analysis data is retained for 5 years from the report date unless contractual terms specify a longer retention time. The archiving system is described in the *SOP for Data Archiving*.

12.5.1 Documentation and Archiving of Routine Analysis Data

The archiving system includes all of the following items for each set of analyses performed:

- Benchsheets describing sample preparation (if appropriate);
- Instrument parameters;
- Sample analysis sequence;
- Analysis benchsheets and instrument printouts;
- Chromatograms and peak integration reports for all samples, standards, blanks, spikes and reruns;
- Logbook ID number for the appropriate standards;
- Copies of report sheets submitted to the work request file; and
- Copies of Nonconformity and Corrective Action Reports, if necessary.

Individual sets of analyses are identified by analysis date and service request number. Since many analyses are performed with computer-based data systems, the final sample concentrations can be automatically calculated. If additional calculations are needed, they are written on the integration report or securely stapled to the chromatogram, if done on a separate sheet.

12.5.2 Documentation of QC and Data

To summarize the recovery data for surrogates and matrix spikes, a separate documentation system has been established. The results are segregated according to the sample matrix. Additional information is included, indicating

those results affected by matrix interferences, etc. Surrogate and matrix spike acceptance limits are listed in Appendix D. This system also includes results for the most recent calibration curves, as well as method validation results.

12.6 Deliverables

In order to meet individual project needs, CAS provides several levels of analytical reports. Basic specifications for each level of deliverable are described in Table 12-1. Variations may be provided based on client or project specifications. This includes (but is not limited to) the following specialized deliverables:

- ADEC – Alaska Department of Conservation specified data package
- ACOE/HTRW – Army Corps of Engineers HTRW specified data package and reporting requirements
- AFCEE – Air Force Center for Environmental Excellence project-specific reporting

When requested, CAS provides Electronic Data Deliverables (EDDs) in the format specified by client need or project specification. The EDD is prepared by report production staff using the electronic version of the laboratory report to minimize transcription errors. User guides and EDD specification outlines are used in preparing the EDD. The EDD is reviewed and compared to the hard-copy report for accuracy.

Figure 12-1
Evaluation of Method Calibration

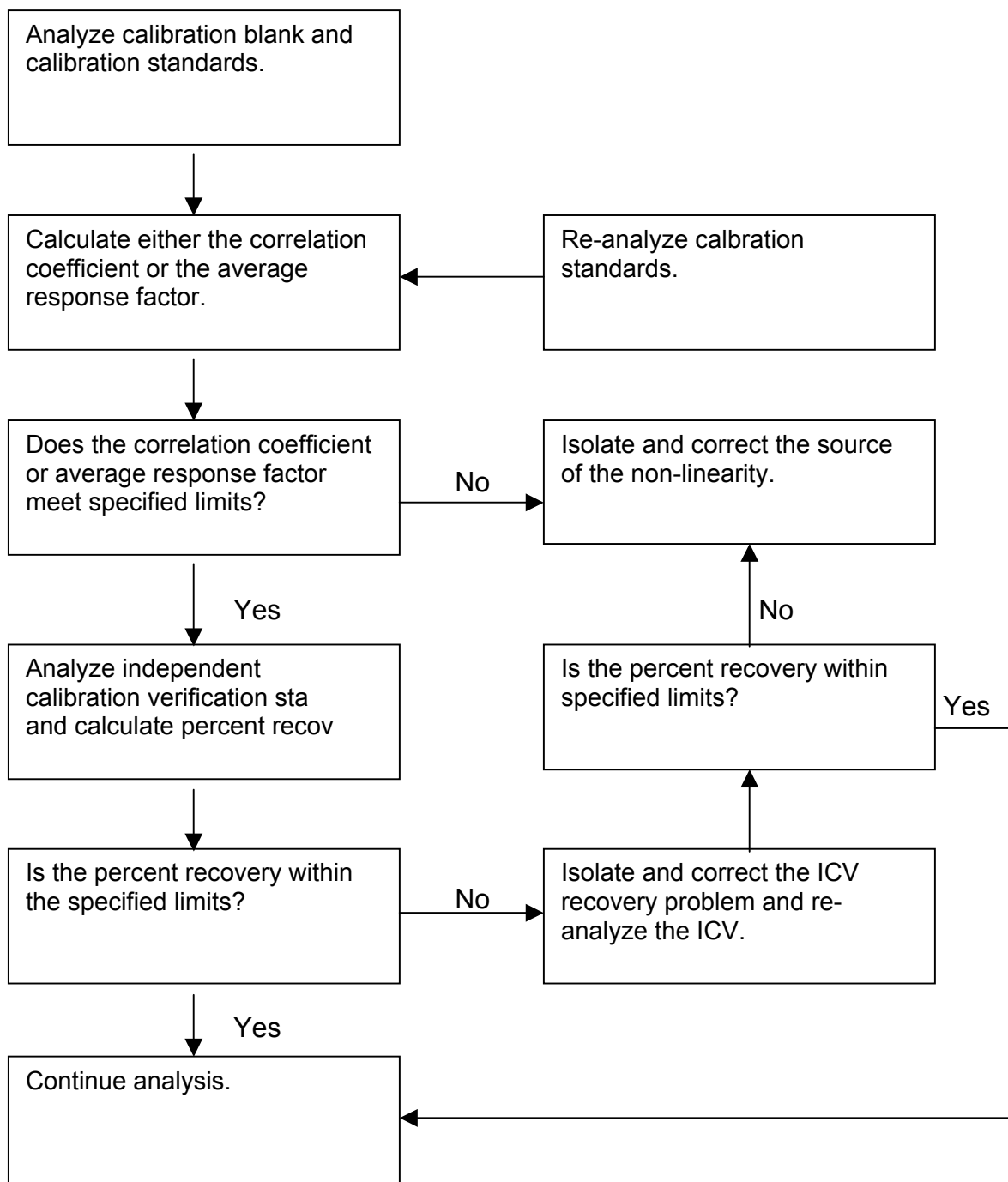


Figure 12-2
Evaluation of Continuing Calibration

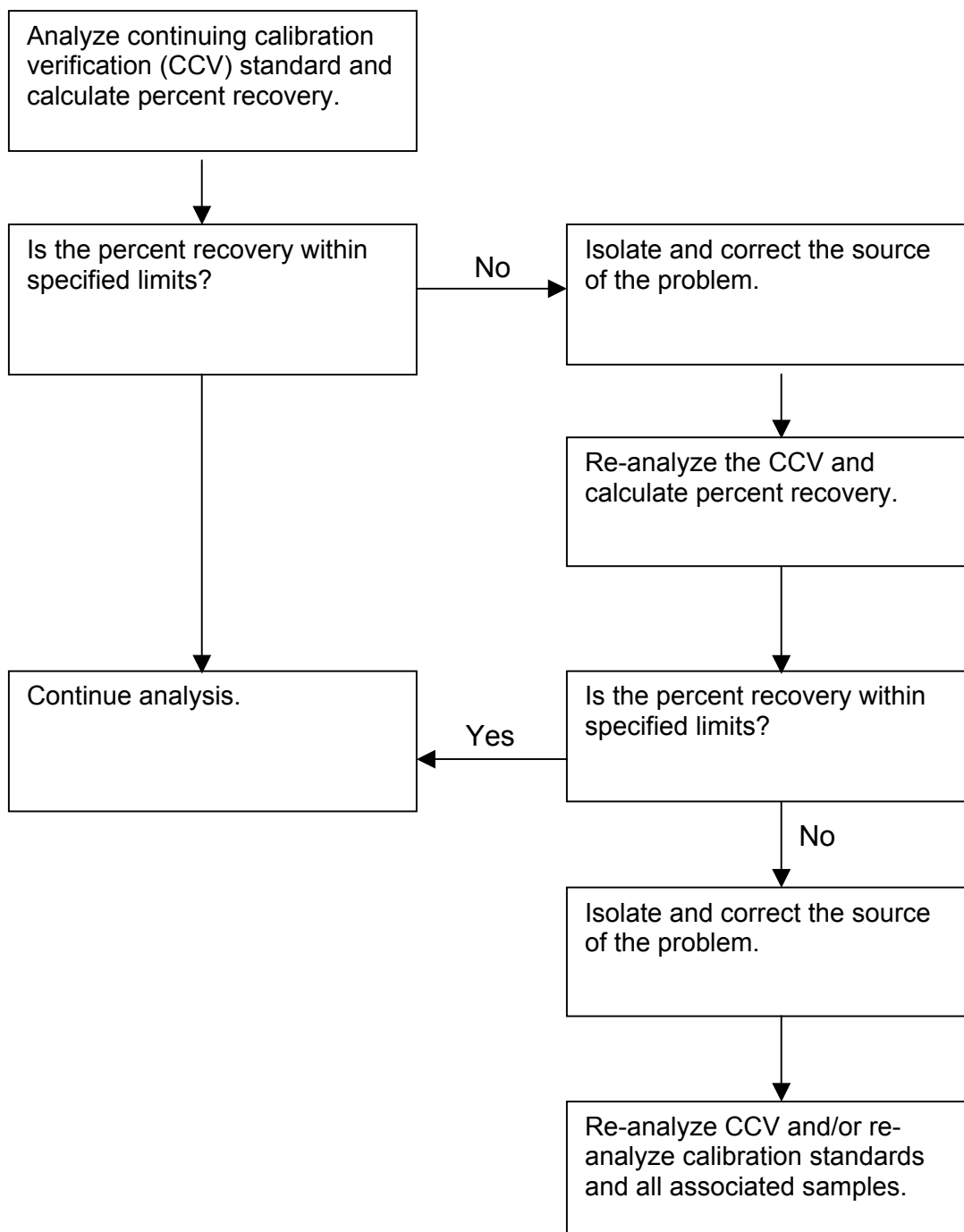


Figure 12-3
Evaluation of Method Blank and Instrument Blank Results

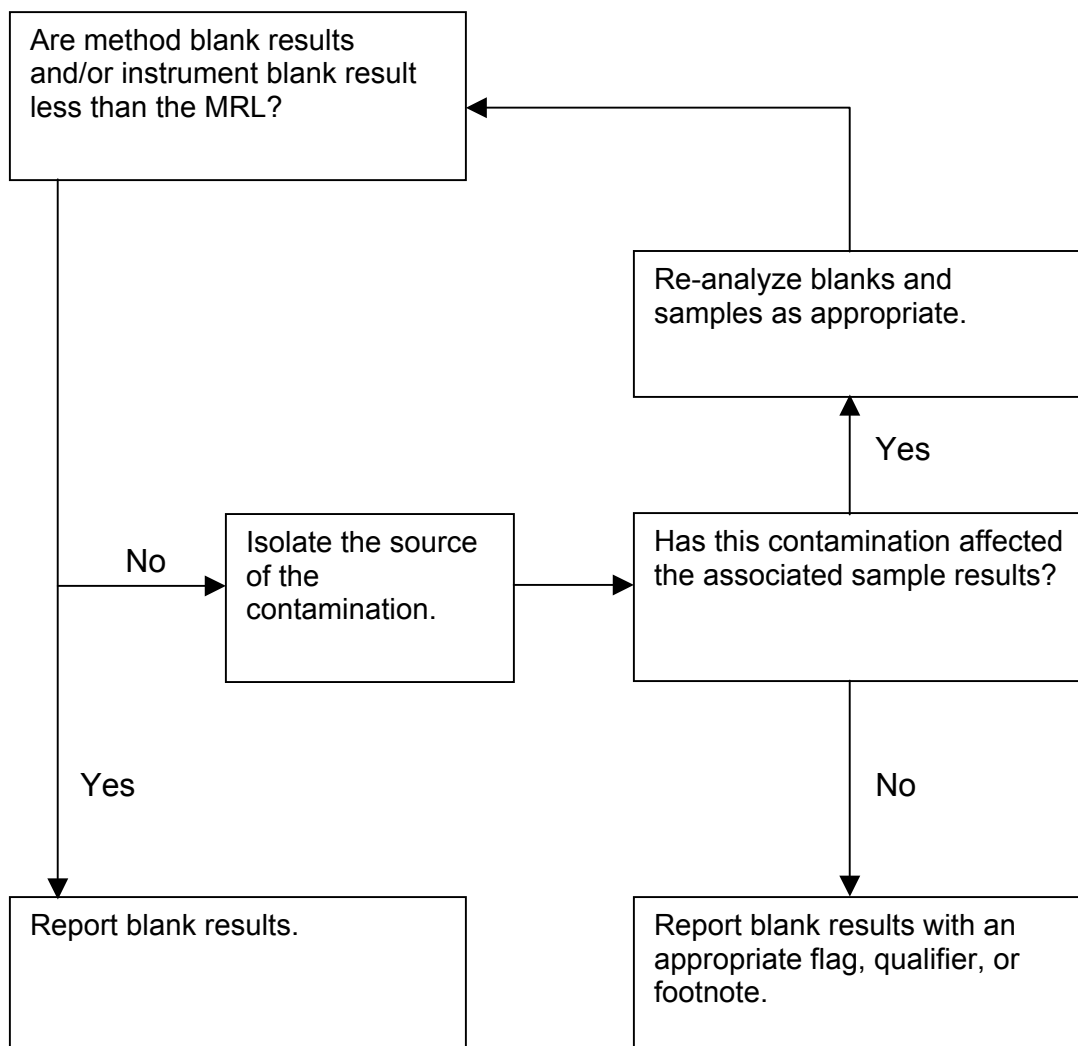


Figure 12-4
Evaluation of Sample Results for Inorganic Analyses

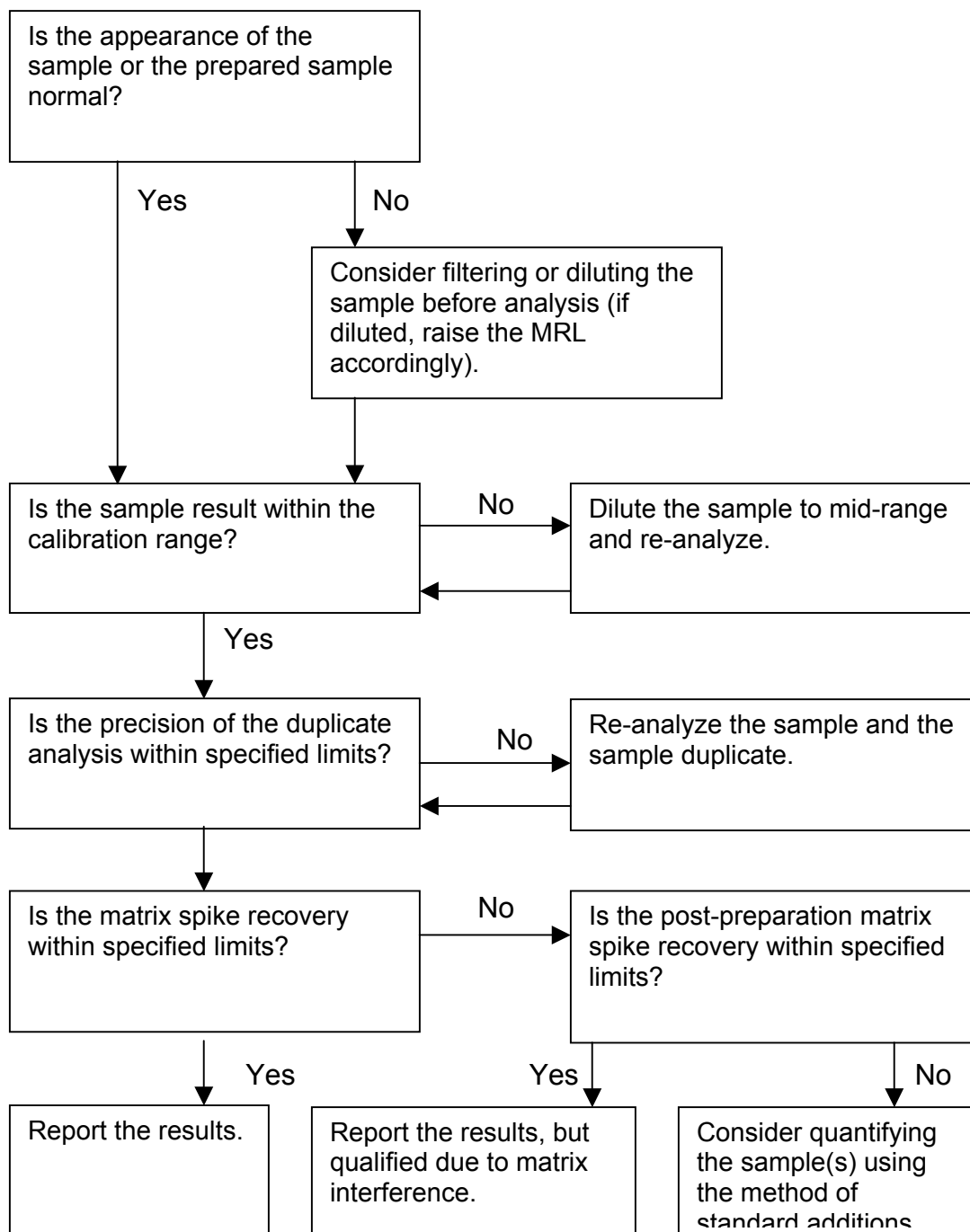


Figure 12-5
Evaluation of Sample Results for Organic Analyses

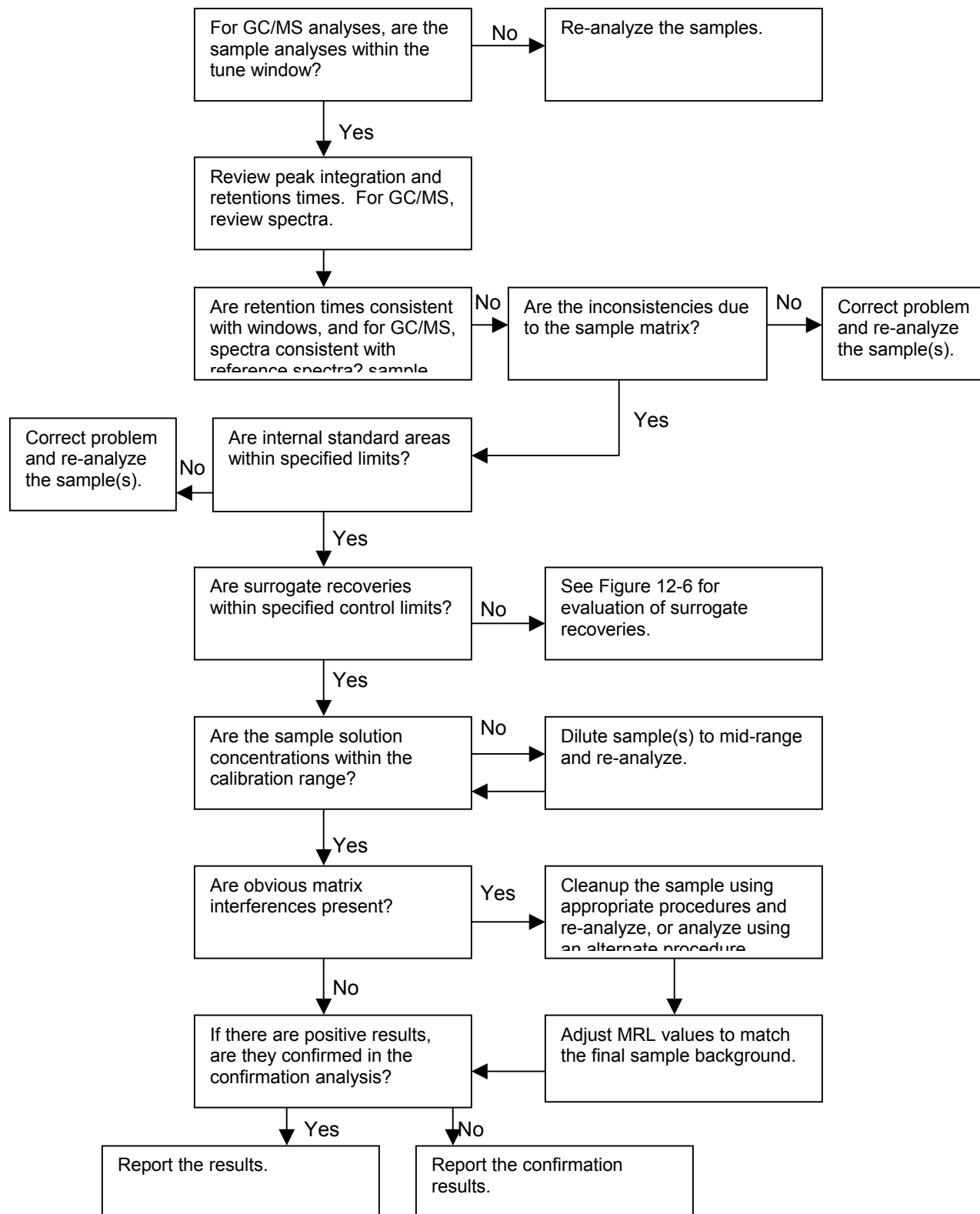


Figure 12-6
Evaluation of Surrogate Compound Recoveries

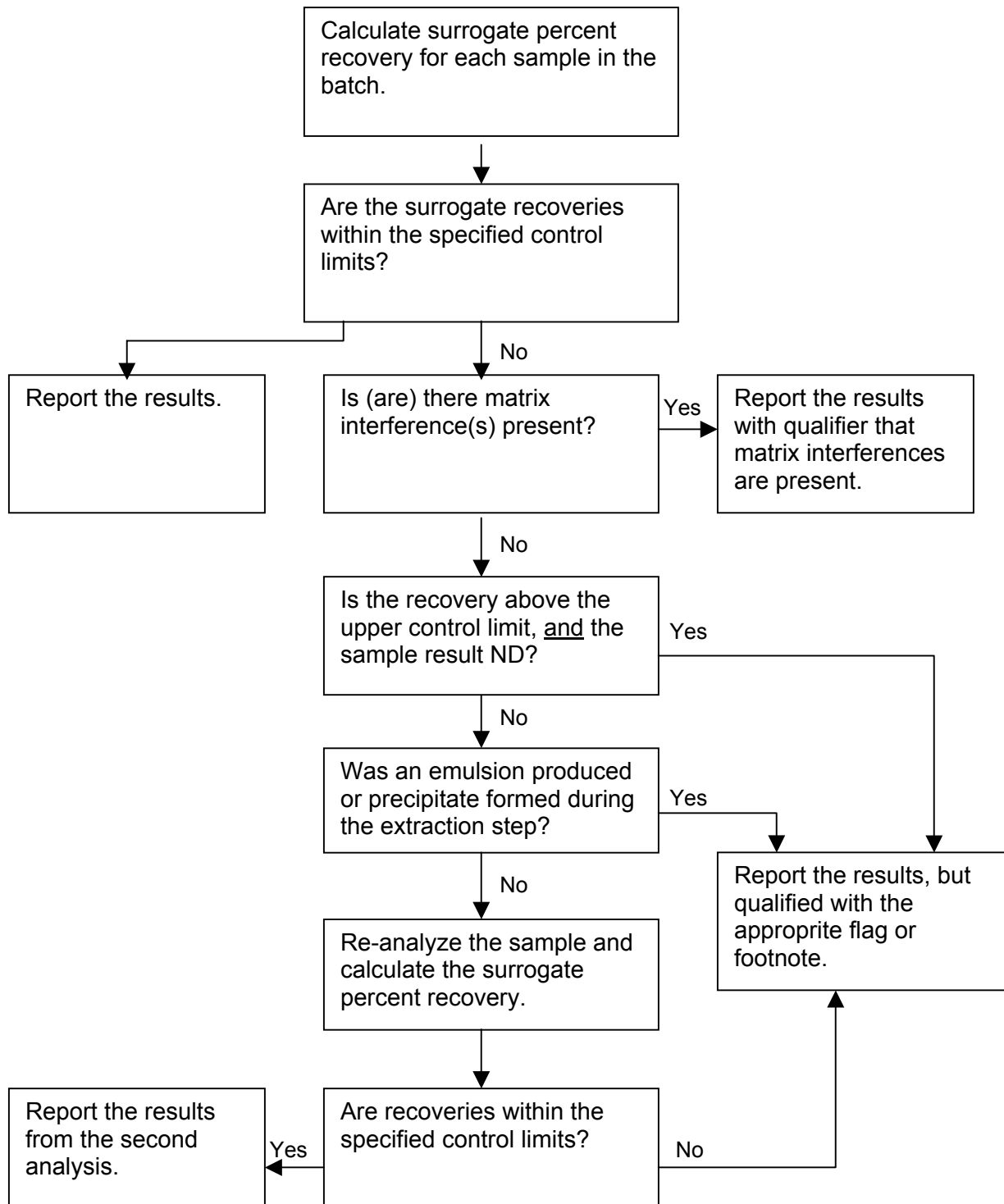


Figure 12-7
Evaluation of Duplicate Sample and/or Duplicate Matrix Spike Results

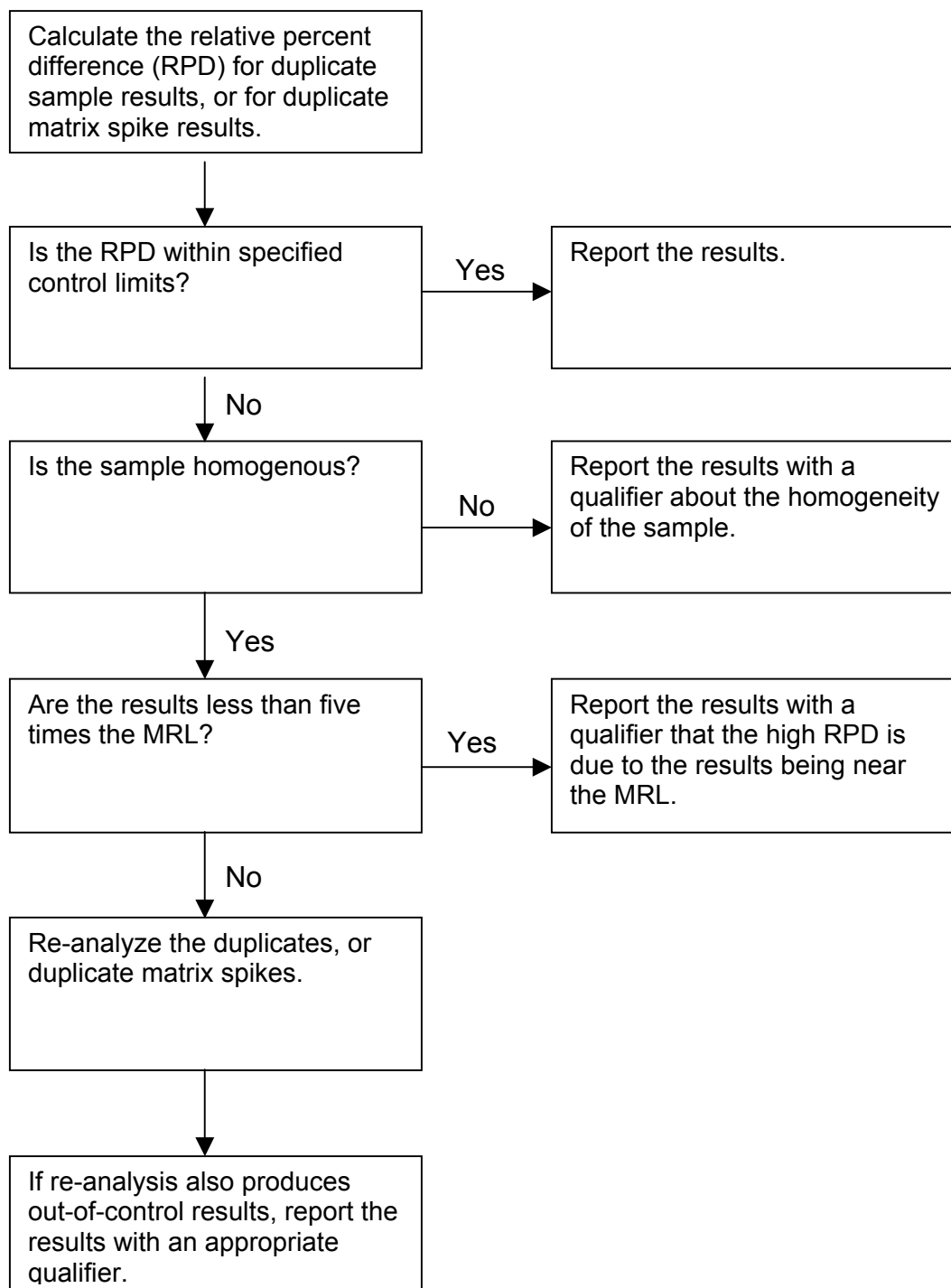


Figure 12-8
Evaluation of Matrix Spike Recoveries

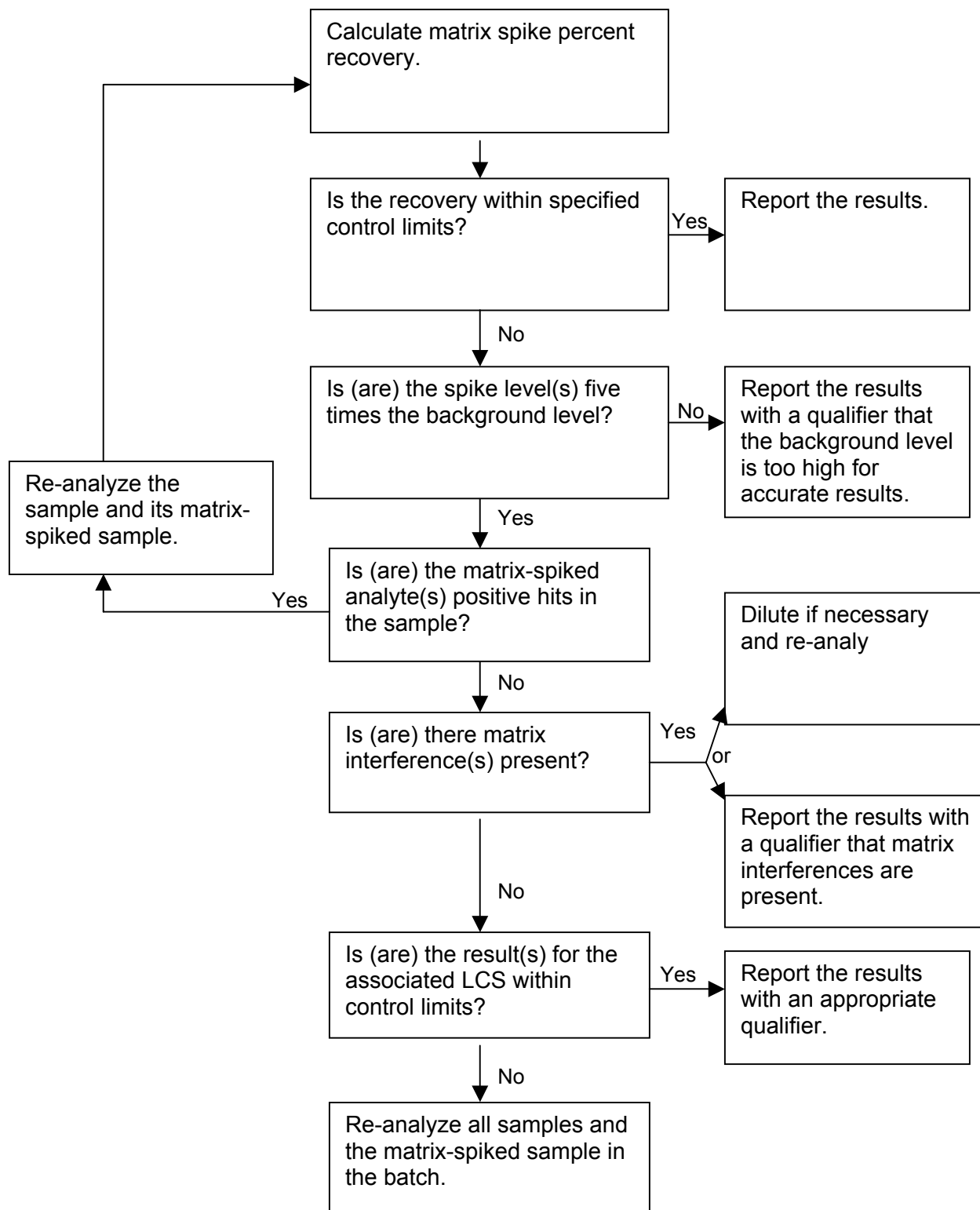


Figure 12-9
Evaluation of Laboratory Control Sample (LCS) Results

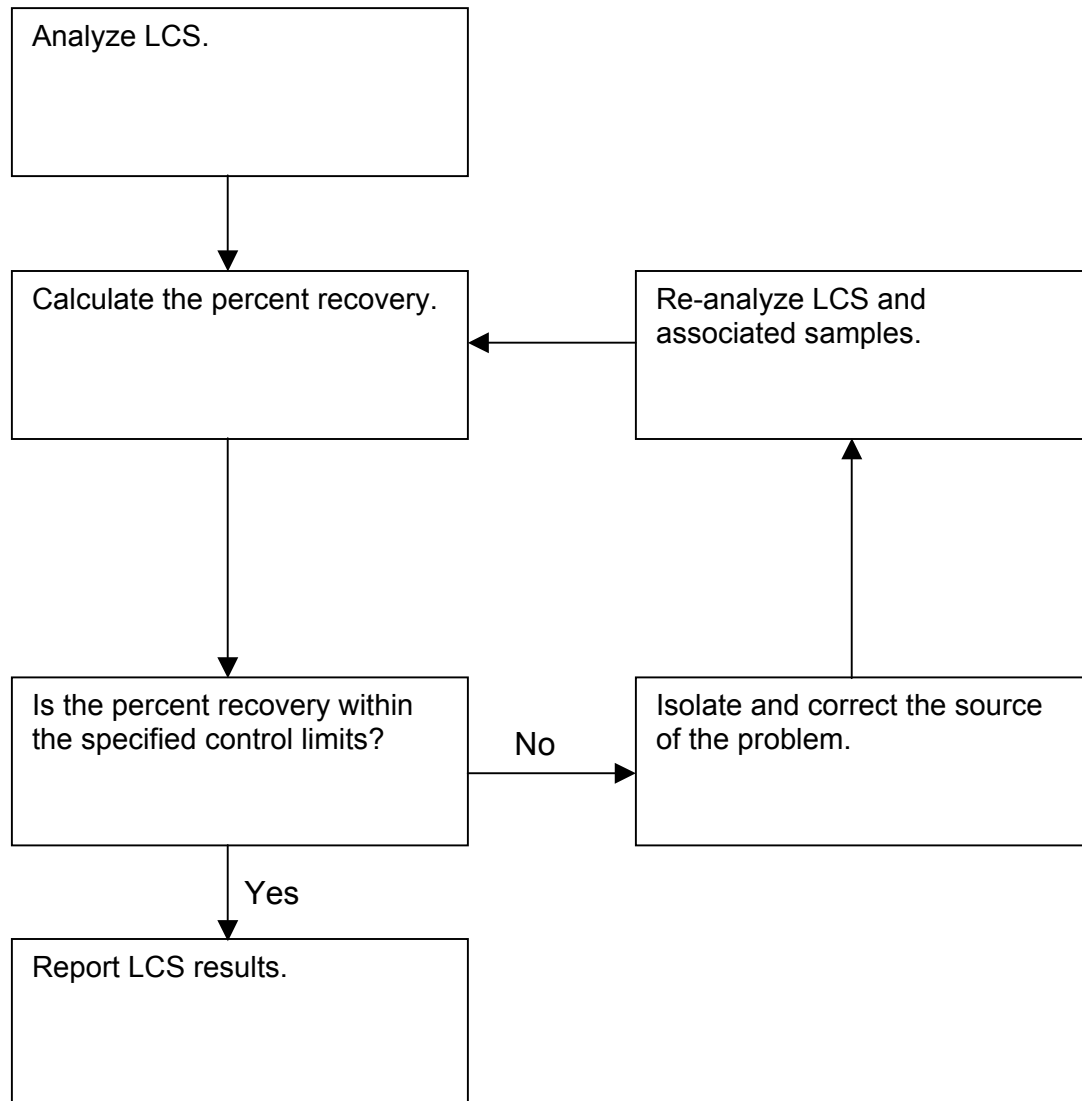


Table 12-1
Descriptions of CAS Data Deliverables

Tier I. Routine Certified Analytical Report (CAR) includes the following:

1. Transmittal letter
2. Sample analytical results
3. Method blank results
4. Surrogate recovery results and acceptance criteria for applicable organic methods
5. Chain of custody documents
6. Dates of sample preparation and analysis for all tests

Tier II and IIA. In addition to the Tier I Deliverables, this CAR includes the following:

1. Matrix spike result(s) with calculated recovery and including associated acceptance criteria
2. Duplicate or duplicate matrix spike result(s) (as appropriate to method), with calculated relative percent difference
3. Tier IIA also includes Laboratory Control Sample (LCS) result(s) with calculated recovery and including associated acceptance criteria

Tier III. Data Validation Package. In addition to the Tier II Deliverables, this CAR includes the following:

1. Case narrative
2. Calibration records and results of initial and continuing calibration verification standards, with calculated recoveries
3. Results of laboratory control sample (LCS) or Quality Control check sample, with calculated recovery and/or associated acceptance limit criteria
4. Results of calibration blanks or solvent blanks (as appropriate to method)
5. Summary forms for associated QC and calibration parameters
6. Copies of all raw data, including extraction/preparation bench sheets, chromatograms, and instrument printouts. For GC/MS, this includes tuning criteria and mass spectra of all positive hits. Results and spectra of TIC compounds will be included upon request.

Tier IV. CLP-Level Data Validation Package.

A complete Data Validation Package containing all sample results, quality control and calibration results, and raw data necessary to fulfill all deliverable requirements of an EPA Contract Laboratory Program (CLP) data package.

13.0 PERFORMANCE AND SYSTEM AUDITS

Quality audits are an essential part of CAS/Kelso's quality assurance program. There are two types of audits used at the facility: System Audits are conducted to qualitatively evaluate the operational details of the QA program, while Performance Audits are conducted by analyzing performance evaluation samples in order to quantitatively evaluate the outputs of the various measurement systems.

13.1 System Audits

The system audit examines the presence and appropriateness of laboratory systems. External system audits of CAS/Kelso are conducted regularly by various regulatory agencies and clients. Table 13-1 summarizes some of the major programs in which CAS/Kelso participates. Programs and certifications are added as required. Additionally, internal system audits of CAS/Kelso are conducted regularly by the Quality Assurance Manager and by the CAS Quality Assurance Director. The internal audit procedures are described in the *SOP for Internal Audits*. The internal audits are performed as follows:

- Comprehensive lab-wide system audit – performed annually by the QA Director.
- Focused systems audits – performed twice quarterly by the QA Manager.
- Hardcopy data audits – minimum of 3 per quarter.
- Electronic data audits – minimum of 3 per quarter.

The results of each audit are reported to the Laboratory Director for review and comment. All audit and review findings, and corrective actions are documented. Any deficiencies noted by the auditor are summarized in an audit report and corrective action is identified within a specified length of time to correct each deficiency. Should problems impacting data quality be found during an internal audit, any client whose data is adversely impacted will be given written notification if not already provided.

Electronic data audits may be performed in conjunction with hardcopy data audits. The electronic audits focus on organic chromatographic data and include an examination of audit trails, peak integrations, calibration practices and files, GCMS tuning data, peak response data, use of appropriate files, and other components of the analysis. The audit also verifies that the electronic data supports the hardcopy reported data.

13.2 Performance Audits

CAS/Kelso also participates in the analysis of interlaboratory proficiency testing (PT) samples. Participation in PT studies is performed on a regular basis and is designed to evaluate all analytical areas of the laboratory. CAS routinely participates in the following studies:

- Water Pollution (WP) and additional water parameters, 2 per year.
- Water Supply (WS) PT studies, 2 per year.
- Hazardous Waste/Soil PT studies, 2 per year.
- Underground Storage Tank PT studies, 2 per year.
- Microbiology (WS and WP) PT studies, 2 per year.
- Other studies as required for specific certifications, accreditations, or validations.

PT samples are processed by entering them into the LIMS system as samples (assigned Service Request, due date, testing requirements, etc.) and are processed the same as field samples. The laboratory sections handle samples the same as field samples, performing the analyses following method requirements and performing data review. The laboratory sections prepare an analytical report, which is forwarded to the QA Manager for subsequent reporting to the appropriate agencies or study coordinator. Results of the performance evaluation samples and audits are reviewed by the Quality Assurance Manager, Laboratory Director, the laboratory staff, and the CAS Quality Assurance Director. For any results outside acceptance criteria, the analysis data is reviewed to identify a possible cause for the deficiency, and corrective action is taken and documented.

Table 13-1
Current CAS Performance and System Audit Programs

Federal and National Programs

- Naval Facilities Engineering Service Center Validated Laboratory for Drinking Water, Wastewater and Hazardous Waste
- U.S. Air Force, Air Force Center for Environmental Excellence (AFCEE) Approved Laboratory for AFCEE Projects
- U.S. Army Corps of Engineers - MRD, HTRW Center of Expertise Validated for HTRW parameters
- National Environmental Laboratory Accreditation Conference (NELAC)

State and Local Programs

- State of Alaska, Department of Environmental Conservation
UST Laboratory, Lab I.D. UST040
- State of Arkansas, Department of Environmental Quality
Certified Environmental Laboratory
- State of Arizona, Department of Health Services
License No. AZ0339
- State of California, Department of Health Services, Environmental Laboratory Accreditation Program
Certification No. 2286
- State of Colorado, Department of Public Health and Environment
Certified Drinking Water Laboratory
- State of Florida, Department of Health
Primary NELAC Accreditation No. E87412
- State of Hawaii, Department of Health
Certified Drinking Water Laboratory
- State of Idaho, Department of Health and Welfare
Certified Drinking Water Laboratory
- State of Indiana, Department of Health
Certified Drinking Water Laboratory
- State of Louisiana, Department of Environmental Quality
Accredited Environmental Laboratory, Lab I.D. 3016
- State of Maine, Department of Human Services
Certified Environmental Laboratory, Lab I.D. WA901
- State of Minnesota, Department of Health
Certified Environmental Laboratory, Lab I.D. 053-999-368
- State of Montana, Department of Health and Environmental Sciences
Certified Drinking Water Laboratory, Lab I.D. 0047
- State of New Jersey, Department of Environmental Protection
Accredited Environmental Laboratory, Lab I.D. WA005
- State of New York, Department of Health
Accredited Environmental Laboratory, Lab I.D. 11775
- State of Nebraska, Health and Human Services System
Certified Drinking Water Laboratory
- State of North Carolina, Department of Environment and Natural Resources
Certified Environmental Laboratory, Lab I.D. 605

Table 13-1 (continued)

State and Local Programs (continued)

- State of Oklahoma, Department of Environmental Quality
General Water Quality/Sludge Testing, Lab I.D. 9801
- State of Oregon, ORELAP Laboratory Accreditation Program
Accredited Environmental Laboratory, Lab I.D. WA200001
- State of South Carolina, Department of Health and Environmental Control
Certified Environmental Laboratory, Lab I.D. 61002
- State of Utah, Department of Health, Division of Laboratory Services
Accredited Environmental Laboratory
- State of Washington, Department of Ecology, Environmental Laboratory Accreditation Program
Accreditation No. C001

14.0 PREVENTIVE MAINTENANCE

Preventive maintenance is a crucial element of Columbia Analytical Services Quality Assurance program. Instruments at CAS (e.g., ICP/MS and ICP systems, GC/MS systems, atomic absorption spectrometers, analytical balances, gas and liquid chromatographs, etc.) are maintained under commercial service contracts or by qualified, in-house personnel. All instruments are operated and maintained according to the instrument operating manuals. All routine and special maintenance activities pertaining to the instruments are recorded in instrument maintenance logbooks. The maintenance logbooks used at CAS contain extensive information about the instruments used at the laboratory.

An initial demonstration of analytical control is required on every instrument used at CAS before it may be used for sample analysis. If an instrument is modified or repaired, a return to analytical control is required before subsequent sample analyses can occur. When an instrument is acquired at the laboratory, the following information is noted in a bound maintenance notebook specifically associated with the new equipment:

- The equipment's serial number;
- Date the equipment was received;
- Date the equipment was placed into service;
- Condition of equipment when received (new, used, reconditioned, etc.); and
- Prior history of damage, malfunction, modification or repair (if known).

Equipment records also include a copy of the manufacturer's manual(s) and dates and results of calibrations.

Preventive maintenance procedures, frequencies, etc. are available for each instrument used at CAS. They may be found in the various SOPs for routine methods performed on an instrument and may also be found in the operating or maintenance manuals provided with the equipment at the time of purchase.

Responsibility for ensuring that routine maintenance is performed lies with the section supervisor. The supervisor may perform the maintenance or assign the maintenance task to a qualified bench level analyst who routinely operates the equipment. In the case of non-routine repair of capital equipment, the section supervisor is responsible for providing the repair, either by performing the repair themselves with manufacturer guidance or by acquiring on-site manufacturer repair. Each laboratory section maintains a critical parts inventory. The parts inventories include the items needed to perform the preventive maintenance procedures listed in Appendix E.

This inventory or “parts list” also includes the items needed to perform any other routine maintenance and certain in-house non-routine repairs such as gas chromatography/mass spectrometry jet separators and electron multipliers and ICP/MS nebulizer. When performing maintenance on an instrument (whether preventive or corrective), additional information about the problem, attempted repairs, etc. is also recorded in the notebook. Typical logbook entries include the following information:

- Details and symptoms of the problem;
- Repairs and/or maintenance performed;
- Description and/or part number of replaced parts;
- Source(s) of the replaced parts;
- Analyst's signature and date; and
- Demonstration of return to analytical control.

See the table in Appendix E for a list of preventive maintenance activities and frequency for each instrument.

15.0 CORRECTIVE ACTION

To the extent possible, samples shall be reported only if all quality control measures are acceptable. If a quality control measure is found to be out of control, and the data is to be reported, all samples associated with the failed quality control measure shall be reported with the appropriate data qualifier(s). Failure to meet established analytical controls, such as the quality control objectives outlined in Section 9.0, prompts corrective action. In general, corrective action may take several forms and may involve a review of the calculations, a check of the instrument maintenance and operation, a review of analytical technique and methodology, and reanalysis of quality control and field samples. If a potential problem develops that cannot be solved directly by the responsible analyst, the supervisor, team leader, the department manager, and/or the Quality Assurance Manager may examine and pursue alternative solutions. In addition, the appropriate project chemist may be notified in order to ascertain if contact with the client is necessary.

Problems with analysis, as well as the corresponding corrective actions taken, are documented on Nonconformity and Corrective Action Reports (See Figure 15-1) following the requirements in the *SOP for Nonconformity and Corrective Action Documentation* (SOP No. ADM - NCAR). This form is utilized to document corrective actions in response to out-of-control situations. The Quality Assurance Manager reviews each problem, ensuring that appropriate corrective action has been taken by the appropriate personnel. The Nonconformity and Corrective Action Report (NCAR) is filed in the associated service request file and a copy is kept by the Quality Assurance Manager. The Quality Assurance Manager periodically reviews all NCARs looking for chronic, systematic problems that need more in-depth investigation and alternative corrective action consideration. In addition, the appropriate project chemist is promptly notified of any problems in order to inform the client and proceed with any action the client may want to initiate.

Corrective action due to a performance audit or a check sample problem is initiated by the Quality Assurance Manager; the affected laboratory laboratory supervisors and managers are promptly informed of performance audit results requiring corrective action.

16.0 QUALITY ASSURANCE REPORTS

Quality assurance requires an active, ongoing commitment by CAS personnel at all levels of the organization. Information flow and feedback mechanisms are designed so that analysts, supervisors and managers are aware of quality assurance issues in the laboratory.

Analysts performing routine tests in the laboratory are aware of the various method acceptance criteria and in-house control limits that must be met in order to generate acceptable results. The analysts are also responsible for generating a Data Quality Report (DQR), or similar, form with every analytical batch they process; this report contains explicit documentation of the various controls that must be met during the analysis. This report also allows the analyst to provide appropriate notes and/or a case narrative if problems were encountered with the analyses. A Non-Conformity and Corrective Action Report (NCAR) (see Section 15.0) may also be attached to the data prior to review. Supervisors or qualified analysts review all of the completed analytical batches to ensure that all QC criteria have been examined and any deficiencies noted and corrected if possible.

It is the responsibility of each laboratory unit to provide the project chemist with a final report of the data, accompanied by signature approval. Footnotes and/or narrative notes must also accompany any data package if problems were encountered that require further explanation to the client. Each data package is submitted to the appropriate project chemist, who in turn reviews the entire collection of analytical data for completeness. The project chemist must also review the entire body of data to ensure that any and all client-specified objectives were successfully achieved. A case narrative may be written by the project chemist to explain any unusual problems with a specific analysis or sample, etc.

The Quality Assurance Manager (QAM) provides overview support to the project chemists if required to do so (e.g., contractually specified, etc.). The QAM is also responsible for the oversight of all internal and external audits, for all proficiency testing sample and analysis programs, and for all laboratory certification/accreditation responsibilities.

The QAM also prepares quarterly reports for the Laboratory Director that summarizes the various QA/QC activities that have occurred during the previous quarter. The typical report will address such topics as the following:

- Status, schedule, and results of internal and external audits;
- Status, schedule, and results of internal and external proficiency testing studies;
- Status of certifications, accreditations, and approvals;
- Status of QA Manual and SOP review and revision;
- Status of MDLs studies;
- Discussion of QC problems in the laboratory;

- Discussion of corrective action program issues;
- Status of staff training and qualification; and
- Other topics as appropriate.

Any problems noted by the Laboratory Director are then discussed during the regularly scheduled senior staff operations meetings with all appropriate department managers. The Laboratory Director performs an annual documented review of the laboratory quality system to identify any necessary changes or improvements to the quality system.

17.0 PERSONNEL TRAINING

Technical position descriptions are available for all employees, regardless of position or level of seniority. These documents are maintained by the Human Resources personnel and are available for review. In order to assess the technical capabilities and qualifications of a potential employee, all candidates for employment at CAS are evaluated, in part, against the appropriate technical description.

Training begins the first day of employment at CAS when the company policies are presented and discussed. Safety and QA/QC requirements are integral parts of all technical SOPs and, consequently, are integral parts of all training processes at CAS. Safety training begins with the reading of the *Environmental Health and Safety Manual*. All employees are also required to attend safety meetings during which the safety program is discussed and safety training is presented by the Environmental, Health and Safety Officer. Each employee is responsible for complying with the requirements of the QA Manual and QA/QC requirements associated with their function(s).

CAS requires each employee to participate in Ethics training, which is part of the CAS Improper Practices Prevention Program. CAS also encourages its personnel to continue to learn and develop new skills that will enhance their performance and value to the Company. Ongoing training occurs for all employees through a variety of mechanisms. The "CAS University" education system, external and internal technical seminars and training courses, and laboratory-specific training exercises are all used to provide employees with professional growth opportunities.

17.1 Initial Demonstration of Proficiency

Training in analytical procedures typically begins with the reading of the Standard Operating Procedure (SOP) for the method. Hands-on training begins with the observation of an experienced analyst performing the method, followed by the trainee performing the method under close supervision, and culminating with independent performance of the method on quality control samples. Successful completion of the applicable Demonstration of Proficiency analysis qualifies the analyst to perform the method independently. Demonstration of Proficiency is performed by one of the following:

- Successful completion of a Initial Precision and Recovery (IPR) study (required where mandated by the method).

- Analysis of 4 consecutive Laboratory Fortified Blanks, with acceptable accuracy and precision.
- Where spiking is not possible but QC standards are used (“non-spiked” Laboratory Control Samples), analysis of 4 consecutive Laboratory Control Samples with acceptable accuracy and precision.
- Where one of the three above is not possible, special requirements are as follows:
 - Total Settleable Solids: Successful single-blind PT sample analysis and duplicate results with RPD<10%.
 - Color: Four consecutive prepared LCSs with acceptable accuracy and precision of <10% RSD.
 - Physical Tests (Grain size, Corrosivity to Steel, etc.): Supervisor acknowledgement of training and approval.

A flowchart identifying the Demonstration of Proficiency requirements is given in Figure 17-1. The flowchart identifies allowed approaches to assessing Demonstration of Capability when a 4-replicate study is not mandated by the method, when spiking is not an option, or when QC samples are not readily available.

17.2 Continuing Demonstration of Proficiency

A periodic demonstration of proficiency is required to maintain continuing qualification. Continuing Demonstration of Proficiency is required each year, and may be performed one of the following ways:

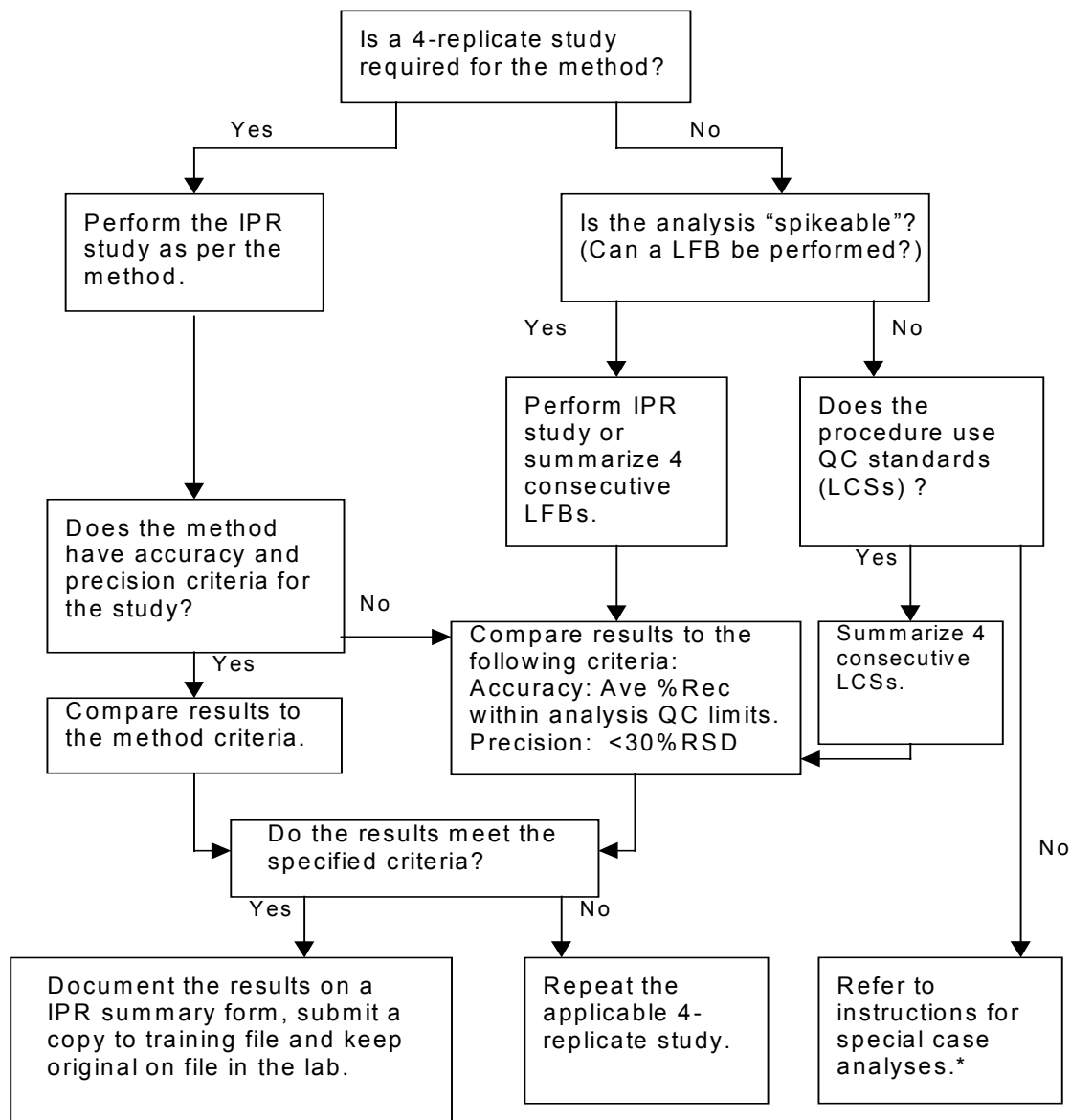
- Successful performance on external (independent) single-blind PT sample analyses using the test method, or a similar test method using the same technology.
- Performing Initial Demonstration of Proficiency as described above, with acceptable levels of precision and accuracy.
- Performing an acceptable Method Detection Limit study for the method.
- For methods for which PT samples are not available and a spiked analysis (LFB, MDL, etc.) is not possible, analysis of field samples that have been analyzed by another analyst with statistically indistinguishable results.

17.3 Documentation of Training

Records are maintained to indicate the employee has the necessary training, education, and experience to perform their functions. Information of previously acquired skills and abilities for a new employee is maintained in Human Resources personnel files and CAS resumes.

A database is used to record the various technical skills and abilities acquired and maintained by an employee while employed by CAS. Information in the database includes the employee's name, a description of the skill including the appropriate method and SOP reference, the mechanism used to document proficiency, and the date the training was completed. General procedures for documenting technical training are described in the *SOP for Documentation of Training (SOP No. ADM-TRANDOC)*.

Figure 17-1
Initial Demonstration of Proficiency Requirements



*Total Settleable Solids: Successful PT sample analysis and duplicate results with RPD<10%.

*Color: Four consecutive prepared LCSSs with acceptable accuracy and precision of <10% RSD.

* Physical Tests (Grain size, Corrosivity to Steel, etc.): Supervisor acknowledgement of training and approval.

18.0 REFERENCES FOR ANALYTICAL PROCEDURES

The analytical methods used at CAS generally depend upon the end-use of the data. Since most of our work involves the analysis of environmental samples for regulatory purposes, specified federal and/or state testing methodologies are used and followed closely. Several factors are involved with the selection of analytical methods to be used in the laboratory. These include the method detection limit, the concentration of the analyte being measured, method selectivity, accuracy and precision of the method, the type of sample being analyzed, and the regulatory compliance objectives. Typical methods used at CAS are taken from the following references:

- *Test Methods for Evaluating Solid Waste, Physical/Chemical Methods*, SW-846, Third Edition, (September 1986) and Updates I (July 1992), II (September 1994), IIA (August 1993), IIB (January 1995), III (December 1996), and Proposed Update IVA (January 1998). See Chapters 1, 2, 3, and 4.
- *Methods for Chemical Analysis of Water and Wastes*, EPA-600/4-79-020, (Revised March 1983).
- *Methods for the Determination of Inorganic Substances in Environmental Samples*, EPA/600/R-93/100 (August 1993).
- *Methods for the Determination of Metals in Environmental Samples*, EPA/600/4-91/010 (June 1991) and Supplements.
- *Methods for Organic Chemical Analysis of Municipal and Industrial Wastewater*, EPA 600/4-82-057 (July 1982) and 40 CFR Part 136, Appendix A.
- *Methods for the Determination of Organic Compounds in Drinking Water*, EPA/600/4-88/039 (December 1988) and Supplements.
- *Standard Methods for the Examination of Water and Wastewater*, 16th Edition (1985); 17th Edition (1989); 18th Edition (1992); 19th Edition (1995). See Introduction in Part 1000.
- 40 CFR Part 136, Guidelines for Establishing Test Procedures for the Analysis of Pollutants Under the Clean Water Act.
- 40 CFR Part 141, National Primary Drinking Water Regulations.

- *Analytical Methods for Petroleum Hydrocarbons*, ECY 97-602, Washington State Department of Ecology, June 1997.
- State-specific total petroleum hydrocarbon methods for the analysis of samples for gasoline, diesel, and other petroleum hydrocarbon products (Alaska, Arizona, California, Oregon, Washington, Wisconsin, etc.).
- Annual Book of ASTM Standards, Part 31, Water.
- EPA Contract Laboratory Program, Statement of Work for Organic Analysis, SOW Nos. OLM01.8, OLM02.0, OLM03.1, OLM03.2, OLM04.2, and OLM04.3.
- EPA Contract Laboratory Program, Statement of Work for Inorganic Analysis, SOW No. ILM04.0, ILM04.1, and ILM05.2.
- *U. S. EPA Contract Laboratory Program National Functional Guidelines for Organic Data Review*, EPA-540/R-94/012 (February 1993).
- *U. S. EPA Contract Laboratory Program National Functional Guidelines for Inorganic Data Review*, EPA-540/R-94/013 (February 1994).
- National Institute for Occupational Safety and Health (NIOSH) *Manual of Analytical Methods*, Third Edition (August 1987); Fourth Edition (August 1994).
- *Recommended Protocols for Measuring Selected Environmental Variables in Puget Sound*, for USEPA and USACE (March 1986), with revisions through April 1997.
- WDOE 83-13, *Chemical Testing Methods for Complying with the State of Washington Dangerous Waste Regulations* (March 1982) and as Revised (July 1983 and April 1991).
- *Identification and Listing of Hazardous Waste*, California Code of Regulations, Title 22, Division 4.5, Chapter 11.
- *Analytical Methods for the Determination of Pollutants in Pulp and Paper Industry Wastewater*, EPA 821-R-93-017 (October 1993).
- *Analytical Methods for the Determination of Pollutants in Pharmaceutical Manufacturing Industry Wastewaters*, EPA 821-B-98-016 (July 1998).
- National Council of the Pulp and Paper Industry for Air and Stream Improvement (NCASI).
- *Good Automated Laboratory Practices, Principles and Guidance to Regulations For Ensuring Data Integrity In Automated Laboratory Operations*, EPA 2185 (August 1995).

- *Manual for the Certification of Laboratories Analyzing Drinking Water*, 4th Edition, EPA 815-B-97-001 (March 1997).
- National Environmental Laboratory Accreditation Conference (NELAC), Quality Standards, 2001 and 2002.

APPENDIX A

LIST of QA PROGRAM DOCUMENTS

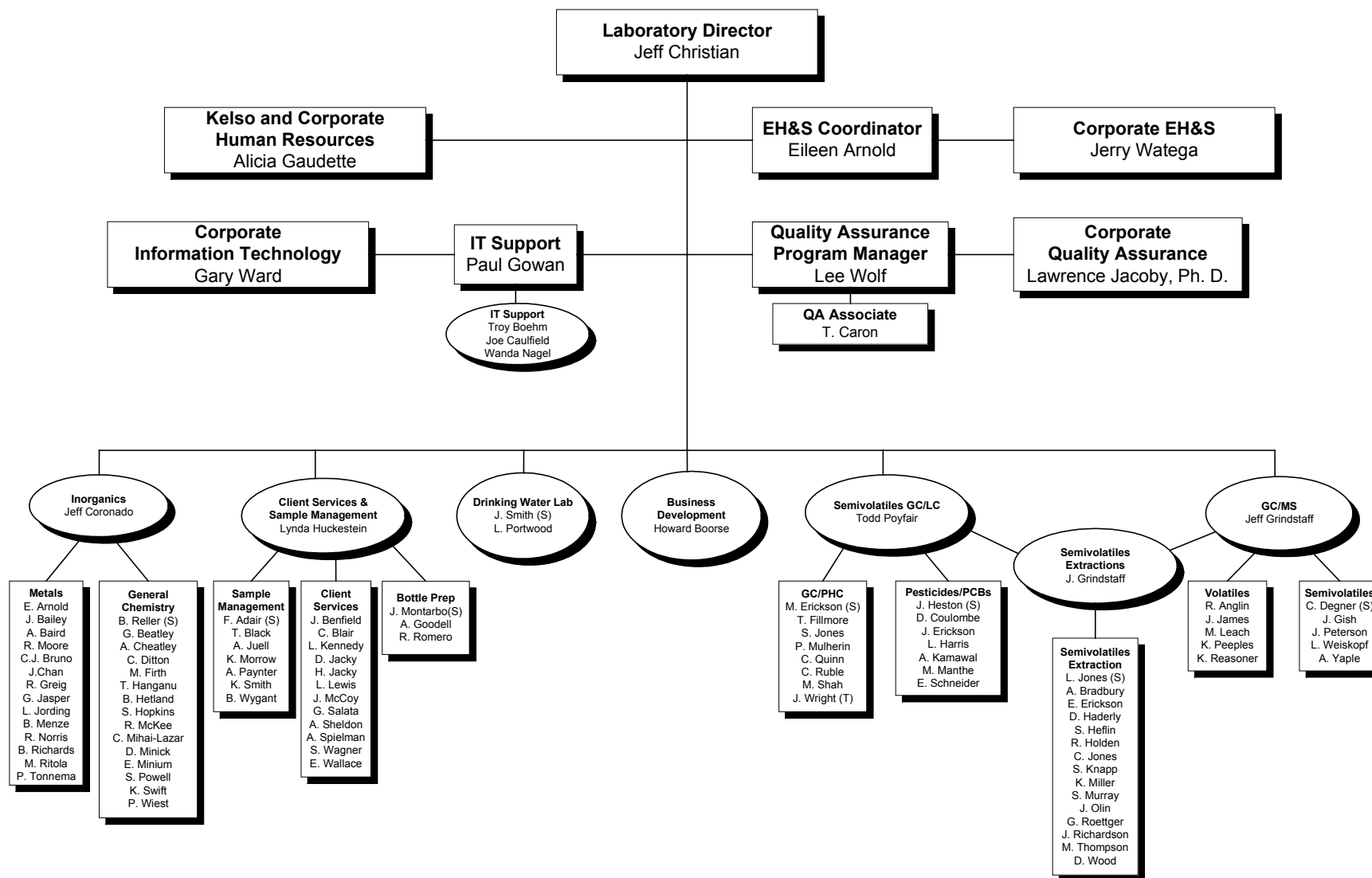
Quality Assurance Manual	10/3/03
Software Quality Assurance Plan	8/7/01
CAS-Kelso Certifications/Accreditations	Cert_kel.xls
Columbia Analytical Services MDL Tracking Spreadsheet	Mdl_list.xls
Technical Training Summary Database	TrainDat.mdb
Approved Signatories List	QA Dept. Files
Personnel resumes/qualifications	(all staff)
Personnel Job Descriptions	HR Department
Quality Control Acceptance Criteria	Qclimits.xls
Master Logbook of Laboratory Logbooks	Masterlog-001
TECHNICAL STANDARD OPERATING PROCEDURES	
SOP TABLE OF CONTENTS	SOPLIST.DOC
ADMINISTRATIVE STANDARD OPERATING PROCEDURES	
<u>ADMINISTRATIVE - CORPORATE</u>	<u>FILE NAME</u>
CHAIN OF CUSTODY FOR SAMPLE TRANSFER BETWEEN LABORATORIES	ADM-COC
CHECKING NEW LOTS OF CHEMICALS FOR CONTAMINATION	ADM-CTMN
CONTROL LIMITS	ADM-CTRL_LIM
DEALING WITH COMPLAINTS	ADM-CMPLT
DOCUMENT CONTROL	ADM-DOCCTRL
DOCUMENTATION OF TRAINING	ADM-TRANDOC
ELECTRONIC DATA AUDITING	ADM-E_DATAUDIT
MAKING ENTRIES INTO LOGBOOKS AND ONTO BENCHSHEETS	ADM-DATANTRY
MANUAL INTEGRATION OF CHROMATOGRAPHIC PEAKS	ADM-INT
NONCONFORMITY AND CORRECTIVE ACTION	ADM-NCAR
PREPARATION OF STANDARD OPERATING PROCEDURES	ADM-SOP
PURCHASING THROUGH CAS PURCHASING AGENT	ADM-PUR
QUALIFICATION OF SUBCONTRACT LABORATORIES	ADM-SUBLAB
SAMPLE BATCHES	ADM-BATCH
SIGNIFICANT FIGURES	ADM-SIG.FIG
THE DETERMINATION OF METHOD DETECTION LIMITS	ADM-MDL

<u>ADMINISTRATIVE – LOCAL LABORATORY</u>	<u>FILE NAME</u>
CHECKING PIPET CALIBRATION	ADM-CPIP
CONTINGENCY PLAN FOR LABORATORY EQUIPMENT FAILURE	ADM-ECP
CONTROL CHARTING QUALITY CONTROL DATA	ADM-CHRT
DATA ARCHIVING	ADM-ARCH
DATA REPORTING AND REPORT GENERATION	ADM-RG
INTERNAL QUALITY ASSURANCE AUDITS	ADM-IAUD
LABORATORY DATA REVIEW PROCESS	ADM-DREV
METHOD DETECTION LIMIT DOCUMENTATION AND CONTROL	ADM-MDLC
PROJECT MANAGEMENT	ADM-PCM
REAGENT LOGIN AND TRACKING	ADM-RLT
SUPPORT EQUIPMENT MONITORING AND CALIBRATION	ADM-SEMC
THERMOMETER CALIBRATION	ADM-TCAL
<u>SAMPLE MANAGEMENT SOPS</u>	<u>FILE NAME</u>
BOTTLE ORDER PREPARATION AND SHIPPING	SMO-BORD
FOREIGN SOILS HANDLING TREATMENT	SMO-FSHT
SAMPLE DISPOSAL	SMO-SDIS
SAMPLE RECEIVING	SMO-GEN
SAMPLE TRACKING AND LABORATORY CHAIN OF CUSTODY	SMO-SCOC

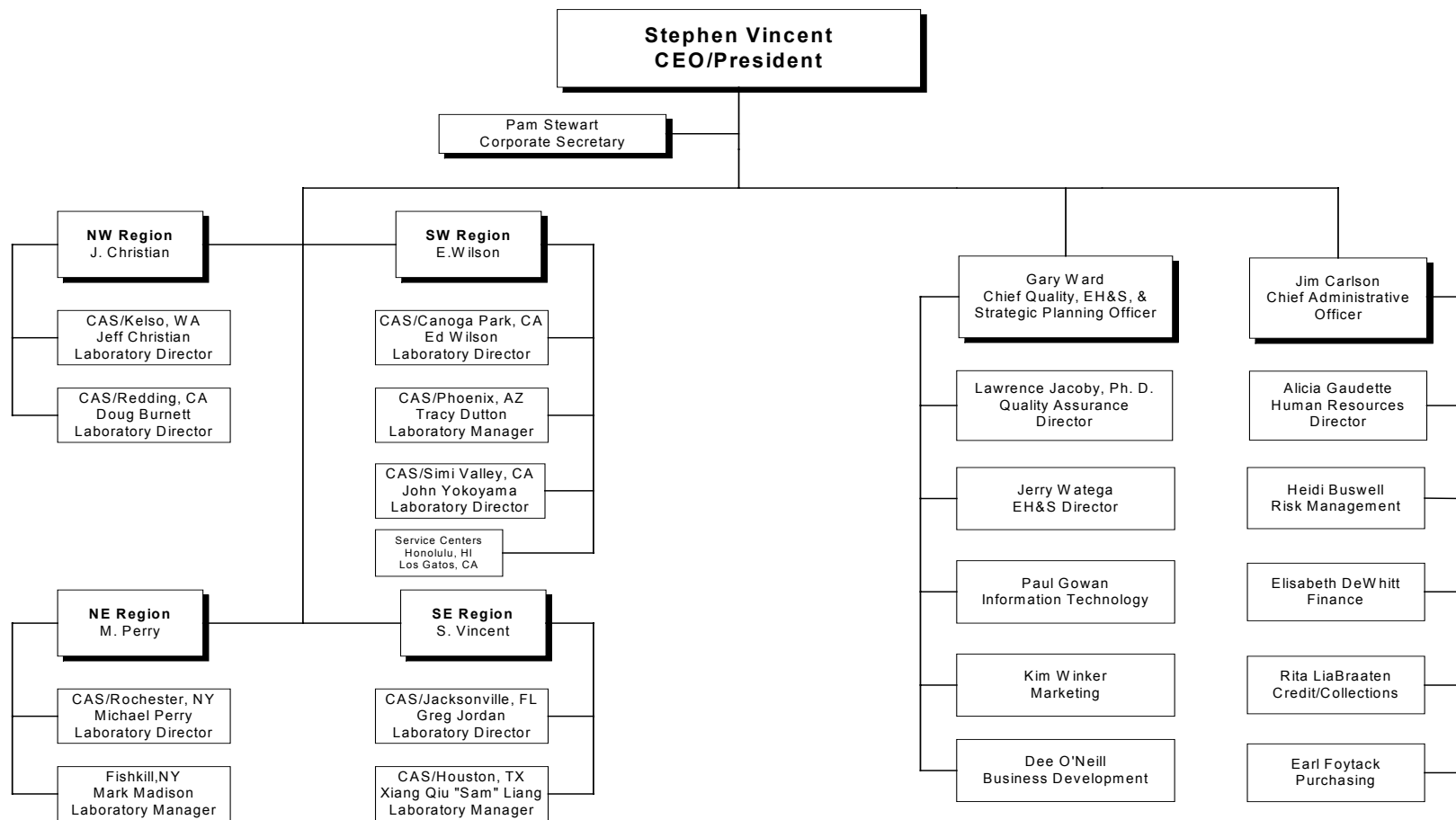
APPENDIX B

ORGANIZATIONAL CHARTS and RESUMES OF KEY PERSONNEL

Columbia Analytical Services, Inc. Kelso, Washington Laboratory Organization



Columbia Analytical Services, Inc. Laboratory Division Organization



JEFFREY D. CHRISTIAN

1989 TO PRESENT

Columbia Analytical Services, Inc., 1317 S. 13th Avenue, Kelso, WA 98626 (360) 577-7222

Current Position

VICE PRESIDENT/NW REGIONAL DIRECTOR – 1996 to Present

Responsibilities

Responsible for all phases of laboratory operations at the Kelso (WA) and Redding (CA) facilities, including project planning, budgeting, and quality assurance. Primary duties include the direct management of the Kelso laboratory (i.e. serves as the Kelso Laboratory Director, 1993-present). Also responsible for additional duties acquired as a member of the Columbia Analytical Services Holdings, Inc., Board of Directors.

Experience

Laboratory Director, Kelso Laboratory, Columbia Analytical Services, Inc., Kelso, Washington, 1993-1995. Responsible for all phases of laboratory operations, including project planning, budgeting, and quality assurance.

Operations Manager, Kelso Laboratory, Columbia Analytical Services, Inc., Kelso, Washington, 1992-1993. Responsibilities included directing the daily operation of the Kelso laboratory. Other responsibilities and duties included functioning as a technical consultant to clients, providing assistance in developing and planning analytical schemes to match client objectives, and writing and developing analytical procedures/methods. Also, served as Project Manager for State of Alaska Department of Environmental Conservation contract and Coordinator for EPA Special Analytical Services (SAS) contracts.

Project Chemist and Manager, Metals Analysis Laboratory, Columbia Analytical Services, Kelso, Washington, 1989-1992. Responsible for directing the daily operation of the Metals Laboratory, including the sample preparation, AAS, ICP-OES, and ICP-MS Laboratories.

Scientist, Weyerhaeuser Technology Center, Federal Way, Washington, 1986-1989. Responsibilities included supervising atomic spectroscopy laboratory which included flame and furnace AAS, ICP-OES, and sample preparation capabilities to handle a wide variety of sample types. Interfaced with internal and external clients to provide technical support. Wrote and developed analytical procedures/methods.

Lead Technician, Metals Lab, Weyerhaeuser Technology Center, Federal Way, Washington, 1981-1986. Responsibilities included primary ICP and AAS analyst for EPA-CLP contract work. Extensive experience in wide variety of environmental and product-related testing.

Research Assistant, ITT Rayonier, Olympic Research Division, Shelton, Washington, 1978-1981. Responsibilities included performing water quality tests, product-related analytical tests, corrosion tests (i.e., potentiometric polarization techniques), and operated pilot equipment specific to the pulp and paper industry.

Education

B.S., Chemistry, Evergreen State College, Olympia, Washington, 1993.

ICP/MS Training Course, VG-Elemental, 1992.

Coursework, Pacific Lutheran University, Tacoma, Washington. 1988-1989.

Coursework, Tacoma Community College, Tacoma, Washington. 1970-1971, 1988-1989.

Perkin-Elmer Advanced Furnace, Norwalk, Connecticut, 1986.

CERTIFICATION, Chemistry, L.H. Bates Technical, Tacoma, Washington, 1978.

Coursework, Central Washington University, Ellensburg, Washington. 1969-1970.

Publications/ Presentations

On request.

LEE E. WOLF
1988 TO PRESENT

Columbia Analytical Services, Inc., 1317 S. 13th Avenue, Kelso, WA 98626 (360) 577-7222

Current Position	TECHNICAL MANAGER IV, KELSO QUALITY ASSURANCE MANAGER – 2002 to Present
Responsibilities	Responsible for the overall coordination of the laboratory QA program, and for ensuring that established quality objectives are met. Responsible for Quality Assurance function, including the Quality Assurance Manual, certifications, documenting SOPs, and maintaining performance evaluation records. Oversee balance calibration and sample storage temperature control. Maintain certifications/accreditations for regulatory agencies and client certifications or approval programs. Act as primary point of contact during laboratory audits. Provides audit responses and initiates any changes in procedures resulting from an audit. Coordinate the analysis of performance evaluation samples required for certification/accreditation programs. Report and review results for these analyses. Conduct internal audits and make recommendations for corrective action.
Experience	Scientist IV, Kelso Quality Assurance Manager, Columbia Analytical Services, Inc., Kelso, Washington, 1996-2002. Duties primarily as listed above. Project Chemist/Principal Organic Scientist, Columbia Analytical Services, Inc., Kelso, Washington, 1994-1996. Responsibilities included GC and GC/MS method development and special projects coordination. Acts as technical advisor to the GC and GC/MS laboratories and GC/MS interpretation specialist and CLP organics specialist. Also responsible for Project Chemist functions, including management and coordination of projects for clients, identifying client needs, and preparation of data reports. Semi-VOA Department Manager, Columbia Analytical Services, 1988-1994. Responsibilities included overall management of the Semi-VOA department. Oversee the operation of Semi-VOA GC/MS, data review and reporting and related QA/QC function. Also responsible for supervision of staff, including training, scheduling, and other personnel issues. Beginning in 1992, increased responsibilities to include Project Chemist functions for organics EPA-SAS and other clients. This involved scheduling projects for clients, identifying client needs, and preparing data reports. GC/MS Chemist, U.S. Testing Co., Richland, Washington, 1985-1988. Responsibilities included GC and GC/MS analysis of water and soil samples for volatiles and Semi-VOA by EPA protocol, including Methods 8240, 8270 and CLP. Coordinated extraction and GC-GC/MS areas to manage sample/data flow through the lab. Experience also with pesticide/PCB analysis by EPA Methods 8080 and CLP. Responsible for development of analysis methods for non-routine pesticides and herbicides and performed HPLC analysis. Laboratory Assistant, Eastern Washington University, Cheney, Washington, 1985. Responsibilities included supervision and instruction of organic chemistry labs. Experience with GC and IR operation. Responsible for lab safety. Chemist Assistant, Spokane County Air Pollution Control Authority, Spokane, Washington, 1984. Responsibilities included gathering and analyzing air samples for CO content using IR equipment.
Education	Documenting Your Quality System, A2LA Short Course, Las Vegas, Nevada, 1998. Internal Laboratory Audits, A2LA Short Course, Las Vegas, Nevada, 1998. Mass Spectra Interpretation, ACS Short Course, Denver, Colorado, 1992. BS, Chemistry, Minor in Geology, Eastern Washington University, Cheney, Washington, 1985.
Publications/ Presentations	<i>On Request.</i>
Affiliations	American Chemical Society.

LYNDA A. HUCKESTEIN

1989 TO PRESENT

Columbia Analytical Services, Inc., 1317 S. 13th Avenue, Kelso, WA 98626 (360) 577-7222

Current Position

CLIENT SERVICES MANAGER IV – 1998 to Present

Responsibilities

Management of the Client Services Departments: Project Management, Electronic Data Deliverables and Report Generation, and Sample Management. Personally responsible for approximately 1.5 million dollars of client work annually performing technical project management and client service. Provides technical and regulatory interpretation assistance as-well-as project organization to work received by the laboratory.

Experience

Documentation of Demonstration of Capabilities is available for review.

Project Chemist, Columbia Analytical Service, Inc., Kelso, Washington, 1992-1998. Primary responsibilities included technical project management and client service in areas of pulp & paper, marine services, mining, and DOD. Also responsible for providing technical and regulatory interpretation assistance as-well-as project organization to work received by the laboratory

Project Chemist and Department Manager, General Chemistry Laboratory, Columbia Analytical Services, Inc., 1989-1992. Responsible for management of the General Chemistry laboratory for routine wastewater, bioassay, and microbiological analyses. Also responsible for supervision of staff, data review, and reporting.

Analyst III, Columbia Analytical Services, Inc., Kelso, Washington, 1989. Primary responsibilities included coliform testing, total recoverable petroleum hydrocarbon extractions and analysis, BODs, ammonias, and TKN, in addition to miscellaneous wet chemistry analyses.

Microbiologist/Chemist, Coffey Laboratories, Portland, Oregon, 1983. Coliform analysis; water chemistry.

Laboratory Assistant, Oregon State University, Corvallis, Oregon, 1983. Wheat spike dissection and tissue culture.

Education

BS, Microbiology, Oregon State University, Corvallis, Oregon, 1983.

JEFFREY A. CORONADO

1989 TO PRESENT

Columbia Analytical Services, Inc., 1317 S. 13th Avenue, Kelso, WA 98626 (360) 577-7222

Current Position	TECHNICAL MANAGER IV, INORGANICS DEPARTMENT MANAGER – 2001 to Present
Responsibilities	Oversee the operation of the inorganic groups, which consists of two separate laboratories: Metals and General Chemistry. Responsible for the quality and timeliness of the inorganic laboratories analytical reports, departmental budgets, workload coordination, method development efforts, cost-effectiveness, and resource allocation.
Experience	Documentation of Demonstration of Capabilities is available for review. Metals Department Manager, Columbia Analytical Services, Inc., Kelso, Washington, 1992-2001. Responsibilities included management of all aspects of the metal laboratory operation, including personnel training and evaluation, review of all metals data, and report generation. Also responsible for client service on a number of ongoing CAS accounts. Technical duties include primary analytical responsibility for trace level metals analysis by ICP/MS. Analyses range from routine water and soil analysis, to marine tissues, as well as industrial applications such as ultra-trace QA/QC work for various semiconductor clients. Also responsible for a number of specialized sample preparation techniques including trace metals in seawater by reductive precipitation, and arsenic and selenium speciation by ion-exchange chromatography. Developed methodology for performing mercury analysis at low part per trillion levels by cold vapor atomic fluorescence.. Supervisor, GFAA Laboratory, Columbia Analytical Services, Inc., Kelso, Washington, 1989-1992. Responsibilities included supervision of metals analysis by graphite furnace atomic absorption following SW-846 and EPA CLP methodologies. Duties include workload scheduling, data review, instrument maintenance, personnel training and evaluation.
Education	Field Immunoassay Training Course, EnSys Inc., 1995. Winter Conference on Plasma Spectrochemistry, San Diego, California, 1994. ICP-MS Training Course, VG-Elemental, 1992. BS, Chemistry, Western Washington University, Bellingham, Washington, 1988. BA, Business Administration, Western Washington University, Bellingham, Washington, 1985.

JEFFREY A. GRINDSTAFF

1991 TO PRESENT

Columbia Analytical Services, Inc., 1317 S. 13th Avenue, Kelso, WA 98626 (360) 577-7222

Current Position	TECHNICAL MANAGER III, GC/MS VOA AND SEMI-VOA LABORATORIES – 1997 to Present
Responsibilities	Primary responsibilities include supervision of GC/MS VOA and Semi-VOA staff, method development, training, data review, tracking department workload, scheduling analyses, and general maintenance and troubleshooting of GC/MS systems. Documentation of Demonstration of Capabilities is available for review.
Experience	Manager, GC/MS VOA Laboratory, Columbia Analytical Services, Inc., Kelso, Washington, 1994-1997. Responsible for supervision of GC/MS VOA staff, method development, training, data review, tracking department workload, scheduling analyses, and general maintenance and troubleshooting of GC/MS systems. Scientist III, GC/MS VOA Laboratory, Columbia Analytical Services, Inc., Kelso, Washington, 1991-1994. Responsibilities included scheduling workload, data review, instrument maintenance and troubleshooting, and personnel training and evaluation. Also responsible for supervision of extraction personnel and instrument analysts. Additional supervisory duties included report generation and data review for GC analyses. Responsibilities also included project management and customer service. Chemist, Enseco-CRL, Ventura, California, 1990-1991. Established GC/MS department including inventory maintenance, preparation of state certification data packages, method development, SOPs, and extended data programs. Performed daily maintenance and troubleshooting of GC and GC/MS instrumentation. Scheduled and performed routine and non-routine VOA analyses. GC/MS Chemist, VOA Laboratory Coast-to-Coast Analytical Service, San Luis Obispo, California, 1990-1991. Responsible for standard preparation for VOA analyses and instrument calibration, tuning, and maintenance. Also implemented and further developed EPA methods for quantitative analysis of pesticides and priority pollutants..
Education	Mass Selective Detector Maintenance, Hewlett-Packard Education Center, 1993. Interpretation of Mass Spectra I, Hewlett-Packard Analytical Education Center, 1992. B.S., Chemistry, California Polytechnic State University, San Luis Obispo, California, 1989. A.A., Liberal Arts, Allan Hancock College, Santa Maria, California. 1986
Publications/ Presentations	<i>Alternate Method to Lower Detection Limits to Satisfy Regulatory Action Levels for Volatiles in Groundwater</i>, with David Edelman, Kairas Parvez, and Paul Laymon. TAPPI National Meeting, Orlando, Florida. 1996
Affiliations	American Chemical Society. 1989

TODD N. POYFAIR

1991 TO PRESENT

Columbia Analytical Services, Inc., 1317 S. 13th Avenue, Kelso, WA 98626 (360) 577-7222

Current Position

TECHNICAL MANAGER III, SVG LABORATORIES – 2001 to Present

Responsibilities

Primary responsibilities include supervision of GC, HPLC, and fuels Semi-VOA laboratory staff. Also responsible for training oversight, data review, tracking department workload, and scheduling and performance of GC and HPLC analyses.

Documentation of Demonstration of Capabilities is available for review.

Experience

Supervisor/Manager, General Chemistry Department, Columbia Analytical Services, Inc., Kelso, Washington, 1995-2001. Responsibilities included supervision, management, and training of General Chemistry staff. Also responsible for workload coordination, data review, reporting, and instrument maintenance within the General Chemistry department.

Project Chemist, Client Services Group, Columbia Analytical Services, Inc., Kelso, Washington, 1993-1995. Responsibilities included technical project management and customer service. Responsible for meeting the clients' needs of timely and appropriate analyses, and to acted as liaison for all client-related activities within CAS.

Scientist II, General Chemistry Laboratory, Columbia Analytical Services, Inc., Kelso, Washington, 1992-1993. Responsibilities included the review and summarization of pH, alkalinity, conductivity, turbidity, hardness, and CODs.

Scientist I, General Chemistry Laboratory, Columbia Analytical Services, Inc., Kelso, Washington, 1992. Responsibilities included analysis of Total Organic Halogens, Chemical Oxygen Demand, Sulfides, Ammonia, TKN, Nitrate/Nitrite by Lachat, and Cyanide.

Analyst III, General Chemistry Laboratory, Columbia Analytical Services, Inc., Kelso, Washington, 1991-1992. Responsibilities included analysis of pH, Conductivity, Alkalinity, Turbidity, and Oil and Grease.

Education

BS, Chemistry, Portland State University, Portland, Oregon, 1991.

BA, German, Portland State University, Portland, Oregon, 1990.

COURSEWORK, Brigham Young University, Provo, Utah. 1982-1983 & 1985-1986.

JAMES R. "JIM" SMITH

2001 TO PRESENT

Columbia Analytical Services, Inc., 1317 S. 13th Avenue, Kelso, WA 98626 (360) 577-7222

Current Position	TECHNICAL MANAGER I, DRINKING WATER LABORATORY SUPERVISOR – 2002 to Present
Responsibilities	Overall implementation of Organic Drinking Water Methods and method development. Project management of Drinking water accounts. Development of Standard Operating Procedures for Drinking Water methods. Operation of Varian GC/MS, Agilent GC/ECD and Agilent HPLC.
Experience	Documentation of Demonstration of Capabilities is available for review. Project Manager III, Columbia Analytical Services, Inc., Kelso, Washington, 2001-2002. Responsible for technical project management, ensuring overall data quality and compliance with customer requirements, and providing technical support to clients regarding laboratory application to projects. Extensive technical experience with the various GC and GC/MS method allow for detailed technical review of organics projects. Also has extensive experience coordinating drinking water and sediment projects. Currently responsible for coordination of approximately \$200,000 of analyses in the laboratory on a monthly basis. Current large clients include Bechtel (Navy work), which involves numerous groundwater-monitoring projects, the Port of Seattle and URS. Also responsible for various storm water studies for Bremerton Naval Shipyard. Director, Trace Organics and Project Manager, Amtest, Inc., Redmond, Washington, 1987-2001. Responsible for project management, client contact, data review, and writing reports. Additional responsibilities pertained to supervision of the trace organics department and running the GC/MS system. Performed various methods by GC/MS for volatiles, semi-volatiles and by GC for pesticides, PCBs, herbicides, and fuels (LUST). Also performed hazardous waste characterization including completion of waste profile forms.
Education	BS, Chemistry, Rochester Institute of Technology, Rochester, New York, 1985.

EILEEN M. ARNOLD

1987 TO PRESENT

Columbia Analytical Services, Inc., 1317 S. 13th Avenue, Kelso, WA 98626 (360) 577-7222

Current Position

SCIENTIST IV, METALS LABORATORY, KELSO HEALTH AND SAFETY OFFICER – 1994 to Present

Responsibilities

Duties include the operation and maintenance of the Inductively Coupled Argon Plasma (ICAP) Emission Spectrometer. This involves digestion, instrumental analysis, and report generation for environmental samples using approved EPA techniques. Health and Safety Officer responsibilities included development and implementation of the Kelso Health and Safety program, including accident investigation and incident review, maintenance of all safety related equipment and documents, and performance of monthly safety audits.

Documentation of Demonstration of Capabilities is available for review.

Experience

Project Chemist, Client Services Group, Kelso Health and Safety Officer, Columbia Analytical Services, Inc., Kelso, Washington, 1992-1994. Duties included technical project management and customer service. Responsible for meeting the clients' needs of timely and appropriate analyses, and to act as liaison for all client-related activities within Columbia Analytical Services, Inc. Health and Safety Officer responsibilities included development and implementation of the Kelso Health and Safety program, including accident investigation and incident review, maintenance of all safety related equipment and documents, and performance of monthly safety audits.

Scientist IV, Metals Laboratory, Health and Safety Officer, Columbia Analytical Services, Inc., Kelso, Washington, 1987-1992. Duties include the operation and maintenance of the Inductively Coupled Argon Plasma (ICAP) Emission Spectrometer. This involves digestion, instrumental analysis, and report generation for environmental samples using approved EPA techniques. Health and Safety Officer responsibilities included development and implementation of the Kelso Health and Safety program, including accident investigation and incident review, maintenance of all safety related equipment and documents, and performance of monthly safety audits.

Chemist, Dow Corning Corporation, Springfield, Oregon, 1986-1987. Responsibilities included ICP and atomic absorption work in silicon manufacturing. Methods development for ICP analysis of minor impurities found in silicon.

Chemist, Ametek, Inc., Harleysville, Pennsylvania, 1982-1985. Responsibilities included product research and development chemist involved in production of thin-film semiconductors for use as solar cells. Work involved AA and SEM techniques.

Chemist, Janbridge, Inc., Philadelphia, Pennsylvania, 1978-1982. Responsibilities included maintaining electroplating process lines through wet chemical analysis techniques, and performed Quality Assurance testing on printed circuit boards.

Education

BA, Chemistry, Immaculata College, Immaculata, Pennsylvania, 1977.

Affiliations

American Chemical Society, Member since 1987.

PAUL GOWAN

1994 TO PRESENT

CAS Holdings Inc., 1317 S. 13th Avenue, Kelso, WA 98626 (360) 577-7222

Current Position

IT MANAGER II, 2002 to Present

Responsibilities

Identify and plan IT requirements by interacting with management personnel to identify current and long-term user objectives. Assist in developing and tracking the IT computer capital budget. Provide electronic data deliverable (EDD) and LIMS system guidance to management personnel throughout the company. Ensure the effective utilization of computer systems. Train users as required. Establish IT policies, standards, practices, and specifications. Participate in the LIMS planning group.

Plan and supervise IT department staffing, organization, hardware and software acquisitions to meet requirements. Acquire, develop, and maintain a professional, skilled, and motivated staff through effective performance review and career development programs. Develop and maintain relationships with local and national vendors of computer hardware, software, and telephone equipment.

Experience

KELSO IT MANAGER, *Columbia Analytical Services, Inc., Kelso, Washington*, 1999-2002. Responsible for all IT efforts related to the CAS laboratory in Kelso, WA, including, but not excluded to computing equipment specification, purchasing and maintenance; network infrastructure; software development; strategic planning for future IT initiatives; budget preparation performance reviews, and career growth planning for IT staff.

TECHNICAL INFORMATION SPECIALIST, *CAS Holdings, Inc., Kelso, Washington*, 1994-1999. Primary responsibilities included support automation of HP chemstation and Enviroquant; support continued development of unified organic laboratories; support and development of project-specific data deliverables, technical assistance in Information Technology at Kelso to meet CAS IT objectives as related to LIMS.

Organics Section Manager, *Anametrix, Inc., San Jose, California*, 1992-1994.

Responsibilities included managing the GC/MS and GC/Pesticide Departments, following protocols of the Department of Defense NEESA contracts (demanding stringent QA/QC and "Level D" data package submittals). Primary responsibilities included supervisor training and development, budget preparation and maintenance, performance reviews, data review, continuing research on environmental trends, SOP generation and updates, method development, capital equipment evaluation for laboratories, and project management.

GC/MS Program Manager, *Anametrix, Inc., San Jose, California*, 1988-1992.

Responsibilities included supervision of five chemists, two Finnigan 4000 GC/MS Systems, and three HP 5971 GC/MS Systems. Primary responsibilities were to maintain high productivity and insure that the GC/MS department generated legally defensible data. Also responsible for sample scheduling and tracking, instrument maintenance and troubleshooting, analyst training and review, client interfacing, and purchasing.

GC/MS Analyst, *Anametrix, Inc., San Jose, California*, 1986-1988. Responsibilities included analyzing for VOA and Semi-VOA priority pollutants using EPA Methods 624/625 and 8240/8370.

Education

BA, Biochemistry, *San Jose State University, San Jose, California*, 1986.

LAWRENCE J. "LAWRY" JACOBY

1990 TO PRESENT

Columbia Analytical Services, Inc., 1317 S. 13th Avenue, Kelso, WA 98626 (360) 577-7222

Current Position	VICE PRESIDENT, QUALITY ASSURANCE DIRECTOR – 1992 to Present
Responsibilities	Responsible for the conduct of the quality assurance (QA) program and activities for CAS; for conducting systems and data audits at each CAS laboratory to ensure that the QA objectives established by management and by the various certifications, accreditations, project plans, and regulations under which CAS operates are satisfactorily met, to ensure that the QA programs are functioning as stated in QA Manuals, and to make appropriate recommendations for corrective actions and improvements; for management of performance evaluation and round-robin samples analyses programs; for evaluating data quality; for maintaining CAS-wide standard operating procedures; for preparing quarterly QA reports to management; for preparing, facilitating, and presenting quarterly ethics training; and for providing technical assistance and training to QA program managers at each CAS laboratory.
Experience	Quality Assurance Coordinator, <i>Columbia Analytical Services, Inc., Kelso, Washington</i>, 1990-1992. Responsible for CAS/Kelso's quality assurance program and projects, and for evaluating data quality. Client Services Manager, <i>CH₂M Hill Laboratory, Redding, California</i>, 1989-1990. Management of client services and sample custody groups; customer service and maintenance; project management; proposal and quotation preparation; project-engineer/laboratory liaison. Inorganic Division Manager, <i>CH₂M Hill Laboratory, Redding, California</i>, 1988-1989. Responsible for managing the operation of the inorganic analyses section including wet chemical, soil, and metals analyses; project management; customer service; proposal and quotation preparation. Laboratory Manager, <i>CH₂M Hill Laboratory, Corvallis, Oregon</i>, 1986-1988. Responsible for managing the operation of the laboratory and coordinating the activities of project support staff; project management; quality assurance; proposal and quotation preparation; laboratory safety; engineering project consulting. Analytical Chemist, <i>Teledyne Wah Chang, Albany, Oregon</i>, 1976-1986. Responsibilities included methods development; instrument maintenance; non-routine analyses; workload scheduling and coordination; and task force assignments. Instructor, <i>Chemeketa Community College, Salem, Oregon</i>, 1971-1976. Taught college courses in general, organic and analytical chemistry. Assistant Professor, <i>Portland State University, Portland, Oregon</i>, 1969-1971. Taught college courses in general and organic chemistry.
Education	PhD, Organic Chemistry, <i>Colorado State University, Ft. Collins, Colorado</i>, 1969. BS, Chemistry, <i>Oregon State University, Corvallis, Oregon</i>, 1965.
Affiliations	American Society for Quality. American Chemical Society. AOAC International.

GARY K. WARD

2001 TO PRESENT

Columbia Analytical Services, Inc., 1317 S. 13th Avenue, Kelso, WA 98626 (360) 577-7222

Current Position

VICE PRESIDENT, CHIEF QUALITY, SAFETY, AND ETHICS OFFICER – 2001 to Present

Responsibilities

Responsibilities include directing and managing the overall corporate-wide quality systems, ethics and safety programs for all CAS facilities, as well as strategic planning, marketing, business development, and information technology. Responsible for all interaction and liaison with government entities involving quality, technical and operational issues.

Experience

Deputy Director, Laboratory Standards, Intertek Testing Services, Houston, Texas, 1998-2001. Responsibilities included professional standards/quality assurance for 240 laboratories in 93 countries, involving laboratory tests ranging from petroleum products and environmental samples to toys, textiles, and building products. Resolution of issues with a variety of governments, agencies, and companies with particular focus on interactions with the US EPA. Was previously responsible for all operations of over 100 labs in the Americas, ranging from Canada to South America, including duties to improve quality, raise profits and revenues, and implement a LIMS.

Director, Technical Operations, Environmental Health Laboratories, South Bend, Indiana, 1995-1998. Responsibilities included operations and quality assurance of the laboratory. Directed, administered and coordinated activities of the lab in accordance with goals and objectives of the company. Responsible for the R&D program, laboratory throughput and financial performance, and implementation of the new LIMS system.

Executive Scientist, Quanterra (Enseco), Arvada, Colorado, 1987-1995. Responsibilities included providing expertise and experience in laboratory analysis and operations to the entire laboratory system. Duties included implementation of network-wide LIMS as well as coordination of the Technology, QA, IS, and Operations groups. As Director of Technology and Quality Assurance was responsible for management of the R&D program, Quality Assurance program, and Environment, Health and Safety program throughout the Enseco lab system. Direct reports were all QA managers, safety managers, and chief scientists from each of the 13 laboratories.

Deputy Branch Chief, U.S. Environmental Protection Agency, 1983-1987. Responsibilities included providing expertise to entire Superfund program ranging from lab analytical services to sampling. Duties involved managing the CLP program as well as the Superfund R&D program. As CLP National Program Manager was responsible for development and implementation of CLP analytical protocols, administration of contracts for over 100 laboratories throughout the country, and liaison with contract divisions, other EPA programs, and enforcement. Responsible for development and implementation of disk deliverables, automated contract screening, as well as writing new protocols for specific methods such as ICP/MS and for EPA methods such as included in SW846, 3rd Edition. Duties also included coordination of the annual CLP conferences.

Education

MS, Chemical Oceanography, RSMAS, University of Miami, Miami, Florida, 1973.

BS, Chemistry, Loyola University, Los Angeles, California, 1970.

Publications, Presentations, And Affiliations

Mr. Ward has a number of publications and presentations, and is affiliated with several professional organizations. For a list of these, please contact CAS.

STEPHEN W. VINCENT

1986 TO PRESENT

Columbia Analytical Services, Inc., 1317 S. 13th Avenue, Kelso, WA 98626 (360) 577-7222

Current Position	PRESIDENT, CAS HOLDINGS INC. – 1986 to Present
Responsibilities	Responsible for the overall growth and profitability of the CAS laboratory network. This includes establishing and implementing long-range objectives, plans, and policies, and representing the company with its major customers, technical community, and the public.
Experience	Laboratory Manager, Weyerhaeuser Company, Federal Way, Washington, 1979-1986. Responsibilities involved all phases of technical and administrative management. This included management of organic, inorganic, and microbiological analyses and management of capital; an annual operating budget of approximately \$2 million; management of thirty staff members; contract procurement, and project management. Projects included an EPA Inorganic CLP contract; an EPA acid rain deposition contract; a contract with the Fish and Wildlife Service to measure trace organic contaminants in animal tissues; and others.
	Analytical Chemist, Weyerhaeuser Company, Longview, Washington, 1975-1979. Responsibilities: Method development, routine analysis and supervision for the Weyerhaeuser Multi-Region Support Lab. Responsible for setting up a company-wide laboratory audit, round robin, and quality assurance program.
Education	Market Strategy for Technology Based Companies, Executives Program, Stanford University. 1994. Advanced Technical Management Program, University of California at Los Angeles, Department of Business, Engineering and Management, 1991. Completion of Coursework for MS, Pulp and Paper Technology, University of Washington, Seattle, Washington, 1984. Post Graduate Coursework, Engineering and Management, University of California at Los Angeles, Graduate School of Engineering and Applied Science, Los Angeles, California, 1981. BS, Oceanography, University of Washington, Seattle, Washington, 1974.
Publications/ Presentations	<i>Mr. Vincent has a number of publications and presentations. For a list of these publications and presentations, please contact CAS.</i>
Affiliations	American Chemical Society. Technical Association of the Pulp and Paper Industry.

APPENDIX C

MAJOR ANALYTICAL EQUIPMENT

GENERAL CHEMISTRY/WATER CHEMISTRY LABORATORY			
Equipment Description	Year Acquired	Manufacturer or Laboratory Maintained (MM/LM)	# of Trained Operators
Analytical Balances (9): Precisa and Mettler models	1988-2000	MM	15
Autoclave - Market Forge Sterilmatic	1988	LM	5
Calorimeter - Parr 1241 EA Adiabatic	1987	LM	5
Centrifuge - Damon/IEC Model K	1992	LM	15
Colony Counter - Quebec Darkfield	1988	LM	5
Conductivity Meters (2): Amber Science Model 604	1987	LM	8
VWR	2001	LM	8
Digestion Systems (5): COD (4)	1987, 1989	LM	8
Kjeldahl, Lachat 46-place (1)	1999	LM	5
Dissolved Oxygen Meter - YSI Model 58 (3)	1987, 1988, 1991	LM	8
Distillation apparatus (Midi) - Easy Still (2)	1996, 2000	LM	7
Drying Ovens (11): Shel-Lab and VWR models	1988 - 2003	LM	15
Flash Point Testers: ERDCO Setaflash Tester (2)	1988, 1991	LM	5
Flow-Injection Analyzers (2): Lachat Quik-Chem AE	1990	LM	5
Bran-Leubbe	2002	LM	3
Ion Chromatographs (5) Dionex 2000i with Peaknet Data Systems (2)	1988	LM	5
Dionex DX-120 with Peaknet Data System	1998	LM	5
Dionex DX-100 with Peaknet Data System	2000	LM	3
Dionex ICS-2500 with Chromchem Data System	2002	LM	3
Ion Selective Electrode Meters (5) Fisher Scientific Accumet Model 50	1997	LM	9
Fisher Scientific Accumet Model 25	1993	LM	9
Fisher Scientific Accumet Model 20	2000	LM	9
Orion Model 920A	1990	LM	9
Corning pH/ion Meter Model 135	1992	LM	9
Microscopes (3): Olympus BH-2	1987	LM	13
Bausch & Lomb	1988	LM	13
Swift	1988	LM	13
Muffle Furnaces- Sybron Thermolyne Model F-A1730	1991	LM	15

GENERAL CHEMISTRY/WATER CHEMISTRY LABORATORY (continued)			
Equipment Description	Year Acquired	Manufacturer or Laboratory Maintained (MM/LM)	# of Trained Operators
pH Meters (3):			
Beckman 34 (2)	1989	LM	9
Fisher Scientific Accumet Model 20	1993	LM	9
Shatter Box - GP 1000	1989	LM	5
Sieve Shakers (2):			
CE Tyler - Portable RX 24	1990	LM	5
WS Tyler - RX 86	1991	LM	5
Thomas-Wiley Laboratory Mill, Model 4	1989	LM	7
Total Organic Carbon (TOC) Analyzers (3)			
O-I Corporation, Model 700	1993	LM	3
Coulemetrics Model 5012	1997	LM	5
O-I Corporation Model 1010	2002	LM	3
Total Organic Halogen (TOX) Analyzers (4):			
Mitsubishi (MCI) TOX-10	1986	LM	5
Mitsubishi TOX-Sigma	1995	LM	5
Mitsubishi TOX-100 (2)	2001	LM	4
Turbidimeter - Hach Model 2100N	1996	LM	8
UV-Visible Spectrophotometers (2):			
Hitachi 100-40 Single Beam	1986	LM	10
Milton Roy 1001 Plus	1991	LM	10
Vacuum Pumps (2):			
Welch Duo-Seal Model 1376	1990	LM	13
Busch R-5 Series Single Stage	1991	LM	13
Water Baths/Incubators (6):			
Hach Model 15320 Incubator	1986	LM	6
Precision Model L-6 (2)	1989, 1990	LM	6
VWR 1540	1991	LM	6
Fisher 11-680-626M Incubator	1992	LM	6
Fisher Isotemp Incubator	2001	LM	6

METALS LABORATORY			
Equipment Description	Year Acquired	Manufacturer or Laboratory Maintained (MM/LM)	# of Trained Operators
Analytical Balance (6)			
Various Mettler AE 200 analytical balance	1990	MM	12
Various Mettler models (5)	1988	MM	12
Atomic Absorption Spectrophotometers (6):			
Varian SpectrAA 300 Zeeman AA and IBM Data Systems (2)	1989	LM	3
Varian SpectrAA Zeeman/220 AA w/Data Systems (2)	2000	LM	3
Varian SpectrAA 20 with Flame, Cold Vapor, and Hydride Systems	1988	LM	4
CETAC Mercury Analyzer	2000	LM	3
Atomic Fluorescence Spectrophotometer			
Brooks-Rand Model III	1996	LM	4
Centrifuge - IEC Model Clinical Centrifuge	1990	LM	12
Drying Oven - VWR Model 1370F	1990	LM	12
TCLP Extractors (3)	1989, 2002	LM	6
Freeze Dryers (2) - Labconco	1988, 1992	LM	5
Muffle Furnace - Thermolyne Furnatrol Model 53600	1991	LM	5
Shaker - Burrell Wrist Action Model 75	1990	LM	12

ICP LABORATORY			
Equipment Description	Year Acquired	Manufacturer or Laboratory Maintained (MM/LM)	# of Trained Operators
Inductively Coupled Plasma Atomic Emission Spectrometer (ICP-AES) - Thermo Jarrell Ash Model 61E	1988	LM	5
Inductively Coupled Plasma Atomic Emission Spectrometer (ICP-AES): Thermo Jarrell Ash, Model IRIS	2000	MM	3
Inductively Coupled Plasma Mass Spectrometer (ICP-MS): VG PQ-S	1997	MM	4
Inductively Coupled Plasma Mass Spectrometer (ICP-MS): VG Excell	2001	MM	4

GC SEMIVOLATILE ORGANICS LABORATORY			
Equipment Description	Year Acquired	Manufacturer or Laboratory Maintained (MM/LM)	# of Trained Operators
SAMPLE PREPARATION			
Accelerated Solvent Extractor - Dionex ASE 200	1996	LM	5
Analytical Balance (2)			
Mettler BB240	1987	MM	7
Satorious B610	1999	MM	7
Aspirator pumps - Labconco Cole Parmer (1)	1994	LM	7
Centrifuges (2):			
Adams Model DYNAC	1986	LM	7
Sorvall Model GLC-1	1988	LM	7
Drying Oven - Fisher Model 655 G	1991	LM	7
Evaporators (6):			
Organomation N-Evap (3)	1989,1998, 2001	LM	7
Organomation S-Evap (3)	1989-1991	LM	7
Extractors: Lab-Line Multi-Unit Extraction Heaters (60)	1987-1992	LM	7
ABC GPC - single column (2)	1998, 1999	LM	4
Muffle Furnace - Parflow MIC 6000	1994	LM	7
Sonic Water Bath - Branson Model 8200	1991	LM	7
Vacuum Pump - Edwards	1992	LM	7
INSTRUMENTATION			
Analytical Balance - Mettler AT 250	1989	MM	8
Chromatography Data Systems (12)			
HP Enviroquant (8)	1994-2002	LM	4
Thruput Target (4)	1998-2000	LM	3
Gas Chromatographs (11):			
Hewlett-Packard 5890 GC with HP 7673 Autosampler and Dual ECD Detectors (7)	1990 – 1995	LM	7
Hewlett-Packard 5890 GC with HP 7673 Autosampler and Dual FPD Detectors	1991	LM	4
Agilent 6890 GC with Agilent 7683 Autosampler and Dual ECD Detectors (2)	2001	LM	4
Agilent 6890 GC with Agilent 7683 Autosampler and Dual FPD Detectors	2003	MM	4

PETROLEUM HYDROCARBONS GC LABORATORY			
Equipment Description	Year Acquired	Manufacturer or Laboratory Maintained (MM/LM)	# of Trained Operators
SAMPLE PREPARATION			
Analytical Balance (3)			
Mettler BB300	1991	MM	7
Mettler BB240	1994	MM	7
Mettler AE166	1994	MM	7
Aspirator pumps - Labconco Cole Parmer (1)	1994	LM	7
Drying Oven (2) - Fisher Models 630F & 655 G	1991	LM	7
Evaporators (2):			
Organomation N-Evap	1990	LM	6
Organomation S-Evap	1991	LM	6
Extractors (21):			
Lab-Line Multi-Unit Soxhlet Extraction Heaters (18)	1987-1992	LM	6
Sonic Horns (3): Branson, Ultrasonics, Fisher Models	1991-1994	LM	6
INSTRUMENTATION			
HP Enviroquant Chromatography Data Systems (10)	1994-2002	LM	6
Gas Chromatographs (10):			
Varian 3300 with PID/FID detectors	1989	LM	3
O-I 4460A Purge and Trap Concentrator	1989	LM	3
Dynatech PTA-30 Autosampler	1996	LM	3
Hewlett-Packard 5890 Series II with PID/	1991	LM	3
PID/FID det.	1991	LM	3
Tekmar LSC-2000 Purge and Trap Concentrator	1991	LM	3
Dynatech Archon 5100 Autosampler	1992	LM	3
Hewlett-Packard 5890 Series II with PID/FID det.	1988	LM	3
Tekmar LSC-2000 Purge and Trap Concentrator	2003	MM	3
ComBi-Pal Headspace Autosampler	1999	LM	3
Hewlett-Packard 5890 Series II with PID/PID/FID det.	1999	LM	3
O-I 4560A Purge and Trap Concentrator	1999	LM	3
Dynatech Archon 5100 Autosampler			
Hewlett-Packard 5890 GC with HP 7673	1990 - 1995	LM	5
Autosampler and Dual FID Detectors (3)			
Hewlett-Packard 5890 GC with HP 7673	1994	LM	5
Autosampler and FID/ECD Detectors			
Agilent 6890 with Agilent 7873	2001	LM	5
Autosampler and Dual FID Detectors			
Hewlett-Packard 5890 GC with HP 7673	2003	LM	2
Autosampler and Dual ECD Detectors			
High-Performance Liquid Chromatographs (2):			
HP 1090M Series II with HP 1046A Fluorescence	1995, 1999	LM	3
Detector & Diode Array UV Detector (2)			

GC/MS SEMIVOLATILE ORGANICS SAMPLE PREPARATION			
Equipment Description	Year Acquired	Manufacturer or Laboratory Maintained (MM/LM)	# of Trained Operators
Analytical Balances Sartorius 610	2000	MM	6
Evaporators (4): Organomation N-Evap (2)	1989-1990, 2000	LM	5
Organomation S-Evap (2)	1990-1991	LM	5
Extractors (64): Continuous Liquid/Liquid Extractors (24)	1991	LM	5
Branson Model 450 Sonifier (2)	1991	LM	5
Tekmar Sonifier (2)	1994	LM	5
Soxhtherm (36)	2000	LM	3
GPC-ABC Model Autoprep 1000	1995	LM	4
Gas Chromatograph: Hewlett-Packard 5890 with HP 7673 autosampler and FID Detector	1994	LM	5

GC/MS SEMIVOLATILE ORGANICS INSTRUMENT LABORATORY			
Equipment Description	Year Acquired	Manufacturer or Laboratory Maintained (MM/LM)	# of Trained Operators
HP Enviroquant Chromatography Data Systems (9)	1994-2002	LM	8
Semivolatile GC/MS Systems (7): Hewlett-Packard 6890/5973 with HP 6890 Autosampler (2)	1997, 2001	MM	6
Hewlett-Packard 5890/5970 with HP 7673 Autosampler (2)	1990, 1994	MM	6
Hewlett-Packard 5890/5972 with HP 7673 Autosampler (3)	1993, 1994, 1998	MM	6

VOLATILE ORGANICS LABORATORY			
Equipment Description	Year Acquired	Manufacturer or Laboratory Maintained (MM/LM)	# of Trained Operators
Analytical Balance Mettler PE 160	1989	MM	8
Baxter Vortex Mixer	1989	LM	8
Extractors (10): Millipore TCLP Zero Headspace Extractors (10)	1987-1992	LM	2
TCLP Extractor - Tumbler (12 position)	1989	LM	2
HP Enviroquant Chromatography Data Systems (10)	1994-2002	LM	8
Drying Ovens (2): Narco 420	1989	LM	8
VWR 1305 U	1991	LM	8
Sonic Water Bath - Branson Model 2200	1989	LM	8
Volatile GC/MS Systems (5): Hewlett-Packard 5890/5970	1989	MM	6
Tekmar 3000 Purge and Trap Concentrator	1995	LM	6
Dynatech ARCHON 5100 Autosampler	1996	LM	6
Hewlett-Packard 5890/5970	1999	MM	6
EST Encon Purge and Trap Concentrator	2002	LM	6
Dynatech ARCHON 5100 Autosampler	1999	LM	6
Hewlett-Packard 5890/5971	1991	MM	6
Tekmar 3000 Purge and Trap Concentrator	2001	LM	6
Dynatech ARCHON 5100 Autosampler	1995	LM	6
Hewlett-Packard 5890/5972A	1993	MM	6
Tekmar 3000 Purge and Trap Concentrator	1995	LM	6
Dynatech ARCHON 5100 Autosampler	1996	LM	6
Hewlett-Packard 6890/5973	2001	MM	6
Tekmar 3100 Purge and Trap Concentrator	2001	LM	6
Varian Archon Autosampler	2001	LM	6

DRINKING WATER ORGANICS LABORATORY			
Equipment Description	Year Acquired	Manufacturer or Laboratory Maintained (MM/LM)	# of Trained Operators
Analytical Balance - Mettler BB300	1991	MM	2
Extractors (5) – Horizon SPE-DEX Solid Phase Extractor	2003	LM	2
Agilinet Enviroquant Chromatography Data Systems (2)	2003	LM	2
Varian Saturn Chromatography Data System	2003	LM	2
Evaporator - Organomation N-Evap	2003	LM	2
Agilent 1100 HPLC w/post-column derivitization:	2003	LM	2
UV/Fluorescence detectors	2003	LM	2
Pickering PCX-5200 Post-column derivitization unit	2003	LM	2
Agilent 6890N GC/ECD system:	2003	LM	2
Dual micro-ECD detectors	2003	LM	2
Agilent autosampler	2003	LM	2
Varian Ion trap GC/MS:	2003	LM	2
Varian 3900 GC w/CP8400 autosampler	2003	LM	2
Varian Saturn 2100T mass spectrometer	2003	LM	2

AUTOMATED DATA PROCESSING EQUIPMENT			
Equipment Description	Year Acquired	Manufacturer or Laboratory Maintained (MM/LM)	# of Trained Operators
1-WAN: LIMs Sample Manager using ORACLE DBMS running on SEQUENT UNIX/DYNIX platform connected/linked on a frame relay WAN environment.	1994-1995	LM	NA
3- Network Servers Pentium/Pentium II class. 1 for Administration, 1 for Data Acquisition, and 1 for Applications. Network operating system: Microsoft Windows2000®. Data acquisition capacity at 28GB with redundant tape and disk arrays.	1994-2003	LM	NA
Approximately 40+ HP class Laserjet printers (various types from IIIs to SI Ivs and 8150s) linked via LAN.	1991-2002	LM	NA
Approximately 115 HP/Gateway/Dell PC/Workstations on LAN hooked up with 10BT/100BT and TCP/IP for LIMs Terminal Emulation.	1993-2002	LM	NA
Microsoft Office Small Business Edition as the base application for all PC/Workstations.	1994-2000	LM	NA
E-Mail with link to SMTP for internal/external messaging. Web mail via Cobalt Qube interface. Microsoft Outlook® 98 and 2000.	1994-2001	LM	NA
Standard EXCEL® reporting platform application linked to LAN/WAN for data connectivity and EDD generation.	1994-1996	LM	NA
Facsimile Machines 9600-14400 Baud, 11 Pages/Minute (4)	1991-1998	LM	NA
Dot Matrix NLQ (3)	1991-1992	LM	NA
Thruput, MARRS, Stealth, Harold, and Blackbird reporting software systems.	1998-2003	LM	NA

NA: Not applicable. This equipment administered by IT staff but may be used by all staff.

APPENDIX D

DATA QUALITY CAPABILITIES

GENERAL CHEMISTRY/WATER CHEMISTRY ANALYSES						
Method ^a	Analyte	Matrix	Method Reporting Limit	Method Detection Limit	Precision ^b (RPD)	Accuracy ^c (%REC)
110.2	Color	Water	NA	NA	20	NA
120.1 / SM 2510B	Conductivity	Water	2 umhos/cm	0.2 umhos/cm	20	NA
130.2 / SM 2340C	Hardness as CaCO ₃	Water	10 mg/L	3 mg/L	20	NA
150.1	pH	Water	NA	NA	NA	NA
160.1 / SM 2540C	Solids, Total Dissolved (Filterable)	Water	5 mg/L	5 mg/L	20	NA
160.2	Solids, Total Suspended (Nonfilterable)	Water	5 mg/L	5 mg/L	20	NA
160.3	Solids, Total	Soil	NA (%)	NA (%)	20	NA
		Water	5 mg/L	5 mg/L	20	NA
160.4	Solids, Volatile	Soil	NA (%)	NA (%)	20	NA
		Water	5 mg/L	5 mg/L	20	NA
160.5	Solids, Settleable	Water	0.1 ml/L	NA	20	NA
180.1	Turbidity	Water	0.1 NTU	0.05 NTU	20	NA
300.0 / 9056 Ion Chromatography (After Extraction)	Bromide	Soil	1 mg/Kg	0.3 mg/Kg	20	90-110 ^d
	Chloride				20	90-110 ^d
	Nitrate as Nitrogen				20	90-110 ^d
	Nitrite as Nitrogen				20	90-110 ^d
	Sulfate		2 mg/Kg	0.7 mg/Kg	20	90-110 ^d
300.0 / 9056 Ion Chromatography	Bromide	Water	0.2 mg/L	0.02 mg/L	20	90-110 ^d
	Chloride		0.2 mg/L	0.04 mg/L	20	90-110 ^d
	Fluoride		0.2 mg/L	0.01 mg/L	20	90-110 ^d
	Nitrate as Nitrogen		0.1 mg/L	0.008 mg/L	20	90-110 ^d
	Nitrite as Nitrogen		0.1 mg/L	0.006 mg/L	20	90-110 ^d
	Sulfate		0.2 mg/L	0.04 mg/L	20	90-110 ^d
300.1 Ion Chromatography	Bromate	Water	6 ug/L	3 ug/L	20	90-110 ^d
	Bromide		20 ug/L	6 ug/L	20	90-110 ^d
	Chlorite		20 ug/L	5 ug/L	20	90-110 ^d
305.2	Acidity as CaCO ₃	Water	NA (mg/L)	NA (mg/L)	20	NA
310.1 / SM 2320B	Alkalinity as CaCO ₃	Water	2 mg/L	1 mg/L	20	NA
325.3	Chloride, Titrimetric	Water	0.2 mg/L	0.2 mg/L	20	85-115
330.4	Chlorine, Total Residual	Water	0.1 mg/L	0.07 mg/L	20	85-115
335.1	Cyanides Amenable to Chlorination	Soil	0.2 mg/Kg		20	85-115 ^b
		Water	0.01 mg/L	0.003 mg/L	20	85-115 ^b
335.2 / 335.4	Cyanide, Total	Soil	0.2 mg/Kg		20	85-115 ^b
		Water	0.01 mg/L	0.004 mg/L	20	85-115 ^b
SM 4500-CNI	Cyanide, Weak Acid Dissociable	Soil	0.2 mg/Kg		20	85-115 ^b
		Water	0.01 mg/L	0.003 mg/L	20	85-115 ^b
340.1	Fluoride, Bellack Distillation	Soil	1 mg/Kg		20	85-115 ^b
		Water	1.0 mg/L	0.4 mg/L	20	85-115 ^b
340.2 / SM 4500-FC	Fluoride	Soil	2 mg/Kg		20	85-115 ^b
		Water	0.2 mg/L	0.02 mg/L	20	85-115 ^b
350.3	Ammonia as Nitrogen	Soil	0.2 mg/Kg		20	85-115 ^b
		Water	0.05 mg/L	0.03 mg/L	20	85-115 ^b

GENERAL CHEMISTRY/WATER CHEMISTRY ANALYSES						
Method ^a	Analyte	Matrix	Method Reporting Limit	Method Detection Limit	Precision ^b (RPD)	Accuracy ^c (%REC)
351.4	Nitrogen, Total Kjeldahl	Soil	20 mg/Kg	6 mg/kg	20	85-115 ^b
		Water	0.1 mg/L	0.07 mg/L	20	85-115 ^b
353.2	Nitrogen, Nitrate + Nitrite as Nitrogen	Soil	1 mg/Kg		20	85-115 ^b
		Water	0.2 mg/L	0.02 mg/L	20	85-115 ^b
354.1	Nitrite as Nitrogen, Colorimetric	Water	0.01 mg/L	0.003 mg/L	20	85-115 ^b
365.3	Orthophosphate as Phosphorus	Soil	(e) mg/Kg		20	85-115 ^b
		Water	0.01 mg/L	0.003 mg/L	20	85-115 ^b
SM 4500-PF	Orthophosphate as Phosphorus	Water	0.01 mg/L	0.004 mg/L	20	85-115 ^b
365.3M 365.3	Phosphorus, Total	Soil	0.2 mg/Kg		20	85-115 ^b
		Water	0.01 mg/L	0.003 mg/L	20	85-115 ^b
376.1	Sulfide	Water	2 mg/L	0.5 mg/L	20	85-115 ^b
377.1	Sulfite	Water	2 mg/L	0.3 mg/L	20	NA
SM 5550B	Tannin and Lignin	Water	0.2 mg/L	0.07 mg/L	20	85-115 ^b
405.1	Biological Oxygen Demand	Water	4 mg/L	0.7 mg/L	20	NA
410.1 and 410.2	Chemical Oxygen Demand	Soil	50 mg/Kg		20	85-115 ^b
		Water	5 mg/L	2 mg/L	20	85-115 ^b
ASTM D4129-82M 415.1	Total Organic Carbon	Soil	0.05%	0.02%	20	85-115 ^b
		Water	0.5 mg/L	0.2 mg/L	20	85-115 ^b
420.1	Phenolics, Total	Soil	0.5 mg/Kg		20	85-115 ^b
		Water	0.01 mg/L	0.007 mg/L	20	85-115 ^b
425.1	Surfactants (MBAS)	Water	0.05 mg/L	0.02 mg/L	20	75-125 ^b
ASTM D1498	Oxidation-Reduction Potential	Water	NA	NA	20	NA
1010	Flashpoint, Pensky-Marten	Soil	NA	NA		
		Water	NA	NA	20	NA
1020	Flashpoint, Setaflash	Soil	NA	NA		
		Water	NA	NA	20	NA
1110	Corrosivity	Liquid	NA	NA	20	NA
1650A/B/C	Absorbable Organic Halides	Water	10 ug/L	6 ug/L	20	71-116 ^d
3060A/7196A 7196A	Hexavalent Chromium	Soil	0.5 mg/Kg	0.2 mg/Kg	20	85-115 ^b
		Water	0.05 mg/L	0.02 mg/L	20	85-115 ^b
9010A	Cyanide, Total and Amenable	Soil	0.2 mg/Kg		20	85-115 ^b
		Water	0.01 mg/L	0.004 mg/L	20	85-115 ^b
9020	Total Organic Halides	Water	10 ug/L	2 ug/L	20	87-113
9030	Sulfides	Water	0.1 mg/L	0.06 mg/L	20	60-130 ^b
9030M	Sulfides	Soil	0.5 mg/kg	0.2 mg/kg	20	60-130 ^b
9040	Corrosivity (pH)	Water	NA	NA	20	NA
9045C	pH	Soil	NA	NA	20	NA
9050	Specific Conductance	Water	2 mg/L	0.2 mg/L	20	NA
9060A	Total Organic Carbon	Water	0.5 mg/L	0.2 mg/L	20	85-115 ^b
9066	Phenolics, Total	Soil	0.5 mg/Kg		20	85-115 ^b
		Water	0.01 mg/L	0.007 mg/L	20	85-115 ^b
9095	Paint Filter Test	Soil	NA	NA	NA	NA
9252	Chloride, Titrimetric	Water	0.2 mg/L	0.2 mg/L	20	85-115 ^b

METALS ANALYSES						
Method ^a	Analyte	Matrix	Method Reporting Limit	Method Detection Limit	Precision ^b (RPD)	Accuracy ^c (%REC)
200.7 (ICP)	Aluminum	Soil	10 mg/Kg	8 mg/Kg	30	70-130 ^m
	Antimony		10 mg/Kg	6 mg/Kg	30	70-130 ^m
	Barium		1 mg/Kg	0.2 mg/Kg	30	70-130 ^m
	Beryllium		1 mg/Kg	0.2 mg/Kg	30	70-130 ^m
	Boron		20 mg/Kg	20 mg/Kg	30	70-130 ^m
	Cadmium		1 mg/Kg	0.8 mg/Kg	30	70-130 ^m
	Calcium		10 mg/Kg	3 mg/Kg	30	70-130 ^m
	Chromium		2 mg/Kg	0.6 mg/Kg	30	70-130 ^m
	Cobalt		2 mg/Kg	0.6 mg/Kg	30	70-130 ^m
	Copper		2 mg/Kg	2 mg/Kg	30	70-130 ^m
	Iron		4 mg/Kg	1 mg/Kg	30	70-130 ^m
	Lead		20 mg/Kg	5 mg/Kg	30	70-130 ^m
	Magnesium		4 mg/Kg	2 mg/Kg	30	70-130 ^m
	Manganese		1 mg/Kg	0.2 mg/Kg	30	70-130 ^m
	Molybdenum		2 mg/Kg	2 mg/Kg	30	70-130 ^m
	Nickel		4 mg/Kg	2 mg/Kg	30	70-130 ^m
	Potassium		400 mg/Kg	100 mg/Kg	30	70-130 ^m
	Silver		2 mg/Kg	2 mg/Kg	30	70-130 ^m
	Sodium		20 mg/Kg	20 mg/Kg	30	70-130 ^m
	Tin		10 mg/Kg	4 mg/Kg	30	70-130 ^m
	Vanadium		2 mg/Kg	2 mg/Kg	30	70-130 ^m
	Zinc		2 mg/Kg	0.5 mg/Kg	30	70-130 ^m
200.7 (ICP)	Aluminum	Water	50 ug/L	50 ug/L	20	85-115 ^d
	Antimony		50 ug/L	40 ug/L	20	85-115 ^d
	Barium		5 ug/L	2 ug/L	20	85-115 ^d
	Beryllium		5 ug/L	1 ug/L	20	85-115 ^d
	Boron		50 ug/L	40 ug/L	20	85-115 ^d
	Cadmium		5 ug/L	3 ug/L	20	85-115 ^d
	Calcium		50 ug/L	30 ug/L	20	85-115 ^d
	Chromium		5 ug/L	3 ug/L	20	85-115 ^d
	Cobalt		10 ug/L	5 ug/L	20	85-115 ^d
	Copper		10 ug/L	8 ug/L	20	85-115 ^d
	Iron		20 ug/L	6 ug/L	20	85-115 ^d
	Magnesium		20 ug/L	20 ug/L	20	85-115 ^d
	Manganese		5 ug/L	1 ug/L	20	85-115 ^d
	Molybdenum		10 ug/L	4 ug/L	20	85-115 ^d
	Nickel		20 ug/L	20 ug/L	20	85-115 ^d
	Potassium		2000 ug/L	700 ug/L	20	85-115 ^d
	Silver		10 ug/L	9 ug/L	20	85-115 ^d
	Sodium		100 ug/L	70 ug/L	20	85-115 ^d
	Tin		50 ug/L	20 ug/L	20	85-115 ^d
	Vanadium		10 ug/L	4 ug/L	20	85-115 ^d
	Zinc		10 ug/L	2 ug/L	20	85-115 ^d

METALS ANALYSES						
Method ^a	Analyte	Matrix	Method Reporting Limit	Method Detection Limit	Precision ^b (RPD)	Accuracy ^c (%REC)
200.9 (GFAA)	Arsenic	Soil	1 mg/Kg	0.2 mg/Kg	30	70-130 ^m
200.9 (GFAA)	Lead		1 mg/Kg	0.2 mg/Kg	30	70-130 ^m
200.9 (GFAA)	Selenium	Soil	1 mg/Kg	0.2 mg/Kg	30	70-130 ^m
200.9 (GFAA)	Thallium		1 mg/Kg	0.2 mg/Kg	30	70-130 ^m
206.2/200.9 ^f (GFAA)	Arsenic	Water	5 ug/L	1 ug/L	20	85-115 ^d
239.2/200.9 ^f (GFAA)	Lead		2 ug/L	1 ug/L	20	85-115 ^d
245.1 (CVAA)	Mercury		0.2 ug/L	0.1 ug/L	20	85-115 ^d
1631	Mercury		1 ng/L	0.06 ng/L	20	71-125 ^d
270.2/200.9 ^f (GFAA)	Selenium		5 ug/L	1 ug/L	20	85-115 ^d
279.2/200.9 ^f (GFAA)	Thallium		5 ug/L	1 ug/L	20	85-115 ^d
200.8 (ICP/MS)	Aluminum	Soil	2.0 mg/kg	2 mg/kg	30	70-130 ^m
	Antimony		0.05 mg/kg	0.02 mg/kg	30	70-130 ^m
	Arsenic		0.5 mg/kg	0.2 mg/kg	30	70-130 ^m
	Barium		0.05 mg/kg	0.02 mg/kg	30	70-130 ^m
	Beryllium		0.02 mg/kg	0.007 mg/kg	30	70-130 ^m
	Cadmium		0.05 mg/kg	0.03 mg/kg	30	70-130 ^m
	Chromium		0.2 mg/kg	0.07 mg/kg	30	70-130 ^m
	Cobalt		0.02 mg/kg	0.008 mg/kg	30	70-130 ^m
	Copper		0.1 mg/kg	0.08 mg/kg	30	70-130 ^m
	Lead		0.05 mg/kg	0.02 mg/kg	30	70-130 ^m
	Manganese		0.05 mg/kg	0.03 mg/kg	30	70-130 ^m
	Molybdenum		0.05 mg/kg	0.04 mg/kg	30	70-130 ^m
	Nickel		0.2 mg/kg	0.07 mg/kg	30	70-130 ^m
	Selenium		1.0 mg/kg	0.2 mg/kg	30	70-130 ^m
	Silver		0.02 mg/kg	0.02 mg/kg	30	70-130 ^m
	Thallium		0.02 mg/kg	0.006 mg/kg	30	70-130 ^m
	Vanadium		0.2 mg/kg	0.06 mg/kg	30	70-130 ^m
	Zinc		0.5 mg/kg	0.2 mg/kg	30	70-130 ^m
200.8 (ICP/MS)	Aluminum	Water	2.0 ug/L	0.7 ug/L	20	85-115 ^d
	Antimony		0.05 ug/L	0.02 ug/L	20	85-115 ^d
	Arsenic		0.5 ug/L	0.2 ug/L	20	85-115 ^d
	Barium		0.05 ug/L	0.02 ug/L	20	85-115 ^d
	Beryllium		0.02 ug/L	0.02 ug/L	20	85-115 ^d
	Cadmium		0.02 ug/L	0.01 ug/L	20	85-115 ^d
	Chromium		0.2 ug/L	0.06 ug/L	20	85-115 ^d
	Cobalt		0.02 ug/L	0.01 ug/L	20	85-115 ^d
	Copper		0.1 ug/L	0.04 ug/L	20	85-115 ^d
	Lead		0.02 ug/L	0.01 ug/L	20	85-115 ^d
	Manganese		0.05 ug/L	0.03 ug/L	20	85-115 ^d
	Molybdenum		0.05 ug/L	0.03 ug/L	20	85-115 ^d
	Nickel		0.2 ug/L	0.04 ug/L	20	85-115 ^d
	Selenium		1.0 ug/L	0.2 ug/L	20	85-115 ^d
	Silver		0.02 ug/L	0.01 ug/L	20	85-115 ^d
	Thallium		0.02 ug/L	0.005 ug/L	20	85-115 ^d
	Vanadium		0.2 ug/L	0.07 ug/L	20	85-115 ^d
	Zinc		0.5 ug/L	0.2 ug/L	20	85-115 ^d

METALS ANALYSES						
Method ^a	Analyte	Matrix	Method Reporting Limit	Method Detection Limit	Precision ^b (RPD)	Accuracy ^c (%REC)
6010B (ICP)	Aluminum	Soil	10 mg/Kg	8 mg/Kg	30	75-125 ^{dm}
	Antimony		10 mg/Kg	6 mg/Kg	30	48-152
	Barium		1 mg/Kg	0.2 mg/Kg	30	73-131
	Beryllium		1 mg/Kg	0.2 mg/Kg	30	89-119
	Boron		20 mg/Kg	20 mg/Kg	30	67-136
	Cadmium		1 mg/Kg	0.8 mg/Kg	30	58-147
	Calcium		10 mg/Kg	3 mg/Kg	30	75-125 ^{dm}
	Chromium		2 mg/Kg	0.6 mg/Kg	30	54-149
	Cobalt		2 mg/Kg	0.6 mg/Kg	30	84-115
	Copper		2 mg/Kg	2 mg/Kg	30	62-145
	Iron		4 mg/Kg	1 mg/Kg	30	75-125 ^{dm}
	Lead		20 mg/Kg	5 mg/Kg	30	55-150
	Magnesium		4 mg/Kg	2 mg/Kg	30	75-125 ^{dm}
	Manganese		1 mg/Kg	0.2 mg/Kg	30	47-163
	Molybdenum		2 mg/Kg	2 mg/Kg	30	77-117
	Nickel		4 mg/Kg	2 mg/Kg	30	79-125
	Potassium		400 mg/Kg	100 mg/Kg	30	75-125 ^{dm}
	Silver		2 mg/Kg	2 mg/Kg	30	28-150
	Sodium		20 mg/Kg	20 mg/Kg	30	75-125 ^{dm}
	Tin		20 mg/Kg	4 mg/Kg	30	75-125 ^{dm}
	Vanadium		2 mg/Kg	2 mg/Kg	30	80-125
	Zinc		2 mg/Kg	0.5 mg/Kg	30	52-150
7060A (GFAA)	Arsenic	Soil	1 mg/Kg	0.2 mg/Kg	30	45-128
7421 (GFAA)	Lead		1 mg/Kg	0.2 mg/Kg	30	46-139
7471A (CVAA)	Mercury		0.02 mg/Kg	0.01 mg/Kg	30	55-137
7740 (GFAA)	Selenium		1 mg/Kg	0.2 mg/Kg	30	45-122
7841 (GFAA)	Thallium		1 mg/Kg	0.2 mg/Kg	30	60-119
6010B (ICP)	Aluminum	Water	50 ug/L	50 ug/L	20	93-113
	Antimony		50 ug/L	40 ug/L	20	93-116
	Barium		5 ug/L	2 ug/L	20	81-130
	Beryllium		5 ug/L	1 ug/L	20	89-113
	Boron		50 ug/L	40 ug/L	20	88-122
	Cadmium		5 ug/L	3 ug/L	20	86-119
	Calcium		50 ug/L	30 ug/L	20	81-124
	Chromium		5 ug/L	3 ug/L	20	95-113
	Cobalt		10 ug/L	5 ug/L	20	95-114
	Copper		10 ug/L	8 ug/L	20	95-113
	Iron		20 ug/L	6 ug/L	20	95-111
	Magnesium		20 ug/L	20 ug/L	20	72-131
	Manganese		5 ug/L	1 ug/L	20	96-112
	Molybdenum		10 ug/L	4 ug/L	20	93-115
	Nickel		20 ug/L	20 ug/L	20	94-114
	Potassium		2000 ug/L	700 ug/L	20	91-117
	Silver		10 ug/L	9 ug/L	20	79-122
	Sodium		100 ug/L	70 ug/L	20	81-127
	Tin		50 ug/L	20 ug/L	20	85-115 ^d

METALS ANALYSES

Method ^a	Analyte	Matrix	Method Reporting Limit	Method Detection Limit	Precision ^b (RPD)	Accuracy ^c (%REC)
6010B (ICP)	Vanadium	Water	10 ug/L	4 ug/L	20	95-114
	Zinc		10 ug/L	2 ug/L	20	95-113
7060A (GFAA)	Arsenic	Water	5 ug/L	1 ug/L	20	77-116
7421 (GFAA)	Lead		2 ug/L	1 ug/L	20	75-122
7470A (CVAA)	Mercury		0.2 ug/L	0.1 ug/L	20	84-114
7740 (GFAA)	Selenium		5 ug/L	1 ug/L	20	78-114
7841 (GFAA)	Thallium		5 ug/L	1 ug/L	20	78-116
6020 (ICP/MS)	Aluminum	Soil	2.0 mg/kg	2 mg/kg	30	70-130 ^m
	Antimony		0.05 mg/kg	0.02 mg/kg	30	70-130 ^m
	Arsenic		0.5 mg/kg	0.2 mg/kg	30	70-130 ^m
	Barium		0.05 mg/kg	0.02 mg/kg	30	70-130 ^m
	Beryllium		0.02 mg/kg	0.007 mg/kg	30	70-130 ^m
	Cadmium		0.05 mg/kg	0.03 mg/kg	30	70-130 ^m
	Chromium		0.2 mg/kg	0.07 mg/kg	30	70-130 ^m
	Cobalt		0.02 mg/kg	0.008 mg/kg	30	70-130 ^m
	Copper		0.1 mg/kg	0.08 mg/kg	30	70-130 ^m
	Lead		0.05 mg/kg	0.02 mg/kg	30	70-130 ^m
	Manganese		0.05 mg/kg	0.03 mg/kg	30	70-130 ^m
	Molybdenum		0.05 mg/kg	0.04 mg/kg	30	70-130 ^m
	Nickel		0.2 mg/kg	0.07 mg/kg	30	70-130 ^m
	Selenium		1.0 mg/kg	0.2 mg/kg	30	70-130 ^m
	Silver		0.02 mg/kg	0.02 mg/kg	30	70-130 ^m
	Thallium		0.02 mg/kg	0.006 mg/kg	30	70-130 ^m
	Vanadium		0.2 mg/kg	0.06 mg/kg	30	70-130 ^m
	Zinc		0.5 mg/kg	0.2 mg/kg	30	70-130 ^m
6020 (ICP/MS)	Aluminum	Water	2.0 ug/L	0.7 ug/L	20	85-115 ^d
	Antimony		0.05 ug/L	0.02 ug/L	20	85-115 ^d
	Arsenic		0.5 ug/L	0.2 ug/L	20	85-115 ^d
	Barium		0.05 ug/L	0.02 ug/L	20	85-115 ^d
	Beryllium		0.02 ug/L	0.02 ug/L	20	85-115 ^d
	Cadmium		0.02 ug/L	0.01 ug/L	20	85-115 ^d
	Chromium		0.2 ug/L	0.06 ug/L	20	85-115 ^d
	Cobalt		0.02 ug/L	0.01 ug/L	20	85-115 ^d
	Copper		0.1 ug/L	0.04 ug/L	20	85-115 ^d
	Lead		0.02 ug/L	0.01 ug/L	20	85-115 ^d
	Manganese		0.05 ug/L	0.03 ug/L	20	85-115 ^d
	Molybdenum		0.05 ug/L	0.03 ug/L	20	85-115 ^d
	Nickel		0.2 ug/L	0.04 ug/L	20	85-115 ^d
	Selenium		1.0 ug/L	0.2 ug/L	20	85-115 ^d
	Silver		0.02 ug/L	0.01 ug/L	20	85-115 ^d
	Thallium		0.02 ug/L	0.005 ug/L	20	85-115 ^d
	Vanadium		0.2 ug/L	0.07 ug/L	20	85-115 ^d
	Zinc		0.5 ug/L	0.2 ug/L	20	85-115 ^d

SEMIVOLATILE ORGANIC COMPOUNDS (SOCs) ANALYSES						
Method ^a	Analyte	Matrix	Method Reporting Limit	Method Detection Limit	Precision ^b (RPD)	Accuracy ^c (%REC)
1664	Hexane Extractable Material	Water	5 mg/L	0.8 mg/L	18	78-114 ^d
1664	Hexane Extractable Material - SGT	Water	5 mg/L	1.2 mg/L	34	64-132 ^d
9071A/1664	Hexane Extractable Material	Soil	100 mg/Kg	50 mg/Kg	40	78-114 ^d
9071A/1664	Hexane Extractable Material - SGT	Soil	100 mg/Kg	40 mg/Kg	40	64-132 ^d
600/4-81-045 PCBs	Aroclor 1016	Oil	1 mg/Kg		40	21-116
	Aroclor 1221		2 mg/Kg		40	
	Aroclor 1232		1 mg/Kg		40	
	Aroclor 1242		1 mg/Kg		40	
	Aroclor 1248		1 mg/Kg		40	
	Aroclor 1254		1 mg/Kg		40	
	Aroclor 1260		1 mg/Kg		40	39-129
	Decachlorobiphenyl ^e		NA	NA	NA	51-133
608 Chlorinated Pesticides and PCBs	alpha-BHC	Water	0.04 ug/L	0.001 ug/L	30	
	gamma-BHC (Lindane)		0.04 ug/L	0.002 ug/L	30	39-134
	beta-BHC		0.04 ug/L	0.002 ug/L	30	
	Heptachlor		0.04 ug/L	0.005 ug/L	30	39-126
	delta-BHC		0.04 ug/L	0.005 ug/L	30	
	Aldrin		0.04 ug/L	0.004 ug/L	30	28-126
	Heptachlor Epoxide		0.04 ug/L	0.005 ug/L	30	
	Endosulfan I		0.04 ug/L	0.002 ug/L	30	
	4,4'-DDE		0.04 ug/L	0.003 ug/L	30	
	Dieldrin		0.04 ug/L	0.002 ug/L	30	44-136
	Endrin		0.04 ug/L	0.004 ug/L	30	44-138
	4,4'-DDD		0.04 ug/L	0.002 ug/L	30	
	Endosulfan II		0.04 ug/L	0.002 ug/L	30	
	4,4'-DDT		0.04 ug/L	0.002 ug/L	30	52-138
	Endosulfan Sulfate		0.04 ug/L	0.001 ug/L	30	
	Toxaphene		1 ug/L	0.05 ug/L	30	
	Chlordane		1 ug/L	0.02 ug/L	30	
	Aroclor 1016		1 ug/L	0.04 ug/L	30	
	Aroclor 1221		1 ug/L	0.04 ug/L	30	
	Aroclor 1232		1 ug/L	0.04 ug/L	30	
	Aroclor 1242		1 ug/L	0.04 ug/L	30	
	Aroclor 1248		1 ug/L	0.04 ug/L	30	
	Aroclor 1254		1 ug/L	0.04 ug/L	30	
	Aroclor 1260		1 ug/L	0.04 ug/L	30	
	Tetrachloro- <i>m</i> -xylene ^e		NA	NA	NA	15-116
	Decachlorobiphenyl ^e		NA	NA	NA	10-153
625 Base Neutral Acid Extractables	<i>N</i> -Nitrosodimethylamine	Water	25 ug/L	0.50 ug/L	30	
	Bis(2-chloroethyl) Ether		10 ug/L	0.34 ug/L	30	
	1,2-Dichlorobenzene		10 ug/L	0.44 ug/L	30	
	1,3-Dichlorobenzene		10 ug/L	0.36 ug/L	30	
	1,4-Dichlorobenzene		10 ug/L	0.32 ug/L	30	55-91
	Bis(2-chloroisopropyl) Ether		10 ug/L	0.32 ug/L	30	
	<i>N</i> -Nitrosodi- <i>n</i> -propylamine		10 ug/L	0.50 ug/L	30	62-113
	Hexachloroethane		10 ug/L	0.29 ug/L	30	
	Nitrobenzene		10 ug/L	0.57 ug/L	30	
	Isophorone		10 ug/L	0.25 ug/L	30	
	Bis(2-chloroethoxy)methane		10 ug/L	0.28 ug/L	30	
	1,2,4-Trichlorobenzene		10 ug/L	0.36 ug/L	30	58-97

SEMIVOLATILE ORGANIC COMPOUNDS (SOCs) ANALYSES						
Method ^a	Analyte	Matrix	Method Reporting Limit	Method Detection Limit	Precision ^b (RPD)	Accuracy ^c (%REC)
625 Base Neutral Acid Extractables	Naphthalene	Water	10 ug/L	0.37 ug/L	30	
	Hexachlorobutadiene		10 ug/L	0.30 ug/L	30	
	2-Chloronaphthalene		10 ug/L	0.29 ug/L	30	
	Dimethyl Phthalate		10 ug/L	0.26 ug/L	30	
	Acenaphthylene		10 ug/L	0.24 ug/L	30	
	Acenaphthene		10 ug/L	0.29 ug/L	30	70-104
	2,4-Dinitrotoluene		10 ug/L	0.28 ug/L	30	77-121
	2,6-Dinitrotoluene		10 ug/L	0.35 ug/L	30	
	Diethyl Phthalate		10 ug/L	0.29 ug/L	30	
	4-Chlorophenyl Phenyl Ether		10 ug/L	0.28 ug/L	30	
	Fluorene		10 ug/L	0.33 ug/L	30	
	4-Bromophenyl Phenyl Ether		10 ug/L	0.28 ug/L	30	
	Hexachlorobenzene		10 ug/L	0.63 ug/L	30	
	Phenanthrene		10 ug/L	0.50 ug/L	30	
	Anthracene		10 ug/L	0.62 ug/L	30	
	Di- <i>n</i> -butyl Phthalate		10 ug/L	0.37 ug/L	30	
	Fluoranthene		10 ug/L	0.66 ug/L	30	
	Benidine		50 ug/L	8.8 ug/L	30	
	Pyrene		10 ug/L	0.74 ug/L	30	65-113
	Butyl Benzyl Phthalate		10 ug/L	0.47 ug/L	30	
	3,3'-Dichlorobenzidine		25 ug/L	0.27 ug/L	30	
	Benz(a)anthracene		10 ug/L	0.60 ug/L	30	
	Bis(2-ethylhexyl) Phthalate		10 ug/L	1.9 ug/L	30	
	Chrysene		10 ug/L	0.79 ug/L	30	
	Di- <i>n</i> -octyl Phthalate		10 ug/L	0.63 ug/L	30	
	Benzo(b)fluoranthene		10 ug/L	0.59 ug/L	30	
	Benzo(k)fluoranthene		10 ug/L	0.83 ug/L	30	
	Benzo(a)pyrene		10 ug/L	0.66 ug/L	30	
	Indeno(1,2,3- <i>c,d</i>)pyrene		10 ug/L	0.69 ug/L	30	
	Dibenz(a,h)anthracene		10 ug/L	0.76 ug/L	30	
	Benzo(g,h,i)perylene		10 ug/L	0.82 ug/L	30	
	Phenol		10 ug/L	0.33 ug/L	30	48-101
	2-Chlorophenol		10 ug/L	0.32 ug/L	30	60-100
	2-Nitrophenol		10 ug/L	0.38 ug/L	30	
	2,4-Dimethylphenol		10 ug/L	0.27 ug/L	30	
	2,4-Dichlorophenol		10 ug/L	0.30 ug/L	30	
	4-Chloro-3-methylphenol		10 ug/L	0.49 ug/L	30	50-120
	2,4,6-Trichlorophenol		10 ug/L	0.21 ug/L	30	
	2,4-Dinitrophenol		25 ug/L	2.3 ug/L	30	
	4-Nitrophenol		25 ug/L	2.0 ug/L	30	49-123
	2-Methyl-4,6-dinitrophenol		25 ug/L	2.2 ug/L	30	
	Pentachlorophenol		25 ug/L	2.5 ug/L	30	50-122
	2-Fluorophenol ^g		NA	NA	NA	27-107
	Phenol-D6 ^g		NA	NA	NA	22-126
	2,4,6-Tribromophenol ^g		NA	NA	NA	42-127
	Nitrobenzene-D5 ^g		NA	NA	NA	37-119
	2-Fluorobiphenyl ^g		NA	NA	NA	27-119
	Terphenyl-D14 ^g		NA	NA	NA	10-174

SEMIVOLATILE ORGANIC COMPOUNDS (SOCs) ANALYSES						
Method ^a	Analyte	Matrix	Method Reporting Limit	Method Detection Limit	Precision ^b (RPD)	Accuracy ^c (%REC)
1653 Chlorinated Phenolics	4-Chlorophenol	Water	1.25 ug/L	0.07 ug/L	NA	NA
	2,4-Dichlorophenol		2.5 ug/L	0.2 ug/L	NA	NA
	2,6-Dichlorophenol		2.5 ug/L	0.3 ug/L	NA	NA
	2,4,5-Trichlorophenol		2.5 ug/L	0.07 ug/L	NA	NA
	2,4,6-Trichlorophenol		2.5 ug/L	0.08 ug/L	NA	NA
	2,3,4,6-Tetrachlorophenol		2.5 ug/L	0.1 ug/L	NA	NA
	Pentachlorophenol		5 ug/L	0.3 ug/L	NA	NA
	4-Chloroguaiacol		1.25 ug/L	0.04 ug/L	NA	NA
	3,4-Dichloroguaiacol		2.5 ug/L	0.2 ug/L	NA	NA
	4,5-Dichloroguaiacol		2.5 ug/L	0.08 ug/L	NA	NA
	4,6-Dichloroguaiacol		2.5 ug/L	0.2 ug/L	NA	NA
	3,4,5-Trichloroguaiacol		2.5 ug/L	0.08 ug/L	NA	NA
	3,4,6-Trichloroguaiacol		2.5 ug/L	0.06 ug/L	NA	NA
	4,5,6-Trichloroguaiacol		2.5 ug/L	0.07 ug/L	NA	NA
	Tetrachloroguaiacol		5 ug/L	0.2 ug/L	NA	NA
	4-Chlorocatechol		1.25 ug/L	0.05 ug/L	NA	NA
	3,4-Dichlorocatechol		2.5 ug/L	0.08 ug/L	NA	NA
	3,6-Dichlorocatechol		2.5 ug/L	0.06 ug/L	NA	NA
	4,5-Dichlorocatechol		2.5 ug/L	0.09 ug/L	NA	NA
	3,4,5-Trichlorocatechol		5 ug/L	0.2 ug/L	NA	NA
	3,4,6-Trichlorocatechol		5 ug/L	0.2 ug/L	NA	NA
	Tetrachlorocatechol		5 ug/L	0.3 ug/L	NA	NA
	5-Chlorovanillin		2.5 ug/L	0.04 ug/L	NA	NA
	6-Chlorovanillin		2.5 ug/L	0.2 ug/L	NA	NA
	5,6-Dichlorovanillin		5 ug/L	0.2 ug/L	NA	NA
	2-Chlorosyringaldehyde		2.5 ug/L	0.3 ug/L	NA	NA
	2,6-Dichlorosyringaldehyde		5 ug/L	0.4 ug/L	NA	NA
	Trichlorosyringol		2.5 ug/L	0.1 ug/L	NA	NA
	2,4-Dichlorophenol-D3 ^g		NA	NA	NA	27-143 ^d
	4-Chloroguaiacol- ¹³ C ₆ ^g		NA	NA	NA	43-168 ^d
	3,4,5-Trichlorophenol ^g		NA	NA	NA	24-167 ^d
	5-Chlorovanillin- ¹³ C ₆ ^g		NA	NA	NA	32-254 ^d
	4,5-Dichlorocatechol- ¹³ C ₆ ^g		NA	NA	NA	D-190 ^d
	4,5,6-Trichloroguaiacol- ¹³ C ₆ ^g		NA	NA	NA	51-139 ^d
	Pentachlorophenol- ¹³ C ₆ ^g		NA	NA	NA	27-167 ^d
	Tetrachloroguaiacol- ¹³ C ₆ ^g		NA	NA	NA	27-161 ^d
	Tetrachlorocatechol- ¹³ C ₆ ^g		NA	NA	NA	D-184 ^d
8015B	Ethylene Glycol	Water	5 mg/L	1.2 mg/L	30	45-148
	Propylene Glycol		5 mg/L	1.8 mg/L	30	49-147
	Isopropyl Ether		1.0 ug/L	0.32 ug/L	30	84-121
	Cyclohexanol ^h		NA	NA	NA	50-161
	2,3-Butylene Glycol ^h		NA	NA	NA	58-163
8081A Chlorinated Pesticides	alpha-BHC	Soil	5 ug/Kg	0.40 ug/Kg	40	
	gamma-BHC (Lindane)		5 ug/Kg	1.2 ug/Kg	40	63-137
	beta-BHC		5 ug/Kg	0.59 ug/Kg	40	
	Heptachlor		5 ug/Kg	0.88 ug/Kg	40	61-123
	delta-BHC		5 ug/Kg	0.45 ug/Kg	40	
	gamma-Chlordane		5 ug/Kg	0.44 ug/Kg	40	
	alpha-Chlordane		5 ug/Kg	0.33 ug/Kg	40	

SEMIVOLATILE ORGANIC COMPOUNDS (SOCs) ANALYSES						
Method ^a	Analyte	Matrix	Method Reporting Limit	Method Detection Limit	Precision ^b (RPD)	Accuracy ^c (%REC)
8081A Chlorinated Pesticides	Aldrin	Soil	5 ug/Kg	0.69 ug/Kg	40	59-127
	Heptachlor Epoxide		5 ug/Kg	0.55 ug/Kg	40	
	Endosulfan I		5 ug/Kg	0.62 ug/Kg	40	
	4,4'-DDE		5 ug/Kg	0.63 ug/Kg	40	
	Dieldrin		5 ug/Kg	0.48 ug/Kg	40	68-131
	Endrin		5 ug/Kg	1.2 ug/Kg	40	72-133
	4,4'-DDD		5 ug/Kg	1.9 ug/Kg	40	
	Endosulfan II		5 ug/Kg	2.5 ug/Kg	40	
	4,4'-DDT		5 ug/Kg	0.67 ug/Kg	40	68-144
	Endrin Aldehyde		5 ug/Kg	0.46 ug/Kg	40	
	Endosulfan Sulfate		5 ug/Kg	0.93 ug/Kg	40	
	Methoxychlor		5 ug/Kg	0.19 ug/Kg	40	
	Toxaphene		250 ug/Kg	38 ug/Kg	40	
	Tetrachloro- <i>m</i> -xylene ^d		NA	NA	NA	39-129
	Decachlorobiphenyl ^e		NA	NA	NA	29-141
8081A Chlorinated Pesticides	alpha-BHC	Water	0.01 ug/L	0.003 ug/L	30	
	gamma-BHC (Lindane)		0.01 ug/L	0.003 ug/L	30	59-130
	beta-BHC		0.01 ug/L	0.003 ug/L	30	
	Heptachlor		0.01 ug/L	0.005 ug/L	30	39-120
	delta-BHC		0.01 ug/L	0.002 ug/L	30	
	gamma-Chlordane		0.01 ug/L	0.003 ug/L	30	
	alpha-Chlordane		0.01 ug/L	0.002 ug/L	30	
	Aldrin		0.01 ug/L	0.004 ug/L	30	38-121
	Heptachlor Epoxide		0.01 ug/L	0.005 ug/L	30	
	Endosulfan I		0.01 ug/L	0.002 ug/L	30	
	4,4'-DDE		0.01 ug/L	0.003 ug/L	30	
	Dieldrin		0.01 ug/L	0.004 ug/L	30	64-126
	Endrin		0.01 ug/L	0.003 ug/L	30	63-128
	4,4'-DDD		0.01 ug/L	0.004 ug/L	30	
	Endosulfan II		0.01 ug/L	0.003 ug/L	30	
	4,4'-DDT		0.01 ug/L	0.005 ug/L	30	47-157
	Endrin Aldehyde		0.01 ug/L	0.003 ug/L	30	
	Endosulfan Sulfate		0.01 ug/L	0.003 ug/L	30	
	Methoxychlor		0.01 ug/L	0.004 ug/L	30	
	Toxaphene		0.5 ug/L	0.05 ug/L	30	
8082 PCBs	Tetrachloro- <i>m</i> -xylene ^d		NA	NA	NA	17-128
	Decachlorobiphenyl ^e		NA	NA	NA	10-136
	Aroclor 1016	Soil	0.1 mg/Kg	0.04 mg/Kg	40	47-138
	Aroclor 1221		0.2 mg/Kg	0.01 mg/Kg	40	
	Aroclor 1232		0.1 mg/Kg	0.02 mg/Kg	40	
	Aroclor 1242		0.1 mg/Kg	0.01 mg/Kg	40	
	Aroclor 1248		0.1 mg/Kg	0.01 mg/Kg	40	
	Aroclor 1254		0.1 mg/Kg	0.01 mg/Kg	40	
	Aroclor 1260		0.1 mg/Kg	0.01 mg/Kg	40	48-149
	Decachlorobiphenyl ^e		NA	NA	NA	40-145
8082 PCBs	Aroclor 1016	Water	0.2 ug/L	0.10 ug/L	30	46-143
	Aroclor 1221		0.4 ug/L	0.05 ug/L	30	
	Aroclor 1232		0.2 ug/L	0.09 ug/L	30	
	Aroclor 1242		0.2 ug/L	0.06 ug/L	30	
	Aroclor 1248		0.2 ug/L	0.04 ug/L	30	
8082 PCBs	Aroclor 1254	Water	0.2 ug/L	0.03 ug/L	30	
	Aroclor 1260		0.2 ug/L	0.05 ug/L	30	50-139
	Decachlorobiphenyl ^e		NA	NA	NA	10-147

SEMIVOLATILE ORGANIC COMPOUNDS (SOCs) ANALYSES						
Method ^a	Analyte	Matrix	Method Reporting Limit	Method Detection Limit	Precision ^b (RPD)	Accuracy ^c (%REC)
8082 PCB Congeners	2,4'-Dichlorobiphenyl (PCB 8)	Soil	0.5 ug/Kg	0.11 ug/Kg	40	35-146
	2,2',5'-Trichlorobiphenyl (PCB 18)		0.5 ug/Kg	0.06 ug/Kg	40	
	2,4,4'-Trichlorobiphenyl (PCB 28)		0.5 ug/Kg	0.08 ug/Kg	40	34-151
	2,2',3,5'-Tetrachlorobiphenyl (PCB 44)		0.5 ug/Kg	0.06 ug/Kg	40	
	2,2',5,5'-Tetrachlorobiphenyl (PCB 52)		0.5 ug/Kg	0.11 ug/Kg	40	38-141
	2,3',4,4'-Tetrachlorobiphenyl (PCB 66)		0.5 ug/Kg	0.12 ug/Kg	40	39-136
	3,3',4,4'-Tetrachlorobiphenyl (PCB 77)		0.5 ug/Kg	0.05 ug/Kg	40	46-141
	2,2',3,4,5'-Pentachlorobiphenyl (PCB 87)		0.5 ug/Kg	0.08 ug/Kg	40	
	2,2',3,4',5'-Pentachlorobiphenyl (PCB 90)		0.5 ug/Kg	0.08 ug/Kg	40	45-153
	2,2',4,5,5'-Pentachlorobiphenyl (PCB 101)		0.5 ug/Kg	0.04 ug/Kg	40	
	2,3,3',4,4'-Pentachlorobiphenyl (PCB 105)		0.5 ug/Kg	0.10 ug/Kg	40	38-157
	2,3,4,4',5'-Pentachlorobiphenyl (PCB 114)		0.5 ug/Kg	0.40 ug/Kg	40	
	2,3',4,4',5'-Pentachlorobiphenyl (PCB 118)		0.5 ug/Kg	0.05 ug/Kg	40	
	2',3,4,4',5'-Pentachlorobiphenyl (PCB 123)		0.5 ug/Kg	0.08 ug/Kg	40	
	3,3',4,4',5'-Pentachlorobiphenyl (PCB 126)		0.5 ug/Kg	0.14 ug/Kg	40	
	2,2',3,3',4,4'-Hexachlorobiphenyl (PCB 128)		0.5 ug/Kg	0.29 ug/Kg	40	
	2,2',3,4,4',5'-Hexachlorobiphenyl (PCB 138)		0.5 ug/Kg	0.05 ug/Kg	40	
	2,2',4,4',5,5'-Hexachlorobiphenyl (PCB 153)		0.5 ug/Kg	0.11 ug/Kg	40	
	2,3,3',4,4',5'-Hexachlorobiphenyl (PCB 156)		0.5 ug/Kg	0.10 ug/Kg	40	38-159
	2,3,3',4,4',5'-Hexachlorobiphenyl (PCB 157)		0.5 ug/Kg	0.20 ug/Kg	40	
	2,3',4,4',5,5'-Hexachlorobiphenyl (PCB 167)		0.5 ug/Kg	0.33 ug/Kg	40	
	3,3',4,4',5,5'-Hexachlorobiphenyl (PCB 169)		0.5 ug/Kg	0.14 ug/Kg	40	
	2,2',3,3',4,4',5'-Heptachlorobiphenyl (PCB 170)		0.5 ug/Kg	0.07 ug/Kg	40	
	2,2',3,4,4',5,5'-Heptachlorobiphenyl (PCB 180)		0.5 ug/Kg	0.04 ug/Kg	40	39-158
	2,2',3,4,4',5',6'-Heptachlorobiphenyl (PCB 183)		0.5 ug/Kg	0.09 ug/Kg	40	35-154
	2,2',3,4,4',6,6'-Heptachlorobiphenyl (PCB 184)		0.5 ug/Kg	0.05 ug/Kg	40	27-174
	2,2',3,4',5,5',6'-Heptachlorobiphenyl (PCB 187)		0.5 ug/Kg	0.14 ug/Kg	40	
	2,3,3',4,4',5,5'-Heptachlorobiphenyl (PCB 189)		0.5 ug/Kg	0.10 ug/Kg	40	39-159
	2,2',3,3',4,4',5,6-Octachlorobiphenyl (PCB 195)		0.5 ug/Kg	0.14 ug/Kg	40	
	2,2',3,3',4,4',5,5',6-Nonachlorobiphenyl (PCB 206)		0.5 ug/Kg	0.10 ug/Kg	40	
	Decachlorobiphenyl (PCB 209)		0.5 ug/Kg	0.06 ug/Kg	40	36-151
	Tetrachloro- <i>m</i> -xylene ^d		NA	NA	NA	10-128
8082 PCB Congeners	2,4'-Dichlorobiphenyl (PCB 8)	Water	5 ng/L	1.4 ng/L	30	70-130 ^d
	2,2',5'-Trichlorobiphenyl (PCB 18)		5 ng/L	1.1 ng/L	30	
	2,4,4'-Trichlorobiphenyl (PCB 28)		5 ng/L	1.1 ng/L	30	70-130 ^d
	2,2',3,5'-Tetrachlorobiphenyl (PCB 44)		5 ng/L	1.3 ng/L	30	
	2,2',5,5'-Tetrachlorobiphenyl (PCB 52)		5 ng/L	0.94 ng/L	30	70-130 ^d
	2,3',4,4'-Tetrachlorobiphenyl (PCB 66)		5 ng/L	0.79 ng/L	30	70-130 ^d
	3,3',4,4'-Tetrachlorobiphenyl (PCB 77)		5 ng/L	1.1 ng/L	30	70-130 ^d
	2,2',3,4,5'-Pentachlorobiphenyl (PCB 87)		5 ng/L	1.2 ng/L	30	
	2,2',3,4',5'-Pentachlorobiphenyl (PCB 90)		5 ng/L	0.74 ng/L	30	70-130 ^d
	2,2',4,5,5'-Pentachlorobiphenyl (PCB 101)		5 ng/L	0.67 ng/L	30	
	2,3,3',4,4'-Pentachlorobiphenyl (PCB 105)		5 ng/L	1.1 ng/L	30	70-130 ^d
	2,3,4,4',5'-Pentachlorobiphenyl (PCB 114)		5 ng/L	0.59 ng/L	30	
	2,3',4,4',5'-Pentachlorobiphenyl (PCB 118)		5 ng/L	0.84 ng/L	30	

SEMIVOLATILE ORGANIC COMPOUNDS (SOCs) ANALYSES						
Method ^a	Analyte	Matrix	Method Reporting Limit	Method Detection Limit	Precision ^b (RPD)	Accuracy ^c (%REC)
8082 PCB Congeners	2',3,4,4',5-Pentachlorobiphenyl (PCB 123)	Water	5 ng/L	0.62 ng/L	30	
	3,3',4,4',5-Pentachlorobiphenyl (PCB 126)		5 ng/L	0.95 ng/L	30	
	2,2',3,3',4,4'-Hexachlorobiphenyl (PCB 128)		5 ng/L	1.3 ng/L	30	
	2,2',3,4,4',5'-Hexachlorobiphenyl (PCB 138)		5 ng/L	0.66 ng/L	30	
	2,2',4,4',5,5'-Hexachlorobiphenyl (PCB 153)		5 ng/L	0.47 ng/L	30	
	2,3,3',4,4',5-Hexachlorobiphenyl (PCB 156)		5 ng/L	0.90 ng/L	30	70-130 ^d
	2,3,3',4,4',5-Hexachlorobiphenyl (PCB 157)		5 ng/L	1.0 ng/L	30	
	2,3',4,4',5,5'-Hexachlorobiphenyl (PCB 167)		5 ng/L	1.1 ng/L	30	
	3,3',4,4',5,5'-Hexachlorobiphenyl (PCB 169)		5 ng/L	1.1 ng/L	30	
	2,2',3,3',4,4',5-Heptachlorobiphenyl (PCB 170)		5 ng/L	0.81 ng/L	30	
	2,2',3,4,4',5,5'-Heptachlorobiphenyl (PCB 180)		5 ng/L	0.56 ng/L	30	70-130 ^d
	2,2',3,4,4',5,6-Heptachlorobiphenyl (PCB 183)		5 ng/L	0.65 ng/L	30	70-130 ^d
	2,2',3,4,4',6,6'-Heptachlorobiphenyl (PCB 184)		5 ng/L	0.54 ng/L	30	70-130 ^d
	2,2',3,4',5,5',6-Heptachlorobiphenyl (PCB 187)		5 ng/L	0.51 ng/L	30	
	2,3,3',4,4',5,5'-Heptachlorobiphenyl (PCB 189)		5 ng/L	0.63 ng/L	30	70-130 ^d
	2,2',3,3',4,4',5,6-Octachlorobiphenyl (PCB 195)		5 ng/L	0.63 ng/L	30	
	2,2',3,3',4,4',5,5',6-Nonachlorobiphenyl (PCB 206)		5 ng/L	0.58 ng/L	30	
	Decachlorobiphenyl (PCB 209)		5 ng/L	0.41 ng/L	30	70-130 ^d
	Tetrachloro- <i>m</i> -xylene ^e		NA	NA	NA	10-125
8141A Organo-phosphorus Pesticides	Azinphos Methyl	Soil	0.05 mg/Kg	0.01 mg/Kg	40	
	Bolstar		0.05 mg/Kg	0.01 mg/Kg	40	35-131
	Chlorpyrifos		0.05 mg/Kg	0.01 mg/Kg	40	47-120
	Coumaphos		0.1 mg/Kg	0.01 mg/Kg	40	
	Demeton-O and Demeton-S ^h		0.1 mg/Kg	0.02 mg/Kg	40	
	Diazinon		0.05 mg/Kg	0.01 mg/Kg	40	
	Dichlorvos		0.05 mg/Kg	0.02 mg/Kg	40	
	Dimethoate		0.05 mg/Kg	0.01 mg/Kg	40	
	Disulfoton		0.05 mg/Kg	0.01 mg/Kg	40	10-129
	EPN		0.05 mg/Kg	0.01 mg/Kg	40	
	Ethoprop		0.05 mg/Kg	0.02 mg/Kg	40	
	Ethyl Parathion		0.05 mg/Kg	0.01 mg/Kg	40	
	Fensulfothion		0.05 mg/Kg	0.02 mg/Kg	40	44-149
	Fenthion		0.05 mg/Kg	0.01 mg/Kg	40	
	Merphos		0.05 mg/Kg	0.01 mg/Kg	40	
	Mevinphos		0.05 mg/Kg	0.02 mg/Kg	40	
	Parathion Methyl		0.05 mg/Kg	0.01 mg/Kg	40	43-125
	Phorate		0.05 mg/Kg	0.01 mg/Kg	40	
	Ronnel		0.05 mg/Kg	0.01 mg/Kg	40	42-119
	Stirophos		0.05 mg/Kg	0.01 mg/Kg	40	
	Sulfotepp		0.05 mg/Kg	0.01 mg/Kg	40	
	Tokuthion (Prothiofos)		0.05 mg/Kg	0.01 mg/Kg	40	
	Trichloronate		0.05 mg/Kg	0.01 mg/Kg	40	
	Malathion		0.05 mg/Kg	0.01 mg/Kg	40	
	Triphenyl Phosphate ^g		NA	NA	NA	35-122
8141A Organo-phosphorus Pesticides	Azinphos Methyl	Water	1 ug/L	0.05 ug/L	30	
	Bolstar		0.5 ug/L	0.15 ug/L	30	10-154
	Chlorpyrifos		0.2 ug/L	0.06 ug/L	30	53-117
	Coumaphos		1 ug/L	0.05 ug/L	30	
	Demeton-O and Demeton-S ^h		2 ug/L	1.75 ug/L	30	

SEMIVOLATILE ORGANIC COMPOUNDS (SOCs) ANALYSES

Method ^a	Analyte	Matrix	Method Reporting Limit	Method Detection Limit	Precision ^b (RPD)	Accuracy ^c (%REC)
8141A Organo-phosphorus Pesticides	Diazinon	Water	0.2 ug/L	0.04 ug/L	30	
	Dichlorvos		0.5 ug/L	0.07 ug/L	30	
	Dimethoate		0.5 ug/L	0.06 ug/L	40	
	Disulfoton		1 ug/L	0.23 ug/L	30	10-121
	EPN		0.2 ug/L	0.04 ug/L	40	
	Ethoprop		0.2 ug/L	0.08 ug/L	30	
	Ethyl Parathion		0.5 ug/L	0.04 ug/L	40	
	Fensulfothion		0.5 ug/L	0.05 ug/L	30	46-152
	Fenthion		0.5 ug/L	0.14 ug/L	30	
	Merphos		0.2 ug/L	0.05 ug/L	30	
	Mevinphos		0.5 ug/L	0.05 ug/L	30	
	Parathion Methyl		0.5 ug/L	0.05 ug/L	30	60-118
	Phorate		0.5 ug/L	0.12 ug/L	30	
	Ronnel		0.2 ug/L	0.04 ug/L	30	62-110
	Stiropfos		0.2 ug/L	0.06 ug/L	30	
	Sulfotepp		0.2 ug/L	0.04 ug/L	40	
	Tokuthion (Prothiofos)		0.2 ug/L	0.04 ug/L	30	
	Trichloronate		0.2 ug/L	0.06 ug/L	30	
	Malathion		0.2 ug/L	0.05 ug/L	30	
	Triphenyl Phosphate [®]		NA	NA	NA	23-139
8151A Chlorinated Herbicides	Dalapon	Soil	50 ug/Kg	7.0 ug/Kg	40	
	Dicamba		50 ug/Kg	5.4 ug/Kg	40	
	MCPA		10 mg/Kg	0.52 mg/Kg	40	
	MCP		10 mg/Kg	0.53 mg/Kg	40	
	Dichloroprop		50 ug/Kg	9.5 ug/Kg	40	
	2,4-D		50 ug/Kg	8.0 ug/Kg	40	30-148
	2,4,5-TP (Silvex)		50 ug/Kg	3.9 ug/Kg	40	36-150
	2,4,5-T		50 ug/Kg	5.9 ug/Kg	40	38-161
	2,4-DB		50 ug/Kg	9.7 ug/Kg	40	
	Dinoseb		50 ug/Kg	3.5 ug/Kg	40	
	2,4-Dichlorophenylacetic Acid [®]		NA	NA	NA	19-151
8151A Chlorinated Herbicides	Dalapon	Water	0.4 ug/L	0.06 ug/L	30	
	Dicamba		0.4 ug/L	0.08 ug/L	30	
	MCPA		100 ug/L	24 ug/L	30	
	MCP		100 ug/L	23 ug/L	30	
	Dichloroprop		0.4 ug/L	0.07 ug/L	30	
	2,4-D		0.4 ug/L	0.08 ug/L	30	24-139
	2,4,5-TP (Silvex)		0.2 ug/L	0.09 ug/L	30	17-139
	2,4,5-T		0.2 ug/L	0.17 ug/L	30	14-118
	2,4-DB		0.4 ug/L	0.13 ug/L	30	
	Dinoseb		0.2 ug/L	0.10 ug/L	30	
	2,4-Dichlorophenylacetic Acid [®]		NA	NA	NA	15-126
8151M Chlorinated Phenols	2,4,6-Trichlorophenol	Soil	5 ug/Kg	0.7 ug/Kg	40	48-93
	2,3,4,5 -Tetrachlorophenol		10 ug/Kg	3 ug/Kg	40	50-111
	2,3,5,6 -Tetrachlorophenol		10 ug/Kg	4 ug/Kg	40	57-115
	Pentachlorophenol		5 ug/Kg	2 ug/Kg	40	55-110
	4-Bromo-2,6-dichlorophenol [®]		NA	NA	NA	21-145

SEMIVOLATILE ORGANIC COMPOUNDS (SOCs) ANALYSES

Method ^a	Analyte	Matrix	Method Reporting Limit	Method Detection Limit	Precision ^b (RPD)	Accuracy ^c (%REC)
8151M Chlorinated Phenols	2,4,6-Trichlorophenol	Water	0.5 ug/L	0.03 ug/L	30	27-87
	2,3,4,5 -Tetrachlorophenol		0.5 ug/L	0.2 ug/L	30	34-107
	2,3,5,6 -Tetrachlorophenol		0.5 ug/L	0.2 ug/L	30	43-102
	Pentachlorophenol		0.5 ug/L	0.06 ug/L	30	43-107
	4-Bromo-2,6-dichlorophenol ^b		NA	NA	NA	32-124
8270C Base Neutral Acid Extractables	N-Nitrosodimethylamine	Soil	2 mg/Kg	0.03 mg/Kg	40	
	Aniline		1 mg/Kg	0.03 mg/Kg	40	
	Bis(2-chloroethyl) Ether		0.33 mg/Kg	0.02 mg/Kg	40	
	1,2-Dichlorobenzene		0.33 mg/Kg	0.02 mg/Kg	40	
	1,3-Dichlorobenzene		0.33 mg/Kg	0.02 mg/Kg	40	
	1,4-Dichlorobenzene		0.33 mg/Kg	0.02 mg/Kg	40	43-91
	Bis(2-chloroisopropyl) Ether		0.33 mg/Kg	0.02 mg/Kg	40	
	N-Nitrosodi-n-propylamine		0.33 mg/Kg	0.02 mg/Kg	40	46-104
	Hexachloroethane		0.33 mg/Kg	0.03 mg/Kg	40	
	Nitrobenzene		0.33 mg/Kg	0.03 mg/Kg	40	
	Isophorone		0.33 mg/Kg	0.02 mg/Kg	40	
	Bis(2-chloroethoxy)methane		0.33 mg/Kg	0.02 mg/Kg	40	
	1,2,4-Trichlorobenzene		0.33 mg/Kg	0.02 mg/Kg	40	48-93
	Naphthalene		0.33 mg/Kg	0.02 mg/Kg	40	
	4-Chloroaniline		0.33 mg/Kg	0.02 mg/Kg	40	
	Hexachlorobutadiene		0.33 mg/Kg	0.02 mg/Kg	40	
	2-Methylnaphthalene		0.33 mg/Kg	0.02 mg/Kg	40	
	Hexachlorocyclopentadiene		0.33 mg/Kg	0.02 mg/Kg	40	
	2-Chloronaphthalene		0.33 mg/Kg	0.01 mg/Kg	40	
	2-Nitroaniline		2 mg/Kg	0.02 mg/Kg	40	
	Dimethyl Phthalate		0.33 mg/Kg	0.02 mg/Kg	40	
	Acenaphthylene		0.33 mg/Kg	0.02 mg/Kg	40	
	3-Nitroaniline		2 mg/Kg	0.18 mg/Kg	40	
	Acenaphthene		0.33 mg/Kg	0.02 mg/Kg	40	54-97
	Dibenzofuran		0.33 mg/Kg	0.02 mg/Kg	40	
	2,4-Dinitrotoluene		0.33 mg/Kg	0.02 mg/Kg	40	60-120
	2,6-Dinitrotoluene		0.33 mg/Kg	0.02 mg/Kg	40	
	Diethyl Phthalate		0.33 mg/Kg	0.02 mg/Kg	40	
	4-Chlorophenyl Phenyl Ether		0.33 mg/Kg	0.02 mg/Kg	40	
	Fluorene		0.33 mg/Kg	0.02 mg/Kg	40	
	4-Nitroaniline		2 mg/Kg	0.18 mg/Kg	40	
	N-Nitrosodiphenylamine		0.33 mg/Kg	0.02 mg/Kg	40	
	4-Bromophenyl Phenyl Ether		0.33 mg/Kg	0.02 mg/Kg	40	
	Hexachlorobenzene		0.33 mg/Kg	0.02 mg/Kg	40	
	Phenanthrene		0.33 mg/Kg	0.01 mg/Kg	40	
	Anthracene		0.33 mg/Kg	0.02 mg/Kg	40	
	Di-n-butyl Phthalate		0.33 mg/Kg	0.02 mg/Kg	40	
	Fluoranthene		0.33 mg/Kg	0.02 mg/Kg	40	
	Pyrene		0.33 mg/Kg	0.02 mg/Kg	40	54-103
	Butyl Benzyl Phthalate		0.33 mg/Kg	0.02 mg/Kg	40	
	3,3'-Dichlorobenzidine		2 mg/Kg	0.03 mg/Kg	40	
	Benz(a)anthracene		0.33 mg/Kg	0.02 mg/Kg	40	
	Bis(2-ethylhexyl) Phthalate		0.33 mg/Kg	0.02 mg/Kg	40	
	Chrysene		0.33 mg/Kg	0.02 mg/Kg	40	
	Di-n-octyl Phthalate		0.33 mg/Kg	0.03 mg/Kg	40	

SEMIVOLATILE ORGANIC COMPOUNDS (SOCs) ANALYSES

Method ^a	Analyte	Matrix	Method Reporting Limit	Method Detection Limit	Precision ^b (RPD)	Accuracy ^c (%REC)
8270C Base Neutral Acid Extractables	Benzo(b)fluoranthene	Soil	0.33 mg/Kg	0.02 mg/Kg	40	
	Benzo(k)fluoranthene		0.33 mg/Kg	0.02 mg/Kg	40	
	Benzo(a)pyrene		0.33 mg/Kg	0.02 mg/Kg	40	
	Indeno(1,2,3-cd)pyrene		0.33 mg/Kg	0.04 mg/Kg	40	
	Dibenz(a,h)anthracene		0.33 mg/Kg	0.03 mg/Kg	40	
	Benzo(g,h,i)perylene		0.33 mg/Kg	0.03 mg/Kg	40	
	Phenol		0.33 mg/Kg	0.02 mg/Kg	40	45-90
	2-Chlorophenol		0.33 mg/Kg	0.01 mg/Kg	40	44-93
	Benzyl Alcohol		0.33 mg/Kg	0.02 mg/Kg	40	
	2-Methylphenol		0.33 mg/Kg	0.02 mg/Kg	40	
	3- and 4-Methylphenol ^b		0.33 mg/Kg	0.02 mg/Kg	40	
	2-Nitrophenol		0.33 mg/Kg	0.02 mg/Kg	40	
	2,4-Dimethylphenol		0.33 mg/Kg	0.02 mg/Kg	40	
	Benzoic Acid		2 mg/Kg	0.14 mg/Kg	40	
	2,4-Dichlorophenol		0.33 mg/Kg	0.02 mg/Kg	40	
	4-Chloro-3-methylphenol		0.33 mg/Kg	0.02 mg/Kg	40	52-102
	2,4,6-Trichlorophenol		0.33 mg/Kg	0.02 mg/Kg	40	
	2,4,5-Trichlorophenol		0.33 mg/Kg	0.02 mg/Kg	40	
	2,4-Dinitrophenol		2 mg/Kg	0.12 mg/Kg	40	
	4-Nitrophenol		2 mg/Kg	0.15 mg/Kg	40	42-107
	2-Methyl-4,6-dinitrophenol		2 mg/Kg	0.15 mg/Kg	40	
	Pentachlorophenol		2 mg/Kg	0.13 mg/Kg	40	46-112
Additional Non-routine Analytes (Appendix I, II, IX, Etc.)						
8270C Base Neutral Acid Extractables	2-Picoline	Soil	0.67 mg/Kg			
	N-Nitrosodiethylamine		0.33 mg/Kg			
	Methyl Methanesulfonate		0.33 mg/Kg			
	N-Nitrosomethylethylamine		0.33 mg/Kg			
	Pentachloroethane		1 mg/Kg			
	Acetophenone		0.33 mg/Kg	0.02 mg/Kg		
	N-Nitrosopyrrolidine		0.33 mg/Kg			
	N-Nitrosomorpholine		0.33 mg/Kg			
	N-Nitrosopiperidine		0.33 mg/Kg			
	O,O,O-Triethyl Phosphorothioate		0.33 mg/Kg			
	2,6-Dichlorophenol		0.33 mg/Kg			
	Hexachloropropene		0.33 mg/Kg			
	N-Nitrosodi-n-butylamine		0.33 mg/Kg			
	p-Phenylenediamine		2 mg/Kg	1.2 mg/Kg		
	Safrole		0.33 mg/Kg			
	1,2,4,5-Tetrachlorobenzene		0.33 mg/Kg			
	Isosafrole		0.67 mg/Kg			
	1,3-Dinitrobenzene		0.33 mg/Kg			
	Pentachlorobenzene		0.33 mg/Kg			
	1-Naphthylamine		0.33 mg/Kg			
	2-Naphthylamine		0.33 mg/Kg			
	2,3,4,6-Tetrachlorophenol		2 mg/Kg	0.04 mg/Kg		
	Diphenylamine		0.33 mg/Kg			
	1,3,5-Trinitrobenzene		0.67 mg/Kg	0.05 mg/Kg		
	Phenacetin		2 mg/Kg			
	4-Aminobiphenyl		0.33 mg/Kg			
	4-Nitroquinoline N-Oxide		3 mg/Kg	0.04 mg/Kg		

SEMIVOLATILE ORGANIC COMPOUNDS (SOCs) ANALYSES						
Method ^a	Analyte	Matrix	Method Reporting Limit	Method Detection Limit	Precision ^b (RPD)	Accuracy ^c (%REC)
8270C Base Neutral Acid Extractables	Aramite, Total	Soil	2 mg/Kg	0.04 mg/Kg		
	3,3'-Dimethylbenzidine		2 mg/Kg	1.1 mg/Kg		
	7,12-Dimethylbenz(a)anthracene		0.33 mg/Kg			
	Hexachlorophene		5 mg/Kg	2.8 mg/Kg		
	3-Methylcholanthrene		0.33 mg/Kg			
	a,a-Dimethylphenethylamine		1 mg/Kg			
	2-Acetylaminofluorene		4 mg/Kg			
	o-Toluidine		0.33 mg/Kg			
	Ethyl methanesulfonate		0.33 mg/Kg			
	1,4-Naphthoquinone		0.33 mg/Kg			
	5-Nitro-o-toluidine		0.33 mg/Kg			
	p-Dimethylaminoazobenzene		0.33 mg/Kg			
	Pentachloronitrobenzene		2 mg/Kg			
	Methapyrilene		1 mg/Kg			
	Chlorobenzilate		0.33 mg/Kg			
	1,2-Diphenylhydrazine		0.33 mg/Kg			
	1,4-Dichlorobutane		0.33 mg/Kg			
	1-Chloronaphthalen		0.33 mg/Kg			
	1-Methylnaphthalene		0.33 mg/Kg			
	Biphenyl		0.33 mg/Kg	0.01 mg/Kg		
	Atrazine		0.33 mg/Kg	0.02 mg/Kg		
	Benzidine		2 mg/Kg	0.34 mg/Kg		
	Carbazole		0.33 mg/Kg	0.02 mg/Kg		
	Diallate		0.33 mg/Kg			
	Dicyclopentadiene		0.33 mg/Kg	0.2 mg/Kg		
	Dimethoate		0.33 mg/Kg			
	Dinoseb		0.33 mg/Kg	0.07 mg/Kg		
	Disulfoton		0.33 mg/Kg			
	Famphur		4 mg/Kg	0.05 mg/Kg		
	Isodrin		0.33 mg/Kg			
	Kepone		4 mg/Kg	0.41 mg/Kg		
	Malathion		1 mg/Kg			
	Methyl Parathion		0.33 mg/Kg			
	Parathion		0.33 mg/Kg			
	Phorate		0.33 mg/Kg			
	Pronamide		0.33 mg/Kg	0.01 mg/Kg		
	Pyridine		0.33 mg/Kg	0.04 mg/Kg		
	Sulfotepp		0.33 mg/Kg	0.02 mg/Kg		
	Thionazin		2 mg/Kg			
	2-Fluorophenol ^g		NA	NA	NA	26-86
	Phenol-D6 ^g		NA	NA	NA	29-100
	2,4,6-Tribromophenol ^g		NA	NA	NA	33-106
	Nitrobenzene-D5 ^g		NA	NA	NA	31-102
	2-Fluorobiphenyl ^g		NA	NA	NA	26-104
	Terphenyl-D14 ^g		NA	NA	NA	46-135
8270C Base Neutral Acid Extractables	N-Nitrosodimethylamine	Water	25 ug/L	0.48 ug/L	30	
	Pyridine		25 ug/L	0.83 ug/L	30	
	Aniline		25 ug/L	0.49 ug/L	30	
	Bis(2-chloroethyl) Ether		10 ug/L	0.34 ug/L	30	

SEMIVOLATILE ORGANIC COMPOUNDS (SOCs) ANALYSES						
Method ^a	Analyte	Matrix	Method Reporting Limit	Method Detection Limit	Precision ^b (RPD)	Accuracy ^c (%REC)
8270C Base Neutral Acid Extractables	1,2-Dichlorobenzene	Water	10 ug/L	0.44 ug/L	30	
	1,3-Dichlorobenzene		10 ug/L	0.36 ug/L	30	
	1,4-Dichlorobenzene		10 ug/L	0.32 ug/L	30	45-92
	Bis(2-chloroisopropyl) Ether		10 ug/L	0.32 ug/L	30	
	N-Nitrosodi-n-propylamine		10 ug/L	0.50 ug/L	30	61-106
	Hexachloroethane		10 ug/L	0.29 ug/L	30	
	Nitrobenzene		10 ug/L	0.57 ug/L	30	
	Isophorone		10 ug/L	0.25 ug/L	30	
	Bis(2-chloroethoxy)methane		10 ug/L	0.28 ug/L	30	
	1,2,4-Trichlorobenzene		10 ug/L	0.36 ug/L	30	53-91
	Naphthalene		10 ug/L	0.37 ug/L	30	
	4-Chloroaniline		10 ug/L	0.38 ug/L	30	
	Hexachlorobutadiene		10 ug/L	0.29 ug/L	30	
	2-Methylnaphthalene		10 ug/L	0.24 ug/L	30	
	Hexachlorocyclopentadiene		10 ug/L	1.3 ug/L	30	
	2-Chloronaphthalene		10 ug/L	0.29 ug/L	30	
	2-Nitroaniline		25 ug/L	0.34 ug/L	30	
	Dimethyl Phthalate		10 ug/L	0.26 ug/L	30	
	Acenaphthylene		10 ug/L	0.24 ug/L	30	
	3-Nitroaniline		25 ug/L	3.3 ug/L	30	
	Acenaphthene		10 ug/L	0.29 ug/L	30	55-106
	Dibenzofuran		10 ug/L	0.33 ug/L	30	
	2,4-Dinitrotoluene		10 ug/L	0.28 ug/L	30	76-125
	2,6-Dinitrotoluene		10 ug/L	0.35 ug/L	30	
	Diethyl Phthalate		10 ug/L	0.29 ug/L	30	
	4-Chlorophenyl Phenyl Ether		10 ug/L	0.28 ug/L	30	
	Fluorene		10 ug/L	0.33 ug/L	30	
	4-Nitroaniline		25 ug/L	4.1 ug/L	30	
	N-Nitrosodiphenylamine		10 ug/L	0.48 ug/L	30	
	4-Bromophenyl Phenyl Ether		10 ug/L	0.28 ug/L	30	
	Hexachlorobenzene		10 ug/L	0.63 ug/L	30	
	Phenanthrene		10 ug/L	0.49 ug/L	30	
	Anthracene		10 ug/L	0.62 ug/L	30	
	Carbazole		10 ug/L	0.53 ug/L	30	
	Di-n-butyl Phthalate		10 ug/L	0.37 ug/L	30	
	Fluoranthene		10 ug/L	0.66 ug/L	30	
	Pyrene		10 ug/L	0.74 ug/L	30	53-112
	Butyl Benzyl Phthalate		10 ug/L	0.47 ug/L	30	
	3,3'-Dichlorobenzidine		25 ug/L	0.27 ug/L	30	
	Benz(a)anthracene		10 ug/L	0.60 ug/L	30	
	Bis(2-ethylhexyl) Phthalate		10 ug/L	1.9 ug/L	30	
	Chrysene		10 ug/L	0.79 ug/L	30	
	Di-n-octyl Phthalate		10 ug/L	0.63 ug/L	30	
	Benzo(b)fluoranthene		10 ug/L	0.59 ug/L	30	
	Benzo(k)fluoranthene		10 ug/L	0.83 ug/L	30	
	Benzo(a)pyrene		10 ug/L	0.66 ug/L	30	
	Indeno(1,2,3-cd)pyrene		10 ug/L	0.69 ug/L	30	
	Dibenz(a,h)anthracene		10 ug/L	0.76 ug/L	30	
	Benzo(g,h,i)perylene		10 ug/L	0.82 ug/L	30	
	Phenol		10 ug/L	0.33 ug/L	30	53-94

SEMIVOLATILE ORGANIC COMPOUNDS (SOCs) ANALYSES						
Method ^a	Analyte	Matrix	Method Reporting Limit	Method Detection Limit	Precision ^b (RPD)	Accuracy ^c (%REC)
8270C Base Neutral Acid Extractables	2-Chlorophenol	Water	10 ug/L	0.32 ug/L	30	53-97
	Benzyl Alcohol		10 ug/L	0.38 ug/L	30	
	2-Methylphenol		10 ug/L	0.33 ug/L	30	
	3- and 4-Methylphenol ^h		10 ug/L	0.48 ug/L	30	
	2-Nitrophenol		10 ug/L	0.38 ug/L	30	
	2,4-Dimethylphenol		10 ug/L	0.27 ug/L	30	
	Benzoic Acid		25 ug/L	5.9 ug/L	30	
	2,4-Dichlorophenol		10 ug/L	0.30 ug/L	30	
	4-Chloro-3-methylphenol		10 ug/L	0.49 ug/L	30	71-102
	2,4,6-Trichlorophenol		10 ug/L	0.21 ug/L	30	
	2,4,5-Trichlorophenol		10 ug/L	0.39 ug/L	30	
	2,4-Dinitrophenol		25 ug/L	2.3 ug/L	30	
	4-Nitrophenol		25 ug/L	2.0 ug/L	30	56-115
	2-Methyl-4,6-dinitrophenol		25 ug/L	2.2 ug/L	30	
	Pentachlorophenol		25 ug/L	2.5 ug/L	30	65-112
Additional Non-routine Analytes (Appendix I, II, IX, Etc.)						
8270C Base Neutral Acid Extractables	2-Picoline	Water	20 ug/L	4.2 ug/L		
	N-Nitrosodiethylamine		10 ug/L			
	Methyl Methanesulfonate		10 ug/L			
	N-Nitrosomethylethylamine		10 ug/L			
	Pentachloroethane		25 ug/L			
	Acetophenone		10 ug/L	0.58 ug/L		
	N-Nitrosopyrrolidine		10 ug/L			
	N-Nitrosomorpholine		10 ug/L			
	N-Nitrosopiperidine		10 ug/L			
	O,O,O-Triethyl Phosphorothioate		10 ug/L			
	2,6-Dichlorophenol		10 ug/L			
	Hexachloropropene		10 ug/L			
	N-Nitrosodi-n-butylamine		10 ug/L			
	p-Phenylenediamine		100 ug/L			
	Safrole		10 ug/L			
	1,2,4,5-Tetrachlorobenzene		10 ug/L			
	Isosafrole		10 ug/L			
	1,3-Dinitrobenzene		10 ug/L			
	Pentachlorobenzene		10 ug/L			
	1-Naphthylamine		10 ug/L			
	2-Naphthylamine		10 ug/L			
	2,3,4,6-Tetrachlorophenol		10 ug/L			
	Diphenylamine		10 ug/L			
	1,3,5-Trinitrobenzene		25 ug/L	1.4 ug/L		
	Phenacetin		50 ug/L			
	4-Aminobiphenyl		10 ug/L			
	4-Nitroquinoline N-Oxide		100 ug/L	1.6 ug/L		
	Aramite, Total		50 ug/L	1.1 ug/L		
	3,3'-Dimethylbenzidine		10 ug/L	2.8 ug/L		
	7,12-Dimethylbenz(a)anthracene		10 ug/L			
	Hexachlorophene		150 ug/L			
	3-Methylcholanthrene		10 ug/L			
	a,a-Dimethylphenethylamine		25 ug/L			

SEMIVOLATILE ORGANIC COMPOUNDS (SOCs) ANALYSES						
Method ^a	Analyte	Matrix	Method Reporting Limit	Method Detection Limit	Precision ^b (RPD)	Accuracy ^c (%REC)
8270C Base Neutral Acid Extractables	2-Acetylaminofluorene	Water	100 ug/L			
	o-Toluidine		10 ug/L			
	Ethyl methanesulfonate		10 ug/L			
	1,4-Naphthoquinone		10 ug/L			
	5-Nitro-o-toluidine		10 ug/L			
	p-Dimethylaminoazobenzene		10 ug/L			
	Pentachloronitrobenzene		50 ug/L			
	Methapyrilene		100 ug/L	15 ug/L		
	Chlorobenzilate		10 ug/L			
	1,2-Diphenylhydrazine		10 ug/L			
	1,4-Dichlorobutane		10 ug/L			
	1-Chloronaphthalen		10 ug/L			
	1-Methylnaphthalene		10 ug/L			
	Biphenyl		10 ug/L	0.4 ug/L		
	Atrazine		10 ug/L	0.5 ug/L		
	Benzydine		50 ug/L	8.8 ug/L		
	Carbazole		10 ug/L			
	Diallate		10 ug/L			
	Dicyclopentadiene		10 ug/L			
	Dimethoate		10 ug/L			
	Dinoseb		10 ug/L	1.8 ug/L		
	Disulfoton		10 ug/L			
	Famphur		10 ug/L	1.2 ug/L		
	Isodrin		10 ug/L			
	Kepone		10 ug/L	3.6 ug/L		
	Malathion		25 ug/L			
	Methyl Parathion		10 ug/L			
	Parathion		10 ug/L			
	Phorate		10 ug/L			
	Pronamide		10 ug/L	0.44 ug/L		
	Pyridine		25 ug/L			
	Sulfotepp		10 ug/L	0.51 ug/L		
	Thionazin		25 ug/L			
	2-Fluorophenol [§]		NA	NA	NA	45-97
	Phenol-D6 [§]		NA	NA	NA	45-108
	2,4,6-Tribromophenol [§]		NA	NA	NA	56-116
	Nitrobenzene-D5 [§]		NA	NA	NA	47-112
	2-Fluorobiphenyl [§]		NA	NA	NA	48-103
	Terphenyl-D14 [§]		NA	NA	NA	33-158
8310 Polynuclear Aromatic Hydrocarbons	Naphthalene	Soil	0.1 mg/Kg	0.020 mg/Kg	40	
	Acenaphthene		0.1 mg/Kg	0.013 mg/Kg	40	46-91
	Acenaphthylene		0.1 mg/Kg	0.026 mg/Kg	40	
	Fluorene		0.02 mg/Kg	0.014 mg/Kg	40	
	Phenanthrene		0.01 mg/Kg	0.001 mg/Kg	40	
	Anthracene		0.01 mg/Kg	0.001 mg/Kg	40	
	Fluoranthene		0.02 mg/Kg	0.001 mg/Kg	40	47-119
	Pyrene		0.02 mg/Kg	0.002 mg/Kg	40	
	Benz(a)anthracene		0.01 mg/Kg	0.002 mg/Kg	40	
	Chrysene		0.01 mg/Kg	0.001 mg/Kg	40	
	Benzo(b)fluoranthene		0.02 mg/Kg	0.001 mg/Kg	40	

SEMIVOLATILE ORGANIC COMPOUNDS (SOCs) ANALYSES						
Method ^a	Analyte	Matrix	Method Reporting Limit	Method Detection Limit	Precision ^b (RPD)	Accuracy ^c (%REC)
8310 Polynuclear Aromatic Hydrocarbons	Benzo(k)fluoranthene	Soil	0.01 mg/Kg	0.001 mg/Kg	40	
	Benzo(a)pyrene		0.01 mg/Kg	0.001 mg/Kg	40	13-144
	Dibenz(a,h)anthracene		0.02 mg/Kg	0.004 mg/Kg	40	
	Benzo(g,h,i)perylene		0.02 mg/Kg	0.003 mg/Kg	40	
	Indeno(1,2,3-cd)pyrene		0.01 mg/Kg	0.002 mg/Kg	40	
	<i>p</i> -Terphenyl ¹⁸		NA	NA	NA	39-142
8310 Polynuclear Aromatic Hydrocarbons	Naphthalene	Water	1 ug/L	0.23 ug/L	30	
	Acenaphthene		1 ug/L	0.21 ug/L	30	50-100
	Acenaphthylene		1 ug/L	0.22 ug/L	30	
	Fluorene		0.2 ug/L	0.014 ug/L	30	
	Phenanthrene		0.1 ug/L	0.010 ug/L	30	
	Anthracene		0.1 ug/L	0.012 ug/L	30	
	Fluoranthene		0.2 ug/L	0.019 ug/L	30	65-102
	Pyrene		0.2 ug/L	0.024 ug/L	30	
	Benz(a)anthracene		0.1 ug/L	0.023 ug/L	30	
	Chrysene		0.1 ug/L	0.037 ug/L	30	
	Benzo(b)fluoranthene		0.2 ug/L	0.020 ug/L	30	
	Benzo(k)fluoranthene		0.1 ug/L	0.017 ug/L	30	
	Benzo(a)pyrene		0.1 ug/L	0.017 ug/L	30	63-109
	Dibenz(a,h)anthracene		0.2 ug/L	0.051 ug/L	30	
	Benzo(g,h,i)perylene		0.2 ug/L	0.054 ug/L	30	
	Indeno(1,2,3-cd)pyrene		0.1 ug/L	0.034 ug/L	30	
	<i>p</i> -Terphenyl ¹⁸		NA	NA	NA	48-126
8315	Formaldehyde	Soil	2 mg/Kg	0.42 mg/Kg	40	39-153 ^d
8315	Formaldehyde	Water	100 ug/L	14 ug/L	30	39-153 ^d
8330 Explosives	Octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine (HMX)	Soil	2 mg/Kg	0.050 mg/Kg	40	
	Hexahydro-1,3,5-trinitro-1,3,5-triazine (RDX)		2 mg/Kg	0.098 mg/Kg	40	
	1,3,5-Trinitrobenzene		2 mg/Kg	0.061 mg/Kg	40	
	Methyl-2,4,6-trinitrophenylnitramine (Tetryl)		2 mg/Kg	0.120 mg/Kg	40	
	1,3-Dinitrobenzene		2 mg/Kg	0.053 mg/Kg	40	
	2,4,6-Trinitrotoluene		2 mg/Kg	0.056 mg/Kg	40	70-123
	Nitrobenzene		2 mg/Kg	0.062 mg/Kg	40	72-118
	4-Amino-2,6-dinitrotoluene		2 mg/Kg	0.066 mg/Kg	40	
	2-Amino-4,6-dinitrotoluene		2 mg/Kg	0.072 mg/Kg	40	
	2,6-Dinitrotoluene		2 mg/Kg	0.082 mg/Kg	40	
	2,4-Dinitrotoluene		2 mg/Kg	0.067 mg/Kg	40	71-122
	2-Nitrotoluene		2 mg/Kg	0.080 mg/Kg	40	
	4-Nitrotoluene		2 mg/Kg	0.110 mg/Kg	40	
	3-Nitrotoluene		2 mg/Kg	0.069 mg/Kg	40	
	1-Chloro-3-nitrobenzene ¹⁸		NA	NA	NA	63-118
8330 Explosives	Octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine (HMX)	Water	2 ug/L	0.31 ug/L	30	
	Hexahydro-1,3,5-trinitro-1,3,5-triazine (RDX)		2 ug/L	0.19 ug/L	30	
	1,3,5-Trinitrobenzene		2 ug/L	0.23 ug/L	30	
	Methyl-2,4,6-trinitrophenylnitramine (Tetryl)		2 ug/L	0.26 ug/L	30	
	1,3-Dinitrobenzene		2 ug/L	0.14 ug/L	30	
	2,4,6-Trinitrotoluene		2 ug/L	0.15 ug/L	30	71-129
	Nitrobenzene		2 ug/L	0.17 ug/L	30	56-121
	4-Amino-2,6-dinitrotoluene		2 ug/L	0.13 ug/L	30	

SEMIVOLATILE ORGANIC COMPOUNDS (SOCs) ANALYSES						
Method ^a	Analyte	Matrix	Method Reporting Limit	Method Detection Limit	Precision ^b (RPD)	Accuracy ^c (%REC)
8330 Explosives	2-Amino-4,6-dinitrotoluene	Water	2 ug/L	0.17 ug/L	30	
	2,6-Dinitrotoluene		2 ug/L	0.24 ug/L	30	
	2,4-Dinitrotoluene		2 ug/L	0.12 ug/L	30	74-127
	2-Nitrotoluene		2 ug/L	0.41 ug/L	30	
	4-Nitrotoluene		2 ug/L	0.47 ug/L	30	
	3-Nitrotoluene		2 ug/L	0.30 ug/L	30	
	1-Chloro-3-nitrobenzene ^g		NA	NA	NA	47-134
8332 Explosives	Nitroglycerin	Soil	2 mg/Kg	0.90 mg/Kg	40	70-130 ^d
	PETN		2 mg/Kg	0.92 mg/Kg	40	70-130 ^d
	1-Chloro-3-nitrobenzene ^g		NA	NA	NA	49-123
8332 Explosives	Nitroglycerin	Water	2 ug/L	0.94 ug/L	30	70-130 ^d
	PETN		2 ug/L	0.87 ug/L	30	70-130 ^d
	1-Chloro-3-nitrobenzene ^g		NA	NA	NA	47-114
GC/MS-SIM Polynuclear Aromatic Hydrocarbons	Naphthalene	Soil	5 ug/Kg	0.21 ug/Kg	40	
	1-Methylnaphthalene		5 ug/Kg	0.14 ug/Kg	40	
	2-Methylnaphthalene		5 ug/Kg	0.21 ug/Kg	40	
	Biphenyl		5 ug/Kg	0.18 ug/Kg	40	
	2,6-Dimethylnaphthalene		5 ug/Kg	0.09 ug/Kg	40	
	Acenaphthylene		5 ug/Kg	0.16 ug/kg	40	
	Dibenzofuran		5 ug/Kg	0.20 ug/Kg	40	
	Acenaphthene		5 ug/Kg	0.21 ug/kg	40	50-105
	2,3,5-Trimethylnaphthalene		5 ug/Kg	0.10 ug/kg	40	
	Fluorene		5 ug/Kg	0.17 ug/kg	40	
	Phenanthrene		5 ug/Kg	0.15 ug/kg	40	
	Anthracene		5 ug/Kg	0.19 ug/kg	40	
	1-Methylphenanthrene		5 ug/Kg	0.19 ug/kg	40	
	Fluoranthene		5 ug/Kg	0.17 ug/kg	40	
	Pyrene		5 ug/Kg	0.11 ug/kg	40	59-121
	Benz(a)anthracene		5 ug/Kg	0.13 ug/kg	40	
	Chrysene		5 ug/Kg	0.15 ug/kg	40	
	Benzo(b)fluoranthene		5 ug/Kg	0.14 ug/kg	40	
	Benzo(k)fluoranthene		5 ug/Kg	0.15 ug/kg	40	
	Benzo(a)pyrene		5 ug/Kg	0.14 ug/kg	40	58-128
	Benzo(e)pyrene		5 ug/Kg	0.15 ug/kg	40	
	Indeno(1,2,3-cd)pyrene		5 ug/Kg	0.15 ug/kg	40	
	Dibenz(a,h)anthracene		5 ug/Kg	0.18 ug/kg	40	
	Benzo(g,h,i)perylene		5 ug/Kg	0.10 ug/kg	40	
	Fluorene-d10 ^g		NA	NA	NA	27-110
	Fluoranthene-d10 ^g		NA	NA	NA	34-122
	Terphenyl-d14 ^g		NA	NA	NA	50-132
GC/MS-SIM Polynuclear Aromatic Hydrocarbons	Naphthalene	Water	0.02 ug/L	0.004 ug/L	30	
	1-Methylnaphthalene		0.02 ug/L	0.004 ug/L	30	
	2-Methylnaphthalene		0.02 ug/L	0.003 ug/L	30	
	Biphenyl		0.02 ug/L	0.005 ug/L	30	
	2,6-Dimethylnaphthalene		0.02 ug/L	0.004 ug/L	30	
	Acenaphthylene		0.02 ug/L	0.002 ug/L	30	
	Dibenzofuran		0.02 ug/L	0.008 ug/L	30	
	Acenaphthene		0.02 ug/L	0.002 ug/L	30	48-107
	2,3,5-Trimethylnaphthalene		0.02 ug/L	0.004 ug/L	30	

SEMIVOLATILE ORGANIC COMPOUNDS (SOCs) ANALYSES						
Method ^a	Analyte	Matrix	Method Reporting Limit	Method Detection Limit	Precision ^b (RPD)	Accuracy ^c (%REC)
GC/MS-SIM Polynuclear Aromatic Hydrocarbons	Fluorene	Water	0.02 ug/L	0.003 ug/L	30	
	Phenanthrene		0.02 ug/L	0.004 ug/L	30	
	Anthracene		0.02 ug/L	0.002 ug/L	30	
	1-Methylphenanthrene		0.02 ug/L	0.004 ug/L	30	
	Fluoranthene		0.02 ug/L	0.003 ug/L	30	
	Pyrene		0.02 ug/L	0.003 ug/L	30	53-123
	Benz(a)anthracene		0.02 ug/L	0.003 ug/L	30	
	Chrysene		0.02 ug/L	0.002 ug/L	30	
	Benzo(b)fluoranthene		0.02 ug/L	0.002 ug/L	30	
	Benzo(k)fluoranthene		0.02 ug/L	0.002 ug/L	30	
	Benzo(a)pyrene		0.02 ug/L	0.002 ug/L	30	38-142
	Benzo(e)pyrene		0.02 ug/L	0.003 ug/L	30	
	Indeno(1,2,3-cd)pyrene		0.02 ug/L	0.003 ug/L	30	
	Dibenz(a,h)anthracene		0.02 ug/L	0.002 ug/L	30	
	Benzo(g,h,i)perylene		0.02 ug/L	0.004 ug/L	30	
	Fluorene-d10 ^b		NA	NA	NA	37-107
	Fluoranthene-d10 ^b		NA	NA	NA	18-137
	Terphenyl-d14 ^b		NA	NA	NA	18-153
AK 102	Diesel Range Petroleum Hydrocarbons	Soil	10 mg/Kg	5.8 mg/Kg	40	75-125 ^d
8015B			10 mg/Kg	7.1 mg/Kg	40	74-150
NWTPH-Dx			25 mg/Kg	7.1 mg/Kg	40	74-150
AK 102	o-Terphenyl ^b		NA	NA	NA	50-150 ^d
8015B	o-Terphenyl ^b		NA	NA	NA	31-151
NWTPH-Dx	o-Terphenyl ^b		NA	NA	NA	50-150 ^d
AK 102	Diesel Range Petroleum Hydrocarbons	Water	100 ug/L	31 ug/L	30	75-125 ^d
8015B			250 ug/L	36 ug/L	30	71-146
NWTPH-Dx			250 ug/L	36 ug/L	30	71-146
AK 102	o-Terphenyl ^b		NA	NA	NA	50-150 ^d
8015B	o-Terphenyl ^b		NA	NA	NA	37-141
NWTPH-Dx	o-Terphenyl ^b		NA	NA	NA	50-150 ^d
AK 103	Residual Range Petroleum Hydrocarbons	Soil	100 mg/Kg	4.6 mg/Kg	40	60-120 ^d
	n-Triacontane ^b		NA	NA	NA	50-150 ^d

VOLATILE ORGANIC COMPOUNDS (VOCs) ANALYSES

Method ^a	Analyte	Matrix	Method Reporting Limit	Method Detection Limit	Precision ^b (RPD)	Accuracy ^c (%REC)
602	Benzene	Water	0.5 ug/L	0.059 ug/L	30	39-150 ^d
	Toluene		1 ug/L	0.070 ug/L	30	46-148 ^d
	Ethylbenzene		1 ug/L	0.092 ug/L	30	32-160 ^d
	m&p-Xylenes		1 ug/L	0.19 ug/L	30	32-160 ^d
	o-Xylene		1 ug/L	0.13 ug/L	30	32-160 ^d
	1,4-Difluorobenzene ^g		NA	NA	NA	77-117
624	Chloromethane	Water	5 ug/L	0.34 ug/L	30	D-273 ^d
	Vinyl Chloride		5 ug/L	0.40 ug/L	30	D-251 ^d
	Bromomethane		5 ug/L	0.81 ug/L	30	D-242 ^d
	Chloroethane		5 ug/L	0.38 ug/L	30	14-230 ^d
	Trichlorofluoromethane (CFC 11)		5 ug/L	0.46 ug/L	30	17-181 ^d
	1,1-Dichloroethene		5 ug/L	0.39 ug/L	30	D-234 ^d
	Methylene Chloride		5 ug/L	0.25 ug/L	30	D-221 ^d
	trans-1,2-Dichloroethene		5 ug/L	0.37 ug/L	30	54-156 ^d
	1,1-Dichloroethane		5 ug/L	0.11 ug/L	30	59-155 ^d
	Chloroform		5 ug/L	0.29 ug/L	30	51-138 ^d
	1,1,1-Trichloroethane (TCA)		5 ug/L	0.37 ug/L	30	52-162 ^d
	Carbon Tetrachloride		5 ug/L	0.36 ug/L	30	70-140 ^d
	Benzene		5 ug/L	0.28 ug/L	30	37-151 ^d
	1,2-Dichloroethane		5 ug/L	0.23 ug/L	30	49-155 ^d
	Trichloroethene (TCE)		5 ug/L	0.39 ug/L	30	71-157 ^d
	1,2-Dichloropropane		5 ug/L	0.20 ug/L	30	D-210 ^d
	Bromodichloromethane		5 ug/L	0.25 ug/L	30	35-155 ^d
	2-Chloroethyl Vinyl Ether		10 ug/L	0.36 ug/L	30	D-305 ^d
	trans-1,3-Dichloropropene		5 ug/L	0.18 ug/L	30	17-183 ^d
	Toluene		5 ug/L	0.31 ug/L	30	47-150 ^d
	cis-1,3-Dichloropropene		5 ug/L	0.17 ug/L	30	D-227 ^d
	1,1,2-Trichloroethane		5 ug/L	0.20 ug/L	30	52-150 ^d
	Tetrachloroethene (PCE)		5 ug/L	0.41 ug/L	30	64-148 ^d
	Dibromochloromethane		5 ug/L	0.23 ug/L	30	53-149 ^d
	Chlorobenzene		5 ug/L	0.27 ug/L	30	37-160 ^d
	Ethylbenzene		5 ug/L	0.37 ug/L	30	37-162 ^d
	Bromoform		5 ug/L	0.25 ug/L	30	45-169 ^d
	1,1,2,2-Tetrachloroethane		5 ug/L	0.15 ug/L	30	46-157 ^d
	1,3-Dichlorobenzene		5 ug/L	0.16 ug/L	30	59-156 ^d
	1,4-Dichlorobenzene		5 ug/L	0.19 ug/L	30	18-190 ^d
	1,2-Dichlorobenzene		5 ug/L	0.13 ug/L	30	18-190 ^d
	Acrolein		50 ug/L	4.0 ug/L	31	18-190 ^d
	Acrylonitrile		10 ug/L	0.45 ug/L	32	18-190 ^d
	Dibromofluoromethane ^g		NA	NA	NA	69-123
	Toluene-D8 ^g		NA	NA	NA	84-116
	4-Bromofluorobenzene ^g		NA	NA	NA	75-117
8021B BTEX (Mid Level)	Benzene	Soil	0.05 mg/Kg	0.009 mg/Kg	40	45-150
	Toluene		0.1 mg/Kg	0.009 mg/Kg	40	44-153
	Ethylbenzene		0.1 mg/Kg	0.008 mg/Kg	40	47-151
	m&p-Xylenes		0.1 mg/Kg	0.017 mg/Kg	40	49-155
	o-Xylene		0.1 mg/Kg	0.010 mg/Kg	40	46-148
	4-Bromofluorobenzene ^g		NA	NA	NA	31-154

VOLATILE ORGANIC COMPOUNDS (VOCs) ANALYSES

Method ^a	Analyte	Matrix	Method Reporting Limit	Method Detection Limit	Precision ^b (RPD)	Accuracy ^c (%REC)
8021B BTEX	Benzene	Water	0.5 ug/L	0.059 ug/L	30	81-120
	Toluene		1 ug/L	0.070 ug/L	30	61-138
	Ethylbenzene		1 ug/L	0.092 ug/L	30	83-122
	m&p-Xylenes		1 ug/L	0.19 ug/L	30	86-123
	o-Xylene		1 ug/L	0.13 ug/L	30	82-120
	1,4-Difluorobenzene ^g		NA	NA	NA	75-121
8260B Volatile Organics	Dichlorodifluoromethane (CFC 12)	Soil	5 ug/Kg	0.77 ug/Kg	40	
	Chloromethane		5 ug/Kg	1.3 ug/Kg	40	
	Vinyl Chloride		5 ug/Kg	0.72 ug/Kg	40	
	Bromomethane		5 ug/Kg	0.88 ug/Kg	40	
	Chloroethane		5 ug/Kg	0.74 ug/Kg	40	
	Trichlorofluoromethane (CFC 11)		5 ug/Kg	0.93 ug/Kg	40	
	Trichlorotrifluoromethane (CFC 113)		5 ug/Kg	1.4 ug/Kg	40	
	Acetone		50 ug/Kg	3.6 ug/Kg	40	
	1,1-Dichloroethene		5 ug/Kg	0.74 ug/Kg	40	71-127
	Carbon Disulfide		5 ug/Kg	0.71 ug/Kg	40	
	Methylene Chloride		10 ug/Kg	0.83 ug/Kg	40	
	<i>trans</i> -1,2-Dichloroethene		5 ug/Kg	0.94 ug/Kg	40	
	1,1-Dichloroethane		5 ug/Kg	0.68 ug/Kg	40	
	Methyl tert-butyl ether		5 ug/Kg	2.1 ug/Kg	40	
	2-Butanone (MEK)		20 ug/Kg	3.6 ug/Kg	40	
	2,2-Dichloropropane		5 ug/Kg	0.76 ug/Kg	40	
	<i>cis</i> -1,2-Dichloroethene		5 ug/Kg	0.52 ug/Kg	40	
	Chloroform		5 ug/Kg	0.62 ug/Kg	40	
	Bromochloromethane		5 ug/Kg	0.81 ug/Kg	40	
	1,1,1-Trichloroethane (TCA)		5 ug/Kg	0.82 ug/Kg	40	
	1,1-Dichloropropene		5 ug/Kg	0.68 ug/Kg	40	
	Carbon Tetrachloride		5 ug/Kg	0.73 ug/Kg	40	
	1,2-Dichloroethane		5 ug/Kg	0.59 ug/Kg	40	
	Benzene		5 ug/Kg	0.52 ug/Kg	40	78-124
	Trichloroethene (TCE)		5 ug/Kg	0.88 ug/Kg	40	69-128
	1,2-Dichloropropane		5 ug/Kg	0.61 ug/Kg	40	
	Bromodichloromethane		5 ug/Kg	0.67 ug/Kg	40	
	Dibromomethane		5 ug/Kg	0.71 ug/Kg	40	
	2-Hexanone		20 ug/Kg	1.7 ug/Kg	40	
	<i>cis</i> -1,3-Dichloropropene		5 ug/Kg	0.78 ug/Kg	40	
	Toluene		5 ug/Kg	1.1 ug/Kg	40	75-128
	<i>trans</i> -1,3-Dichloropropene		5 ug/Kg	0.51 ug/Kg	40	
	1,1,2-Trichloroethane		5 ug/Kg	0.54 ug/Kg	40	
	4-Methyl-2-pentanone (MIBK)		20 ug/Kg	2.6 ug/Kg	40	
	1,3-Dichloropropane		5 ug/Kg	0.56 ug/Kg	40	
	Tetrachloroethene (PCE)		5 ug/Kg	0.85 ug/Kg	40	
	Dibromochloromethane		5 ug/Kg	0.31 ug/Kg	40	
	1,2-Dibromoethane (EDB)		20 ug/Kg	0.21 ug/Kg	40	
	Chlorobenzene		5 ug/Kg	0.63 ug/Kg	40	76-119
	1,1,1,2-Tetrachloroethane		5 ug/Kg	0.47 ug/Kg	40	
	Ethylbenzene		5 ug/Kg	0.73 ug/Kg	40	
	m&p-Xylenes		5 ug/Kg	1.9 ug/Kg	40	
	o-Xylene		5 ug/Kg	0.71 ug/Kg	40	
	Styrene		5 ug/Kg	0.62 ug/Kg	40	

VOLATILE ORGANIC COMPOUNDS (VOCs) ANALYSES						
Method ^a	Analyte	Matrix	Method Reporting Limit	Method Detection Limit	Precision ^b (RPD)	Accuracy ^c (%REC)
8260B Volatile Organics	Bromoform	Soil	5 ug/Kg	0.34 ug/Kg	40	
	Isopropylbenzene		20 ug/Kg	0.88 ug/Kg	40	
	1,1,2,2-Tetrachloroethane		5 ug/Kg	0.64 ug/Kg	40	
	1,2,3-Trichloropropane		5 ug/Kg	0.77 ug/Kg	40	
	Bromobenzene		5 ug/Kg	0.56 ug/Kg	40	
	<i>n</i> -Propylbenzene		20 ug/Kg	0.88 ug/Kg	40	
	2-Chlorotoluene		20 ug/Kg	0.76 ug/Kg	40	
	4-Chlorotoluene		20 ug/Kg	0.98 ug/Kg	40	
	1,3,5-Trimethylbenzene		20 ug/Kg	0.83 ug/Kg	40	
	<i>tert</i> -Butylbenzene		20 ug/Kg	1.0 ug/Kg	40	
	1,2,4-Trimethylbenzene		20 ug/Kg	0.96 ug/Kg	40	
	<i>sec</i> -Butylbenzene		20 ug/Kg	1.1 ug/Kg	40	
	1,3-Dichlorobenzene		5 ug/Kg	0.95 ug/Kg	40	
	4-Isopropyltoluene		20 ug/Kg	1.0 ug/Kg	40	
	1,4-Dichlorobenzene		5 ug/Kg	0.94 ug/Kg	40	
	<i>n</i> -Butylbenzene		20 ug/Kg	1.1 ug/Kg	40	
	1,2-Dichlorobenzene		5 ug/Kg	0.92 ug/Kg	40	73-123
	1,2-Dibromo-3-chloropropane (DBCP)		20 ug/Kg	0.89 ug/Kg	40	
	1,2,4-Trichlorobenzene		20 ug/Kg	1.1 ug/Kg	40	
	1,2,3-Trichlorobenzene		20 ug/Kg	0.97 ug/Kg	40	
	Naphthalene		20 ug/Kg	1.0 ug/Kg	40	69-134
	Hexachlorobutadiene		20 ug/Kg	1.0 ug/Kg	40	
Additional Non-routine Analytes (Gasoline Additives, Appendix I, II, IX, Etc.)						
8260B Volatile Organics	Tert-Butyl Alcohol (TBA)	Soil	50 ug/Kg	10 ug/Kg		
	Diisopropyl ether (DIPE)		10 ug/Kg	5 ug/Kg		
	Tert-amyl Methyl Ether (TAME)		10 ug/Kg	5 ug/Kg		
	Allyl Chloride		20 ug/Kg			
	Acrolein		100 ug/Kg			
	Iodomethane		20 ug/Kg			
	Acetonitrile		20 ug/Kg			
	3-Chloro-1-propene		5 ug/Kg			
	<i>n</i> -Hexane		5 ug/Kg			
	Chloroprene		20 ug/Kg			
	Acrylonitrile		20 ug/Kg	1.2 ug/Kg		
	Vinyl Acetate		20 ug/Kg	1.8 ug/Kg		
	Propionitrile		20 ug/Kg			
	Ethyl Acetate		5 ug/Kg			
	Methacrylonitrile		20 ug/Kg			
	Isobutyl Alcohol		100 ug/Kg			
	1-Chlorohexane		5 ug/Kg	0.47 ug/Kg		
	Methylmethacrylate		20 ug/Kg			
	1,4-Dioxane		250 ug/Kg	20 ug/Kg		
	2-Nitropropane		5 ug/Kg			
	Ethylmethacrylate		20 ug/Kg			
	<i>cis</i> -1,4-dichloro-2-butene		20 ug/Kg			
	<i>trans</i> -1,4-dichloro-2-butene		20 ug/Kg			
	Ethyl Ether		5 ug/Kg			
	1,3,5-Trichlorobenzene		5 ug/Kg	0.5 ug/Kg		
	2-Chloroethyl Vinyl Ether		10 ug/Kg	1.3 ug/Kg		

VOLATILE ORGANIC COMPOUNDS (VOCs) ANALYSES						
Method ^a	Analyte	Matrix	Method Reporting Limit	Method Detection Limit	Precision ^b (RPD)	Accuracy ^c (%REC)
8260B Volatile Organics	Toluene-D8 ^g	Soil	NA	NA	NA	77-131
	4-Bromofluorobenzene ^g		NA	NA	NA	74-116
	Dibromofluoromethane ^g		NA	NA	NA	81-120
	Toluene-D8 ^g	Soil-mid	NA	NA	NA	35-153
	4-Bromofluorobenzene ^g		NA	NA	NA	35-144
	Dibromofluoromethane ^g		NA	NA	NA	36-148
8260B Volatile Organics	Dichlorodifluoromethane (CFC 12)	Water	0.5 ug/L	0.12 ug/L	30	
	Chloromethane		0.5 ug/L	0.14 ug/L	30	
	Vinyl Chloride		0.5 ug/L	0.11 ug/L	30	
	Bromomethane		0.5 ug/L	0.17 ug/L	30	
	Chloroethane		0.5 ug/L	0.20 ug/L	30	
	Trichlorofluoromethane (CFC 11)		0.5 ug/L	0.13 ug/L	30	
	Trichlorotrifluoromethane (CFC 113)		0.5 ug/L	0.13 ug/L	30	
	Acetone		20 ug/L	1.8 ug/L	30	
	1,1-Dichloroethene		0.5 ug/L	0.14 ug/L	30	76-128
	Methyl tert-butyl ether		0.5 ug/L	0.09 ug/L	30	
	Carbon Disulfide		0.5 ug/L	0.12 ug/L	30	
	Methylene Chloride		2 ug/L	0.10 ug/L	30	
	<i>trans</i> -1,2-Dichloroethene		0.5 ug/L	0.10 ug/L	30	
	1,1-Dichloroethane		0.5 ug/L	0.10 ug/L	30	
	2-Butanone (MEK)		20 ug/L	1.6 ug/L	30	
	2,2-Dichloropropane		0.5 ug/L	0.10 ug/L	30	
	<i>cis</i> -1,2-Dichloroethene		0.5 ug/L	0.10 ug/L	30	
	Chloroform		0.5 ug/L	0.10 ug/L	30	
	Bromochloromethane		0.5 ug/L	0.12 ug/L	30	
	1,1,1-Trichloroethane (TCA)		0.5 ug/L	0.14 ug/L	30	
	1,1-Dichloropropene		0.5 ug/L	0.12 ug/L	30	
	Carbon Tetrachloride		0.5 ug/L	0.14 ug/L	30	
	1,2-Dichloroethane		0.5 ug/L	0.09 ug/L	30	
	Benzene		0.5 ug/L	0.11 ug/L	30	87-122
	Trichloroethene (TCE)		0.5 ug/L	0.11 ug/L	30	82-124
	1,2-Dichloropropane		0.5 ug/L	0.10 ug/L	30	
	Bromodichloromethane		0.5 ug/L	0.08 ug/L	30	
	Dibromomethane		0.5 ug/L	0.09 ug/L	30	
	2-Hexanone		20 ug/L	2.1 ug/L	30	
	<i>cis</i> -1,3-Dichloropropene		0.5 ug/L	0.08 ug/L	30	
	Toluene		0.5 ug/L	0.10 ug/L	30	84-120
	<i>trans</i> -1,3-Dichloropropene		0.5 ug/L	0.07 ug/L	30	
	1,1,2-Trichloroethane		0.5 ug/L	0.08 ug/L	30	
	4-Methyl-2-pentanone (MIBK)		20 ug/L	2.6 ug/L	30	
	1,3-Dichloropropane		0.5 ug/L	0.09 ug/L	30	
	Tetrachloroethene (PCE)		0.5 ug/L	0.11 ug/L	30	
	Dibromochloromethane		0.5 ug/L	0.06 ug/L	30	
	1,2-Dibromoethane (EDB)		2 ug/L	0.10 ug/L	30	
	Chlorobenzene		0.5 ug/L	0.09 ug/L	30	85-114
	1,1,1,2-Tetrachloroethane		0.5 ug/L	0.10 ug/L	30	
	Ethylbenzene		0.5 ug/L	0.12 ug/L	30	
	m&p-Xylenes		0.5 ug/L	0.24 ug/L	30	
	o-Xylene		0.5 ug/L	0.10 ug/L	30	
	Styrene		0.5 ug/L	0.10 ug/L	30	

VOLATILE ORGANIC COMPOUNDS (VOCs) ANALYSES						
Method ^a	Analyte	Matrix	Method Reporting Limit	Method Detection Limit	Precision ^b (RPD)	Accuracy ^c (%REC)
8260B Volatile Organics	Bromoform	Water	0.5 ug/L	0.09 ug/L	30	
	Isopropylbenzene		2 ug/L	0.12 ug/L	30	
	1,1,2,2-Tetrachloroethane		0.5 ug/L	0.13 ug/L	30	
	1,2,3-Trichloropropane		0.5 ug/L	0.28 ug/L	30	
	Bromobenzene		2 ug/L	0.14 ug/L	30	
	<i>n</i> -Propylbenzene		2 ug/L	0.15 ug/L	30	
	2-Chlorotoluene		2 ug/L	0.13 ug/L	30	
	4-Chlorotoluene		2 ug/L	0.13 ug/L	30	
	1,3,5-Trimethylbenzene		2 ug/L	0.11 ug/L	30	
	<i>tert</i> -Butylbenzene		2 ug/L	0.15 ug/L	30	
	1,2,4-Trimethylbenzene		2 ug/L	0.12 ug/L	30	
	<i>sec</i> -Butylbenzene		2 ug/L	0.17 ug/L	30	
	1,3-Dichlorobenzene		0.5 ug/L	0.11 ug/L	30	
	4-Isopropyltoluene		2 ug/L	0.14 ug/L	30	
	1,4-Dichlorobenzene		0.5 ug/L	0.09 ug/L	30	
	<i>n</i> -Butylbenzene		2 ug/L	0.13 ug/L	30	
	1,2-Dichlorobenzene		0.5 ug/L	0.09 ug/L	30	82-117
	1,2-Dibromo-3-chloropropane (DBCP)		2 ug/L	0.39 ug/L	30	
	1,2,4-Trichlorobenzene		2 ug/L	0.09 ug/L	30	
	1,2,3-Trichlorobenzene		2 ug/L	0.12 ug/L	30	
Naphthalene	2 ug/L	0.14 ug/L	30	64-145		
Hexachlorobutadiene	2 ug/L	0.28 ug/L	30			
Additional Non-routine Analytes (Gasoline Additives, Appendix I, II, IX, Etc.)						
8260B Volatile Organics	Tert-Butyl Alcohol (TBA)	Water	20 ug/L	1.7 ug/L		
	Diisopropyl ether (DIPE)		2 ug/L	0.12 ug/L		
	Tert-amyl Methyl Ether (TAME)		2 ug/L	0.10 ug/L		
	Allyl Chloride		0.5 ug/L			
	Acrolein		20 ug/L	2.0 ug/L		
	Iodomethane		5 ug/L	0.32 ug/L		
	Acetonitrile		50 ug/L	2.2 ug/L		
	3-Chloro-1-propene		5 ug/L	0.08 ug/L		
	<i>n</i> -Hexane		0.5 ug/L	0.10 ug/L		
	Chloroprene		10 ug/L	0.11 ug/L		
	Acrylonitrile		5 ug/L	0.30 ug/L		
	Vinyl Acetate		5 ug/L	0.90 ug/L		
	Propionitrile		5 ug/L	1.2 ug/L		
	Ethyl Acetate		5 ug/L	0.90 ug/L		
	Methacrylonitrile		5 ug/L	0.25 ug/L		
	Isobutyl Alcohol		100 ug/L	5.8 ug/L		
	1-Chlorohexane		0.5 ug/L	0.11 ug/L		
	Methylmethacrylate		0.5 ug/L	0.30 ug/L		
	1,4-Dioxane		100 ug/L	9 ug/L		
	2-Nitropropane		5 ug/L	0.44 ug/L		
	Ethylmethacrylate		5 ug/L	0.07 ug/L		
	<i>cis</i> -1,4-dichloro-2-butene		10 ug/L	0.36 ug/L		
	<i>trans</i> -1,4-dichloro-2-butene		10 ug/L	0.26 ug/L		
	Ethyl Ether		1 ug/L	0.07 ug/L		
	1,3,5-Trichlorobenzene		5 ug/L	0.1 ug/L		
	2-Chloroethyl Vinyl Ether		5 ug/L	0.34 ug/L		

VOLATILE ORGANIC COMPOUNDS (VOCs) ANALYSES						
Method ^a	Analyte	Matrix	Method Reporting Limit	Method Detection Limit	Precision ^b (RPD)	Accuracy ^c (%REC)
8260B Volatile Organics	Toluene-D8 ^g	Water	NA	NA	NA	93-109
	4-Bromofluorobenzene ^g		NA	NA	NA	78-114
	Dibromofluoromethane ^g		NA	NA	NA	85-112
AK 101	Gasoline Range Petroleum Hydrocarbons	Soil	5 mg/Kg	0.76 mg/Kg	40	60-120 ^d
CA-TPH-G			10 mg/Kg	3.2 mg/Kg	40	72-129
NWTPH-Gx			10 mg/Kg	3.2 mg/Kg	40	72-129
AK 101	4-Bromofluorobenzene ^g		NA	NA	NA	60-120 ^d
CA-TPH-G	4-Bromofluorobenzene ^g		NA	NA	NA	41-136
NWTPH-Gx	4-Bromofluorobenzene ^g		NA	NA	NA	50-150 ^d
AK 101	Gasoline Range Petroleum Hydrocarbons	Water	50 ug/L	13 ug/L	30	60-120 ^d
CA-TPH-G			50 ug/L	12 ug/L	30	65-133
NWTPH-Gx			50 ug/L	12 ug/L	30	65-133
AK 101	1,4-Difluorobenzene ^g		NA	NA	NA	60-120 ^d
CA-TPH-G	1,4-Difluorobenzene ^g		NA	NA	NA	70-122
NWTPH-Gx	1,4-Difluorobenzene ^g		NA	NA	NA	50-150 ^d

ORGANIC COMPOUNDS IN DRINKING WATER ANALYSES

Method ^a	Analyte	Matrix	Method Reporting Limit	Method Detection Limit	Precision ^b (RPD)	Accuracy ^c (%REC)
504.1	1,2,3-Trichloropropane	Drinking	0.5 ug/L	0.02 ug/L	30	70-130 ^d
	1,2-Dibromo-3-chloropropane (DBCP)	Water	0.01 ug/L	0.003 ug/L	30	70-130 ^d
	Ethylene Dibromide (EDB)		0.01 ug/L	0.003 ug/L	30	70-130 ^d
508.1 Pesticides and PCBs	Aldrin	Drinking	0.005 ug/L	0.003 ug/L	30	70-130 ^d
	Alpha-BHC	Water	0.005 ug/L	0.003 ug/L	30	70-130 ^d
	Alpha-Chlordane		0.007 ug/L	0.004 ug/L	30	70-130 ^d
	Beta-BHC		0.007 ug/L	0.004 ug/L	30	70-130 ^d
	Chlordane		0.10 ug/L	0.007 ug/L	30	70-130 ^d
	4,4'-DDD		0.005 ug/L	0.003 ug/L	30	70-130 ^d
	4,4'-DDE		0.005 ug/L	0.003 ug/L	30	70-130 ^d
	4,4'-DDT		0.008 ug/L	0.004 ug/L	30	70-130 ^d
	Delta-BHC		0.005 ug/L	0.003 ug/L	30	70-130 ^d
	Dieldrin		0.005 ug/L	0.003 ug/L	30	70-130 ^d
	Endosulfan I		0.005 ug/L	0.003 ug/L	30	70-130 ^d
	Endosulfan II		0.007 ug/L	0.004 ug/L	30	70-130 ^d
	Endosulfan Sulfate		0.006 ug/L	0.003 ug/L	30	70-130 ^d
	Endrin		0.006 ug/L	0.003 ug/L	30	70-130 ^d
	Endrin Aldehyde		0.008 ug/L	0.004 ug/L	30	70-130 ^d
	Gamma-BHC(Lindane)		0.005 ug/L	0.003 ug/L	30	70-130 ^d
	Gamma-Chlordane		0.006 ug/L	0.003 ug/L	30	70-130 ^d
	Heptachlor		0.006 ug/L	0.003 ug/L	30	70-130 ^d
	Heptachlor Epoxide		0.006 ug/L	0.003 ug/L	30	70-130 ^d
	Heptachlor Epoxide (isomer A)		0.006 ug/L	0.003 ug/L	30	70-130 ^d
	Methoxychlor		0.007 ug/L	0.004 ug/L	30	70-130 ^d
	Toxaphene		0.10 ug/L	0.025 ug/L	30	70-130 ^d
	Aroclor 1016		0.080 ug/L	0.024 ug/L	30	70-130 ^d
	Aroclor 1221		0.10 ug/L	0.017 ug/L	30	70-130 ^d
	Aroclor 1232		0.10 ug/L	0.056 ug/L	30	70-130 ^d
	Aroclor 1242		0.10 ug/L	0.031 ug/L	30	70-130 ^d
	Aroclor 1248		0.10 ug/L	0.013 ug/L	30	70-130 ^d
	Aroclor 1254		0.10 ug/L	0.018 ug/L	30	70-130 ^d
	Aroclor 1260		0.10 ug/L	0.015 ug/L	30	70-130 ^d
	4,4'-Dibromooctafluorobiphenyl ^g		NA	NA	NA	70-130 ^d
515.4 Herbicides	Aciflurofen	Drinking	0.20 ug/L	0.026 ug/L	30	70-130 ^d
	Bentazon	Water	0.40 ug/L	0.097 ug/L	30	70-130 ^d
	Chloramben		0.20 ug/L	0.037 ug/L	30	70-130 ^d
	2,4-D		0.20 ug/L	0.042 ug/L	30	70-130 ^d
	Dalapon		0.54 ug/L	0.18 ug/L	30	70-130 ^d
	2,4-DB		0.40 ug/L	0.020 ug/L	30	70-130 ^d
	Dacthal Diacid		0.10 ug/L	0.019 ug/L	30	70-130 ^d
	Dicamba		0.20 ug/L	0.015 ug/L	30	70-130 ^d
	3,5-Dichlorobenzoic acid		0.20 ug/L	0.023 ug/L	30	70-130 ^d
	Dichlorprop		0.40 ug/L	0.033 ug/L	30	70-130 ^d
	Dinoseb		0.40 ug/L	0.091 ug/L	30	70-130 ^d
	Pentachlorophenol		0.04 ug/L	0.004 ug/L	30	70-130 ^d
	Picloram		0.20 ug/L	0.018 ug/L	30	70-130 ^d
	2,4,5-T		0.20 ug/L	0.022 ug/L	30	70-130 ^d
	2,4,5-TP (Silvex)		0.05 ug/L	0.012 ug/L	30	70-130 ^d
	4-Nitrophenol		0.40 ug/L	0.080 ug/L	30	70-130 ^d
	2,4-Dichlorophenylacetic acid ^g		NA	NA	NA	70-130 ^d

ORGANIC COMPOUNDS IN DRINKING WATER ANALYSES

Method ^a	Analyte	Matrix	Method Reporting Limit	Method Detection Limit	Precision ^b (RPD)	Accuracy ^c (%REC)
524.2 Volatile Organics	Dichlorodifluoromethane (CFC 12)	Drinking Water	0.5 ug/L	0.14 ug/L	NA	70-130 ^d
	Chloromethane		0.5 ug/L	0.07 ug/L	NA	70-130 ^d
	Vinyl Chloride		0.5 ug/L	0.12 ug/L	NA	70-130 ^d
	Bromomethane		0.5 ug/L	0.30 ug/L	NA	70-130 ^d
	Chloroethane		0.5 ug/L	0.16 ug/L	NA	70-130 ^d
	Trichlorofluoromethane (CFC 11)		0.5 ug/L	0.14 ug/L	NA	70-130 ^d
	1,1-Dichloroethene		0.5 ug/L	0.16 ug/L	NA	70-130 ^d
	Methylene Chloride		0.5 ug/L	0.09 ug/L	NA	70-130 ^d
	trans-1,2-Dichloroethene		0.5 ug/L	0.13 ug/L	NA	70-130 ^d
	2,2-Dichloropropane		0.5 ug/L	0.13 ug/L	NA	70-130 ^d
	cis-1,2-Dichloroethene		0.5 ug/L	0.07 ug/L	NA	70-130 ^d
	1,1-Dichloroethane		0.5 ug/L	0.07 ug/L	NA	70-130 ^d
	Chloroform		0.5 ug/L	0.07 ug/L	NA	70-130 ^d
	Bromochloromethane		0.5 ug/L	0.10 ug/L	NA	70-130 ^d
	1,1,1-Trichloroethane (TCA)		0.5 ug/L	0.11 ug/L	NA	70-130 ^d
	1,1-Dichloropropene		0.5 ug/L	0.14 ug/L	NA	70-130 ^d
	Carbon Tetrachloride		0.5 ug/L	0.17 ug/L	NA	70-130 ^d
	Benzene		0.5 ug/L	0.08 ug/L	NA	70-130 ^d
	1,2-Dichloroethane		0.5 ug/L	0.09 ug/L	NA	70-130 ^d
	Trichloroethene (TCE)		0.5 ug/L	0.08 ug/L	NA	70-130 ^d
	1,2-Dichloropropane		0.5 ug/L	0.08 ug/L	NA	70-130 ^d
	Bromodichloromethane		0.5 ug/L	0.05 ug/L	NA	70-130 ^d
	Dibromomethane		0.5 ug/L	0.12 ug/L	NA	70-130 ^d
	cis-1,3-Dichloropropene		0.5 ug/L	0.07 ug/L	NA	70-130 ^d
	Toluene		0.5 ug/L	0.09 ug/L	NA	70-130 ^d
	trans-1,3-Dichloropropene		0.5 ug/L	0.10 ug/L	NA	70-130 ^d
	1,1,2-Trichloroethane		0.5 ug/L	0.11 ug/L	NA	70-130 ^d
	Tetrachloroethene (PCE)		0.5 ug/L	0.14 ug/L	NA	70-130 ^d
	1,3-Dichloropropane		0.5 ug/L	0.11 ug/L	NA	70-130 ^d
	1,2,3-Trichlorobenzene		0.5 ug/L	0.19 ug/L	NA	70-130 ^d
	Dibromochloromethane		0.5 ug/L	0.07 ug/L	NA	70-130 ^d
	1,2-Dibromoethane (EDB)		0.5 ug/L	0.10 ug/L	NA	70-130 ^d
	Chlorobenzene		0.5 ug/L	0.06 ug/L	NA	70-130 ^d
	Ethylbenzene		0.5 ug/L	0.15 ug/L	NA	70-130 ^d
	1,1,1,2-Tetrachloroethane		0.5 ug/L	0.06 ug/L	NA	70-130 ^d
	Styrene		0.5 ug/L	0.20 ug/L	NA	70-130 ^d
	m&p Xylenes		0.5 ug/L	0.42 ug/L	NA	70-130 ^d
	o-Xylene		0.5 ug/L	0.22 ug/L	NA	70-130 ^d
	Bromoform		0.5 ug/L	0.10 ug/L	NA	70-130 ^d
	Isopropylbenzene		0.5 ug/L	0.24 ug/L	NA	70-130 ^d
	1,1,2,2-Tetrachloroethane		0.5 ug/L	0.10 ug/L	NA	70-130 ^d
	1,2,3-Trichloropropane		0.5 ug/L	0.25 ug/L	NA	70-130 ^d
	Bromobenzene		0.5 ug/L	0.12 ug/L	NA	70-130 ^d
	n-Propylbenzene		0.5 ug/L	0.18 ug/L	NA	70-130 ^d
	1,3,5-Trimethylbenzene		0.5 ug/L	0.09 ug/L	NA	70-130 ^d
	2-Chlorotoluene		0.5 ug/L	0.15 ug/L	NA	70-130 ^d
	4-Chlorotoluene		0.5 ug/L	0.11 ug/L	NA	70-130 ^d

ORGANIC COMPOUNDS IN DRINKING WATER ANALYSES

Method ^a	Analyte	Matrix	Method Reporting Limit	Method Detection Limit	Precision ^b (RPD)	Accuracy ^c (%REC)
524.2	tert-Butylbenzene	Drinking Water	0.5 ug/L	0.18 ug/L	NA	70-130 ^d
	1,2,4-Trimethylbenzene		0.5 ug/L	0.10 ug/L	NA	70-130 ^d
	sec-Butylbenzene		0.5 ug/L	0.16 ug/L	NA	70-130 ^d
	4-Isopropyltoluene		0.5 ug/L	0.12 ug/L	NA	70-130 ^d
	1,3-Dichlorobenzene		0.5 ug/L	0.11 ug/L	NA	70-130 ^d
	1,4-Dichlorobenzene		0.5 ug/L	0.11 ug/L	NA	70-130 ^d
	n-Butylbenzene		0.5 ug/L	0.16 ug/L	NA	70-130 ^d
	1,2-Dichlorobenzene		0.5 ug/L	0.12 ug/L	NA	70-130 ^d
	1,2-Dibromo-3-chloropropane (DBCP)		0.5 ug/L	0.23 ug/L	NA	70-130 ^d
	1,2,4-Trichlorobenzene		0.5 ug/L	0.12 ug/L	NA	70-130 ^d
	Hexachlorobutadiene		0.5 ug/L	0.13 ug/L	NA	70-130 ^d
	Naphthalene		0.5 ug/L	0.15 ug/L	NA	70-130 ^d
	Ethyl-tert-Butyl Ether (ETBE)		0.5 ug/L	0.31 ug/L	NA	70-130 ^d
	Methyl tert-Butyl Ether (MTBE)		0.5 ug/L	0.31 ug/L	NA	70-130 ^d
	tert-Amyl Methyl Ether		0.5 ug/L	0.30 ug/L	NA	70-130 ^d
	tert-Butyl Alcohol		20 ug/L	1.1 ug/L	NA	70-130 ^d
	1,2-Dichlorobenzene-D4 ^e		NA	NA	NA	73-120
	4-Bromofluorobenzene ^e		NA	NA	NA	82-106
525.2 SOCs	2,4-Dinitrotoluene	Drinking Water	0.10 ug/L	0.037 ug/L	30	70-130 ^d
	2,6-Dinitrotoluene		0.10 ug/L	0.031 ug/L	30	70-130 ^d
	4,4'-DDD		0.05 ug/L	0.024 ug/L	30	70-130 ^d
	4,4'-DDE		0.03 ug/L	0.017 ug/L	30	70-130 ^d
	4,4'-DDT		0.05 ug/L	0.025 ug/L	30	70-130 ^d
	Acenaphthene		0.05 ug/L	0.026 ug/L	30	70-130 ^d
	Acenaphthylene		0.05 ug/L	0.027 ug/L	30	70-130 ^d
	Acetochlor		0.06 ug/L	0.03 ug/L	30	70-130 ^d
	Alachlor		0.07 ug/L	0.036 ug/L	30	70-130 ^d
	Aldrin		0.09 ug/L	0.047 ug/L	30	70-130 ^d
	alpha-BHC		0.05 ug/L	0.021 ug/L	30	70-130 ^d
	Ametryn		0.05 ug/L	0.019 ug/L	30	70-130 ^d
	Anthracene		0.07 ug/L	0.034 ug/L	30	70-130 ^d
	Atrazine		0.10 ug/L	0.05 ug/L	30	70-130 ^d
	Benz(a)anthracene		0.10 ug/L	0.024 ug/L	30	70-130 ^d
	Benzo(a)pyrene		0.04 ug/L	0.036 ug/L	30	70-130 ^d
	Benzo(b)fluoranthene		0.10 ug/L	0.023 ug/L	30	70-130 ^d
	Benzo(g,h,i)perylene		0.10 ug/L	0.03 ug/L	30	70-130 ^d
	Benzo(k)fluoranthene		0.10 ug/L	0.017 ug/L	30	70-130 ^d
	Benzyl butyl phthalate		0.05 ug/L	0.021 ug/L	30	70-130 ^d
	Beta-BHC		0.05 ug/L	0.027 ug/L	30	70-130 ^d
	Bis(2-ethylhexyl)adipate		0.50 ug/L	0.091 ug/L	30	70-130 ^d
	Bis(2-ethylhexyl)phthalate		0.50 ug/L	0.12 ug/L	30	70-130 ^d
	Bromacil		0.10 ug/L	0.024 ug/L	30	70-130 ^d
	Butachlor		0.05 ug/L	0.026 ug/L	30	70-130 ^d
	Butylate		0.03 ug/L	0.015 ug/L	30	70-130 ^d
	Caffeine		0.10 ug/L	0.041 ug/L	30	70-130 ^d
	Chlorobenzilate		0.04 ug/L	0.02 ug/L	30	70-130 ^d
	Chloroneb		0.11 ug/L	0.055 ug/L	30	70-130 ^d
	Chlorothalonil		0.10 ug/L	0.025 ug/L	30	70-130 ^d
	Chlorpropham		0.07 ug/L	0.035 ug/L	30	70-130 ^d
	Chorpyrifos		0.06 ug/L	0.031 ug/L	30	70-130 ^d

ORGANIC COMPOUNDS IN DRINKING WATER ANALYSES

Method ^a	Analyte	Matrix	Method Reporting Limit	Method Detection Limit	Precision ^b (RPD)	Accuracy ^c (%REC)
525.2 SOCs	Chrysene	Drinking Water	0.05 ug/L	0.016 ug/L	30	70-130 ^d
	alpha-Chlordane		0.08 ug/L	0.04 ug/L	30	70-130 ^d
	cis-Permethrin		0.06 ug/L	0.028 ug/L	30	70-130 ^d
	Cyanazine		0.09 ug/L	0.046 ug/L	30	70-130 ^d
	Cycloate		0.07 ug/L	0.037 ug/L	30	70-130 ^d
	Dacthal		0.04 ug/L	0.021 ug/L	30	70-130 ^d
	delta-BHC		0.05 ug/L	0.025 ug/L	30	70-130 ^d
	Diazinon		0.05 ug/L	0.026 ug/L	30	70-130 ^d
	Dibenz(a,h)anthracene		0.11 ug/L	0.053 ug/L	30	70-130 ^d
	Dibutyl phthalate		0.50 ug/L	0.055 ug/L	30	70-130 ^d
	Dichlorvos		0.05 ug/L	0.017 ug/L	30	70-130 ^d
	Dieldrin		0.20 ug/L	0.13 ug/L	30	70-130 ^d
	Diethyl Phthalate		0.50 ug/L	0.029 ug/L	30	70-130 ^d
	Dimethoate		0.12 ug/L	0.06 ug/L	30	70-130 ^d
	Dimethyl phthalate		0.50 ug/L	0.02 ug/L	30	70-130 ^d
	Di-n-octyl phthalate		0.10 ug/L	0.036 ug/L	30	70-130 ^d
	Diphenamide		0.05 ug/L	0.027 ug/L	30	70-130 ^d
	Endosulfan I		0.08 ug/L	0.04 ug/L	30	70-130 ^d
	Endosulfan II		0.08 ug/L	0.042 ug/L	30	70-130 ^d
	Endosulfan Sulfate		0.08 ug/L	0.038 ug/L	30	70-130 ^d
	Endrin		0.05 ug/L	0.027 ug/L	30	70-130 ^d
	Endrin Aldehyde		0.11 ug/L	0.054 ug/L	30	70-130 ^d
	EPTC		0.05 ug/L	0.026 ug/L	30	70-130 ^d
	Ethoprophos		0.04 ug/L	0.02 ug/L	30	70-130 ^d
	Fluoranthene		0.10 ug/L	0.016 ug/L	30	70-130 ^d
	Fluorene		0.07 ug/L	0.033 ug/L	30	70-130 ^d
	Heptachlor		0.08 ug/L	0.041 ug/L	30	70-130 ^d
	Heptachlor Epoxide		0.04 ug/L	0.037 ug/L	30	70-130 ^d
	Hexachlorobenzene		0.06 ug/L	0.028 ug/L	30	70-130 ^d
	Hexachlorocyclopentadiene		0.07 ug/L	0.034 ug/L	30	70-130 ^d
	Indeno(1,2,3-cd)pyrene		0.20 ug/L	0.16 ug/L	30	70-130 ^d
	Isophorone		0.05 ug/L	0.024 ug/L	30	70-130 ^d
	Lindane (gamma-BHC)		0.04 ug/L	0.022 ug/L	30	70-130 ^d
	Malathion		0.10 ug/L	0.051 ug/L	30	70-130 ^d
	Methoxychlor		0.04 ug/L	0.02 ug/L	30	70-130 ^d
	Metolachlor		0.09 ug/L	0.045 ug/L	30	70-130 ^d
	Metribuzin		0.08 ug/L	0.038 ug/L	30	70-130 ^d
	Mevinphos		0.05 ug/L	0.014 ug/L	30	70-130 ^d
	Molinate		0.05 ug/L	0.021 ug/L	30	70-130 ^d
	Parathion		0.16 ug/L	0.079 ug/L	30	70-130 ^d
	Pebulate		0.05 ug/L	0.024 ug/L	30	70-130 ^d
	Phenanthrene		0.03 ug/L	0.011 ug/L	30	70-130 ^d
	Prometon		0.05 ug/L	0.015 ug/L	30	70-130 ^d
	Prometryn		0.10 ug/L	0.03 ug/L	30	70-130 ^d
	Propachlor		0.08 ug/L	0.038 ug/L	30	70-130 ^d
	Propazine		0.05 ug/L	0.02 ug/L	30	70-130 ^d
	Propyzamide (Pronamide)		0.06 ug/L	0.032 ug/L	30	70-130 ^d
	Pyrene		0.03 ug/L	0.012 ug/L	30	70-130 ^d
	Simazine		0.10 ug/L	0.042 ug/L	30	70-130 ^d
	Simetryn		0.10 ug/L	0.041 ug/L	30	70-130 ^d

ORGANIC COMPOUNDS IN DRINKING WATER ANALYSES

Method ^a	Analyte	Matrix	Method Reporting Limit	Method Detection Limit	Precision ^b (RPD)	Accuracy ^c (%REC)
525.2 SOCs	Terbutryn	Drinking Water	0.05 ug/L	0.02 ug/L	30	70-130 ^d
	Terbacil		0.10 ug/L	0.021 ug/L	30	70-130 ^d
	Terbufos		0.10 ug/L	0.013 ug/L	30	70-130 ^d
	Tetrachlorvinphos		0.07 ug/L	0.033 ug/L	30	70-130 ^d
	Thiobencarb		0.05 ug/L	0.018 ug/L	30	70-130 ^d
	gamma-Chlordane		0.04 ug/L	0.022 ug/L	30	70-130 ^d
	trans-Nonachlor		0.09 ug/L	0.045 ug/L	30	70-130 ^d
	trans-Permethrin		0.07 ug/L	0.033 ug/L	30	70-130 ^d
	Triadimefon		0.03 ug/L	0.016 ug/L	30	70-130 ^d
	Trifluralin		0.05 ug/L	0.027 ug/L	30	70-130 ^d
	Vernolate		0.05 ug/L	0.027 ug/L	30	70-130 ^d
	1,3-dimethyl-2-nitrobenzene ^g		NA	NA	NA	70-130 ^d
	Perylene-D12 ^g		NA	NA	NA	70-130 ^d
	Triphenylphosphate ^g		NA	NA	NA	70-130 ^d
531.1 Carbamates	Aldicarb	Drinking Water	0.5 ug/L	0.11 ug/L	30	80-120 ^d
	Aldicarb Sulfone		0.5 ug/L	0.13 ug/L	30	80-120 ^d
	Aldicarb Sulfoxide		0.5 ug/L	0.11 ug/L	30	80-120 ^d
	Baygon(Propoxur)		0.5 ug/L	0.14 ug/L	30	80-120 ^d
	Carbaryl		0.5 ug/L	0.17 ug/L	30	80-120 ^d
	Carbofuran		0.5 ug/L	0.13 ug/L	30	80-120 ^d
	3-Hydroxycarbofuran		0.5 ug/L	0.12 ug/L	30	80-120 ^d
	Methiocarb		0.5 ug/L	0.21 ug/L	30	80-120 ^d
	Methomyl		0.5 ug/L	0.09 ug/L	30	80-120 ^d
	Oxamyl		0.5 ug/L	0.16 ug/L	30	80-120 ^d
547	Glyphosate	DW	6 ug/L	1.9 ug/L	30	70-130 ^d
548.1	Endothall	DW	2 ug/L	0.78 ug/L	30	80-120 ^d
549.2	Diquat	DW	0.4 ug/L	0.14 ug/L	30	70-130 ^d
	Paraquat		1.6 ug/L	0.20 ug/L	30	70-130 ^d
552.2 Haloacetic Acids	Bromochloroacetic Acid	Drinking Water	0.40 ug/L	0.17 ug/L	30	70-130 ^d
	Bromodichloroacetic Acid		1.6 ug/L	0.23 ug/L	30	70-130 ^d
	Chlorodibromoacetic Acid		2.0 ug/L	0.74 ug/L	30	70-130 ^d
	Dibromoacetic Acid		0.2 ug/L	0.10 ug/L	30	70-130 ^d
	Dichloroacetic Acid		0.6 ug/L	0.15 ug/L	30	70-130 ^d
	Monobromoacetic Acid		0.4 ug/L	0.15 ug/L	30	70-130 ^d
	Monochloroacetic Acid		1.2 ug/L	0.22 ug/L	30	70-130 ^d
	Trichloroacetic Acid		0.40 ug/L	0.11 ug/L	30	70-130 ^d
	2,3-Dibromopropionic acid ^g		NA	NA	NA	70-130 ^d

SELECTED MARINE WATER, SEDIMENT, AND TISSUE ANALYSES						
Method ^a	Analyte	Matrix	Method Reporting Limit	Method Detection Limit	Precision ^b (RPD)	Accuracy ^c (%REC)
ASTM D4129-82M	Total Organic Carbon	Sediment	0.05%	0.02%	20	85-115 ^b
9030M	Sulfides	Sediment	0.1 mg/kg	0.05 mg/kg	20	60-130 ^b
PSEP	Particle Size	Sediment		NA	NA	NA
6010B - ICP AVS-SEM	Cadmium	Sediment	0.2 mg/kg		30	75-125
	Copper		0.4 mg/kg		30	75-125
	Lead		3 mg/kg		30	75-125
	Nickel		0.5 mg/kg		30	75-125
	Zinc		0.4 mg/kg		30	75-125
7470A	Mercury		0.01 mg/kg		30	75-125
200.8 - ICP/MS	Aluminum	Tissue	2 mg/kg	0.4 mg/kg	30	70-130 ^m
200.8 - ICP/MS	Antimony		0.05 mg/kg	0.02 mg/kg	30	70-130 ^m
200.8 - ICP/MS	Arsenic		0.5 mg/kg	0.05 mg/kg	30	70-130 ^m
200.8 - ICP/MS	Barium		0.05 mg/kg	0.006 mg/kg	30	70-130 ^m
200.8 - ICP/MS	Beryllium		0.02 mg/kg	0.006 mg/kg	30	70-130 ^m
200.8 - ICP/MS	Cadmium		0.02 mg/kg	0.01 mg/kg	30	70-130 ^m
6010B - ICP	Chromium		0.5 mg/kg	0.5 mg/kg	30	75-125 ^m
200.8 - ICP/MS	Cobalt		0.02 mg/kg	0.005 mg/kg	30	70-130 ^m
200.8 - ICP/MS	Copper		0.1 mg/kg	0.06 mg/kg	30	70-130 ^m
200.8 - ICP/MS	Lead		0.02 mg/kg	0.004 mg/kg	30	70-130 ^m
200.8 - ICP/MS	Manganese		0.05 mg/kg	0.01 mg/kg	30	70-130 ^m
7174A- CVAA	Mercury		0.02 mg/kg	0.01 mg/kg	30	60-130 ^m
200.8 - ICP/MS	Molybdenum		0.05 mg/kg	0.009 mg/kg	30	70-130 ^m
200.8 - ICP/MS	Nickel		0.2 mg/kg	0.03 mg/kg	30	70-130 ^m
7740 - GFAA	Selenium		1 mg/kg	1 mg/kg	30	60-130 ^m
200.8 - ICP/MS	Silver		0.02 mg/kg	0.004 mg/kg	30	70-130 ^m
200.8 - ICP/MS	Thallium		0.02 mg/kg	0.002 mg/kg	30	70-130 ^m
200.8 - ICP/MS	Vanadium		0.2 mg/kg	0.05 mg/kg	30	75-125 ^m
200.8 - ICP/MS	Zinc		0.5 mg/kg	0.2 mg/kg	30	70-130 ^m
200.8 - ICP/MS Reductive Precipitation	Arsenic	Seawater	0.5 ug/L	0.2 ug/L	20	56-99
	Beryllium		0.02 ug/L	0.003 ug/L	20	70-130
	Cadmium		0.02 ug/L	0.007 ug/L	20	80-106
	Chromium		0.2 ug/L	0.2 ug/L	20	62-115
	Cobalt		0.02 ug/L	0.005 ug/L	20	70-130
	Copper		0.1 ug/L	0.02 ug/L	20	77-113
	Lead		0.02 ug/L	0.02 ug/L	20	82-116
	Nickel		0.2 ug/L	0.04 ug/L	20	77-114
	Silver		0.02 ug/L	0.008 ug/L	20	74-109
	Thallium		0.02 ug/L	0.004 ug/L	20	70-130
7742 - BRAA	Selenium	Seawater	1 ug/L	0.7 ug/L	20	75-125

SELECTED MARINE WATER, SEDIMENT, AND TISSUE ANALYSES

Method ^a	Analyte	Matrix	Method Reporting Limit	Method Detection Limit	Precision ^b (RPD)	Accuracy ^c (%REC)
8081A Chlorinated Pesticides	alpha-BHC	Sediment	5 ug/Kg	0.40 ug/Kg	40	64-135
	gamma-BHC (Lindane)		5 ug/Kg	1.2 ug/Kg	40	63-137
	beta-BHC		5 ug/Kg	0.59 ug/Kg	40	49-145
	Heptachlor		5 ug/Kg	0.88 ug/Kg	40	61-123
	delta-BHC		5 ug/Kg	0.45 ug/Kg	40	68-144
	gamma-Chlordane		5 ug/Kg	0.44 ug/Kg	40	63-127
	alpha-Chlordane		5 ug/Kg	0.33 ug/Kg	40	63-125
8081A Chlorinated Pesticides	Aldrin	Sediment	5 ug/Kg	0.69 ug/Kg	40	59-127
	Heptachlor Epoxide		5 ug/Kg	0.55 ug/Kg	40	64-124
	Endosulfan I		5 ug/Kg	0.62 ug/Kg	40	55-124
	4,4'-DDE		5 ug/Kg	0.63 ug/Kg	40	67-133
	Dieldrin		5 ug/Kg	0.48 ug/Kg	40	68-131
	Endrin		5 ug/Kg	1.2 ug/Kg	40	72-133
	4,4'-DDD		5 ug/Kg	1.9 ug/Kg	40	67-139
	Endosulfan II		5 ug/Kg	2.5 ug/Kg	40	62-126
	4,4'-DDT		5 ug/Kg	0.67 ug/Kg	40	68-144
	Endrin Aldehyde		5 ug/Kg	0.46 ug/Kg	40	48-120
	Endosulfan Sulfate		5 ug/Kg	0.93 ug/Kg	40	62-131
	Methoxychlor		5 ug/Kg	0.19 ug/Kg	40	65-140
	Toxaphene		250 ug/Kg	38 ug/Kg	40	
	Tetrachloro- <i>m</i> -xylene ^g		NA	NA	NA	39-129
	Decachlorobiphenyl ^f		NA	NA	NA	29-141
8081A Chlorinated Pesticides	alpha-BHC	Tissue	5 ug/Kg	0.40 ug/Kg	40	54-128
	gamma-BHC (Lindane)		5 ug/Kg	1.2 ug/Kg	40	58-125
	beta-BHC		5 ug/Kg	0.59 ug/Kg	40	54-119
	Heptachlor		5 ug/Kg	0.88 ug/Kg	40	48-117
	delta-BHC		5 ug/Kg	0.45 ug/Kg	40	61-131
	gamma-Chlordane		5 ug/Kg	0.44 ug/Kg	40	60-117
	alpha-Chlordane		5 ug/Kg	0.33 ug/Kg	40	60-114
	Aldrin		5 ug/Kg	0.69 ug/Kg	40	56-120
	Heptachlor Epoxide		5 ug/Kg	0.55 ug/Kg	40	60-118
	Endosulfan I		5 ug/Kg	0.62 ug/Kg	40	55-114
	4,4'-DDE		5 ug/Kg	0.63 ug/Kg	40	58-131
	Dieldrin		5 ug/Kg	0.48 ug/Kg	40	61-122
	Endrin		5 ug/Kg	1.2 ug/Kg	40	62-129
	4,4'-DDD		5 ug/Kg	1.9 ug/Kg	40	47-141
	Endosulfan II		5 ug/Kg	2.5 ug/Kg	40	55-115
	4,4'-DDT		5 ug/Kg	0.67 ug/Kg	40	52-143
	Endrin Aldehyde		5 ug/Kg	0.46 ug/Kg	40	10-109
	Endosulfan Sulfate		5 ug/Kg	0.93 ug/Kg	40	57-121
	Methoxychlor		5 ug/Kg	0.19 ug/Kg	40	60-128
	Toxaphene		250 ug/Kg	38 ug/Kg	40	
	Tetrachloro- <i>m</i> -xylene ^g		NA	NA	NA	10-171
	Decachlorobiphenyl ^f		NA	NA	NA	38-167

SELECTED MARINE WATER, SEDIMENT, AND TISSUE ANALYSES

Method ^a	Analyte	Matrix	Method Reporting Limit	Method Detection Limit	Precision ^b (RPD)	Accuracy ^c (%REC)
8082 PCBs	Aroclor 1016	Sediment	0.1 mg/Kg	0.04 mg/Kg	40	47-138
	Aroclor 1221		0.2 mg/Kg	0.01 mg/Kg	40	
	Aroclor 1232		0.1 mg/Kg	0.02 mg/Kg	40	
	Aroclor 1242		0.1 mg/Kg	0.01 mg/Kg	40	
	Aroclor 1248		0.1 mg/Kg	0.01 mg/Kg	40	
	Aroclor 1254		0.1 mg/Kg	0.01 mg/Kg	40	
	Aroclor 1260		0.1 mg/Kg	0.01 mg/Kg	40	48-149
	Decachlorobiphenyl ^f		NA	NA	NA	40-145
8082 PCBs	Aroclor 1016	Tissue	0.1 mg/Kg	0.04 mg/Kg	40	38-150
	Aroclor 1221		0.2 mg/Kg	0.01 mg/Kg	40	
	Aroclor 1232		0.1 mg/Kg	0.02 mg/Kg	40	
	Aroclor 1242		0.1 mg/Kg	0.01 mg/Kg	40	
	Aroclor 1248		0.1 mg/Kg	0.01 mg/Kg	40	
8082 PCBs	Aroclor 1254	Tissue	0.1 mg/Kg	0.01 mg/Kg	40	
	Aroclor 1260		0.1 mg/Kg	0.01 mg/Kg	40	30-149
	Decachlorobiphenyl ^f		NA	NA	NA	22-172
8082 PCB Congeners	2,4'-Dichlorobiphenyl (8)	Sediment	0.5 ug/Kg	0.11 ug/Kg	40	35-146
	2,2',5'-Trichlorobiphenyl (18)		0.5 ug/Kg	0.06 ug/Kg	40	
	2,4,4'-Trichlorobiphenyl (28)		0.5 ug/Kg	0.08 ug/Kg	40	34-151
	2,2',3,5'-Tetrachlorobiphenyl (44)		0.5 ug/Kg	0.06 ug/Kg	40	
	2,2',5,5'-Tetrachlorobiphenyl (52)		0.5 ug/Kg	0.11 ug/Kg	40	38-141
	2,3',4,4'-Tetrachlorobiphenyl (66)		0.5 ug/Kg	0.12 ug/Kg	40	39-136
	3,3',4,4'-Tetrachlorobiphenyl (77)		0.5 ug/Kg	0.05 ug/Kg	40	46-141
	2,2',3,4,5'-Pentachlorobiphenyl (87)		0.5 ug/Kg	0.08 ug/Kg	40	
	2,2',3,4',5'-Pentachlorobiphenyl (90)		0.5 ug/Kg	0.08 ug/Kg	40	45-153
	2,2',4,5,5'-Pentachlorobiphenyl (101)		0.5 ug/Kg	0.04 ug/Kg	40	
	2,3,3',4,4'-Pentachlorobiphenyl (105)		0.5 ug/Kg	0.10 ug/Kg	40	38-157
	2,3,4,4',5'-Pentachlorobiphenyl (114)		0.5 ug/Kg	0.40 ug/Kg	40	
	2,3',4,4',5'-Pentachlorobiphenyl (118)		0.5 ug/Kg	0.05 ug/Kg	40	
	2',3,4,4',5'-Pentachlorobiphenyl (123)		0.5 ug/Kg	0.08 ug/Kg	40	
	3,3',4,4',5'-Pentachlorobiphenyl (126)		0.5 ug/Kg	0.14 ug/Kg	40	
	2,2',3,3',4,4'-Hexachlorobiphenyl (128)		0.5 ug/Kg	0.29 ug/Kg	40	
	2,2',3,4,4',5'-Hexachlorobiphenyl (138)		0.5 ug/Kg	0.05 ug/Kg	40	
	2,2',4,4',5,5'-Hexachlorobiphenyl (153)		0.5 ug/Kg	0.11 ug/Kg	40	
	2,3,3',4,4',5'-Hexachlorobiphenyl (156)		0.5 ug/Kg	0.10 ug/Kg	40	38-159
	2,3,3',4,4',5'-Hexachlorobiphenyl (157)		0.5 ug/Kg	0.20 ug/Kg	40	
	2,3',4,4',5,5'-Hexachlorobiphenyl (167)		0.5 ug/Kg	0.33 ug/Kg	40	
	3,3',4,4',5,5'-Hexachlorobiphenyl (169)		0.5 ug/Kg	0.14 ug/Kg	40	
	2,2',3,3',4,4',5'-Heptachlorobiphenyl (170)		0.5 ug/Kg	0.07 ug/Kg	40	
	2,2',3,4,4',5,5'-Heptachlorobiphenyl (180)		0.5 ug/Kg	0.04 ug/Kg	40	39-158
	2,2',3,4,4',5',6'-Heptachlorobiphenyl (183)		0.5 ug/Kg	0.09 ug/Kg	40	35-154
	2,2',3,4,4',6,6'-Heptachlorobiphenyl (184)		0.5 ug/Kg	0.05 ug/Kg	40	27-174
	2,2',3,4',5,5',6'-Heptachlorobiphenyl (187)		0.5 ug/Kg	0.14 ug/Kg	40	
	2,3,3',4,4',5,5'-Heptachlorobiphenyl (189)		0.5 ug/Kg	0.10 ug/Kg	40	39-159
	2,2',3,3',4,4',5,6-Octachlorobiphenyl (195)		0.5 ug/Kg	0.14 ug/Kg	40	
	2,2',3,3',4,4',5,5',6-Nonachlorobiphenyl (206)		0.5 ug/Kg	0.10 ug/Kg	40	
	Decachlorobiphenyl (209)		0.5 ug/Kg	0.06 ug/Kg	40	36-151
	Tetrachloro- <i>m</i> -xylene ^g		NA	NA	NA	10-128

SELECTED MARINE WATER, SEDIMENT, AND TISSUE ANALYSES						
Method ^a	Analyte	Matrix	Method Reporting Limit	Method Detection Limit	Precision ^b (RPD)	Accuracy ^c (%REC)
8082 PCB Congeners	2,4'-Dichlorobiphenyl (8)	Tissue	0.5 ug/Kg	0.14 ug/Kg	40	25-152
	2,2',5'-Trichlorobiphenyl (18)		0.5 ug/Kg	0.11 ug/Kg	40	
	2,4,4'-Trichlorobiphenyl (28)		0.5 ug/Kg	0.031 ug/Kg	40	13-167
	2,2',3,5'-Tetrachlorobiphenyl (44)		0.5 ug/Kg	0.063 ug/Kg	40	
	2,2',5,5'-Tetrachlorobiphenyl (52)		0.5 ug/Kg	0.08 ug/Kg	40	32-136
	2,3',4,4'-Tetrachlorobiphenyl (66)		0.5 ug/Kg	0.073 ug/Kg	40	23-140
	3,3',4,4'-Tetrachlorobiphenyl (77)		0.5 ug/Kg	0.092 ug/Kg	40	14-174
	2,2',3,4,5'-Pentachlorobiphenyl (87)		0.5 ug/Kg	0.23 ug/Kg	40	
	2,2',3,4',5-Pentachlorobiphenyl (90)		0.5 ug/Kg	0.11 ug/Kg	40	18-164
	2,2',4,5,5'-Pentachlorobiphenyl (101)		0.5 ug/Kg	0.065 ug/Kg	40	
	2,3,3',4,4'-Pentachlorobiphenyl (105)		0.5 ug/Kg	0.21 ug/Kg	40	14-165
	2,3,4,4',5-Pentachlorobiphenyl (114)		0.7 ug/Kg	0.32 ug/Kg	40	
	2,3',4,4',5-Pentachlorobiphenyl (118)		0.5 ug/Kg	0.10 ug/Kg	40	
	2',3,4,4',5-Pentachlorobiphenyl (123)		0.5 ug/Kg	0.11 ug/Kg	40	
	3,3',4,4',5-Pentachlorobiphenyl (126)		0.5 ug/Kg	0.12 ug/Kg	40	
8082 PCB Congeners	2,2',3,3',4,4'-Hexachlorobiphenyl (128)	Tissue	0.5 ug/Kg	0.091 ug/Kg	40	
	2,2',3,4,4',5'-Hexachlorobiphenyl (138)		0.5 ug/Kg	0.23 ug/Kg	40	
	2,2',4,4',5,5'-Hexachlorobiphenyl (153)		0.5 ug/Kg	0.15 ug/Kg	40	
	2,3,3',4,4',5-Hexachlorobiphenyl (156)		0.5 ug/Kg	0.13 ug/Kg	40	29-155
	2,3,3',4,4',5-Hexachlorobiphenyl (157)		0.5 ug/Kg	0.082 ug/Kg	40	
	2,3',4,4',5,5'-Hexachlorobiphenyl (167)		0.5 ug/Kg	0.22 ug/Kg	40	
	3,3',4,4',5,5'-Hexachlorobiphenyl (169)		0.5 ug/Kg	0.085 ug/Kg	40	
	2,2',3,3',4,4',5-Heptachlorobiphenyl (170)		0.5 ug/Kg	0.08 ug/Kg	40	
	2,2',3,4,4',5,5'-Heptachlorobiphenyl (180)		0.5 ug/Kg	0.11 ug/Kg	40	28-148
	2,2',3,4,4',5',6-Heptachlorobiphenyl (183)		0.5 ug/Kg	0.18 ug/Kg	40	31-145
	2,2',3,4,4',6,6'-Heptachlorobiphenyl (184)		0.5 ug/Kg	0.082 ug/Kg	40	20-169
	2,2',3,4',5,5',6-Heptachlorobiphenyl (187)		0.5 ug/Kg	0.18 ug/Kg	40	
	2,3,3',4,4',5,5'-Heptachlorobiphenyl (189)		0.5 ug/Kg	0.089 ug/Kg	40	32-150
	2,2',3,3',4,4',5,6-Octachlorobiphenyl (195)		0.5 ug/Kg	0.095 ug/Kg	40	
	2,2',3,3',4,4',5,5',6-Nonachlorobiphenyl (206)		0.5 ug/Kg	0.077 ug/Kg	40	
	Decachlorobiphenyl (209)		0.5 ug/Kg	0.095 ug/Kg	40	31-143
	Tetrachloro- <i>m</i> -xylene ^d		NA	NA	NA	34-97

SELECTED MARINE WATER, SEDIMENT, AND TISSUE ANALYSES

Method ^a	Analyte	Matrix	Method Reporting Limit	Method Detection Limit	Precision ^b (RPD)	Accuracy ^c (%REC)
GC/MS-SIM Polynuclear Aromatic Hydrocarbons	Naphthalene	Sediment	5 ug/Kg	0.21 ug/Kg	40	43-102
	1-Methylnaphthalene		5 ug/Kg	0.14 ug/Kg	40	44-108
	2-Methylnaphthalene		5 ug/Kg	0.21 ug/Kg	40	44-105
	Biphenyl		5 ug/Kg	0.18 ug/Kg	40	49-105
	2,6-Dimethylnaphthalene		5 ug/Kg	0.09 ug/Kg	40	43-112
	Acenaphthylene		5 ug/Kg	0.16 ug/kg	40	51-107
	Dibenzofuran		5 ug/Kg	0.20 ug/Kg	40	50-106
	Acenaphthene		5 ug/Kg	0.21 ug/kg	40	50-105
	2,3,5-Trimethylnaphthalene		5 ug/Kg	0.10 ug/kg	40	49-112
	Fluorene		5 ug/Kg	0.17 ug/kg	40	54-108
	Phenanthrene		5 ug/Kg	0.15 ug/kg	40	58-106
	Anthracene		5 ug/Kg	0.19 ug/kg	40	61-113
	1-Methylphenanthrene		5 ug/Kg	0.19 ug/kg	40	61-115
	Fluoranthene		5 ug/Kg	0.17 ug/kg	40	63-117
	Pyrene		5 ug/Kg	0.11 ug/kg	40	59-121
	Benz(a)anthracene		5 ug/Kg	0.13 ug/kg	40	57-120
	Chrysene		5 ug/Kg	0.15 ug/kg	40	64-116
	Benzo(b)fluoranthene		5 ug/Kg	0.14 ug/kg	40	58-126
	Benzo(k)fluoranthene		5 ug/Kg	0.15 ug/kg	40	61-122
	Benzo(a)pyrene		5 ug/Kg	0.14 ug/kg	40	58-128
	Benzo(e)pyrene		5 ug/Kg	0.15 ug/kg	40	61-121
	Indeno(1,2,3-cd)pyrene		5 ug/Kg	0.15 ug/kg	40	46-133
	Dibenz(a,h)anthracene		5 ug/Kg	0.18 ug/kg	40	50-128
	Benzo(g,h,i)perylene		5 ug/Kg	0.10 ug/kg	40	52-125
	Fluorene-d10 ^f		NA	NA	NA	27-110
	Fluoranthene-d10 ^f		NA	NA	NA	34-122
	Terphenyl-d14 ^f		NA	NA	NA	50-132
GC/MS-SIM Polynuclear Aromatic Hydrocarbons	Naphthalene	Tissue	5 ug/Kg	0.21 ug/Kg	40	53-103
	1-Methylnaphthalene		5 ug/Kg	0.14 ug/Kg	40	28-141
	2-Methylnaphthalene		5 ug/Kg	0.21 ug/Kg	40	27-138
	Biphenyl		5 ug/Kg	0.18 ug/Kg	40	56-107
	2,6-Dimethylnaphthalene		5 ug/Kg	0.09 ug/Kg	40	53-109
	Acenaphthylene		5 ug/Kg	0.16 ug/kg	40	56-111
GC/MS-SIM Polynuclear Aromatic Hydrocarbons	Dibenzofuran	Tissue	5 ug/Kg	0.20 ug/Kg	40	27-160
	Acenaphthene		5 ug/Kg	0.21 ug/kg	40	57-108
	2,3,5-Trimethylnaphthalene		5 ug/Kg	0.10 ug/kg	40	53-114
	Fluorene		5 ug/Kg	0.17 ug/kg	40	57-114
	Phenanthrene		5 ug/Kg	0.15 ug/kg	40	56-112
	Anthracene		5 ug/Kg	0.19 ug/kg	40	61-116
	1-Methylphenanthrene		5 ug/Kg	0.19 ug/kg	40	57-126
	Fluoranthene		5 ug/Kg	0.17 ug/kg	40	59-127
	Pyrene		5 ug/Kg	0.11 ug/kg	40	48-121
	Benz(a)anthracene		5 ug/Kg	0.13 ug/kg	40	43-127
	Chrysene		5 ug/Kg	0.15 ug/kg	40	50-127
	Benzo(b)fluoranthene		5 ug/Kg	0.14 ug/kg	40	59-132
	Benzo(k)fluoranthene		5 ug/Kg	0.15 ug/kg	40	57-141
	Benzo(a)pyrene		5 ug/Kg	0.14 ug/kg	40	55-139
	Benzo(e)pyrene		5 ug/Kg	0.15 ug/kg	40	56-131
	Indeno(1,2,3-cd)pyrene		5 ug/Kg	0.15 ug/kg	40	48-142
	Dibenz(a,h)anthracene		5 ug/Kg	0.18 ug/kg	40	49-144
	Benzo(g,h,i)perylene		5 ug/Kg	0.10 ug/kg	40	53-130
	Fluorene-d10 ^f		NA	NA	NA	53-103
	Fluoranthene-d10 ^f		NA	NA	NA	56-109
	Terphenyl-d14 ^f		NA	NA	NA	50-124

SELECTED MARINE WATER, SEDIMENT, AND TISSUE ANALYSES

Method ^a	Analyte	Matrix	Method Reporting Limit	Method Detection Limit	Precision ^b (RPD)	Accuracy ^c (%REC)
GC/MS-SIM Polynuclear Aromatic Hydrocarbons	Naphthalene	Water	0.02 ug/L	0.004 ug/L	30	44-101
	1-Methylnaphthalene		0.02 ug/L	0.004 ug/L	30	37-110
	2-Methylnaphthalene		0.02 ug/L	0.003 ug/L	30	36-106
	Biphenyl		0.02 ug/L	0.005 ug/L	30	36-113
	2,6-Dimethylnaphthalene		0.02 ug/L	0.004 ug/L	30	33-113
	Acenaphthylene		0.02 ug/L	0.002 ug/L	30	49-114
	Dibenzofuran		0.02 ug/L	0.008 ug/L	30	40-115
	Acenaphthene		0.02 ug/L	0.002 ug/L	30	48-107
	2,3,5-Trimethylnaphthalene		0.02 ug/L	0.004 ug/L	30	39-118
	Fluorene		0.02 ug/L	0.003 ug/L	30	55-111
	Phenanthrene		0.02 ug/L	0.004 ug/L	30	56-108
	Anthracene		0.02 ug/L	0.002 ug/L	30	42-117
	1-Methylphenanthrene		0.02 ug/L	0.004 ug/L	30	47-131
	Fluoranthene		0.02 ug/L	0.003 ug/L	30	61-123
	Pyrene		0.02 ug/L	0.003 ug/L	30	53-123
	Benz(a)anthracene		0.02 ug/L	0.003 ug/L	30	53-123
	Chrysene		0.02 ug/L	0.002 ug/L	30	57-118
	Benzo(b)fluoranthene		0.02 ug/L	0.002 ug/L	30	57-132
	Benzo(k)fluoranthene		0.02 ug/L	0.002 ug/L	30	54-126
	Benzo(a)pyrene		0.02 ug/L	0.002 ug/L	30	38-142
	Benzo(e)pyrene		0.02 ug/L	0.003 ug/L	30	46-133
	Indeno(1,2,3-cd)pyrene		0.02 ug/L	0.003 ug/L	30	49-139
	Dibenz(a,h)anthracene		0.02 ug/L	0.002 ug/L	30	47-138
	Benzo(g,h,i)perylene		0.02 ug/L	0.004 ug/L	30	50-125
	Fluorene-d10 ^f		NA	NA	NA	37-107
	Fluoranthene-d10 ^f		NA	NA	NA	18-137
	Terphenyl-d14 ^f		NA	NA	NA	18-153
GC/FPD Organotin Compounds	Tributyltin	Sediment	1 ug/Kg	0.33 ug/Kg	40	10-144
	Dibutyltin		1 ug/Kg	0.35 ug/Kg	40	10-150
	Monobutyltin		1 ug/Kg	0.38 ug/Kg	40	10-137
	Tetrabutyltin		1 ug/Kg	0.38 ug/Kg	40	10-128
	Tripropyltin ^g		NA	NA	NA	10-132
GC/FPD Organotin Compounds	Tributyltin	Tissue	1 ug/Kg	0.37 ug/Kg	40	37-141
	Dibutyltin		1 ug/Kg	0.24 ug/Kg	40	43-136
	Monobutyltin		1 ug/Kg	0.39 ug/Kg	40	29-120
	Tetrabutyltin		1 ug/Kg	0.34 ug/Kg	40	32-131
	Tripropyltin ^g		NA	NA	NA	25-161
GC/FPD Organotin Compounds	Tributyltin	Water	0.02 ug/L	0.004 ug/L	30	11-145
	Dibutyltin		0.05 ug/L	0.008 ug/L	30	10-128
	Monobutyltin		0.05 ug/L	0.005 ug/L	30	13-167
	Tetrabutyltin		0.05 ug/L	0.010 ug/L	30	10-112
	Tripropyltin ^g		NA	NA	NA	19-146

MICROBIOLOGICAL ANALYSES						
Method ^a	Analyte	Matrix	Method Reporting Limit	Method Detection Limit	Precision ^b (RPD)	Accuracy ^c (%REC)
SM 9215B	Heterotrophic Plate Count (Pour)	Water	1 CFU/mL	NA	NA	NA
SM 9215C	Heterotrophic Plate Count (Spread)		1 CFU/mL	NA	NA	NA
SM 9221B	Coliform, Total (MPN)		2 MPN/100mL ⁱ	NA	NA	NA
SM 9221E	Coliform, Fecal (MPN)		2 MPN/100mL ⁱ	NA	NA	NA
SM 9223B	Coliform (Colilert)		Presence/100mL	NA	NA	NA
SM 9230B	Enterococcus		2 MPN/100mL	NA	NA	NA
SM 9230B	Fecal Streptococcus		2 MPN/100mL	NA	NA	NA
SM 10200H	Chlorophyll A		0.8 mg/L	0.2 mg/L	20	NA

Legend: NA = Not Applicable PCBs = Polychlorinated Biphenyls

a See Section 18 for list of references. Unless noted, the listed methods are EPA methods:

SM = *Standard Methods for the Examination of Water and Wastewater*;

ASTM = *American Society for Testing and Materials*.

Microbiology methods are *Standard Methods for the Examination of Water and Wastewater*, 18th edition.

b In-house limits, unless footnoted.

c Statistically derived Laboratory Control Sample (LCS) limits, unless footnoted.

d Method specified control limits.

e Method MRLs and matrix spike percent recovery data vary according to the method of extraction.

f Either method may be used, depending on project requirements.

g Surrogate compound

h These compounds coelute; therefore, results are reported as the combined concentration.

i MRL is 1.1 MPN/100mL for drinking water samples (10 tube method).

m Matrix spike control limits.

APPENDIX E

PREVENTIVE MAINTENANCE PROCEDURES

Instrument	Activity	Frequency
Refrigerators and Coolers	Record temperatures Clean coils Check coolant	Daily Annually Annually or if temperature outside limits
Vacuum Pumps	Clean and change pump oil	Every month or as needed
Fume Hoods	Face velocity measured Sash operation Change filters Inspect fan belts	Quarterly As needed Annually Annually
Ovens	Clean Record temperatures	As needed or if temperature outside lim. Daily, when in use
Incubators	Record temperatures	Daily, morning and evening
Water Baths	Record temperatures Wash with disinfectant solution	Daily, morning and evening When water is murky, dirty, or growth appears
Autoclave	Check sterility Check temperature Clean	Every month Every month When mold or growth appears
Analytical Balances	Check alignment Check calibration Clean pans and compartment	Before every use Daily After every use
Dissolved Oxygen Meter	Change membrane	When fluctuations occur
pH probes	Condition probe	When fluctuations occur
Fluoride ISE	Store in storage solution	Between uses
Ammonia ISE	Store in storage solution	Between uses
UV-visible Spectrophotometer	Wavelength check	Annually
Total Organic Carbon Analyzers	Check IR zero Check digestion/condensation vessels Clean digestion chamber Clean permeation tube Clean six-port valves Clean sample pump Clean carbon scrubber Clean IR cell	Weekly Each use Every 2000 hours, or as needed Every 2000 hours, or as needed Every 200 - 2000 hours, or as needed Every 200 - 2000 hours, or as needed Every 200 - 2000 hours, or as needed Every 2000 - 4000 hours, or as needed

Instrument	Activity	Frequency
Total Organic Halogen Analyzers	Change cell electrolyte Change electrode fluids Change pyrolysis tube Change inlet and outlet tubes Change electrodes	Daily Daily As needed As needed As needed
Flow Injection Analyzer	Check valve flares Check valve ports Check pump tubing Check light counts Check flow cell flares Change bulb Check manifold tubing Check T's and connectors	Each use Each use Each use Each use Quarterly As needed Each use Each use
Ion Chromatographs	Change column Change valve port face & hex nut Clean valve slider Change tubing Eluent pump	Every six months or as needed Every six months or as needed Every six months or as needed Annually or as needed Annually
Atomic Absorption Spectro- photometers - FAA and CVAA	Check gases Clean burner head Check aspiration tubing Clean optics Empty waste container	Daily Daily Daily Every three months Weekly
Atomic Absorption Spectro- photometers - GFAA	Check gases Check argon dewar Change graphite tube Clean furnace windows	Daily Daily Daily, as needed Monthly
ICP - AES	Check argon dewar Replace peristaltic pump tubing Empty waste container Clean nebulizer, spray chamber, and torch Replace water filter Replace vacuum air filters	Daily Daily Weekly Every two weeks Quarterly Monthly

Instrument	Activity	Frequency
ICP - MS	Check argon dewar	Daily
	Check water level in chiller	Daily
	Complete instrument log	Daily
	Replace peristaltic pump tubing	Daily
	Clean sample and skimmer cones	As needed
	Clean RF contact strip	As needed
	Inspect nebulizer, spray chamber, and torch	Clean as needed
	Clean lens stack/extraction lens	As needed
	Check rotary pump oil	Monthly
	Change rotary pump oil	Every six months
Gel-Permeation Chromatographs	Clean and repack column	As needed
	Backflush valves	As needed
High Pressure Liquid Chromatographs	Backflush guard column	As needed
	Backflush column	As needed
	Change guard column	As needed when back pressure to high
	Change column	Annually or as needed
	Change in-line filters	As needed
	Leak check	After column maintenance
	Change pump seals	As needed
	Change pump diaphragm	Annually
	Clean flow cell	As needed
	Fluorescence detector check	Daily
	Diode array absorbance check	Daily
Gas Chromatographs, Semivolatiles	Check gas supplies	Daily, replace when pressure reaches 50 psi
	Change in-line filters	Quarterly or after 30 tanks of gas
	Change septum	Daily
	Change injection port liner	Weekly or as needed
	Clip first 6-12" of capillary column	As needed
	Change guard column	As needed
	Replace analytical column	As needed when peak resolution fails
	Check system for gas leaks	After changing columns and after any power failure
	Clean FID	Weekly or as needed
	Clean ECD	Quarterly or as needed
	Leak test ECD	Annually

Instrument	Activity	Frequency
Gas Chromatograph/Mass Spectrometers, Semivolatiles	Check gas supplies	Daily, replace when pressure reaches 50 psi
	Change in-line filters	Annually or as needed
	Change septum	Daily, when in use
	Change injection port liner	Weekly or as needed
	Clip first 6-12" of capillary column	As needed
	Change guard column	As needed
	Replace analytical column	As needed when peak resolution fails
	Clean source	As needed when tuning problems
Purge and Trap Concentrators	Change pump oil	As specified by service specifications
	Change trap	Every four months or as needed
	Change transfer lines	Every six months or as needed
Gas Chromatographs, Volatiles	Clean purge vessel	Daily
	Check gas supplies	Daily, replace when pressure reaches 50 psi
	Change in-line filters	Quarterly or after 30 tanks of gas
	Change septum	Daily
	Clip first 6-12" of capillary column	As needed
	Change guard column	As needed
	Replace analytical column	As needed when peak resolution fails
	Check system for gas leaks	After changing columns and after any power failure
	Clean PID lamp	As needed
	Clean FID	As needed
Gas Chromatograph/Mass Spectrometers, Volatiles	Change ion exchange resin	Every 60 days
	Replace nickel tubing	Quarterly or as needed
	Check gas supplies	Daily, replace when pressure reaches 50 psi
	Change in-line filters	Annually or as needed
	Change septum	Daily
	Clip first foot of capillary column	As needed
	Change guard column	As needed
	Replace analytical column	As needed when peak resolution fails
	Clean jet separator	As needed
	Clean source	As needed when tuning problems
	Change pump oil	As specified by service specifications

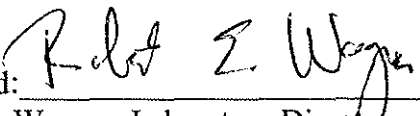
APPENDIX F

ADDITIONAL AGENCY-SPECIFIC DOCUMENTS

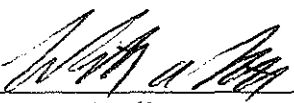
QUALITY ASSURANCE PLAN

NORTHEAST ANALYTICAL, INC.

2190 Technology Drive
Schenectady, NY 12308
(518) 346-4592

Approved: 
Robert E. Wagner, Laboratory Director

Date: 5/21/2003

Approved: 
William A. Kotas, Quality Assurance Officer

Date: 5/21/2003

NORTHEAST ANALYTICAL, INC.

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22-July-2002

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QUALITY ASSURANCE PLAN

REVISION INFORMATION

<u>Version</u>	<u>Revision</u>	<u>Date</u>	<u>Author(s)</u>
QAP_04	02	22-July-2002	William A. Kotas, Quality Assurance Officer Robert E. Wagner, Laboratory Director

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1.0 QUALITY ASSURANCE INTRODUCTION

1.1 GENERAL

Northeast Analytical, Inc. (NEA), is committed to the generation of the highest quality data. This is achieved by employing state-of-the-art instrumentation, the latest validated methods and highly qualified staff. To ensure accountability, sample integrity and data accuracy this quality assurance (QA) program has been implemented. NEA recognizes that analytical qualitative and quantitative results are the key to the decision making process. We also understand that incorrect or inaccurate results may lead to faulty interpretations or poor decisions that would be worse than no results at all.

Northeast Analytical Inc. prides itself on quality work and client satisfaction. NEA's spectrum of clients has ranged from individual homeowners to some of the largest national and international organizations. References from individual clients are available upon request.

1.2 QUALITY ASSURANCE PROGRAM

Northeast Analytical is approved by the New York State Department of Health Environmental Laboratory Approval Program (ELAP), which is a Primary Accrediting Authority for the National Environmental Laboratory Approval Program (NELAP). Procedures used at the laboratory are designed to meet or exceed quality assurance guidelines established by ELAP, NELAP, and the US-EPA. This document has been designed to describe the QA program at NEA. The following procedures allow the laboratory to assess analytical performance, validate standard operating procedures and insure that accuracy and precision goals are being met. Detailed descriptions of analytical methods and procedures can be found in the Standard Operation Procedures (SOP) for the individual methods.

1.3 ANALYTICAL METHODS

When applicable NEA uses published methods from the EPA, New York State Department of Environmental Conservation (NYS-DEC), ASTM, AOAC, Standard Methods, NIOSH, and other sources. Custom analytical services are also available to meet client's unique requirements. All laboratory methods are outlined and documented in SOP documents. The SOP contains detailed descriptions of the laboratory procedures including modifications to published procedures. Since SOPs are used to document the current and historical procedures followed to analyze a sample, all versions and revisions are permanently archived.

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1.4 LABORATORY FACILITIES AND SERVICES

Northeast Analytical, Inc. is located in a modern 22000 sq. ft. facility in Riverside Technology Park in the city of Schenectady, New York. The laboratory building constructed in 1999 has doubled our previous laboratory space and provides room for expansion of services. The facility is centrally located in upstate New York, in close proximity to the cities of Albany and Troy. It is approximately three hours north of New York City, three hours west of Boston and two hours east of Syracuse NY.

Address: Northeast Analytical, Inc.
2190 Technology Drive
Riverside Technology Park
Schenectady, New York 12308
Phone: (518) 346 - 4592
FAX: (518) 381 - 6055
e-Mail: information@nealab.com

The facility houses the following laboratory and administrative units:

Non-Volatile Organic Extraction Lab
GC and GC-MS Instrument Analysis Lab
Trace Level Aqueous Organics Extraction Lab.
Volatile Organics Analysis Lab
Sample Cooler/Freezer Storage Area
Inorganics Analysis Lab
Inorganics /TCLP Preparation Lab
Dishwashing Facility
Sample Login Area
Sample Container Storage Room
Waste Storage Room
Data Archive/Storage Room
Computer Network Center
Administrative Offices

Additionally Northeast Analytical, Inc. has the following physical services:

- 10' x 14' walk-in sample cooler
- 12' x 17' walk-in sample freezer
- Ultra pure 18 mega ohm water system
- 12 individual laboratory hoods for samples and standard preparation
- 19' boat w/75 hp & 9 hp motors for sampling
- 2 - 1992 Chevrolet 1/2 ton 4 x 4 pickup trucks

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2.0 Quality Assurance Policy Statements

2.1 QA POLICY

Northeast Analytical continuously strives to produce the highest quality data and reports. NEA adheres to the strict QA/QC program outlined in the NYS ELAP manuals. Northeast Analytical Inc. warrants that it will employ professionally qualified personnel to test samples using, whenever possible, established and generally accepted techniques. Northeast Analytical, Inc. makes no other warranties, expressed or implied.

2.2 CONFIDENTIALITY

All sample, client and results information is deemed confidential between Northeast Analytical, Inc. and the client. All laboratory employees are required to sign confidentiality statements and instructed not to discuss client matters with anyone other than the client. A copy of the confidentiality statement signed by all employees is shown in Appendix A. NEA requires written requests from the client to transfer data to other parties.

2.3 ETHICAL AND LEGAL RESPONSIBILITIES

Northeast Analytical Inc. promotes strict adherence to requirements of promulgated test methods and approved quality plans. Any deliberate falsification of test results or deliberate misapplication of test procedures is grounds for immediate dismissal. All employees are required to sign an affidavit stating that they are responsible for conducting their work in an ethical manner when they are hired. Northeast Analytical has developed a proactive program for detecting fraud that includes periodic internal training seminars for employees, which describes ethical responsibilities and potential penalties for improper, unethical, or illegal actions.

2.4 COMPLAINTS POLICY

Client satisfaction is held as the key to success of our commercial laboratory. All complaints are handled in a timely fashion. Serious complaints are recorded using conversation/transmittal logs. This information is generally archived with the work order documentation/test results information associated with the project. A complaint may warrant issuance of a corrective action report (CAR) described in section 10.5. (see also section 10.6.4) The results of Client feed back

3.0 Organizational Structure and Responsibilities

3.1 INTRODUCTION

Northeast Analytical's major function is to provide high quality analytical testing services. To meet and maintain quality services, NEA employs qualified scientists and technicians well versed in analytical and environmental chemistry. The expertise and experience of the management and senior chemists plays an important role in project supervision and the training of laboratory technicians to perform chemical analyses correctly and produce highly respected analytical information.

NEA also believes that the training and caliber of the staff is directly reflected in the quality of work delivered, which is why the laboratory promotes internal seminars, presentations, and training in addition to external training and conferences organized by vendors, professional groups, and regulatory agencies.

3.2 LABORATORY ORGANIZATION STRUCTURE

Northeast Analytical, Inc. is a privately owned company, which is owned and operated by Robert Wagner and Robert Stoll. The laboratory is organized into four basic departments; Organics, Inorganics, Office/Project Management and Quality Assurance / Quality Control (QAU). The organization structure is outline in the flow chart in Appendix B.

3.3 LABORATORY STAFF

Statement of qualifications and resumes for Northeast Analytical's key staff are presented in Appendix C of this manual.

3.4 TRAINING

Each employee of NEA is issued a Personnel Training Log which documents specific training received at Northeast Analytical Inc. All training is conducted by qualified instructors. When the specific training is completed the trainee receives approval from the instructor that is documented in his/her training log. The trainee may at the judgement of the instructor be approved to perform the given task or both perform and instruct in the given task. An example page from the employee-training log is included in Appendix D of this document. An analyst or technician is required to perform and initial Demonstration of Competency, which includes successful analysis of method precision and accuracy samples before the analyst may work unsupervised on client samples. An Initial Demonstration of Competency Certificate

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is maintained in the employee's personnel file and training records file.

3.5 RELATIONSHIP OF MANAGEMENT AND QUALITY ASSURANCE UNIT

The Quality Assurance Unit functions as an independent entity from laboratory technical operations and unit managers. The Quality Assurance Unit (QAU) is administered by the Quality Assurance Officer. The Quality Assurance Officer reports directly to the Laboratory Director. The Laboratory Director is responsible for ensuring that the functions Quality Assurance Unit are discharged properly, that the Quality Assurance Plan (QAP) is communicated to all personnel concerned, and that the principles and requirements QAP are adhered to. The Laboratory Director is also responsible for certifying that personnel meet the appropriate educational and/or technical requirements for their job function.

4.0 Sample Custody, Storage and Tracking

4.1 INTRODUCTION

All samples at Northeast Analytical Inc. are received, stored and tracked in accordance with New York State Environmental Laboratory Approval Program (ELAP) and National Environmental Laboratory Approval Program (NELAP) requirements. Further details regarding sample management is outlined in the Sample Management SOP document.

4.2 SAMPLE TRACKING, LOGIN AND IDENTIFICATION

Samples are tracked internally using the Labworks® Laboratory Information Management System (LIMS) computer program. The LIMS assigns unique sample ID numbers and records storage locations for samples.

All sample custody transfers between NEA and clients or subcontracting organizations are recorded on the sample chain-of-custody (COC). The COC document provides detail about the custody transfer including date/time sampled and received, matrix, sample condition, preservative, storage temperature, client identification, NEA identification number and required analyses. An example of an NEA chain-of-custody document is included in Appendix E of this manual.

4.3 SAMPLE STORAGE

Samples are stored according to NYS ELAP and US-EPA method requirements.

4.3.1 SAMPLE INTEGRITY AND CONTAMINATION

Samples are segregated according to storage requirements for the method and to minimize possible cross-sample contamination (ie: volatile samples are stored independent from other samples). NEA also maintains a sample storage blank quality assurance program to ensure that samples are not contaminated through laboratory storage.

4.3.2 SAMPLE PRESERVATION AND HOLD TIMES

Sample preservation and extraction/analytical hold time are noted and tracked using "Sample Progress Folders". NEA strives to inform clients of any deviations or possible problems with either NYS

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ELAP/NELAP or US-EPA holding time and preservative requirements upon sample receipt. In the event that a sample is received past extraction holding time or with insufficient hold time remaining to extract or analyze the sample the client will be notified and given the choice to proceed with sample analysis. All deviations from regulatory requirements will be noted on the certificate of analysis. Northeast Analytical provides the required preservative agent in sample containers as per request of the client. In cases where the client adds preservative to the samples in the field the client is asked to fill out the chain of custody indicating the preservative added. If no preservative is indicated Northeast Analytical will add the required preservative upon receipt of the sample.

For additional information regarding sample preservation and holding requirements please consult **The Guide to Environmental Analytical Methods** 4th Ed. (Edited by NEA Staff) available from Genium Publishing Corporation, 1171 Riverfront Center Amsterdam, NY 12010 (518) 842-4111.

4.3.3 SAMPLE AND EXTRACT ARCHIVING

NEA's policy is to maintain remaining raw samples for greater than 90 days after sample receipt and to hold the sample extracts for at least 90 days after sample analysis. Long-term archive facilities are available at NEA for an additional fee.

4.4 INTERNAL SAMPLE CUSTODY

Custody of samples is maintained in secure storage areas. NEA maintains individual "Sample Progress Folders" for each group of samples. The folder tracks sample progress and contains raw and processed sample data. These folders follow the sample throughout the sample's life at NEA. Ultimately the folders, raw data and computer files are stored and maintained for a minimum of seven years unless otherwise requested by the client. In cases where a legal/evidentiary record of sample custody transfers is required an Internal Chain of Custody tracking form indicating internal custody transfers is included in the Sample Progress Folder. An example of the Internal Chain of Custody Tracking form is included in appendix F.

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5.0 General Laboratory Procedures

5.1 INTRODUCTION

NEA goes to great efforts to produce high quality data by employing the most qualified staff, methods, facility and instruments.

5.2 LABORATORY SERVICES

Laboratory physical services and instrumentation are maintained in accordance with OSHA, NYS ELAP/NELAP and US-EPA requirements. Specific information regarding these topics can be found in the Laboratory Chemical Hygiene Plan (CHP) and individual instrument or method SOPs.

Laboratory Hoods: Fume Hoods are decontaminated after each use by laboratory staff. They are also cleaned periodically by technicians and support staff. Hood face velocities are measured at intervals prescribed in the CHP.

Laboratory Ultra Pure Water System: NEA utilizes a Continental model Modulab® LB PUO 1002 reverse osmosis (RO) system to supply laboratory type II water. The RO water system is monitored for volume used at each use through a RO system logbook. The specific conductance is also monitored at regular intervals using an independent meter.

5.3 GLASSWARE

All laboratory glassware is thoroughly cleaned and carefully maintained utilizing the most appropriate procedures for the given type of glassware. The cleanliness of glassware and equipment is monitored through the analysis of Method Blanks. Method blanks are routinely run with each analytical/extraction batch. The cleaning procedures are detailed in NEA Standard Operating Procedures (SOPs).

5.4 REAGENTS, SOLVENTS AND GASES

NEA utilizes the highest grades of reagents, solvents and gases for laboratory analysis. Reagents and solvents are initially evaluated and then routinely monitored for target analyte contamination. All gases used by the laboratory are purified for gas chromatography use by passing through absorbent/filtration traps where applicable and then monitored for contamination.

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5.5 INSTRUMENTATION

NEA uses the latest state-of-the-art instrumentation. A listing of major NEA instrumentation can be found in Appendix G. All instruments are maintained internally by staff using the routine preventive maintenance schedules outlined in the respective method SOP. Major instruments (ie: GC, GC/MS, ICP, GFAA, etc.) are also maintained through vendor service contracts and parts contracts. General Instrumentation procedures and record keeping is outlined below, further information can be found in method SOPs and Instrument Run and Maintenance Logs.

5.5.1 INSTRUMENT LOG BOOKS

Instrument use as well as routine and non-routine maintenance for major instrumentation is monitored and documented by using Instrument Run Logs and Instrument Maintenance Logs. The Instrument Run Logs document the routine analytical procedures conducted for all samples. All parameters that may impact a sample analysis are recorded to assist in documenting proper analytical procedures and to assist in any troubleshooting. An example of an instrument Run Log is included in Appendix H.

The items addressed in the Logs are outlined below:

- **QA/QC frequency**
 - Calibration
 - Calibration Verification
 - Analytical sequence
 - Date of analysis
 - Instrument operator
 - Standards used (using standard codes)
- **Sample analysis**
 - Sample analytical sequence
 - Comments regarding analysis of individual samples
 - Re-analysis, re-extraction information
 - Analytical dilutions (sample volume)
- **Routine maintenance, system performance**
 - Routine maintenance
 - System performance monitoring (ie: purge flow)

The Instrument Maintenance Log also contains information about non-routine maintenance. It is divided into three sections:

1. Description of the Problem
2. Procedures Conducted to Correct Problem / Troubleshooting
3. Problem Resolution / Outcome

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This has been found to be a great aid in documenting analytical problems as well as troubleshooting recurring problems. An example of an Instrument Maintenance Log is included in Appendix I.

5.5.2 INSTRUMENT PREVENTATIVE MAINTENANCE

Routine preventative maintenance (PM) is paramount for proper instrument operation and the production of quality data. PM schedules are generated based on manufacturer's recommendations, regulatory requirements Laboratory SOPs. Preventive maintenance frequency is based on system performance, number of samples analyzed and fixed time periods. Detail for individual PM schedules can be found in method SOPs, and instrument maintenance logbooks.

5.5.3 INSTRUMENT MAINTENANCE AND SERVICE

NEA strives to utilize screening techniques whenever practical to minimize damage to instrumentation due to sample overload or contamination. However, given the unknown nature and matrices of environmental samples analyzed on laboratory instrumentation, troubleshooting and non-routine instrument maintenance will unfortunately be required even under the best conditions. All instrument problems, troubleshooting and maintenance are recorded in the Instrument Maintenance Logbook. Instrument maintenance is performed in-house when possible. If a problem requires further service, a service technician from the vendor is contacted to repair the instrument. NEA maintains vendor service contracts or parts contracts on all major instruments (ie: GC, GC/MS, ICP, GFAA, etc).

5.5.4 ACCEPTANCE OF NEW PROJECTS

Acceptance of new test methods/projects at Northeast Analytical is contingent upon review of the proposed project by the Lab Director, Laboratory Manager and other technical staff. Appropriate resources are assembled before commencing such work. Written test method SOPs and Initial Demonstration of Capability are completed before reporting test results by a new test method.

6.0 Calibration Procedures / Standards / Frequency

6.1 INTRODUCTION

NEA believes the accuracy of analytical results relies on the use of quality reagents and standards. Reagents and standards are tested for quality and lack of contamination BEFORE use. Outlined in the following sections are the general practices utilized to ensure that standards and reagents are of sufficient quality for analytical use. More detail on these quality assurance practices can be found in the Standard Preparation, individual method and General Laboratory Practices SOPs.

6.2 REAGENTS AND STANDARDS

All chemicals received at the laboratory are labeled with the date received and when containers are opened they are labeled with date opened. Standards are logged into the lab by recording the date received, vendor, vendor code, concentration and standard code in the Standard Receipt Logbook. Reagents and standards are tested for accuracy and lack of target compound contamination when they are received and after any subsequent preparation steps. Reagents and standards are certified by lot. Standard and reagent preparation is recorded in the Standard Prep Logbook along with an expiration date and standard preparation code.

The standard preparation sequence is as follows:

1. Check standard expiration date
2. Fill out Standard Prep Logbook:
 - a. Date
 - b. Analyst
 - c. Standard vendor, standard name, vendor code, vendor lot number, standard expiration date
 - d. Solvent type, vendor and lot
 - e. All standard preparation steps
 - f. Standard code:
MMDDYYBNPnnnA
- g. Prepare a standard label including:
 - Where: MM = month
 - DD = day
 - YY = year
 - N = prep. logbook number
 - nnn = standard prep logbook page
 - A = letter for standard preparation on the page (ie: first prep = A, second prep = B ...)

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standard contents
standard concentration
standard code
standard solvent
expiration date

3. Prepare standard as outlined in the logbook.

- a. Use only class "A" or equivalent volumetric glassware
- b. Prepare standard utilizing proper safety equipment (ie: Fume Hood, gloves, etc)

4. Mark the standard "DO NOT USE UNTIL TESTED - analyst initials"

5. Test the standard against a laboratory reference standard. If the standard does not have any target contamination and is within the laboratory specified accuracy criteria do the following:

- a. remove the "DO NOT USE ..." label
- b. Mark the standard prep logbook with the date tested, analytical queue or batch name and analyst initials.
- c. File the analytical raw data and % difference calculations as appropriate.

6.3 STANDARD REFERENCE MATERIALS

To ensure the accuracy of the analytical standards and results, standards prepared in the laboratory are tested against an independent mixture of known quality and accuracy. Standards are first checked by vendor lot for accuracy and lack of contamination BEFORE use. Independent standards may be from one of the following certification programs:

- NIST
- NIST Traceable Vendor
- Other appropriate Certification Source

All subsequent preparation of standards may also be checked against an independent mixture BEFORE use.

6.4. INSTRUMENT CALIBRATION

All instruments and equipment are calibrated and the calibration verified at intervals no greater than specified in the following documents:

• ELAP laboratory manual	• Regulatory method
• NEA SOP	• Vendor recommended calibration interval

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All instruments are calibrated BEFORE analytical procedures are run. The calibration range is determined by the highest calibration standard, the lowest calibration standard, and as appropriate, the laboratory determined method detection limit (MDL). In general, all calibrations are verified by running a continuing calibration check standard (CCC) containing all target compounds at the beginning and (if appropriate) the end of each analytical sequence. A CCC standard is also run after every ten samples throughout the sequence unless specified otherwise in the test method. An analytical sequence is deemed to start at the time of the first injection (CCC standard or tuning standard) and continue uninterrupted with repeated analyses until the final CCC is injected or the system remains inactive for greater than 12 or 24 hours as per the analytical method, whichever occurs first. The frequency, nature, tuning, calibration and CCC criteria are outlined in individual test method SOPs.

Laboratory calibration frequency for the following laboratory equipment is outlined below: (for further information, consult the individual equipment SOPs)

<u>Equipment</u>	<u>Calibration Frequency</u>	<u>Other</u>
• Analytical Balances	Daily	Annual maintenance from vendor
• Analytical Balance Calibration Weights	Annually against NBS certified weight by vendor.	
• pH meters	Daily or with each use	
• Specific Conductance	Daily or with each use	Cell constant determined of meters annually
• Thermometers	Annually against NBS certified thermometer	
• Refrigerators	Temperature verified twice each business day as per NYS ELAP requirements	
• Automatic Pipettors	Gravimetrically verified quarterly	
• Volumetric Glassware	Upon arrival or as necessary	
• Other volumetric	Upon arrival or as necessary	

6.5 TRACEABILITY OF MEASUREMENTS

A traceability record of all test results to NIST traceable primary reference standards or other applicable certified reference material is maintained with the use of standard preparation logbooks, instrument injection logs, and vendor supplied Reference

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Standard Certificates of Analysis. Preparation of Calibration Standards, Secondary Dilution Standards, and Spiking Mixtures are documented in standard preparation logbooks with reference to the original vendor lot code. Additions of spiking mixtures to unknown samples and QC samples are recorded in instrument injection logs and/or sample extraction/preparation logbooks.

All laboratory balances are checked for calibration with NIST traceable class 1 weights. All laboratory thermometers used for test methods are calibrated against a NIST traceable certified thermometer.

Traceability of individual analysts and sample preparation technicians to test results is recorded by the initials of the responsible person in the appropriate sample preparation log or instrument injection logbook.

7.0 Analytical Procedures

7.1 INTRODUCTION

Northeast Analytical, Inc as a member of the NYS ELAP program is required to use only ELAP approved methods for regulatory purposes unless specifically requested otherwise by the client. Most analytical procedures are conducted utilizing the following protocols:

- **US Environmental Protection Agency**
 - National Primary Drinking Water Standards. 40 CFR Part 141; July 1, 1988.
 - EPA 100-400 series - Methods for Chemical Analysis of Water and Wastes: EPA/600/4-79-020, March 1983, EPA-600/R-93/100, August 1993
 - EPA 200 series - Methods for the Determination of Metals in Environmental Samples: EPA/600/4-91-010, June 1991, EPA/600/R-94/111, May 1994
 - EPA 500 series methods - Methods for the Determination of Organic Compounds in Drinking Water, EPA/600/4-88/039, December 1988, EPA/600/4-90/020, 1990, EPA/600/R-92/129, August 1992
 - EPA 600 series methods - 40 CFR Part 136, July 1, 1988
 - Test Methods for the Evaluation of Solid Waste Physical/Chemical Methods (SW-846), Third Edition, Final Update III, December 1996.
- **American Health Association, American Water Works Association, Water Pollution Control Federation**
 - Standard Methods for the Examination of Water and Waste Water. 17th Edition 1989, 18th Edition 1992, 19th Edition 1995

Refer to Appendix J for a complete listing of analytical methods and method reference numbers. Analytical method data quality objectives and criteria are applied as specified in the individual SOPs and regulatory methods.

8.0 Data Collection, Processing and Archiving

8.1 DATA COLLECTION

Northeast Analytical, Inc. strives to improve data quality and laboratory efficiency through continued automation. Data from major computer controlled laboratory instrumentation is collected either directly to a Local Area Network (LAN) File Server or initially to the interfaced computer workstation and then transferred to the LAN Fileserver. The data is archived via tape backup automatically each day at the fileserver.

The following automated data collection programs are utilized:

- GC - Waters Millennium 32 Chromatography Database
- GC/MS - Varian Saturn II Data Acquisition/Processing Software/Target Thruput Processing Software
- CVAA - Leeman chemistry workstation software
- GFAA - Varian SPECTRAA software
- ICP - JY-24 Workstation software

All manual procedures are documented in laboratory notebooks along with the audit trail information (analyst, date, ...) and any other relevant information. An audit trail of raw laboratory data is maintained by archiving the raw data and any modifications to it. Any modifications to hardcopy raw data require the analyst to initial and date the modification while keeping the original entry legible.

8.2 DATA PROCESSING

All data is processed in accordance with Laboratory Standard Operating Procedures. Data processing procedures are verified through checks by the analyst, supervisor and laboratory director. Computer calculations are initially validated and then are routinely verified by hand calculation. Processed results are transferred to the Laboratory Information Management (LIMS) system either by automated data capture of instrument data files or by direct manual entry of results. Modifications to results stored in the LIMS system recorded in the audit trail function of the LIMS.

8.2.1 NUMERICAL MANIPULATIONS AND CALCULATIONS

Procedures for routine numerical calculation and manipulations are outlined in the Standard Operating Procedures for each Methodology.

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8.2.2 STATISTICAL TERMS AND CALCULATIONS

Outlined below are some of the calculations utilized to process routine statistical parameters:

Relative Percent Difference (RPD)

$$= \frac{[D1 - D2]}{\frac{(D1 + D2)}{2}} \times 100$$

where: D1 = First (Original) Sample concentration
D2 = Second (duplicate) Sample concentration

$$\% \text{ RECOVERY} = \frac{(SSR - SR)}{SA} \times 100$$

where: SR = Original Sample concentration
SSR = Spiked Sample concentration
SA = Theoretical Spike concentration

8.3 DATA ARCHIVING

All data at NEA is archived for a minimum of seven years unless otherwise requested by the client. Hardcopy data is kept in active files for a period of one year and then is transferred to archive storage. All computer data including raw data and processed data is archived utilizing the Storage Manager® (SSM) software by Seagate for the Novell® Local Area Network. The SSM data archiving software utilizes the advanced algorithms to maintain data archives. SSM writes and manages three complete backup copies of all network files to three individual backup tapes. The computer backup tapes are managed such that at least one copy of all files are maintained off site in a separate archive location to preserve data integrity in the event of a laboratory disaster. Additional information regarding laboratory data archiving can be found in the Network Archive SOP.

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9.0 Data Validation and Reporting

9.1 DATA VALIDATION

Data validation and quality control are important steps in the production of accurate, high quality data. Data validation at the laboratory is a multi-step process where data is thoroughly reviewed by the analyst, section supervisor, and/or QA officer and/or Laboratory Director. If there are any QA/QC or method deviations encountered during analysis or discovered during data review, they are noted and included in the "Sample Progress Folder". Ultimately, all data is reviewed and signed off by the laboratory director or appointed assistant.

Data validation is routinely conducted as follows:

- **Primary Analyst**
 - Analysis vs. COC specified method
 - Sample history checked
 - Sample analyzed within extraction and analytical hold times
 - Method blank contamination noted
 - All routine deviations annotated
 - Transcriptions checked
 - Reporting units correct
 - Concentrations verified by analyst review
 - Surrogate recoveries within criteria or noted
 - Matrix spikes and duplicates within criteria or noted
 - Instrument tuned within specified limits
 - Calibration curve within criteria
 - Calibration standard has been verified by an independent standard
 - Initial Calibration curve and Check Standards within criteria
 - Analytical sequence within criteria: (standard and QC frequency within criteria)
 - Significant figures checked
 - Sample volumes, conversion factors, and dilution factors checked
 - Solid sample dry weights checked
 - PQLs checked
 - Other Comments

- **Section Supervisor and/or QA officer and/or Lab Director:**

- Analysis vs. COC specified method
- Sample history checked
- Sample analyzed within extraction and analytical hold times
- Method blank contamination noted
- All routine deviations annotated
- Transcriptions checked
- Reporting units correct
- Concentration results verified by analyst review
- Surrogate recoveries within criteria or noted
- Matrix spikes and duplicates within criteria or noted
- Instrument tuned within specified limits
- Calibration curve within criteria
- Has the calibration standard been verified by an independent standard
- Initial Calibration and Check Standards within criteria
- Analytical sequence within criteria: (standard and QC frequency within criteria)
- Significant figures checked
- Sample volumes, conversion factors, and dilution factors checked
- Solid sample dry weights verified
- PQLs checked
- Client identification correct on certificate of analysis
- Client P.O. or billing identification is correct
- Sample results are reasonable for site history and other factors
- Other Comments

The following areas are also reviewed by the Quality Assurance Officer on a spot check basis.

- **Data Audit by QA Officer:**

- Chain-of-Custody (COC)

The COC is used to document all sample transfers, storage and requested analytical methods requested.

Chain-of-Custody is verified for:

- Date Sampled
- Dates of custody
- Proper signatures of custodians

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- Preservatives
 - Storage location and conditions
 - Sample condition including temperature
 - Analysis vs. COC requested tests
- Record-Keeping Requirements

This step of the review process checks to see that the laboratory specified documentation has been completed and documentation procedures have been followed.

The documentation is verified for:

- Completeness (all documents filled out and complete)
 - Initialing, dating and annotating of corrections or errors
 - Identification of each piece of documentation with the sample number or study number
 - Identification of chromatograms, graphs, graphical reports with sample numbers
 - Identification of instruments and analysts used during sample analysis
- Traceability Audit

The traceability step insures that there is a clear and complete trail of any reported value back to the raw data. This step is often completed as part of the Calculation Audit step that follows.

The reported values are spot checked against the raw data by checking all calculations from raw data through final result. This ensures that all necessary data is present and the calculations and results are accurate.

The following items are verified by the document traceability audit;

- Transcription errors
- Volumes, conversion, dilution and solid weight factors checked
- Documentation of all method deviations in the sample narrative, CAR or through QA footnotes or notations

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- Calculations Audit

The calculations audit provides a method to spot check the accuracy of algebra and arithmetic utilized to calculate the final results. This step is most easily performed as part of the Traceability step. Five percent of the calculations are spot checked to ensure accuracy.

As part of the calculations audit the following items are examined:

- Reporting units are verified
- Reasonableness of the results are checked
- Significant figures checked
- Reporting limits checked (MDLs or PQLs)

- Analytical Methods and Reference Standards Audit

The use of validated methods and accurate calibration standards is paramount to data quality. Only validated, regulatory approved analytical methods are used unless specifically requested by the client. All documentation is kept available on site to verify how individual steps in the method were carried out, including sample preparation, extraction, cleanup, dilution and analysis. Any deviations from the method specified in the SOP are documented, dated, initialed, and fully explained on a CAR report or comments with raw data results.

- The following method and standard references are verified:
 - Reference to analytical method and standard codes used
 - Discussion of any problems, deviations or changes included on a CAR report
 - Description of the instrument, analytical conditions and analytical procedures
 - Tuning, calibration and calibration check standard procedures and results
 - calibration curve or check standard within laboratory criteria
 - calibration, standard and sample injection sequence outlined and within criteria
 - properly labeled raw data output for all samples and

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- quality control samples
 - quality control results, including: blanks, spikes, duplicate data
 - calibration curve or check standard within laboratory criteria
 - concentration results verified by analyst review
 - compound concentration within calibration curve
 - method blanks within criteria
 - spiked compound recoveries within criteria
 - surrogates recoveries within criteria
 - Any other relevant materials
- Field Data

When available from the client, field data is included in the sample narrative for completeness.

9.2 DATA REPORTING

Results will only be released to the contracting client unless written approval is given by the client. Results will only be reported as preliminary until it is fully reviewed and validated by all levels of review. NEA will report data through hard-copy certificates of analysis, FAX, computer diskettes, e-mail or modem upon client request. Some of the alternate means of reporting have an associated surcharge; please consult the laboratory for additional details. All raw and final results are maintained in the active files for one year and then archived for a minimum of seven years unless specified otherwise by the client. Certificates of analysis are generated which include but may not be limited to the following:

Date Certificate Generated
 NYS-ELAP Lab ID#
 Sample Collection Date
 Sample Receipt Date
 Test Method Used
 Sample Matrix
 Client Sample Identification
 Sample Date Analyzed
 Concentration results with appropriate units
 Detection Limits

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10.0 Laboratory Quality Control for Analytical Performance

10.1 INTRODUCTION

The Quality Assurance program at Northeast Analytical, Inc. was developed to meet or exceed the Quality Control requirements of the NYS- ELAP and EPA programs. NEA seeks to foster a laboratory environment that will encourage all staff to produce high quality results. Through the combined efforts of management, staff and the Quality Assurance Unit (QAU), data quality is continuously planned, monitored, evaluated and corrected when necessary.

The cornerstones of the QA program are:

- Documentation (ie: QAP, SOPs, training logs ...)
- Continuous training and supervision
- Two-way communication and evaluation between analysts and management
- Clearly defined QA/QC criteria
- QA/QC and lab protocol compliance monitoring (ie: use of surrogates, spikes, checks and internal audits)
- Initial Demonstration of Precision and Refinements and improvements of method after initial validation.
- Performance Evaluation Samples
- Internal Audits
- Annual Review of Quality Systems and Corrective Actions

The remainder of this document will outline the protocols utilized to evaluate and report NEA laboratory results.

10.2 LABORATORY SAMPLE QUALITY CONTROL

10.2.1 SAMPLE CONTAINERS

NEA supplies sample containers to its clients. Sample containers are purchased pre-cleaned, and may be tested and certified by the sample container vendor. Pre-cleaned containers receive no additional testing for contamination other than the analysis of trip and holding blanks. This is outlined in the sample container receipt, storage and QA- SOP.

10.2.2 LABORATORY TRIP BLANKS

When NEA is requested to sample for volatile organic compounds a laboratory trip blank is prepared and carried through all transportation and sampling procedures. The purpose of the trip blank is to evaluate possible contamination from sample transport through sample analysis. NEA highly recommends that clients utilize trip blanks during their own sampling events and laboratory generated trip blanks are supplied upon client request.

10.2.3 LABORATORY HOLDING BLANKS (LHB)

In the Laboratory holding blank (LHB) program VOA holding blanks are setup monthly and subjected to the same storage and analytical procedures as the client samples. This allows the laboratory to evaluate container, storage and analytical sources of laboratory contamination.

10.2.4 LABORATORY SOLVENT BLANKS (LSB)

Laboratory solvents used for sample extraction and preparation are may be tested before use to prevent the contamination of sample extracts from contaminants contained in extraction/dilution solvents. Solvents are tested by vendor production lot.

10.2.5 LABORATORY METHOD BLANKS (LMB)

Laboratory method blanks are extracted with all analytical extraction batches utilizing exactly the same reagents, solvents and procedures to assess possible laboratory contamination incurred during the extraction and analysis steps. This tool is used to ascertain if analyte concentrations in the extraction *batch* are due to contamination. An example of the method blank QA worksheet is included in Appendix L.

If the method blank results are above the analyte detection reporting limit corrective action is performed. When necessary, the client is informed and given the option to decide if the associated samples are to be:

- Re-extracted (if possible)
- Noted for method blank contamination (B –flagged) if re-extraction is not applicable or the client does not request re-extraction
- Re-sampled and re-submitted to the laboratory for analysis.

10.2.6 LABORATORY SAMPLE DUPLICATES

Laboratory sample duplicates are designed to evaluate the analytical precision of the extraction, analyst and instrument for the associated *batch* of samples. Samples are split at the laboratory and receive complete replicate analysis. The results of the duplicate analysis are evaluated for relative percent difference (RPD), and evaluated for conformity to laboratory or method specified criteria. An example of the laboratory sample duplicate QA worksheet is included in Appendix M.

10.2.7 SAMPLE MATRIX SPIKES (MS) AND MATRIX SPIKE DUPLICATES (MSD)

Sample matrix spikes (MS) and matrix spike duplicates (MSD) are designed to evaluate both the precision and accuracy of the analytical method *batch* as applied to the various sample matrices encountered. For matrix spikes, homogeneous samples are split at the laboratory, one sample is spiked with a solution containing the analytes of interest. Both original sample and spiked sample are analyzed and the matrix spike percent recovery is evaluated for conformity with laboratory or method specified criteria. Matrix spike duplicates (MSDs) are replicate spikes on the same sample. MSDs are evaluated for percent recovery and relative percent difference (RPD) with respect to the MS. An example of a Matrix Spike / Matrix Spike Duplicate worksheet is included in Appendix N. Matrix spikes are performed at the frequencies prescribed by the analytical method and NYS ELAP requirements, one spiked sample per every 10 analyses (or one MS/MSD set per 20 samples)unless otherwise specified.

10.2.8 LABORATORY CONTROL SPIKES (LCS) AND LABORATORY CONTROL SPIKE DUPLICATES (LCSD)

Laboratory control spikes (LCS) and control spike duplicates (LCSD) are performed to provide accuracy and precision data about the analytical method *batch* in instances where not enough sample has been provided to perform matrix spike or duplicates on an actual sample. An aliquot of a prepared spike solution is added to a contaminant free matrix. The percent recovery and relative percent difference are calculated for LCS and LCSDs.

10.2.9 SURROGATE SPIKES

NEA spikes all samples for organic analysis with a surrogate compound unless otherwise specified in the analytical method. Surrogate spikes evaluate the efficiency and accuracy of *individual* extractions and analyses. Surrogate compounds are chosen which mimic the behavior of the target analyte(s) during the analysis. Surrogate compounds may be prescribed by the test methodology and are spiked into each sample at appropriate concentration prior to the extraction/analysis. Surrogate percent recoveries are evaluated for conformity with laboratory criteria or method specified criteria.

10.3 LABORATORY QUALITY CONTROL LIMITS AND CRITERIA

10.3.1 ANALYST/METHOD INITIAL DEMONSTRATION OF PRECISION AND ACCURACY

The precision and accuracy (P&A) of a method is established prior to the analysis of any samples. In general, four replicate samples each consisting of a standard spike of known concentration in a contaminant free matrix are analyzed. The results for percent recovery and relative standard deviation are compared to acceptance criteria for the specified method on a per analyte basis. The procedure is performed for each analyst/analytical instrument and each matrix / extraction method combination and is repeated as required by changes in instrumentation or methodology. Initial P&A acceptance criteria must be satisfied before analysis of samples may begin and before the analyst/technician may perform the method without supervision.

10.3.2 METHOD DETECTION LIMITS (MDL)

The method detection limit (MDL) is defined as the constituent concentration that when processed through the entire method produces a signal with a 99% probability that the true value is greater than zero as defined in the Code of Federal Regulations, 40 CFR, Part 136 Appendix B (7-1-91). The MDL is established by analyzing a minimum of 7 replicate spikes of the target analytes spiked at a level that produces a signal approximately 5 times the level of the background signal. MDLs are established on a per-instrument, per-matrix, per-analytical method basis. MDLs are

re-established as changes in instrumentation and methodology warrant. MDLs are verified periodically by measurement of low level reference standards.

10.3.3 METHOD PRACTICAL QUANTITATION LIMIT (PQL)

The method PQL is defined as the lowest level of the constituent concentration that can be quantified in actual sample matrices using routine laboratory operating conditions. The PQL is highly matrix dependant and is generally established at approximately 5 times the MDL. Adjustments to the PQL are made as warranted by the background interferences and any required dilutions of actual samples. PQLs are established as the equivalent concentration of the lowest calibration standard for methodologies that specify this requirement.

10.3.4 METHOD PERFORMANCE LIMITS

Method performance is routinely monitored as specified by EPA methodology and NYS ELAP/NELAP regulations. Statistical derived control limits are established for matrix spikes, surrogate spikes, laboratory control spikes, and reference samples. Control limits are established for each parameter at the onset of a newly established method. The limits are updated annually or as warranted when changes are made to procedures or methodologies. If an analytical result exceeds a control limit, the measurement is repeated. If the repeat analysis confirms a problem, a Corrective Action Report (CAR) may be issued by the analyst or supervisor. The CAR lists the samples involved, the cause of the problem, action taken to correct the problem and preventive actions to prevent future occurrences. The analyst, supervisor, and QA officer review, approve and sign the report.

10.4 LABORATORY PERFORMANCE, SYSTEM AUDITS AND CERTIFICATION.

10.4.1 INTERNAL LABORATORY AUDITS

Internal Audits are distinguished from Independent Audits in that internal audits are initiated in house and are designed to measure compliance with in house established criteria. Internal Audits may consist of Performance Audits, System Audits, and other devices to measure data quality.

10.4.1.1 SYSTEM AUDITS

System audits are performed at scheduled intervals and as warranted by encountered circumstances. System audits may consist of qualitative evaluations of all quality control measurement systems or of selected sub-units. System audits consist of written evaluations of quality control documentation, spot checks of procedures, and review of statistical data generated by control samples. System audits are designed to determine whether activities scheduled by the QA Unit are satisfactorily performed. A record of any corrective action taken in response to the audit is maintained.

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See Appendix O for an example of a System Audit Evaluation Report (SAER). Further detail about laboratory audits can be found in the Laboratory QA SOP.

10.4.1.2 PERFORMANCE AUDITS

Performance Audits are also conducted at scheduled intervals and at the discretion of management or the QA Unit. A performance audit is a quantitative evaluation of the measurement systems for an analytical procedure. Performance audits consist of the submission of samples of known composition under the auspices of the QA Unit with or without the knowledge of the analyst. Single-blind and double-blind performance audits also document whether the analytical method is performed in accordance with the standard operating procedures applicable to the method. The results of the analysis are compared with the known values for conformity with laboratory established acceptance criteria. See the Laboratory QA SOP and Appendix P for an example of Performance Audit Report (PAR).

10.4.2 INDEPENDENT AUDITS

NEA is routinely audited by regulatory agencies (i.e.: NYS ELAP), laboratory clients, and agents contracted by laboratory clients. Independent audits are conducted as scheduled by a regulatory agency or at client request. Independent Audits are conducted in accordance with or under the supervision of the auditing agent. A record of the audit and any corrective actions taken in response to the audit is maintained.

10.4.3 CERTIFICATIONS

NEA is currently certified through the NYS ELAP program for the methods and analytes outlined in Appendix J. In cases where samples may be received from States other than New York State, notification is made to prospective clients as to the current status of certification. All certificates are displayed and new or revised certificates are made available as soon as they become active. NEA maintains certification in other states on an as need basis for client projects. Reciprocal certification between the NYS-ELAP program and several other state certification programs exists.

10.4.3.1 NYS-ELAP AND NELAP CERTIFICATION

NYS ELAP/NELAP certification is maintained for all applicable analytes. NYS ELAP/NELAP certification requires an annual on site inspection of the laboratory facilities and satisfactory analysis of Performance Evaluation (PE) samples. PE samples are submitted by ELAP on a quarterly schedule. Copies of NEA's ELAP/NELAP certificates are contained in Appendix Q.

10.4.4 PERFORMANCE EVALUATION SAMPLES

NORTHEAST ANALYTICAL, INC.

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Northeast Analytical participates in the NYS-ELAP/NELAP performance evaluation sample program where samples are submitted quarterly for testing. The ELAP PE samples test both Potable Water and Non-Potable Water categories along with Solid and Hazardous Waste categories twice annually.

Additional proficiency samples associated with client specific approval programs are also analyzed as specified in client specific agreements.

10.5 LABORATORY CORRECTIVE ACTION

10.5.1 CORRECTIVE ACTION REPORTING AND TRACKING

Laboratory corrective action is warranted whenever there is a major or systematic excursion from standard operating procedures or when laboratory Quality Control criteria have been exceeded due to a systematic problem. Examples of circumstances that may warrant corrective action are: control samples exceeding limits, sample loss during processing, calibration checks exceeding acceptance criteria, etc. The analyst or the party that detects the non-compliant condition may initiate a corrective action report (CAR) at using their professional discretion. The initiator may be the analyst, the QA officer, section supervisor, or laboratory director. The report details a description of the problem, steps taken to investigate the problem, steps taken to remedy the problem, steps taken to prevent a recurrence and a review and signature by the supervisor, analyst, and QA officer. Corrective action reports are tracked numerically and may be retained with the client files and the QA files for future reference. See Appendix K for an example of a CAR.

10.5.2 CORRECTIVE ACTION FOLLOW UP

Within a period of approximately two weeks to one month after the issuance and resolution of a corrective action report, the supervisor or QA officer initiates a follow up investigation. The follow up consists of a review of the CAR and a determination of whether the solution has been properly implemented and has been successful. The follow up is documented and is attached to the original CAR report.

10.5.3 ALLOWED EXCURSIONS FROM STANDARD PROCEDURES

In cases where excursions from test methods or standard operating procedures are necessary, full documentation of the allowed excursion will be maintained with the project work order and test results in the laboratory archives. In some cases, a test method may be reported as modified. Information about test method modifications and excursions is generally described in a sample case narrative that is included with the project data summary report. All excursions and modifications to test method will be made with full disclosure to the client, data user, and/or regulatory agency.

10.6 LABORATORY ADMINISTRATIVE ACTIONS AND CONTROLS

10.6.1 Review of New Projects and Capabilities Assessments

An assessment of Laboratory Capabilities is undertaken when new projects are proposed. New projects may include analytical methods and techniques that the laboratory has not previously employed or may constitute projects of fixed or indefinite quantity of tests methods currently in use by the laboratory. The following concerns are addressed before the acceptance and commencement of the project:

- 10.6.1.1 Adequate facility physical space for sample acceptance, initial processing, and archival storage.
- 10.6.1.2 Adequate qualified personnel to perform the given test methods and meet project specified schedule and data quality objectives.
- 10.6.1.3 Adequate analytical instrumentation and backup instrumentation to perform the given test methods and to meet project specified schedule and data quality objectives including required detection limits.
- 10.6.1.4 Sufficient sources of vendor supplied laboratory consumables for the duration of the project.

The assessment may be conducted formally or informally with senior management and department technical supervisors during weekly management meetings and specially scheduled department meetings.

10.6.2 Laboratory Annual Review of Quality Systems

The Laboratory Quality Systems are reviewed annually this review consists of meeting(s) with Senior Management, QA Personnel, and Section Supervisors. The annual review encompasses the following items:

- 10.6.2.1 Outcome of Internal Audits
- 10.6.2.2 Results of assessments by external bodies
- 10.6.2.3 Results of inter-laboratory comparisons and proficiency tests
- 10.6.2.4 Changes in workload volume and laboratory capacity
- 10.6.2.5 Feedback from clients
- 10.6.2.6 Corrective actions
- 10.6.2.7 Other factors

10.6.3

Client Notification of Results of Internal Audits and Annual Review

In the event that the findings of an internal audit affect analytical results previously delivered to a client, the client is notified immediately in writing of the outcome of the audit and how specific results may be affected. Corrected results are issued for affected data.

11.0 Document Control and Record Keeping Procedures

11.1 DOCUMENT CONTROL

The following Document Control Procedures are employed for laboratory-generated items:

11.1.1 Standard Operating Procedures

Standard Operating Procedures are indexed with an SOP Master List. The Master List records the SOP name, SOP file ID, the author, the date effective, and the date withdrawn. All prior versions of SOPs are stored in the Laboratory Data Archives. Laboratory SOP copies are signed out to laboratory personnel and laboratory section manuals which are maintained in the appropriate work areas. Outdated SOP copies are returned and destroyed. The original master copy is archived in long term storage.

11.1.2 Procedural Manuals

Archived Procedural manuals such as the Quality Assurance Manual and Chemical Hygiene Plan, and outdated Test Method Manuals are stored in the Laboratory Information Archives. A Laboratory Information Archive Master List is maintained for appropriate items.

11.1.3 Document Storage and Access Log

Archived hardcopy materials including raw data, processed data, and laboratory logbooks are stored in a secured onsite data storage area (Laboratory Data Archives). Access to the data storage area is limited to authorized personnel. Items that are removed from the data storage area are signed out in an Access Log and are signed back in when returned.

QUALITY ASSURANCE PLAN

APPENDIX

NORTHEAST ANALYTICAL, INC.

APPENDIX A

LABORATORY EMPLOYEE CONFIDENTIALITY STATEMENT

NORTHEAST ANALYTICAL



ENVIRONMENTAL LAB SERVICES

2190 Technology Drive, Schenectady, NY 12308

(518) 346-4592 • FAX: (518) 381-6055

Northeast Analytical, Inc. has engaged in confidentiality agreements with numerous clientele and these agreements are inclusive to all employees of this company.

Federal regulations require that all employees of this company comply with this confidentiality agreement; failure to do so will result in immediate dismissal and possible Federal infractions.

I, the undersigned, do understand and hereby agree to comply with the above statements, and I will not divulge any information pertaining to this company's business and activities to anyone or any organization which is not directly associated with Northeast Analytical, Inc.

EMPLOYEE: _____ DATE: _____

TITLE: _____

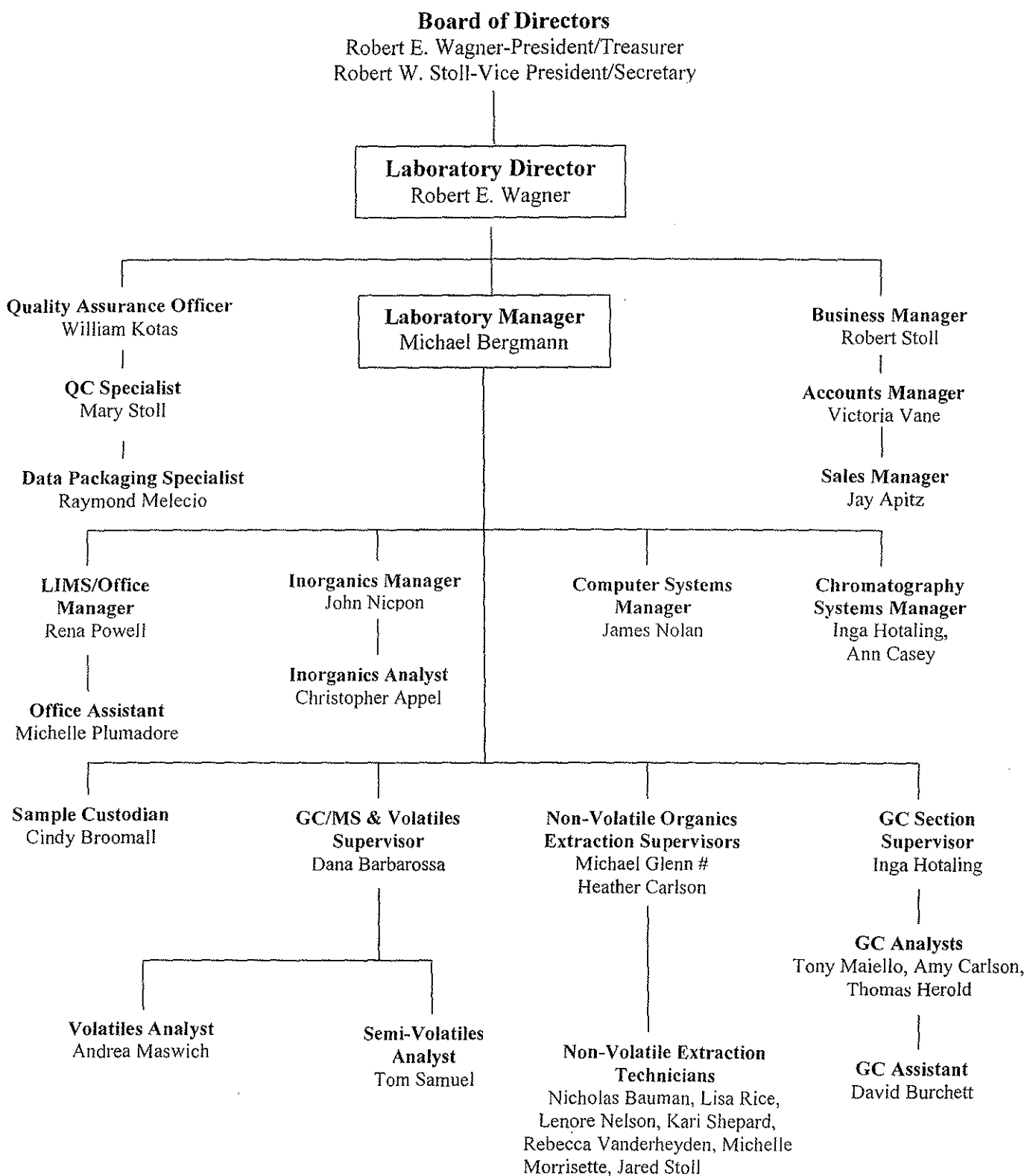
EMPLOYER: _____ DATE: _____

TITLE: Vice President

APPENDIX B

LABORATORY ORGANIZATIONAL OUTLINE

NEA ORGANIZATIONAL CHART



Key Personnel: (For full resumes see Appendix C)

Northeast Analytical, Inc. currently employs a staff of 32 technical and support personnel. The personnel of NEA have worked on the cutting edge of PCB congener specific analysis and has had many years of experience with PCB method development and research. Listed below are the key personnel and a brief description of duties. .

Robert Wagner Laboratory Director (Primary Point of Contact)

As the Lab Director of NEA, Mr. Wagner supervises and manages laboratory staff in the chemical analysis of various environmental samples for PCB, pesticides/herbicides, inorganic, GC/MS and volatiles; develops and implements analytical methods and procedures. He is responsible for review of all data and QA/QC programs.

Robert Stoll Business Manager

Mr. Stoll is the Financial Manager of NEA. He supervises all accounting and business management responsibilities for NEA. Mr. Stoll handles all billing and payments for contracts.

Mike Bergmann Laboratory Manager

Mr. Bergmann will supervise and manage the laboratory staff and supervisors in the organic and inorganic departments, project management, analysis, data review and lab monitoring for QA/QC compliance.

William Kotas QA/QC Officer

Mr. Kotas has over 10 years of experience in environmental analysis and quality assurance. Mr. Kotas Holds a New York State Department of Environmental Conservation certified data validator for Organic and Inorganic analysis data summary reports. He is responsible for internal laboratory QC audits of analytical methods, software systems and sample preparation techniques. Mr. Kotas will be the QA/QC Officer for all contracts.

Inga Hotaling Congener Specific Specialist

Ms. Hotaling has worked in environmental analysis for the past 12 years. She performs High Resolution PCB congener analysis, data processing and reporting for a variety of matrices. She is responsible for Laboratory Chromatography Database System management and oversees all data processing.

Anthony Maiello 8082 & 8081 Specialist

Mr. Maiello has worked in environmental analysis for the past 15 years. He performs data processing and reporting of samples.

Ann Casey

High Resolution & Coplanar PCB Specialist

Ms. Casey has worked for the past 14 years in research and development of congener specific method analysis for PCBs in air, water, soil, sediment, breast milk, blood/serum, urine and tissues. She will oversee all coplanar analysis, data processing and reporting samples.

Thomas Herold

8082 & 8081 Specialist

Mr. Herold has worked in environmental analysis for 4 years. He will perform the data processing and reporting all 8082 samples.

Amy Carlson

Congener Specific Specialist

Ms. Carlson has worked in environmental analysis for the past 2 years. She performs the CQCS GC/ECD High Resolution analysis, data processing and reporting samples. She will assist with data processing and reporting 8082 samples.

Thomas Samuel

GC/MS Specialist

Mr. Samuel has been working as a GC/MS operator for the past 4 years, involved with various EPA methods. He will do the PCB conformation of the coplanar 8082 sample and 680 samples.

Michael Glenn

Extraction Chemist Supervisor

Mr. Glenn supervises environmental extractions. He supervises and manages the extraction technicians involved in the extraction of soil, sediment, tissue and water samples for PCB, pesticides, herbicides and semi-volatile analysis. He will assign and oversee the technicians extracting the samples.

Rena Powell

Office Support

Ms. Powell is responsible for coordinating and assisting the front office staff in producing data summary reports as well as generation of electronic data reporting to the client.

Jim Nolan

Computer Support

Mr. Nolan is responsible for the day-to-day operations of NEA's computer network. He will develop programs to assist in generation of data summary reports and set up the electronic data reporting to the client.

APPENDIX C

LABORATORY PERSONNEL QUALIFICATIONS

APPENDIX C: NORTHEAST ANALYTICAL SENIOR MANAGEMENT

PERSONNEL:

Northeast Analytical's major function is to provide high quality analytical testing services. To meet and maintain quality services, Northeast Analytical employs qualified scientists well versed in environmental and analytical chemistry. The experience of the Senior Chemists plays an important role in project supervision and the training of Lab Technicians to perform chemical analyses correctly and produce highly respected analytical information.

Resumes for Northeast Analytical's Senior Staff are presented on the following pages.

ROBERT E. WAGNER: LABORATORY DIRECTOR

PROFESSIONAL EXPERIENCE:

1989-Present: **Lab Director**
Northeast Analytical, Inc.
2190 Technology Drive
Schenectady, New York

Lab Director of Northeast Analytical, Inc.; supervises and manages laboratory staff in the chemical analysis of various environmental samples for PCB, pesticides/herbicides, inorganic, GC/MS and volatiles; develops and implements analytical methods and procedures; instructs laboratory analysts; project manager responsibilities; responsible for review of all data and QA/QC programs; long range planning; client relations; equipment evaluation and recommendation; maintain laboratory certification programs.

1981-1989: **Associate Staff Analytical Chemist**
General Electric Company
Research & Development Center
P.O. Box 8, 1 River Road
Schenectady, New York 12301

Employed in the field of environmental chemistry (PCB, PCDF, DIOXIN) and analytical polymer chemistry (trace analysis, residue solvent characterization, toxic component analysis). Involved with development of multi-component analysis and synthetic chemistry of standards. Isolation and fractionation of environmental residues from complex matrices. Development of state of the art analytical techniques with high-resolution capillary gas chromatography utilizing a variety of detectors (ECD, FID, TCD, HECD). Knowledge of GC and HPLC (H/P, Varian, Shimadzu) and integration systems. In-depth maintenance capability to board level and hands-on hardware configuration.

1978-1981: **Biochemistry Project Supervisor**
Albany Medical College of Union University
Albany, New York 12208

Coordinated and developed a federally funded research project investigating the aging process using hamsters as models. Companion study explored the effects of lipid-enriched diets on the life span of these animals. Supervised three technicians in the daily work routine. Also conducted clinical research to

ROBERT E. WAGNER: LABORATORY DIRECTOR

develop a quick and accurate determination of serum bilirubin levels based on a fluorescence quenching method.

1975-1978: **Biochemistry Technician**
Albany Medical College of Union University
Albany, New York 12208

Technician on above mentioned federal research project. Prepared enzyme complexes from various organ tissues for extensive biochemical analysis. Experience with centrifuges, A.A., Spectrophotometers, and fluorometer.

EDUCATION:

1975: **B.S. Chemistry**
State University of New York, College at Potsdam
Potsdam, New York

PROFESSIONAL AFFILIATIONS:

American Chemical Society
Schenectady Chamber of Commerce

PUBLICATIONS:

1984

J.F. Brown Jr., R.E. Wagner, D.L. Bedard, M.J. Brennan, J.C. Carnahan, R.J. May, and T.J. Tofflemire; "PCB Transformations in Upper Hudson Sediments". Northeast Environmental Science, Vol. 3, No. 384, p.167-179, 1984.

R.E. Wagner and J.C. Carnahan; "Capillary GC-Quantitation of Polychlorinated Biphenyls". Presented before the Varian Chromatography Symposium, April 1984.

1985

B.J. Vivier and R.E. Wagner; "Gas Chromatography Data Reduction Software". GE CR&D Memo Report #MOR-85-024, Class 2, March 1985.

J.F. Brown Jr., R.E. Wagner, D.L. Bedard, M.J. Brennan, J.C. Carnahan, R.J. May, and T.J. Tofflemire; "PCB Dechlorination in Upper Hudson Sediments". Presented before the Division of Environmental Chemistry, American Chemical Society 189th National Meeting, Miami, Florida, Vol. 25, No. 1, Paper #12, p.35-37, April 29-May 3, 1985.

R.E. Wagner, J.C. Carnahan and R.J. May; "Calibration Method for PCB Analysis by Capillary GC and Electron Capture Detection". Presented before the Division of Analytical Chemistry,

American Chemical Society 189th National Meeting, Miami, Florida, Paper #201, April 28-May 3, 1985.

ROBERT E. WAGNER: LABORATORY DIRECTOR

R.E. Wagner and J.C. Carnahan; "An Internal Standard for Capillary GC Analysis of PCB Mixtures". Presented before the Division of Analytical Chemistry, American Chemical Society 189th National Meeting, Miami, Florida, Paper #202, April 28-May 3, 1985.

D.L. Bedard, L.H. Bopp, M.J. Brennan, R.E. Brooks, J.F. Brown Jr., J.C. Carnahan, D.T. Gibson, M.L. Haberl, C. Johnson, S.H. Lockwood, K.L. Longley, R.J. May, D.P. Mobley, L.M. Nadium, M.J. Schocker, T. Su, R. Unterman, R.E. Wagner, and G.W. Yeager; General Electric Company Research and Development Program for the Destruction of PCBs, Fourth Progress Report, 6/1/84-6/1/85.

R.E. Wagner and J.C. Carnahan; "An Internal Standard for Capillary GC Analysis of PCB Mixtures". Presented before the General Electric Company-Wide Materials Characterization Symposium, 7th Meeting, April 22-24, 1985.

R.E. Wagner and J.C. Carnahan; "Internal Standard for Capillary GC Analysis of PCB Mixtures". Presented before the Varian Chromatography Symposium, March 1985.

J.F. Brown Jr., D.L. Bedard, L.H. Bopp, J.C. Carnahan, R.W. Lawton, R.D. Unterman, and R.E. Wagner; "Human and Environmental Biodegradation of PCBs". Presented before the EPRI PCB Conference, Seattle, Washington, October 22, 1985.

J.F. Brown Jr., D.L. Bedard, J.C. Carnahan, R.W. Lawton, R.E. Wagner; "Environmental Dechlorination of PCBs". Presented before the Society for Environmental Toxicology and Chemistry Meeting, St. Louis, Missouri, November 11, 1985.

1986

J.F. Brown Jr., R.E. Wagner; "Polychlorinated Biphenyl (PCB) Movement and Transformation in Acushnet Estuary Sediments". A draft manuscript prepared for RTE Aerovox Corporation and GE/CEIP to be eventually written into two or more scientific paper discripting the above title. 9/26/86.

1987

D.L. Bedard, M.J. Brennan, R.E. Wagner, M.L. Haberl, and J.F. Brown Jr.; "Extensive Degradation of Aroclors and Environmentally Transformed PCBs by ALCALIGENES EUTROPHUS H850". Applied and Environmental Microbiology, Vol. 53(5), p.1103-1112, May 1987.

J.F. Brown Jr., R.E. Wagner, H. Feng, D.L. Bedard, M.J. Brennan, J.C. Carnahan, and R.J. May; "Environmental Dechlorination of PCBs". Environmental Toxicology and Chemistry, Vol. 6(8), p.579-593, August 1989.

J.F. Brown Jr., D.L. Bedard, M.J. Brennan, J.C. Carnahan, H. Feng, R.E. Wagner; "Polychlorinated Biphenyl Dechlorination in Aquatic Sediments". Science, Vol. 236, p.709-712, May 1987.

J.F. Brown Jr., J.C. Carnahan, S.B. Dorn, J.T. Groves, W.V. Ligon, Jr., R.J. May, R.E. Wagner, and S.B. Hamilton; "The Levels of Toxic PCDF Congeners in Used and Unused PCB Dielectric Fluids". Dioxin '87 - Seventh International Symposium, Las Vegas, Nevada, Oct. 4-9, 1987.

ROBERT E. WAGNER: LABORATORY DIRECTOR

J.F. Brown Jr., and R.E. Wagner; "PCB Dechlorination in Marine Sediments". Abstracts of Papers at the 8th Annual Meeting of the Society for Environmental Toxicology and Chemistry, Pensacola, FL, No. 136, 1987.

1988

J.F. Brown Jr., R.W. Lawton, M.R. Ross, J. Feingold, R.E. Wagner, and S.B. Hamilton; "The Persistence of PCB Congeners in Normal and PCDF-Poisoned Humans". Presented before the DIOXIN '88 Conference, Umea, Sweden, August 21-26, 1988.

J.F. Brown Jr., and R.E. Wagner; "A Simple Index for Summarizing the Alteration State of Environmental PCB Mixtures". Presented before the Society for Environmental Toxicology and Chemistry Meeting, November 1988.

J.F. Brown Jr., J.C. Carnahan, S.B. Dorn, J.T. Groves, M.V. Ligon, R.J. May, R.E. Wagner, and S.B. Hamilton; "Levels of Bioactive PCDF Congeners in PCB Dielectric Fluids from Capacitors and Transformers". Chemosphere.

J.F. Brown Jr., R.E. Wagner, and D.L. Bedard; "PCB Dechlorination in Hudson River Sediment". Science, Vol.240, 1988, p.1674-1676.

1990

J.F. Brown Jr., and R.E. Wagner; "PCB Movement, Dechlorination, and Detoxication in the Acushnet Estuary". Environ. Tox. and Chem., Vol.9, p.1215-1233, 1990.

1996

George M. Frame, R.E. Wagner; James C. Carnahan, John F. Brown Jr., Ralph J. May, Lynn A. Smullen, and Donna L. Bedard "Comprehensive, Quantitative, Congener Specific Analyses of Eight Aroclors and Complete PCB Congener Assignments on DB-1 Capillary GC Columns". Chemosphere, Vol. 33, No. 4, pp. 603-623, 1996.

ROBERT W. STOLL: BUSINESS MANAGER

PROFESSIONAL EXPERIENCE:

1989-Present:

Financial Manager

Northeast Analytical, Inc.
2190 Technology Drive
Schenectady, New York

Financial Manager of Northeast Analytical, Inc. Supervises administrative personnel; performs all ordering and purchasing; accounting and business management responsibilities; interfaces with daily lab activities; long range planning; client relations; equipment and annual budget regulation; staffing; project manager on laboratory programs.

ROBERT W. STOLL: BUSINESS MANAGER

1985-1989:

Process Engineer

General Electric Company
Product Operations Department (POD)
Research and Development Center
P.O. Box 8, 1 River Road
Schenectady, New York 12301

Responsible for the operation of the Thin Film Deposition Area of the liquid Crystal Display Pilot Line. Characterization and process control on all films used in the fabrication of Thin Film Field Effect Transistors using Sputtering, Evaporation, and PECVD. Responsible for the daily work routine of four technicians, as well as the equipment, facilities and operator specification for the US factory design.

1980-1985:

Associate Staff Chemist

General Electric Company
Research and Development Center
P.O. Box 8, 1 River Road
Schenectady, New York 12301

CVD Tungsten Project: Developed a unique CVD reactor that was capable of selectively depositing tungsten in 2 micron, straight side wall vias; at deposition rates in excess of 1000A/min. The technology was sold to GENUS Corp. Developed both selective and non-selective tungsten processes using surface pre-treatments to either enhance or hinder deposition. Analyzed and developed a method of relieving the tungsten film stress which was responsible for the spontaneous delamination of tungsten films on glass surfaces.

Fumed Silica Project: Designed a high temperature infrared flow cell (750C) and a fluidized bed reactor to study the kinetics of fumed silica using a variety of silylating agents. Analyses were conducted using a Nicolet 7199 FT-IR spectrometer and a Micromeritics Digisorb 2500 Surface Area Analyzer. Responsible for the operation and maintenance of both machines.

Translex Project: Synthesis of polycarbonate via the melt polymerization method. The polymers were analyzed for impurities and thermal degradation products utilizing GC, HPLC, and NMR.

1979-1980:

Research Technician

State University of New York at Albany
1400 Washington Avenue
Albany, New York 12222

Provided technical support for a federally funded research project investigating the aging process using hamsters as models. Companion study explored the effect of lipid enriched diets on the life span of these animals. Prepared enzyme complexes from the heart organ for extensive biochemical analysis. Experience with centrifuges, A.A., spectrophotometers, fluorometers, and oxygraphs.

1976-1977:

Chemical Laboratory Technician

Corning Glass Works
Sullivan Park Research and Development
Painted Post, New York 14870

ROBERT W. STOLL: BUSINESS MANAGER

Responsible for the precision hydrofluoric acid etching of Vycor glass tubes. Operated two computerized lathes used to place layers of BC13, GeCl4, and PCL5 on the inside of the Vycor tubes, which were later drawn into optical waveguide fibers.

1972-1975: **Inventory Management Specialist**
Military Service
United States Air Force
Rank: Sergeant E-4

Non-commissioned officer in charge of the Base Composite Tool Kit Program. Duties involved meeting with representatives of the base maintenance organizations to determine their tool requirements. Maintaining and updating all records for each composite tool kit. Supervised two airman in their daily routine.

EDUCATION:

1979: **B.S. Chemistry**
State University of New York at Albany
Albany, New York

PUBLICATIONS:

Co-author of one journal article and four published proceedings of meetings.

PATENTS:

Method for Treating Fumed Silica (U.S.Pat.4,554,147)

Enhancing the Selectivity of Tungsten Deposition on Conductor and Semi-conductor Surfaces (U.S.Pat.4,552,783)

Selective Chemical Vapor Deposition Apparatus (U.S.Pat.4,653,428)

Method for Selective Deposition of Tungsten by Chemical Vapor Deposition onto Metal and Semi-conductor Surfaces (U.S.Pat.4,471,928)

ANN C. CASEY: SR. ANALYTICAL CHEMIST / PROJECT MANAGER

PROFESSIONAL EXPERIENCE:

2000-Present: **Analytical Chemist**
Northeast Analytical, Inc.
2190 Technology Drive
Schenectady, New York 12308

Performs GC-ECD analysis of pesticides, PCBs by EPA 8082 and congener specific methods. Working knowledge of method development for Coplanar PCBs by GC-MS and GC-ECD. Conducts

ANN C. CASEY: SR. ANALYTICAL CHEMIST

research and development for specialty PCB analysis. Maintenance of Agilent GC. Troubleshooting pesticide and PCB projects. Writing SOPs and implementing newly developed methods.

1994-2000

Project Coordinator

Research Foundation of the State University of New York
University At Albany
School of Public Health
Rensselaer, New York

Coordinated the analytical analysis and data delivery system for an NIEHS Superfund Basic Research Project investigating the impacts of hazardous waste (PCB, Dioxins, PAH, Fluoride and Metals). Supervised and managed laboratory staff and graduate students. Coordinated data analysis and data interpretation of PCB laboratory results for principal investigators in toxicology, epidemiology, civil and chemical engineering. Developed research protocols for animal exposure to PCB Aroclors and congeners via dermal, inhalation and ingestion exposure. Worked with communities on Environmental Justice issues and education.

1998-1999

Director of Environmental and Laboratory Planning

Saint Regis Mohawk Tribe Environment Division
Rt. 37 Community Building
Hogansburg, New York

Coordinated and developed the Performance Partnership Agreement (PPG/PPA) between the Tribe's Environment Division and the USEPA Region 2. Program projects included Clean Air, Clean Water, Wetlands Protection, Solid waste and Core development. Worked with program project department heads to develop and execute work plans, budgets, long-range goals. Worked with Native American community members and leaders to preserve and protect the communities' environment, natural resources and health.

1993-1994

Laboratory Manager

Research Foundation of the State University of New York
University At Albany
The Wadsworth Center
Albany, New York

Coordinated the analytical analysis for an NIEHS Superfund Basic Research Project investigating the impacts of hazardous waste (PCB, Dioxins, PAH, Fluoride and Metals). Supervised and managed laboratory staff for the PCB laboratory. Method development for state of the art congener specific analysis for sample matrices including breast milk, urine, whole blood, serum, adipose tissue, sperm, sediments, air, water and soils. Wrote and implemented SOP's and quality control and quality assurance programs. Knowledge and use of GC-ECD, GC/FTIR/MS, HPLC (HP and Waters). In-depth and daily maintenance of all laboratory equipment.

1991-1993

Research Technician II

Research Foundation of the State University of New York
University At Albany
The Wadsworth Center
Albany, New York

ANN C. CASEY: SR. ANALYTICAL CHEMIST

Method development for state of the art congener specific and coplanar analysis. Sample matrices included breast milk, adipose tissue and blood. Experience with GC-ECD and GC-MS.

1990-1991

Research Laboratory Assistant

Research Foundation of the State University of New York
University At Albany
The Wadsworth Center
Albany, New York

Method development and extraction of breast milk and urine for congener specific analysis. Experience with GC-ECD.

1989-1990

Animal Caretaker/Laboratory Technician

Health Research Inc.
New York State Department of Health
Wadsworth Center for Labs and Research
Albany, New York

Technician for the ATSDR Great Lakes PCB program. Prepared, dosed and sacrificed animals in PCB exposures experiments. Dissection of rats and monkeys. Tissue collection and preparation for PCB analysis.

EDUCATION:

1993:

B.S. Biology

The College of Saint Rose
Albany, New York

1993:

B.A. Sociology

The College of Saint Rose
Albany, New York

PROFESSIONAL AFFILIATIONS:

Society of Toxicology and Environmental Chemistry (SETAC)
Association of Occupational and Environmental Clinics (AOEC)
National Environmental Health Association

PUBLICATIONS:

Hong CS, Xiao J, Casey AC, Bush B, Fitzgerald EF, Hwang SA. (1994) Mono-ortho- and non-ortho-substituted polychlorinated biphenyls in human milk from Mohawk and control women: effects of maternal factors and previous lactation. Arch Environ Contam Toxicol. 1994 Oct;27(3):431-7.

Casey, A.C., Bush, B. (1994). The Method Development for Serum Extraction QA/QC. Presented before the Great Lakes Research Program. Madison Wisconsin.

ANN C. CASEY: SR. ANALYTICAL CHEMIST

Casey, A.C., Bush, B. (1995). PCB Contamination of the St. Lawrence Riverway and the Mohawk Ecosystem. Presented before the 22nd Annual Aquatic Toxicity Workshop. St. Andrews, N.B., Canada.

Casey, A.C., Carpenter, D.O., Bush, B., Tarbell, A. (1996). Superfund Basic Research Program. Presented before the Great Lakes Research Consortium. Albany, NY.

Kodavanti PR, Ward TR, Derr-Yellin EC, Mundy WR, Casey AC, Bush B, Tilson HA. (1998) Congener-specific distribution of polychlorinated biphenyls in brain regions, blood, liver, and fat of adult rats following repeated exposure to Aroclor 1254. Toxicol Appl Pharmacol. Dec;153(2):199-210.

Korytko PJ, Casey AC, Bush B, Quimby FW. (1999) Induction of hepatic cytochromes P450 in dogs exposed to a chronic low dose of polychlorinated biphenyls. Toxicol Sci. Jan;47(1):52-61.

Casey AC, Berger DF, Lombardo JP, Hunt A, Quimby F. (1999) Aroclor 1242 inhalation and ingestion by Sprague-Dawley rats. J Toxicol Environ Health A. Mar 12;56(5):311-42.

Crofton KM, Kodavanti PR, Derr-Yellin EC, Casey AC, Kehn LS. (2000). PCBs, thyroid hormones, and ototoxicity in rats: cross-fostering experiments demonstrate the impact of postnatal lactation exposure. Toxicol Sci. Sep;57(1):131-40.

WILLIAM A. KOTAS: QUALITY ASSURANCE OFFICER

PROFESSIONAL EXPERIENCE:

1997-Present: **Quality Assurance Officer/Laboratory Representative**
Northeast Analytical, Inc.
2190 Technology Drive
Schenectady, New York 12308

Responsible for review of analytical reports and data summary packages generated by organics and inorganics sections. Review of analytical procedures for compliance with US EPA, New York State ELAP, NELAP and other regulations for environmental analysis. Responsible for scheduling and performing QA operations including internal audits and spot checks. Maintains Quality Assurance/Quality Control records for the laboratory. Assists current & prospective clients in selection of test methods, sampling requirements and interpretation of test results..

1991-1997: **Quality Assurance Officer/Computer Systems Manager**
Northeast Analytical, Inc.
301 Nott Street
Schenectady, New York 12305

Reviews analytical reports and data summary packages generated by organics and inorganics sections. Reviews analytical procedures for compliance with US EPA, New York State ELAP and other regulations for environmental analysis. Maintains Quality Assurance/Quality Control records for the laboratory. Responsible for installation and maintenance of Novell Local Area Network (LAN) and all workstations and associated peripherals.

WILLIAM A. KOTAS: QUALITY ASSURANCE OFFICER

1990-1991: **Microscopist/Analyst**
Entek Environmental & Technical Services
Troy, New York

Performed analysis of air and bulk materials for the presence of asbestos fibers by Phase Contrast and Polarized Light Microscopy. Contributed to the development of a comprehensive training examination for new analysts.

1988-1990: **Environ. Analyst/Quality Control Coordinator**
Professional Service Industries
Pittsburgh Testing Lab Division
Albany, New York

Analyzed air and bulk samples for asbestos. Collected and compiled quality control data generated by each analyst. Assisted laboratory manager in lab operations and client relations.

EDUCATION:

1990: **B.S. Physics**
Minor: Chemistry
State University of New York at Albany
Albany, New York

1985: **A.S. Mathematics/Science**
Hudson Valley Community College
Troy, NY

PROFESSIONAL AFFILIATIONS:

American Society of Physics-Sigma Pi Sigma Physics Honors Society

PUBLICATIONS:

Contributing editor to *Guide to Environmental Analytical Methods* 4th ed. A summary of Quality Assurance requirements and other pertinent information for select analytical methodologies. Published by Genium Publishing Corp. Schenectady, NY, 1998.

INGA C. HOTALING: CHEMIST/GC SECTION SUPERVISOR

PROFESSIONAL EXPERIENCE:

2001-Present: **GC Section Manager/Chromatography Systems Manager**
Northeast Analytical, Inc.
2190 Technology Drive
Schenectady, New York 12308

Responsible for management of the GC analysis section including analysis scheduling, analyst training and instrument maintenance Performs High Resolution PCB congener analysis, data processing and

INGA C. HOTALING:CHEMIST/GC SECTION SUPERVISOR

reporting for a variety of matrices, Responsible for Laboratory Chromatography Database System management. Duties include system configuration ,optimization and maintenance.

1997-2001: **Chemist/Chromatography Systems Manager**
Northeast Analytical, Inc.
301 Nott Street/2190 Technology Drive
Schenectady, New York 12305

Performs High Resolution PCB congener analysis, data processing and reporting for a variety of matrices,. Responsible for Laboratory Chromatography Database System management. Duties include system configuration, optimization and maintenance.

1993-1997: **Chemist/Silicone Study Manager**
Northeast Analytical, Inc.
301 Nott Street
Schenectady, New York 12305

Responsible for analysis of Polydimethylsiloxane and Dimethylsilanediol in various sample matrices using ICP-SEP/ICP-HPLC. Duties in this field include scheduling sample preparation and analysis, method development, data evaluation and processing, and instrument maintenance and troubleshooting. Duties in other areas include High Resolution PCB congener analysis, data processing, and chromatography workstation optimization for congener specific PCB analysis.

1991-1993: **Chemist**
Northeast Analytical, Inc.
301 Nott Street
Schenectady, New York 12305

Responsibilities included extraction and purification of diverse sample matrices for High Resolution PCB analysis. Data processing for PCB screens on Megabore and 8080 PCB analysis. Sample extract disposal and archival. Performed analysis for metals by FLAA and GFAA.

1989-1991: **Stallion Manager**
Highcliff Farm
Division of Tri-Noble Stable
Delanson, New York

Provided and maintained high quality care for thoroughbred breeding stallions and surroundings. Assisted with surgeries, semen evaluation, transtrachea wash, plasma transfusion, vaccination, x-rays, and administered medication.

1986-1989: **Broodmare Manager**
Schoenborn Brothers Farm
Climax, New York

Responsibilities included organization of daily work schedule, mare and foal care, sales preparation, and assistance in veterinarian reproductive work.

INGA C. HOTALING: CHEMIST/GC SECTION SUPERVISOR

1986: **Chemical Laboratory Assistant**
Smith & Smith Environmental Laboratory
Sierra Vista, Arizona

Initiated GC procedure for testing of herbicides in soil and sludges. Completed bacteriological and chemical water analysis. Other duties included water sample collection and preparation.

1983-1985: **Chemical Laboratory Assistant**
National Agricultural
Research & Development Institute
Augustenberg, Germany

Planned and carried out analytical procedures in connection with several research grants which included studies of heavy metals in sewage sludge and their effect in agriculture. Uptake of heavy metals by crops in relation to their concentration in the soil solution. Determination of pesticides and PCBs in municipal waste waters and the uptake of strontium-90 in agricultural crops in connection to heavy metal content and soil type.

EDUCATION:

1983: Karl-Engler School
National Agricultural
Research & Development Institute
Augustenberg, Germany

PUBLICATIONS:

Contributing editor to *Guide to Environmental Analytical Methods* 4th ed. A summary of Quality Assurance requirements and other pertinent information for select analytical methodologies. Published by Genium Publishing Corp. Schenectady, NY, 1998.

THOMAS SAMUEL: HIGH RESOLUTION PCB CONGENER ANALYST

PROFESSIONAL EXPERIENCE:

December 2001 – Present: **High Resolution PCB Congener Analyst**
Northeast Analytical
2190 Technology Drive
Schenectady, NY 12308

Responsible for high resolution PCB congener analysis of environmental samples of varying matrices, including water, soil and tissue. Analysis is by two specialized types of analysis known as CQCS, or "Comprehensive Quantitative Congener Specific Analysis," and "Congener Specific Green Bay." Involved in organics analysis; data interpretation; computer assisted chromatographic review and editing. This position requires the analyst to edit, review and package final reports; archive sample extracts and maintain computer files.

THOMAS SAMUEL: HIGH RESOLUTION PCB CONGENER ANALYST

June 2001 – December 2001: Extraction Supervisor

Northeast Analytical
2190 Technology Drive
Schenectady, NY 12308

Supervisor of environmental extractions for Northeast Analytical, Inc.; supervises and manages the extraction technicians involved in the extraction of soil, sediment, tissue and water samples for PCB, pesticides, herbicides and semi-volatile analysis. Also involved in the implementation of solid phase extraction to Northeast Analytical. Currently conducting research into the use of HPLC and GC for the elucidation of co-planar PCB compounds.

November 2000 – June 2001: Regional Manager – Rochester, NY

Upstate Laboratories, Inc.
88 Craig Street
Rochester, NY 14611

Managed the Rochester, New York office of Upstate Laboratories, Inc. of Syracuse, New York. Responsible for the sales and field operations in the Rochester area. Maintained a customer base of approximately sixty clients, as well as participating in many of the field sampling operations.

August 1999 – November 2000: Laboratory Manager

Advanced Environmental Services, Inc.
2186 Liberty Drive
Niagara Falls, NY 14304

Employed in the field of environmental chemistry. Supervised and managed laboratory staff in the analysis of environmental samples for PCB, oil and grease, pesticides, herbicides, semi-volatile, non-volatile and volatile organic compounds, inorganic. Managed the daily functions of the laboratory as well as the field operations staff. Handled laboratory staffing as well as instruction of new analysts on laboratory safety and procedures. Responsible for the review of data and maintaining the laboratory's QA/QC programs. Knowledge of GC, GC/MS (HP, Varian), ICP-OES (Perkin Elmer) instrumentation. Maintenance capability of a Hewlett Packard GC, GC/MSD and a Perkin Elmer ICP-OES.

EDUCATION:

August 1995 – December 1998: University of Western Ontario
London, Ontario, Canada

Continuing studies in Immunology, Genetics and Biochemistry towards a Masters of Science degree. Degree not completed.

April 1990 – October 1994: BS Chemistry
Brock University
St. Catharines, Ontario, Canada

PROFESSIONAL AFFILIATIONS:

American Chemical Society – Environmental Chemistry Division

ANTHONY J. MAIELLO: GC ANALYST -PCB SECTION

PROFESSIONAL EXPERIENCE:

1997-Present: **GC Analyst -Organics Section**
Northeast Analytical, Inc.
301 Nott Street/ 2190 Technology Drive
Schenectady, New York 12305

1990-1997: **Senior Chemist**
Friend Laboratory, Inc.
Environmental Laboratory Services
Waverly, New York

Senior chemist in the Inorganic Chemistry Section. Responsible for all Wet Chemical Miscellaneous Testing and Instruments Testing on Pharmaceuticals. Performed EPA and Standard Methods Testing on Drinking Water, Waste Water, and Soils for chemical species requested. Installed Technicon TM Autochemistry Systems for Phenols, Cynaide, and Phosphates with Computer Data Acquisition. Set up system and performed EPA 531.1 for Carbamate Pesticides and EPA 547 Glyphosate in Drinking water by HPLC. Promoted to Manager of Wet Chemistry Department on 6/93.

1987-1990: **Staff Chemist**
Manpower Technical Services
At Imaging and Sensing Technology Corp.
Horseheads, NY
& New York State Electric and Gas
Binghamton, NY

A Technical Services Laboratory:

Worked on FT-IR of organic materials used in manufacturing; Emission Spectroscopy of metals and organic materials; GC analysis of waste water for volatile organics, ICP analysis of metals in waste water, Impurities in alloys and quantification of major elements in alloys.

NYSEG- Environmental Laboratory:

Prepared samples for semi-volatiles analysis. Prepared and analyzed samples for GC analysis for pesticides in water. Analyzed anions by ion Chromatography.

1981-1987 Norwich-Eaton Pharmaceuticals Inc. Staff Scientist
Norwich, NY

Began as Research Scientist II in the Analytical Services Section. Worked with experimental dosage forms, bulk drugs, and special projects as assigned. Consultant for medical device testing programs. Modified existing methods through an evaluation program; adapted methods to new dosages forms or to competitor's products. Promoted to RS III (Staff Scientist) 5/85. Reviewed and witnessed data generated by technicians. Maintained compliance with GLP and FDA guidelines.

ANTHONY J. MAIELLO: GC ANALYST -PCB SECTION

1976-1980

QA Analytical Chemist
USCI Div. of C.R. Bard Inc.
(Medical Device Manufacturer)
Glens Falls, NY

Worked as chemist and supervisor of a small industrial QA laboratory. Worked on chemical and physical test methods. Responsible for developing testing and specifications for raw materials, in-process mixes, and finished products.

1969-1976

QC Chemist
Norwich-Eaton Pharmaceuticals
Norwich, NY

Started as Jr. Chemist working with wet chemical and instrumental techniques on raw materials vs. USP/NF compendia and in-house specifications. Promoted to Control Chemist 8/73 and assumed responsibility for all GC testing for the QC laboratory. Assumed responsibility for calibration and maintenance of QC lab instruments in 1974.

CERTIFICATIONS AND CONTINUING STUDIES:

Gas Chromatography: Sadtler Research Laboratories, Philadelphia, PA
Liquid Chromatography: Waters Associates, Milford, MA.
HPLC Updates and Advances: Dr. Lloyd R. Snyder, LC Resource Inc. (in-house course), San Jose, CA.
Thermoanalytical Methods: Center for Professional Advancement, East Brunswick, N.J.
Quality Assurance Principles: Rensselaer Polytechnic Institute, Troy, N.Y.

PROFESSIONAL AFFILIATIONS:

Member: The American Chemical Society
American Chemical Society Short Course in Interpretation of Mass Spectra

JOHN P. NICPON: INORGANICS LABORATORY MANAGER

PROFESSIONAL EXPERIENCE:

2001-PRESENT: Inorganics Lab Manager

Northeast Analytical, Inc.

2190 Technology Drive

Schenectady, New York 12308

Inorganics Lab Manager of Northeast Analytical, Inc.; supervise and manager laboratory staff in the chemical analysis of various environmental samples for metal analysis by ICP, GFAA and CVA; amend and implement analytical methods and procedures that are currently being used; responsible for the review of data analyzed by the Inorganic department; maintain laboratory certification programs; maintain and instruct laboratory personnel on laboratory instruments; responsible for the Ward packaging system.

1985-2001: Quality Control Manager

Ames Goldsmith Corp.

21 Roger Street

Glens Falls, New York 12801

JOHN P. NICPON: INORGANICS LABORATORY MANAGER

Experience in working in a manufacturing environment in which I developed or enhanced process controls and laboratory analysis. Customer support and interaction was a critical role in my daily responsibilities. My responsibilities include maintenance and repair of analytical equipment and process control equipment. I was responsible for the purchasing and daily management of an analytical laboratory, with my major responsibility for process control and final product analysis. I was responsible for Quality Training, along with Process and

Auditor training in addition to regularly scheduled training sessions at my former position. My responsibility also included the management of the ISO 9002 quality system in which I have performed a significant role in its implementation and continuation of the quality system in which the company had achieved. I was responsible for the organization and management of data for statistical analysis and reporting trends analysis for product lines. I have interacted with state and local regulators on environmental requirements and management.

EDUCATION

1981: B.S. Chemistry

State University of New York at Albany

Professional Affiliation:

American Society for Quality Control

PUBLICATIONS:

J.P. Nicpon and S. Schmidt; "The Determination of Impurities in Silver Nitrate at PPB Level". Presented before the International Precious Metals Institute Proceedings, San Francisco, California, June 1997.

MICHAEL A. BERGMANN: LABORATORY MANAGER

PROFESSIONAL EXPERIENCE:

July 2001 to present: Northeast Analytical, Inc.
2190 Technology Drive
Schenectady, NY 12308

Laboratory Manager of Northeast Analytical, Inc.: Responsibilities include the supervision and management of laboratory staff and supervisors in the organic and inorganic departments, project management, analysis, data review and lab monitoring for QA/QC compliance.

January 2001 to July 2001 **National Renewable Energy Laboratory**
(contract position) **1617 Cole Blvd.**
 Golden, CO 80401

Engineering Tech 5: Responsible for the collection, preparation, analysis, data interpretation and reporting of low level ambient air samples in support of research conducted at the NREL facility. Additional responsibilities included; Analytical instrument setup, configuration, maintenance, method setup and validation for multiple gas chromatographs, HPLC and GCMS systems.

MICHAEL A. BERGMANN: LABORATORY MANAGER

**May 2000 to
January 2001**

**Dharmacon Research, Inc.
1376 Miners Dr., Unit 101
Lafayette, Colorado**

QA/QC Manager: Responsible for the qualitative and quantitative evaluation and certification of RNA/DNA oligonucleotides produced. Evaluation and implementation of QA/QC and GMP procedures for area. Analytical instrument; setup, configuration and maintenance. Analytical method; setup, validation, data reduction, statistical evaluation and reporting. Evaluation of new technologies and techniques. Additional responsibilities included the operation and maintenance of multiple synthesizers for the organic synthesis of RNA/DNA oligonucleotides up to 68 mer in length with modifications.

**March 1988 to Evergreen Analytical Laboratories, Inc.
September 1999 4036 Youngfield Street
Wheat Ridge, CO 80033**

POSITIONS HELD:

Apr. 92 – Sept. 99 Department Manager – General Chemistry, HPLC / IC and Organic Sample Preparation.
Mar. 89 – Apr. 92 Supervisor – General Chemistry, HPLC / IC, Inorganic and Organic Sample Preparation.
Mar. 88 – Mar. 89 Chemist – IC / HPLC / GC / GCMS / AA / GFAA / FTIR and General Chemistry.
Mar. 89 – Sept. 99 Hazardous Waste Manager.

Laboratory Department Manager/Chemist of Evergreen Analytical Laboratories, Inc.: Responsibilities included the supervision and management of laboratory staff and supervisors in the general chemistry, liquid chromatography, organic and inorganic sample preparation departments. Additional responsibilities included; project management, analysis, data review and lab monitoring for QA/QC compliance.

**October 1984 to Industrial Laboratories, Inc.
September 1987 Denver, Colorado**

Laboratory Technician / Assistant Chemist: Responsibilities included the quantitative and qualitative analysis of raw and finished food products, tallow, oils and environmental samples submitted from a variety of industries using AOAC, AACC, AOCS, ASTM and EPA methodologies.

**May 1983 to Henningsen Foods, Inc.
August 1984 Omaha, Nebraska**

Laboratory Technician: Responsibilities included the quantitative and qualitative analysis of dehydrated food, tallow, oil and rendered fat by AOAC and AOCS methodologies for worldwide distribution.

**April 1981 to Witco Chemical Corporation
May 1983 Southwest Petro-Chem Division
Omaha, Nebraska**

MICHAEL A. BERGMANN: LABORATORY MANAGER

Laboratory Technician: Responsible for the analysis of blended motor oils, grease, antifreeze and plastic containers by using ASTM methods.

EDUCATION:

College University of Nebraska – Omaha, NE. General Studies 1978 / 79

Continuing Education Red Rocks Community College – Lakewood, CO. General Chemistry
1994

JAMES J. NOLAN: NETWORK ADMINISTRATOR

PROFESSIONAL EXPERIENCE:

Feb , 1998 – Present

Network Administrator

Northeast Analytical, Inc.
301 Nott Street/2190 Technology Drive
Schenectady, NY 12305

Responsible for the day to day operations of NEA's computer network. Designed and installed current 100-base-T network. Trains and assists staff with computer operations. Develops programs to assist in generation of data summary reports.

March, 1996 – Feb., 1998

Multinet Technologies

18 Computer Drive W
Albany, NY

Worked with a customer base of 200 plus companies. Phone support with software and hardware issues. Installed and trained customers on new equipment and software.

Oct 1993 – March 1996

PcHelper, Inc.

Hinsdale, MA

Worked with a customer base of 200 plus companies. Phone support with software and hardware issues. Installed and trained customers on new equipment and software.

1984 – 1993

Advanced Business Systems

Albany, NY

Installed and supported Point of Sale systems, both PC based and register based. Trained customers in the use of systems. Provided telephone and on site support and repair.

Education

Hudson Valley CC / SUNY Albany 1979 - 1983

Major : Computer Science

Minor : Chemistry

THOMAS E. HEROLD JR.: NON-VOLATILE ORGANICS EXTRACTION SUPERVISOR

PROFESSIONAL EXPERIENCE:

2001-Present: NON-VOLATILE ORGANICS EXTRACTION SUPERVISOR

Northeast Analytical, Inc.
2190 Technology Drive
Schenectady, New York 12308

Supervisor of environmental extractions trains, supervises and manages the extraction technicians involved in the extraction of soil, sediment, tissue and water samples for PCB, pesticides, herbicides and semi-volatile analysis. Organize sample loads and according to turn around times. Keep track of sample hold times. Coordinate with analytical group to ensure that samples are extracted to specifications.

2000-2001: NON-VOLATILE ORGANICS EXTRACTION SUPERVISOR

Northeast Analytical, Inc.
2190 Technology Drive
Schenectady, New York 12308

Performed extraction of soil, sediment, tissue, and water samples for PCB, pesticides, herbicides and semi-volatile analysis.

1997-1999: SALESMAN

Herold's Motor Car
819a Grooms Road
Rexford, New York 12148

Assisted in running family owned business by purchasing cars and selling cars to the public.

EDUCATION:

1999: A. S. Science
Environmental Engineering Sciences
Hudson Valley Community College
Troy, New York

RENA POWELL: OFFICE MANAGER/LIMS SUPPORT

PROFESSIONAL EXPERIENCE:

2001-Present: OFFICE MANAGER/LIMS DATABASE MANAGER

Northeast Analytical, Inc.
2190 Technology Drive
Schenectady, New York 12308

Responsible for front office management, coordination of duties for projects and supervision of secretary/receptionist. Also responsible for management the LIMS database, adding or updating analyses as necessary. Create new reports for Certificates of Analysis and maintain already created reports in an Access database. Occasional data packaging, including metals packaging using EDRWin

RENA POWELL: OFFICE MANAGER/LIMS SUPPORT

2000-2001: SUPERVISOR/DATA PACKAGE PROCESSOR

Northeast Analytical, Inc.
2190 Technology Drive
Schenectady, New York 12308

Responsible for supervision of secretary/receptionist. Maintained the LIMS database, adding or updating analyses as necessary and maintain the reporting end of the database. E-mail electronic data and prepare data packages for various clients including various analyses.

1999-2000: SECRETARY/RECEPTIONIST

Northeast Analytical, Inc.
2190 Technology Drive
Schenectady, New York 12308

Answer phones, type quotes and other miscellaneous letters, prepare mail, maintain filing system, key enter data into the LIMS database for creation of Certificates of Analysis, enter QC data, and prepare electronic file, review, and e-mail electronic data to clients.

1998-1999: SENIOR ACCOUNTING CLERK

Golub Corporation
501 Duanesburg Road
Schenectady, New York 12306

Prepare billing by entering data into a customized bottle redemption billing software package, print out and mail bills to clients, key ledger entries, generate payments to vendors within periodic deadlines, as well as perform system and vendor research and maintenance.

1986-1998: ACCOUNTING CLERK III

Golub Corporation
501 Duanesburg Road
Schenectady, New York 12306

Prepare receivables, receivables for a chain of thirty pharmacies for key entry on the pharmacy software script by script, processed 9-mm payment tapes, and coordinate assistance with keying from other associates. Also prepared ledger entries and performed detailed analysis periodically.

EDUCATION:

1999: **A.A.S. Microcomputer Technology**
State University of New York at Cobleskill
Cobleskill, New York 12043

2001 - 2003: **B.T. Computer Technology**
(Date for Concentration in End User Support
completion State University of New York at Cobleskill
Dec, 2003) Cobleskill, New York 12043

APPENDIX D

EMPLOYEE TRAINING LOG

	TRAINEE		APPROVED TO PERFORM		APPROVED TO INSTRUCT	
	INITS.	DATE	TRAINER'S INITS.	DATE	SUPERVISOR'S INITS.	DATE
Coplanar PCB Method						
Reagent Prep						
Silica Gel Activation/Deactivation						
Silica Gel Calibration						
Standards Prep						
Surrogates (PBB) 34/34 TBB & 24/4 DBB						
Calibration Curve Solutions						
Coplanar WHO Mix and NEA Congener Mix						
Spike Solutions						
Column Chromatography						
Silica Gel Clean-Up Columns						
Solvent Reduction						
Turbo Vap						
MicroBlow Down						
Clean-Ups						
Acid Wash						
Mercury Shakes						
HPLC Operation and Maintenance						
Gilson Pump Operation						
Gilson Pump Cleaning and Maintenance						
Waters Autosampler Operation						
Waters Autosampler Cleaning and Maintenance						
Waters UV Detector Operation						
Waters UV Detector Tuning and Calibration						
Waters UV Detector Cleaning and Maintenance						
Maxima HPLC Software						
Coplanar GC Method						
Set-up of GC Method						
Calibration						
Chromatogram Review and Edits						
Millennium Coplanar Reports						
Coplanar GC/MS Method						
Set-up of Method						
Calibration						
Chromatogram Review and Edits Target Ions						
Coplanar Reports						

APPENDIX E

NEA CHAIN OF CUSTODY DOCUMENT

2190 Technology Drive, Schenectady, NY 12308
Telephone (518) 346-4592 Fax (518) 381-6055
www.nealab.com information@nealab.com

LRF # _____
(NEA USE ONLY)

Additional charges incurred for disposal (if hazardous) or archival. Call for details.

S:\ADMIN\COC FORM.XL and May 2, 2003

APPENDIX F

NEA INTERNAL CHAIN OF CUSTODY DOCUMENT

2190 Technology Drive
Schenectady, NY 12308

(FOR SAMPLES ONLY)

NEA ID #:

Storage Location : _____

[illegible]

APPENDIX G

NEA INSTRUMENTATION LISTING

APPENDIX G LABORATORY INSTRUMENTATION

Northeast Analytical, Inc. utilizes state-of-the-art instrumentation. Following is a listing of major instrumentation at NEA:

Analytical Instrumentation:

Organics Analysis (Non-Volatile):

- Agilent 6890N Gas Chromatograph equipped with 7683 Autosampler (100 position tray), micro electron capture detector, Split/Splitless injector. (Purchased 2001)
- Agilent 6890N Gas Chromatograph equipped with 7683 Autosampler (100 position tray), micro electron capture detector, Split/Splitless injector. (Purchased 2001)
- Agilent 6890 Gas Chromatograph equipped with 7683 Autosampler (100 position tray), micro electron capture detector, Split/Splitless injector. (Purchased 2001)
- Varian 3800 Gas Chromatograph equipped with Varian 8400 Autosampler (48 position), Ni-63 electron capture detector universal capillary 1177 Split/Splitless injector. (Purchased 2002)
- Varian 3800 Gas Chromatograph equipped with Varian 8200 Autosampler (48 position), Ni-63 electron capture detector universal capillary 1177 Split/Splitless injector. (Purchased 2002)
- Varian 3800 Gas Chromatograph equipped with Varian 8200 Autosampler (48 position), Ni-63 electron capture detector universal capillary 1177 Split/Splitless injector. (Purchased 2002)
- Varian 3800 Gas Chromatograph equipped with Varian 8200 Autosampler (48 position), Ni-63 electron capture detector universal capillary 1079 injector. (Purchased 1999)
- Varian 3800 Gas Chromatograph equipped with Varian 8200 Autosampler (48 position), Ni-63 electron capture detector universal capillary 1079 injector. (Purchased 1999)
- Varian 3800 Gas Chromatograph equipped with Varian 8200 Autosampler (48 position), Ni-63 electron capture detector universal capillary 1079 injector. (Purchased 1997)
- Varian 3400 Gas Chromatograph equipped with Varian 8100 Autosampler (48 position), with Ni-63 electron capture detector, Split/Splitless injector and universal injector. (Purchased 1991)
- Varian 3400 Gas Chromatograph equipped with Varian 8100 Autosampler (48 position), two Ni-63 electron capture detectors Split/Splitless injector, and universal injector. (Purchased 1990)
- Varian 3400 Gas Chromatograph equipped with Varian 8035 Autosampler (60 position), with FID detector, Split/Splitless injector, and universal injector. (Purchased 1990)
- Varian 3400 Gas Chromatograph equipped with Varian 8100 Autosampler (48 position), with Ni-63 electron capture detector, SPI injector and universal injector. (Purchased 1989)
- Varian 3400 Gas Chromatograph equipped with Varian 8100 Autosampler (48 position), with Ni-63 electron capture detector, SPI injector and universal injector. (Purchased 1989)

Volatile Organics Analysis (VOA):

- Varian Saturn II GC/MS with Varian 3400 GC, NIST Spectral Library (Purchased 1993)
- Tekmar 3000 Purge and Trap Concentrator (Purchased 1996)

- Tekmar Precept II™ 48 position zero headspace robotic Autosampler equipped with magnetic stir bar accessory for closed system volatiles analysis. (SW-846 Method 5035)
- Varian 3400 Gas Chromatograph equipped with PID detector, HECD detector, FID detector, cryogenic controlled oven, and two universal injectors. (Purchased 1989)
- Tekmar LSC 2000 Purge and Trap Unit
- Tekmar ALS 2016, 16 stage Purge and Trap Autosampler
- Varian Star 3400 cx Gas Chromatograph equipped with PID detector, HECD detector, cryogenic controlled oven, and two universal injectors. (Purchased 1995)
- Tekmar 3100 Purge and Trap Concentrator (Purchased 2001)
- Varian Archon 51 position zero headspace robotic autosampler equipped with magnetic stir bar accessory for closed system volatiles analysis (SW-846 Method 5035). (Purchased 2002)
- Varian 3400 Gas Chromatograph equipped with PID detector, HECD detector, cryogenic controlled oven and two universal injectors. (Purchased 2000)
- Tekmar 3000 Purge and Trap concentrator (Purchased 2000)
- Varian Archon 51 position zero headspace robotic autosampler equipped with magnetic stir bar accessory for closed system volatiles analysis (SW-846 Method 5035). (Purchased 2002)

Semi-Volatile Organics Analysis (SVOA):

- Varian Saturn II GC/MS with Varian 3400 GC, NIST Spectral Library, 8100 Autosampler (48 position, low level), Chemical Ionization option. (Purchased 1993)
- Varian Saturn 2000 GC/MS (with MS/MS option) with Varian GC 3800 (Model # 1177 and 1079 injectors) equipped with Varian 8200 Autosampler (48 Positions, low level). (Purchased 1999)

Varian Saturn 2000 GC/MS (with MS/MS option) with Varian GC 3800 (Model # 1177 and 1079 injectors) equipped with Varian 8200 Autosampler (48 Positions, low level). (Purchased 2002)

Inorganics Analysis:

- J-Y24 Sequential Inductively Coupled Plasma (ICP) Atomic Emission Spectrometer with multi-configuration robotic Autosampler. (Purchased 1993)
- Varian SpectrAA-400 Graphite Furnace Atomic Absorption Spectrometer, with Zeeman background correction, Super lamp accessory, and Varian 50 position Autosampler. (Purchased 1989)
- Buck Scientific Model 404, Infrared Wavelength Total Hydrocarbon Analyzer
- Horiba PIR 2000 Total Organic Carbon (TOC) analyzer
- Bausch & Lomb Spectronic 20 visible wavelength spectrometer
- Leeman Hydra AA Mercury Analyzer, cold vapor atomic absorption. (Purchased 2001)

Sample Extraction/Processing Equipment:

- Dionex ASE 200 Accelerated Solvent Extractor with 24 position robotic autosampling for non-volatile organics extractions. (4 Units) (Purchased 1997-1998)
- CEM MDS-2100 automated microwave digestion apparatus for metals samples (Purchased 1993).

- Corning Accelerated One-Step Continuous Liquid/Liquid Extractor apparatus for aqueous non-volatile organic samples.
- Zymark Turbovap™ (3 units), 6-position solvent extract concentration device
- Zymark Turbovap™ LV (1 unit), 24-position solvent extract concentration device
- HEAT Systems™ Ultrasonic Extraction Apparatus
- Horizon SPE-DEX 4790 Series Automated Solid Phase Extractor for non-volatile organics extractions. (Purchased 2001)
- Toxic Characteristic Leaching Procedure (TCLP) and Zero Headspace Extraction (ZHE) Apparatus.
- Soxhlet Extraction Apparatus for non-volatile organics samples (24 positions)

Data Processing Equipment:

- Local Area Network (LAN) including Main Novell Netware™ Fileserver and Millenium 32™ Chromatography Database Server.
- Twenty five network client workstations, stand alone and interfaced to analytical instrumentation.
- Waters Millennium 32 v3.05 Chromatography Workstations for gas chromatograph data management, each equipped with PC, interfaced to Chromatography Database Server.
- Local Area Network Fileserver based tape backup and archival system including 2-5Gbyte 4mm DAT tape drives managed by Seagate Storage Managep™ backup software.
- Bruning Model 912 High Speed X-Y Plotter
- Labwork™ LIMS (Laboratory Information Management System) software by Analytical Automation Specialists Inc. (Purchased 1997)

Miscellaneous Equipment:

- Mettler AG204 Analytical Balance with 0.1 mg resolution equipped with serial interface for online data acquisition to LIMS. (2 units)
- Mettler PJ3600 DeltaRange™ Balance
- Fisher Model 200 Oven
- VWR Model 1370GD Oven
- VWR Model 1370FO Oven
- Thermolyne Model 30400 Furnace (2 units)
- Miele Melabor G7783 Laboratory Dishwasher

APPENDIX H

INSTRUMENT RUN LOGBOOK EXAMPLE

NORTHEAST ANALYTICAL, INC. GC8 INSTRUMENT INJECTION LOG

OPER REV

Method:				Total Purge Vol:		mL		Samp		Reanal (RA) / Reextract (RE) RERUN (R)		INIT				
	Sprg	Client	Client Sample	Max File ID/	Date	Std	Surr	AMT	QC		Not Use	Internal Standard		DATE		
	#		ID	NEA Sample #		#(s)	(uL)	(ml,g)	#		(NU)	BFB	aaa-TFT	Other	Mass(g)	Dilution
1																
2																
3																
4																
5																
6																
7																
8																
9																
10																
11																
12																
13																
14																
15																
16																
17																

#	Std ID	Conc.(ng/uL)	Std Code	QUALITY CONTROL QUALITY ASSURANCE TALLY		INTERNAL STD LIMITS (+/- 3 STD DEV.)		
1:	Surrogate			SPIKES: SAMPLES (	SPIKES , SAMPLES	LOWER		
2:				DUPS: SAMPLES (1:2	DUPS , SAMPLES	UPPER		
3:				ADDITIONAL COMMENTS:				
4:								
5:								
6:								

APPENDIX I

INSTRUMENT MAINTENANCE LOGBOOK EXAMPLE

NORTHEAST ANALYTICAL, INC. GC12 METHOD PARAMETER LOG

Instrument: GC12

AUTO SAMPLER PRECEPTII

PAGE 1

Serial Number: 5919

Date: _____

Column A: DB-VRX(75Mx0.45mm)

Analyst: _____

Detector A: PID Detector B: HALL

VARIAN (800) 926-3000

Reason for Maintenance:		PLEASE LIST ALL PARTS CHANGED		
routine ☐ problem ☐		PART NAME	PART NUMBER	VENDOR
Routine maintenance performed				
clipped column ☐	new column length ☐	1.)		
cleaned PID lamp ☐	changed O trap ☐	2.)		
replaced Ni tube ☐	changed omi indicator ☐	3.)		
backflush teflon xfer line ☐	non-routine maintenance ☐	4.)		
replaced ion resin ☐	other ☐	5.)		
replaced multiplier ☐	other ☐	6.)		
replaced column ☐	other ☐	7.)		
changed helium tank ☐	other ☐	8.)		
changed HC trap ☐	other ☐	9.)		

DESCRIBE PROBLEM OR NON-ROUTINE MAINTENANCE:

Problem resolution:

(Include if and how problem was resolved)

APPENDIX J

NEA ANALYTICAL METHOD LISTING

APPENDIX J SAMPLE EXTRACTION AND PREPARATION METHODS

Organic Extraction Methods:

3510 Separatory Funnel Extraction (Aqueous Non-Volatile Organics)
3520 Continuous Liquid Liquid Extraction (Aqueous Non-Volatile Organics)
3535 Solid Phase Extraction (SPE) (Aqueous Non-Volatile Organics)
3540 Soxhlet Extraction (Solid Samples - Non-Volatile Organics)
3545 Pressurized Fluid Extraction (Solid Samples Non-Volatile Organics) via Dionex® ASE
3550 Ultrasonic Extraction (Solid Samples- Non-Volatile Organics)
3580 Waste Dilution (Liquid Waste Samples- Non Volatile Organics)

Inorganic (metals) Digestion Methods:

3010 Acid Digestion of Aqueous Samples for FLAA or ICP Spectroscopy
3015 Microwave Assisted Acid Digestion of Aqueous samples
3020 Acid Digestion of Aqueous Samples for GFAA Spectroscopy
3050 Acid Digestion of Sediments Sludges and Soils
3051 Microwave Assisted Acid Digestion of Sediments Sludges and Soils

Volatile Organic Extraction Methods:

3585 Waste Dilution for Volatile Organics
5035 Closed System Purge and Trap and Extraction for VOA in soil and waste

ORGANIC ANALYSES: WATER

VOLATILE ORGANIC ANALYSIS BY GC

502.1-Volatile Halogenated Organic Compounds
502.2-Volatile Halogenated and Aromatic Compounds
503.1-Volatile Aromatic & Unsaturated Organic Compounds
501.3-Trihalomethanes
601-Volatile Halogenated Organic Compound
8010-Volatile Halogenated Organic Compounds List by Method 8021
602-Volatile Aromatic Compounds
8020-Volatile Aromatic Compounds list by Method 8021
8021-Volatile Halogenated & Aromatic Organic Compounds
8021-STARs-New York State DEC STARs List

VOLATILE ORGANIC ANALYSIS BY GC/MS

524.2-Volatile Organics by Capillary Column
624-Purgeable Organics
8240-Purgeable Organics list by Method 8260
8260-Purgeable Organics by Capillary Column CLP Analyte list
8260- Additional Charge for 10 Tentatively Identified Compounds (TICs)

SEMI-VOLATILE ORGANIC ANALYSIS BY GC/MS

525-Semi-Volatile Organic Compounds
625-Base/Neutral & Acid Extractables Analyte List (no Pesticides or PCBs)

ORGANIC ANALYSES: WATER

SEMI-VOLATILE ORGANIC ANALYSIS BY GC/MS

625-Base/Neutral Only Analyte List (no Pesticides or PCBs)

625-Acid Extractables Only Analyte List

PAH by Method 8270

8270-Base/Neutral & Acid Extraction CLP Analyte List

8270-Base/Neutral Only CLP Analyte List

8270-Acid Extractables Only CLP Analyte List

8270-Stars NYS DEC Stars List

8270-Additional Charge for 20 TICs

ORGANICS BY GC

608-Pesticides & PCBs

608-PCBs

608-Pesticides

8151-Herbicides(2,4-D and 2,4,5-TP)

8081-Pesticides

8082-PCBs by Aroclor

8082-PCBs by Congener Specific

PETROLEUM IDENTIFICATION

8015 GRO-Total Petroleum Hydrocarbons as Gasoline

8015 DRO-Total Petroleum Hydrocarbons as Diesel

MA DEP VPH-Volatile Petroleum Hydrocarbons

MA DEP EPH-Extractable Petroleum Hydrocarbons

1664-Oil and Grease (Hexane Extractables)

NYS DOH 310-13-Petroleum Identification Quantification

NYS DOH 310-14-Petroleum Identification

418.1-TPH Total Petroleum Hydrocarbons

MISCELLANEOUS CHEMICAL ANALYSIS

415.2-TOC-Total Organic Carbon

415.1-POC-Particulate Organic Carbon

150.1-pH

Reactive Cyanide Method 7.3.3

Reactive Sulfide Method 7.3.4

Reactivity both Cyanide & Sulfide Method 7.3

1010-Flashpoint EPA Method 1010

Hardness EPA Method 200.7 for ICP Calcium and Magnesium ..

160.1-Total Dissolved Solids

160.2-Total Suspended Solids

160.3-Total Volatile Solids

160.4-Total Solids

ORGANIC ANALYSES: SOILS AND SOLIDS

VOLATILE ORGANICS ANALYSIS BY GC AND GC/MS

8010-Volatile Halogenated Organic Compounds List by Method 8021
8020-Volatile Aromatic Organic Compounds List by Method 8021
8021-Volatile Halogenated & Aromatic Organic Compounds
8021-STARs-New York State DEC STARs List
8260-Volatile Organic Compounds CLP Analyte List
8260-TIC
5035-Closed-System Purge-and-Trap and Extraction for Volatile Organics in Soil and Waste Samples

SEMI-VOLATILE ORGANIC ANALYSIS BY GC/MS

8270 Base Neutral and Acid Extractables CLP Analyte List
8270 Base Neutrals Only CLP Analyte List
8270 Acid Extractable Only CLP Analyte List
8270 STARs
8100-PAH by Method 8270
8270-20 TIC

ORGANICS BY GC

8082-PCBs by Aroclor
8082-PCBs by Congener Specific
8081-Pesticides
8082-PCBs in Oils
8082-PCBs in Wipes
8151-Herbicides(2,4-D and 2,4,5-TP)
PCB Wipe Kits (4oz Jar, Gauze, Hexane, and Template)

PETROLEUM IDENTIFICATION

8015 GRO-Total Petroleum Hydrocarbons as Gasoline
8015 DRO-Total Petroleum Hydrocarbons as Diesel
MA VPH-Volatile Petroleum Hydrocarbons
MA DEP EPH-Extractable Petroleum Hydrocarbons
9071A-Oil and Grease
NYS DOH 310-13-Petroleum Identification Quantification
NYS DOH 310-14-Petroleum Identification
418.1-TPH Total Petroleum Hydrocarbons
TOC-Total Organic Carbon by Lloyd Kahn Method

MISCELLANEOUS CHEMICAL ANALYSIS

9045-pH
9095A-Paint Filter Test
Reactive Cyanide Method 7.3.3
Reactive Sulfide Method 7.3.4
Reactivity both Cyanide & Sulfide Method 7.3
1010-Ignitability (Flashpoint)

ORGANIC ANALYSES: PCBs in Air

Samples

TO-4 PUF Filter Set-up*

TO-4 PUF Filter Set-up and Analysis by Method 8082

NIOSH 5503-Florisil Cartridge by Method 8082

METALS ANALYSIS

INDUCTIVELY COUPLED PLASMA ATOMIC EMISSION SPECTROSCOPY (ICP)

The following elements are available by ICP

Aluminum	Calcium	Lead	Selenium	Tin
Antimony	Cadmium	Magnesium	Silicon	Titanium
Arsenic	Chromium	Manganese	Silver	Vanadium
Barium	Cobalt	Molybdenum	Sodium	Zinc
Beryllium	Copper	Nickel	Strontium	Platinum
Boron	Iron	Potassium	Thallium	

ATOMIC ABSORPTION (AA)

The following elements are available by Atomic Absorption (AA)

Aluminum	Chromium	Lead	Potassium	Zinc
Barium	Cobalt	Magnesium		Silver
Cadmium	Copper	Manganese		Sodium
Calcium	Iron	Nickel		Vanadium

GRAPHITE FURNACE ATOMIC ABSORPTION (GFAA)

The following elements are available by Graphite Furnace (GFAA)

Antimony	Cadmium	Lead	Selenium	Vanadium
Arsenic	Chromium	Manganese	Silver	
Beryllium	Copper	Nickel	Thallium	

Sample Digestion/Preparation by Methods 3015 (Water) and 3051 (Solids)

METALS ANALYSIS

MERCURY

COLD VAPOR ATOMIC ABSORPTION (CVAA)

The following elements are available by Cold Vapor AA (CVAA)

CHROMIUM, HEXAVALENT

Hexavalent Chromium, dissolved by Colorimetric Method (Diphenyl Carbazide) Method SM 18 3500-CrD

REGULATORY GROUPS

The following Regulatory Metals analysis are available as a group (Which includes Digestion):

ICP-Metals Scan (40 CFR Part 136, App C) (25 elements)

Appendix IX (24 Elements)

TCL-Target Compound List (23 Elements)

PPL-Priority Pollutant List (13 Elements)

REGULATORY GROUPS

RCRA-Appendix IX List (17 Elements)

NPDES List (23 Elements)

RCRA Hazardous Waste List (8 Elements)

Dissolved Metals Filtration

RCRA WASTE CHARACTERIZATION (TCLP)

TOXICITY CHARACTERISTIC LEACHING PROCEDURE

40 CFR 261.24 / SW846 Method 1311

EXTRACTIONS

1311-TCLP Extraction Volatiles (ZHE)

1311-TCLP Extraction Semi-Volatiles and Metals

ANALYSIS (DOES NOT INCLUDE EXTRACTION)

TCLP-Metals (8 RCRA) List (Includes Digestion)

TCLP-Volatiles (8260) List

TCLP-Semi-Volatiles (8270) List

TCLP-Herbicides (8151) List

TCLP-Pesticides (8081) List

9045-Corrosivity-pH

7.3-Reactivity

1010-Ignitability

TCLP 8021 Stars

TCLP 8270 Stars

TCLP Analysis-Metals, VOC's, Semi-Voc's (Includes TCLP Extractions)

TCLP Analysis-Metals, VOC's, Semi-Voc's, Herbicides and Pesticides(Includes TCLP Extractions)

CONGENER SPECIFIC PCB ANALYSIS

PCB-Soil/Sediment (Green Bay Mass Balance Method)

PCB-Oil/Wipe (Green Bay Mass Balance Method)

PCB-Water (Green Bay Mass Balance Method)

PCB-Biological/Tissue (Green Bay Mass Balance Method)

PCB-Soil/Sediment (8082 Comprehensive Method)

PCB-Oil/Wipe (8082 Comprehensive Method)

PCB-Water (8082 Comprehensive Method)

PCB-Biological/Tissue (8082 Comprehensive Method)

CONGENER SPECIFIC PCB ANALYSIS

PCB-Soil/Sediment (8082 NOAA Congener List)
PCB-Oil/Wipe (8082 NOAA Congener List)
PCB-Water (8082 NOAA Congener List)
PCB-Biological/Tissue (8082 NOAA Congener List)

PCB-Soil/Sediment (8082 WHO Congener List)
PCB-Biological/Tissue (8082 WHO Congener List)
PCB-Soil/Sediment (8082 USACE Congener List)
PCB-Oil/Wipe (8082 USACE Congener List)
PCB-Water (8082 USACE Congener List)
PCB-Biological/Tissue (8082 USACE Congener List)

PCB-Soil/Sediment (8082 Method Congener List)
PCB-Oil/Wipe (8082 Method Congener List)
PCB-Water (8082 Method Congener List)
PCB-Biological/Tissue (8082 Method Congener List)

NEA Level 2 Data Summary Deliverables(CLP Equivalent)

Congener lists

Green Bay Mass Balance Congener List:

Please contact the Lab for details and congeners reported by this method. This method relies on the use of Aroclor standards to report approximately 165 PCB congeners.

8082 Comprehensive Method Congener List:

This method reports all 209 PCB congeners, utilizing a mathematical deconvolution for PCB congeners that co-elute during GC analysis.

8082 WHO Coplanar Method Congener List:

This method reports all 12 Congeners listed by IUPAC Congener Number: 81, 77, 123, 118, 114, 105, 126, 167, 156, 157, 169, and 189 utilizing hypercarb fractionalization with ECD detection.

NOAA Congener List by National Status and Trends Programs listed by IUPAC Congener Number:
8, 18, 28, 44, 52, 66, 77, 101, 105, 118, 126, 128, 138, 153, 170, 180, 187, 195, 206, & 209

USACE Congener List by US Army Corps of Engineers listed by IUPAC Congener Number:
8, 18, 28, 44, 49, 52, 66, 87, 101, 105, 118, 128, 138, 153, 170, 180, 183, 184, 187, 195, 206, & 209

Method 8082 Congener List by SW-846, Update III, 12/96 listed by IUPAC Congener Number:
1, 5, 18, 31, 44, 52, 66, 87, 101, 110, 138, 141, 151, 153, 170, 180, 183, 187, & 206

IUPAC Congener Number: The IUPAC Congener Number is a consecutive number system from 1 to 209 that labels all 209 possible PCB Congeners. The labeling sequence conforms to the International Union of Pure and Applied Chemistry (IUPAC) rules for nomenclature of organic chemistry.

REFERENCES:

Green Bay Mass Balance Congener List: Quality Assurance Plan, Green Bay Mass Balance Study, I. PCBs and Dieldrin, USEPA Great Lakes National Program Office, Final Draft, D.L. Swackhamer, December 11, 1987.
Frame, George M.; Cochran, Jack W.; Bowadt, Soren S.; "Complete PCB Congener Distributions for 17 Aroclor mixtures determined by 3 HRGC systems optimized for Comprehensive Quantitative Congener Specific Analysis," (1996), J. High Resolution Chromatography Volume 19: 657-668.

Frame, George M., "A Collaborative Study of 209 PCB Congeners and 6 Aroclors on 20 Different HRGC Columns 1. Retention and Coelution database," (1995), Fresenius J., Anal. Chem., 1141: 1-13.

NOAA Congener List: NOAA Technical Memorandum NOS ORCA 71, National Status and Trends Program for Marine Environmental Quality; Sampling and Analytical Methods of the National Status and Trends Program, National Benthic Surveillance and Mussel Watch Projects 1984-1992; Volume 1 Overview and Summary of Methods; G.G. Lauenstein and A.Y. Cantillo (Editors); Silver Spring, Maryland; July 1993.

USACE Congener List: Evaluation of Dredged Material Proposed for Ocean Disposal (Testing Manual) EPA/USACE, 1991. Also: USACE New York District, EPA Region II Guidance for Performing Tests on Dredges Material Proposed for Ocean Disposal, 1992.

Method 8082 Congener List: Method 8082, Polychlorinated Biphenyls (PCBs) by Gas Chromatography. Test Methods for Evaluating Solid Waste Physical/Chemical Methods (SW-846), Third Edition, Final Update III, Dec 1996.

BIOLOGICAL ANALYSIS and PREPARATION

PREPARATION

Metals Digestion/Preparation

Fish Filleting and Grinding (12" and under)

Fish Filleting and Grinding (Over 12")

Grinding of Animals*

* NEA has experience with preparing many different types of animal including: aquatic animals(Bass, Bullhead, Perch, Sunfish, Striped Bass, Mulletts, Shad, Blue Catfish, American eel, Snapping turtles, minnows, frogs, mussels, clams), earthworms, shrews, moles, ground squirrels, and mice.

ANALYSIS

% Lipid Analysis

8082-PCBs by Aroclor

8081-Pesticides

8150-Herbicides (2,4-D and 2,4,5-TP)

8260-Volatiles CLP List

8270-Base Neutral and Acid Extractables CLP List

8270-Base Neutrals Only CLP List

Metals Priority Pollutant List

DATA DELIVERABLES

1. Standard - Chain of Custody documents, analytical reports, including methodology used, minimum detection limits, analytical results, customer identification number, NEA identification number, date collected and date analyzed..
2. NEA Level I - Deliverables include NEA Standard Deliverables plus the following:
 - Title Page
 - Project Narrative
 - (Organics/Inorganics)
 - Spiked Sample/Duplicate Sample Summary
 - Method Blank Summary
 - Chromatograms
3. NEA Level II- Deliverables include NEA Standard Deliverables plus the following:
 - (Organics) (Inorganics)
 - Surrogate Recovery Summary Initial and Continuing Cal. Summary
 - Spiked Sample Summary Spike Sample Summary
 - Method Blank Summary Duplicate Summary
 - Breakdown Check (Pesticides) Lab Control Sample Summary
 - Instrument Tune Summary (GC/MS) Instrument Detection Limit Summary
 - Initial Calibration Summary Correction Factor Summary (ICP)
 - Continuing Calibration Summary Linear Range (ICP)
 - Sample Analytical Sequence Sample Run Log
 - Internal Standard Area Summary (GC/MS) Raw Instrument Data
 - Raw Instrument Data
 - Chromatograms
4. NEA Level III- US-EPA CLP or NYS-DEC ASP Equivalent Deliverables.

DATA VALIDATION REVIEW

Northeast Analytical, Inc. can provide data validation for both organics and inorganics using Regional Specific EPA Data Validation Protocol or NYS DEC Data Validation Protocol.

Our Certified Data Validation is recognized by the New York State Department of Environmental Conservation as acceptable to perform organic and inorganic data validation for the Division of Hazardous Waste.

APPENDIX K

CORRECTIVE ACTION REPORT (CAR) EXAMPLE

NORTHEAST ANALYTICAL, INC.
CORRECTIVE ACTION REPORT

REPORT #: _____ (QA Use Only)

DATE: _____

Sample Number(s): _____

Client(s): _____

Sample Matrix: Water [] Soil [] Oil [] Other: _____

Type of Sample(s): QC [] Client [] Other: _____

I. PROBLEM IDENTIFICATION (To be completed immediately by individual discovering problem)

Brief description of problem: (give details, ie: low surrogate recovery 78%, limit 80% etc.)

FORWARD CAR TO RESPONSIBLE PARTIES AND SUPERVISOR UPON COMPLETION OF THIS SECTION

II. PROBLEM INVESTIGATION (To be completed by individual(s) responsible for resolution of the problem)

Probable cause of problem:

Steps taken to investigate problem:

Corrective Action Plan (CAP):

Signature(s) _____

Date: _____

FORWARD CAR TO SUPERVISOR AND Q.A. UPON COMPLETION OF THIS SECTION

III. SUPERVISORY REVIEW (To be completed by supervisor responsible for project/area/function)

Response and CAP review: Acceptable [] Unacceptable []

If unacceptable, preferred course of action:

Corrective actions taken: Verified by: _____
Title: _____

Date: _____

Steps taken to prevent recurrence:

Comments:

Q.A. Review/Signature(s) _____

Date: _____

APPENDIX L

LABORATORY METHOD BLANK FORM

4C-1¹
PCB METHOD BLANK SUMMARY

Northeast Analytical Inc.

ELAP ID No.:

11078

Lab Sample ID :

SDG No. :

Matrix :

SEDIMENT

Lab File ID :

Date Analyzed :

Extraction :

Time Analyzed :

Date Extracted :

Instrument ID :

GC07

GC Column (1) : J&W, NARROWBORE CAPILLARY, DB-1, 30M; ID:0.25mm

NEA Form ID: S:\FORMS\CATB\SOIL_GC_07_010603.XLS

NEA File ID: S:\CERT02\4C-1-1

THIS METHOD BLANK APPLIES TO THE FOLLOWING SAMPLES, MS, MSD, AND MSB

	CLIENT SAMPLE ID	LAB SAMPLE ID	LAB FILE ID	DATE ANALYZED	TIME ANALYZED
01					
02					
03					
04					
05					
06					
07					
08					
09					
10					
11					
12					
13					
14					
15					
16					
17					
18					
19					
20					
21					
22					
23					
24					
25					
26					
27					
28					
29					
30					

¹ Form based upon NYS-DEC Form IV-CLP-PEST FORM IV-CLP-PCB (NEA)

APPENDIX M

LABORATORY SAMPLE DUPLICATE FORM

3F-9
PCB DUPLICATE SAMPLE ANALYSIS SUMMARY

Northeast Analytical Inc.

SDG No.: _____

ELAP ID No.: 11078

DUPLICATE SAMPLE FILE ID: _____

ORIGINAL SAMPLE FILE ID: _____

NEA Form ID: S:\FORMS\CATB\CLP-3F-9.XLS

NEA File ID: S:\FORMS\CATB\CLP-3F9.XLS\3F9

CAS NO.	COMPOUND	SAMPLE CONCENTRATION:		DUPLICATE SAMPLE CONCENTRATION :		RELATIVE % DIFFERENCE*
		(ug/kg)	Q	(ug/kg)	Q	
12674-11-2	Aroclor 1016					
11104-28-2	Aroclor 1221					
11141-16-5	Aroclor 1232					
53469-21-9	Aroclor 1242					
12672-29-6	Aroclor 1248					
11097-69-1	Aroclor 1254					
11096-82-5	Aroclor 1260					

* RELATIVE PERCENT DIFFERENCE MUST BE LESS THAN 20%

APPENDIX N

LABORATORY MATRIX SPIKE / MATRIX DUPLICATE FORM

3F-1¹
PCB MATRIX SPIKE / MATRIX SPIKE DUPLICATE RECOVERY

Northeast Analytical Inc.

ELAP ID No. :

11078

SDG No.:

0

Matrix Spike NEA ID No. :

M / K

NEA Form ID:

S:\FORMS\CATB\SOIL_GC_07_010603.XLS

NEA File ID:

S:\CERT02\3F1-1-1

COMPOUND	SPIKE ADDED (µg/g)	SAMPLE CONCENTRATION (µg/g)	MS CONCENTRATION (µg/g)	MS % REC #	QC LIMITS ² REC.
Aroclor 1016					70 -130
Aroclor 1221					70 -130
Aroclor 1232					70 -130
Aroclor 1242					70 -130
Aroclor 1248					70 -130
Aroclor 1254					70 -130
Aroclor 1260					70 -130

COMPOUND	SPIKE ADDED (µg/g)	MSD CONCENTRATION (µg/g)	MSD % REC #	% RPD #	QC LIMITS ² RPD REC.
Aroclor 1016					20 70 -130
Aroclor 1221					20 70 -130
Aroclor 1232					20 70 -130
Aroclor 1242					20 70 -130
Aroclor 1248					20 70 -130
Aroclor 1254					20 70 -130
Aroclor 1260					20 70 -130

Column to be used to flag recovery values

* Values outside QC limits

² QC limits based upon laboratory defaults.

RPD : 0 out of 1 outside limits.

Spike Recovery : 0 out of 2 outside limits.

COMMENTS:

APPENDIX O

SYSTEM AUDIT EVALUATION REPORT (SAER)

APPENDIX O: SYSTEM AUDIT EVALUATION REPORT (SAER)

Northeast Analytical, Inc.

Quality Assurance/Quality Control

REPORT #: _____
DATE: _____

System Audit Evaluation

Date of Evaluation: _____ to _____ Analytical Method(s): _____
Period Evaluated: _____ Matrix: _____

System Parameters Evaluated:

(Circle if applicable)

- [1] Instrument maintenance schedules
- [2] Instrument calibration frequency
- [3] QC control sample frequency
- [4] QC method blank frequency
- [5] QC reagent check frequency
- [6] QC control chart/control limit update frequency
- [7] QC sample container check frequency
- [8] Reagent preparation frequency
- [9] Standard preparation frequency
- [10] Sample Chain of Custody completeness
- [11] Glassware/Equipment decontamination procedures
- [12] Other: _____

Synopsis of System Audit:

Corrective Action Report Issued?: [Yes] or [No] Ref. # if yes: _____

Review Signatures:

Date:

Preparation Chemist(s): _____

Instrumental Analyst(s): _____

Section Supervisor: _____

QA Officer: _____

Lab Director: _____

PH 500FORMS EVAL SEVAL_01.WD

NORTHEAST ANALYTICAL, INC

Laboratory Quality Assurance Plan

Document : QAPAO_02.SOP, Revision 01

11-November-1997 page: 1 of 1

APPENDIX P

PERFORMANCE AUDIT REPORT (PAR)

APPENDIX P: PERFORMANCE AUDIT REPORT (PAR)

NORTHEAST ANALYTICAL, INC.
Quality Assurance/Quality Control

REPORT #: _____
DATE: _____

Performance Audit Evaluation

Analytical Method: _____
Sample Matrix: _____
Sample ID Number(s): _____
Date Samples Submitted: _____
Analyst(s): _____

Extraction Logbook Entries Complete ? : 1. Date _____
(OK for acceptable, NO for not acceptable) 2. Sample ID _____
3. Sample Mass/Volume _____
4. Extraction Method _____
5. Analytical Method _____
6. Matrix _____
7. QC Standard Addition _____
(i) Matrix Spike _____
(ii) Surrogate _____
8. Method Blank _____

Comments: _____

Extraction/ Sample Processing Observed ? : [Yes] or [No]
Initials of observer: _____
Date: _____

Deviations from Standard Operating Procedure ? : [Yes] or [No] (Explain if Yes)

Comments: _____

Analyst/Instrument Logbook entries complete ? : [Yes] or [No] (Explain if No)

Comments: _____

Final Data Package complete ? : [Yes] or [No] (Explain if No)

Comments: _____

APPENDIX P: PERFORMANCE AUDIT REPORT (PAR)

Analytical Sequence in order ? [Yes] or [No] (Explain if No)

Comments:

Calibration, Check Standards,
Performance Evaluation Standards
and Retention Times in criteria ?

[Yes] or [No] (Explain if No)

Comments:

Synopsis of Analytical results:

Analyte percent recovery in criteria ? [Yes] or [No]

List outliers below if NO:

ID#	Compound	%Recovery	Limits

Continue on reverse

Matrix Spike percent recovery in criteria ? [Yes] or [No]

List outliers below if NO:

ID#	Compound	%Recovery	Limits

Surrogate percent recovery in criteria? [Yes] or [No]

List outliers below if NO:

ID#	Surrogate	%Recovery	Limits

APPENDIX P: PERFORMANCE AUDIT REPORT (PAR)

Duplicate relative % difference in criteria?: [Yes] or [No]

List outliers below if NO:

ID#	Compound	RPD%	Limits

Replicate relative std. deviation in criteria?: [Yes] or [No]

(At least four replicates for RSD)

List outliers below if NO:

ID#(S)	Compound	RSD%	Limits

Comments:

Corrective Action Report Issued ?:

[Yes] or [No]

Ref. # if yes: _____

Review Signatures:

Date:

Preparation Chemist(s):

Instrumental Analyst(s):

Instrument Supervisor:

QA Officer:

Lab Director:

APPENDIX Q

NYS ELAP CERTIFICATIONS



STATE OF NEW YORK DEPARTMENT OF HEALTH

Wadsworth Center The Governor Nelson A. Rockefeller Empire State Plaza P.O. BOX 509 Albany, New York 12201-0509

Antonia C. Novello, M.D., M.P.H., Dr.P.H.
Commissioner

Dennis P. Whalen
Executive Deputy Commissioner

LAB ID: 11078

March 20, 2003

MR. ROBERT E. WAGNER
NORTHEAST ANALYTICAL INC
2190 TECHNOLOGY DRIVE
SCHENECTADY NY 12308

Certificate Expiration Date: June 16, 2003

Dear Mr. Wagner,

Enclosed are the ELAP and/or NELAP Certificate(s) of Approval issued to your environmental laboratory for the current permit year. The Certificate(s) supersede any previously issued and are in effect through the expiration date listed above. Please carefully examine the Certificate(s) to insure that the category(ies), subcategory(ies), analyte(s) and method(s) for which your laboratory is approved are listed correctly, as well as verifying your laboratory's name, address, lead technical director and identification number.

Pursuant to regulation (Part 55-2 NYCRR), certificates must be posted conspicuously in the laboratory and shall, upon request, be made available to any client of the laboratory. Certificates remain the property of the New York State Department of Health and must be surrendered promptly on demand.

Please note that pursuant to Section 55-2.5(a) NYCRR, any misrepresentation of the analytes or subcategories for which your laboratory is approved may result in suspension, limitation or termination of said certification.

The National Environmental Laboratory Accreditation Conference (NELAC) further defines and limits the use of NELAP accreditation and the NELAP logo.

Please notify the ELAP office of any changes you feel need to be made to your certificate(s). We may be reached via email to elap@health.state.ny.us or by calling (518) 485-5570.

Sincerely,

Joyce Reilly

Administrative Assistant
Environmental Laboratory
Approval Program

NEW YORK STATE DEPARTMENT OF HEALTH
WADSWORTH CENTER
Antonia C. Novello, M.D., M.P.H., Dr.P.H. Commissioner



Expires 12:01 AM April 01, 2003
Issued July 05, 2002

CERTIFICATE OF APPROVAL FOR LABORATORY SERVICE
Issued in accordance with and pursuant to section 502 Public Health Law of New York State

MR. ROBERT E. WAGNER
NORTHEAST ANALYTICAL INC
2190 TECHNOLOGY DRIVE
SCHENECTADY NY 12308 USA

NY Lab Id No: 11078
EPA Lab Code: NY00906

*is hereby APPROVED as an Environmental Laboratory in conformance with the
National Environmental Laboratory Accreditation Conference Standards for the category
ENVIRONMENTAL ANALYSES POTABLE WATER
All approved analytes are listed below:*

Drinking Water Metals I

Arsenic, Total	EPA 200.9
Barium, Total	EPA 200.7
Cadmium, Total	EPA 200.7
Chromium, Total	EPA 200.7
Copper, Total	EPA 200.7
Iron, Total	EPA 200.7
Lead, Total	EPA 200.9
Manganese, Total	EPA 200.7
Mercury, Total	EPA 245.2
Selenium, Total	EPA 200.9
Silver, Total	EPA 200.7
Sodium, Total	EPA 200.7

Drinking Water Metals II

Antimony, Total	EPA 200.9
Beryllium, Total	EPA 200.7
Nickel, Total	EPA 200.7
Thallium, Total	EPA 200.9

Drinking Water Non-Metals

Hydrogen Ion (pH)	EPA 150.1

Drinking Water Trihalomethanes

Bromodichloromethane	EPA 502.2
Bromoform	EPA 502.2
Chloroform	EPA 502.2

Drinking Water Trihalomethanes

Dibromochloromethane	EPA 502.2

Volatile Aromatics

1,2,3-Trichlorobenzene	EPA 502.2
1,2,4-Trichlorobenzene	EPA 502.2
1,2,4-Trimethylbenzene	EPA 502.2
1,2-Dichlorobenzene	EPA 502.2
1,3,5-Trimethylbenzene	EPA 502.2
1,3-Dichlorobenzene	EPA 502.2
1,4-Dichlorobenzene	EPA 502.2
2-Chlorotoluene	EPA 502.2
4-Chlorotoluene	EPA 502.2
Benzene	EPA 502.2
Bromobenzene	EPA 502.2
Chlorobenzene	EPA 502.2
Ethyl benzene	EPA 502.2
Hexachlorobutadiene	EPA 502.2
Isopropylbenzene	EPA 502.2
m-Xylene	EPA 502.2
n-Butylbenzene	EPA 502.2
n-Propylbenzene	EPA 502.2
o-Xylene	EPA 502.2
p-Isopropyltoluene (P-Cymene)	EPA 502.2
p-Xylene	EPA 502.2

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ENVIRONMENTAL ANALYSES POTABLE WATER
All approved analytes are listed below:*

Volatile Aromatics

sec-Butylbenzene	EPA 502.2
Styrene	EPA 502.2
tert-Butylbenzene	EPA 502.2
Toluene	EPA 502.2

Volatile Halocarbons

1,1,1,2-Tetrachloroethane	EPA 502.2
1,1,1-Trichloroethane	EPA 502.2
1,1,2,2-Tetrachloroethane	EPA 502.2
1,1,2-Trichloroethane	EPA 502.2
1,1-Dichloroethane	EPA 502.2
1,1-Dichloroethene	EPA 502.2
1,1-Dichloropropene	EPA 502.2
1,2,3-Trichloropropane	EPA 502.2
1,2-Dichloroethane	EPA 502.2
1,2-Dichloropropane	EPA 502.2
1,3-Dichloropropane	EPA 502.2
2,2-Dichloropropane	EPA 502.2
Bromochloromethane	EPA 502.2
Bromomethane	EPA 502.2
Carbon tetrachloride	EPA 502.2
Chloroethane	EPA 502.2
Chloromethane	EPA 502.2
cis-1,2-Dichloroethene	EPA 502.2

Volatile Halocarbons

cis-1,3-Dichloropropene	EPA 502.2
Dibromomethane	EPA 502.2
Dichlorodifluoromethane	EPA 502.2
Methylene chloride	EPA 502.2
Tetrachloroethene	EPA 502.2
trans-1,2-Dichloroethene	EPA 502.2
trans-1,3-Dichloropropene	EPA 502.2
Trichloroethene	EPA 502.2
Trichlorofluoromethane	EPA 502.2
Vinyl chloride	EPA 502.2

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ENVIRONMENTAL ANALYSES NON POTABLE WATER
All approved analytes are listed below:

Benzidines		Haloethers	
3,3 -dichlorobenzidine	EPA 625	4-Bromophenylphenyl ether	EPA 625
Benzidine	EPA 625	4-Chlorophenylphenyl ether	EPA 625
Chlorinated Hydrocarbon Pesticides		Bis (2-chloroisopropyl) ether	EPA 625
4,4 -DOE	EPA 608	Bis(2-chloroethoxy)methane	EPA 625
4,4 -DDT	EPA 608	Bis(2-chloroethyl)ether	EPA 625
Aldrin	EPA 608	Mineral	
beta-BHC	EPA 608	Calcium Hardness	EPA 200.7
Chlordane Total	EPA 608	Hardness, Total	EPA 200.7
delta-BHC	EPA 608	Nitroaromatics and Isophorone	
Endosulfan II	EPA 608	2,4-Dinitrotoluene	EPA 625
Endrin	EPA 608	2,6-Dinitrotoluene	EPA 625
Heptachlor	EPA 608	Isophorone	EPA 625
Methoxychlor	SM18 6630C	Nitrobenzene	EPA 625
Chlorinated Hydrocarbons		Nitrosoamines	
1,2,4-Trichlorobenzene	EPA 625	N-Nitrosodimethylamine	EPA 625
2-Chloronaphthalene	EPA 625	N-Nitrosodi-n-propylamine	EPA 625
Hexachlorobenzene	EPA 625	N-Nitrosodiphenylamine	EPA 625
Hexachlorobutadiene	EPA 625	Phthalate Esters	
Hexachlorocyclopentadiene	EPA 625	Benzyl butyl phthalate	EPA 625
Hexachloroethane	EPA 625	Bis(2-ethylhexyl) phthalate	EPA 625
Chlorophenoxy Acid Pesticides		Diethyl phthalate	EPA 625
2,4,5-TP (Silvax)	SM18 6640B	Dimethyl phthalate	EPA 625
2,4-D	SM18 6640B		

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ENVIRONMENTAL ANALYSES NON POTABLE WATER
All approved analytes are listed below:

Phthalate Esters		Purgeable Aromatics	
Di-n-butyl phthalate	EPA 625	1,3-Dichlorobenzene	EPA 601
Di-n-octyl phthalate	EPA 625		EPA 624
			EPA 625
Polychlorinated Biphenyls		Benzene	EPA 602
PCB-1260	EPA 608		EPA 624
Polynuclear Aromatics		Chlorobenzene	EPA 601
Benzo(a)anthracene	EPA 625		EPA 624
Benzo(a)pyrene	EPA 625	Ethyl benzene	EPA 602
Benzo(b)fluoranthene	EPA 625		EPA 624
Fluoranthene	EPA 625	Toluene	EPA 602
Indeno(1,2,3-cd)pyrene	EPA 625		EPA 624
Pyrene	EPA 625	Total Xylenes	EPA 602
			EPA 624
Priority Pollutant Phenols		Purgeable Halocarbons	
2,4,5-Trichlorophenol	SW-846 8270C	1,1,1-Trichloroethane	EPA 624
2,4,6-Trichlorophenol	EPA 625	1,1,2,2-Tetrachloroethane	EPA 601
2,4-Dichlorophenol	EPA 625		EPA 624
2,4-Dimethylphenol	EPA 625	1,1-Dichloroethene	EPA 601
2,4-Dinitrophenol	EPA 625		EPA 624
2-Chlorophenol	EPA 625	1,2-Dichloroethane	EPA 601
2-Methyl-4,6-dinitrophenol	EPA 625		EPA 624
2-Nitrophenol	EPA 625	Bromomethane	EPA 601
4-Chloro-3-methylphenol	EPA 625		EPA 624
4-Nitrophenol	EPA 625		
Pentachlorophenol	EPA 625		

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All approved analytes are listed below:*

Purgeable Halocarbons

Carbon tetrachloride	EPA 601
	EPA 624
Chloroethane	EPA 624
Chloroform	EPA 601
	EPA 624
Dibromochloromethane	EPA 601
	EPA 624
Dichlorodifluoromethane	EPA 601
Methylene chloride	EPA 601
	EPA 624
Trichloroethene	EPA 601
	EPA 624
Trichlorofluoromethane	EPA 601
Vinyl chloride	EPA 601
	EPA 624

Residue

Solids, Total	EPA 160.3
Solids, Total Dissolved	EPA 160.1
Solids, Total Suspended	EPA 160.2

Wastewater Metals I

Barium, Total	EPA 200.7
Cadmium, Total	EPA 200.7
	MICROWAVE P/DIGEST

Wastewater Metals I

Calcium, Total	EPA 200.7
Chromium, Total	EPA 200.7
	MICROWAVE P/DIGEST
Copper, Total	EPA 200.7
	MICROWAVE P/DIGEST
Iron, Total	EPA 200.7
	MICROWAVE P/DIGEST
Lead, Total	EPA 200.7
	EPA 200.9
	MICROWAVE P/DIGEST
Magnesium, Total	EPA 200.7
Manganese, Total	EPA 200.7
	MICROWAVE P/DIGEST
Nickel, Total	EPA 200.7
	MICROWAVE P/DIGEST
Potassium, Total	EPA 200.7
Silver, Total	EPA 200.7
Sodium, Total	EPA 200.7

Wastewater Metals II

Aluminum, Total	EPA 200.7
	MICROWAVE P/DIGEST
Antimony, Total	EPA 200.7
	MICROWAVE P/DIGEST

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ENVIRONMENTAL ANALYSES NON POTABLE WATER
All approved analytes are listed below:*

Wastewater Metals II

Arsenic, Total	EPA 200.7
	EPA 200.9
	MICROWAVE P/DIGEST
Beryllium, Total	EPA 200.7
Mercury, Total	EPA 245.2
Selenium, Total	EPA 200.7
	EPA 270.2
	MICROWAVE P/DIGEST
Vanadium, Total	EPA 200.7
Zinc, Total	EPA 200.7
	MICROWAVE P/DIGEST

Wastewater Metals III

Cobalt, Total	EPA 200.7
Molybdenum, Total	EPA 200.7
Thallium, Total	EPA 200.7
	EPA 200.9
Tin, Total	EPA 200.7
Titanium, Total	EPA 200.7

Wastewater Miscellaneous

Boron, Total	EPA 200.7
Hydrogen Ion (pH)	EPA 150.1
Oil & Grease Total Recoverabl	EPA 1664-A
Organic Carbon, Total	EPA 415.1

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ENVIRONMENTAL ANALYSES NON POTABLE WATER
All approved subcategories and/or analytes are listed below:

Chlorinated Hydrocarbon Pesticides

4,4-DDD	EPA 608
alpha-BHC	EPA 608
Dieldrin	EPA 608
Endosulfan I	EPA 608
	SM18 6630C
Endosulfan sulfate	EPA 608
Endrin aldehyde	EPA 608
Heptachlor epoxide	EPA 608
Lindane	EPA 608
Toxaphene	EPA 608

Polychlorinated Biphenyls

PCB-1016	EPA 608
PCB-1221	EPA 608
PCB-1232	EPA 608
PCB-1242	EPA 608
PCB-1248	EPA 608
PCB-1254	EPA 608

Polynuclear Aromatics

Acenaphthene	Method Not Specified
Acenaphthylene	EPA 625
Anthracene	Method Not Specified
Benzo(ghi)perylene	EPA 625
Benzo(k)fluoranthene	EPA 625

Polynuclear Aromatics

Chrysene	EPA 625
Dibenzo(a,h)anthracene	EPA 625
Fluorene	EPA 625
Naphthalene	EPA 625
Phenanthrene	EPA 625

Priority Pollutant Phenols

Phenol	EPA 625

Purgeable Aromatics

1,2-Dichlorobenzene	EPA 624
	EPA 625
1,4-Dichlorobenzene	EPA 601
	EPA 624
	EPA 625

Purgeable Halocarbons

1,1,2-Trichloroethane	EPA 601
	EPA 624
1,1-Dichloroethane	EPA 601
	EPA 624
1,2-Dichloroethene (total)	EPA 601
	EPA 624
1,2-Dichloropropane	EPA 601
	EPA 624
2-Chloroethylvinyl ether	Method Not Specified

Serial No.: 16472

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DOH-3317 (3/97)

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ENVIRONMENTAL ANALYSES NON POTABLE WATER
All approved subcategories and/or analytes are listed below:*

Purgeable Halocarbons

Bromodichloromethane	EPA 601
	EPA 624
Bromoform	EPA 601
	EPA 624
Chloromethane	EPA 601
	EPA 624
cis-1,3-Dichloropropene	EPA 601
	EPA 624
Tetrachloroethene	EPA 601
	EPA 624
trans-1,3-Dichloropropene	EPA 601
	EPA 624

TCLP Additional Compounds

Cresol	SW-846 8270C
Methylethyl ketone (2-butanon)	SW-846 8260B
Pyridine	SW-846 8270C

Wastewater Metals II

Chromium VI	USGS I-1230-85

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ENVIRONMENTAL ANALYSES SOLID AND HAZARDOUS WASTE
All approved analytes are listed below:

Characteristic Testing

E.P. Toxicity	SW-846 1310
Ignitability	SW-846 1010
Reactivity	SW-846 Ch7, Sec. 7.3
TCLP	FED REG 1311

Chlorinated Hydrocarbon Pesticides

4,4-DDD	SW-846 8081A
alpha-BHC	SW-846 8081A
Chlordane Total	SW-846 8081A
Dieldrin	SW-846 8081A
Endosulfan I	SW-846 8081A
Endosulfan sulfate	SW-846 8081A
Endrin aldehyde	SW-846 8081A
Heptachlor epoxide	SW-846 8081A
Lindane	SW-846 8081A

Chlorinated Hydrocarbons

1,2,4-Trichlorobenzene	SW-846 8270C
2-Chloronaphthalene	SW-846 8270C
Hexachlorobenzene	SW-846 8270C
Hexachlorobutadiene	SW-846 8270C
Hexachlorocyclopentadiene	SW-846 8270C
Hexachloroethane	SW-846 8270C

Haloethers

Bis (2-chloroisopropyl) ether	SW-846 8270C

Haloethers

Bis(2-chloroethoxy)methane	SW-846 8270C

Metals I

Barium, Total	SW-846 6010B
Cadmium, Total	SW-846 6010B
Chromium, Total	SW-846 6010B
Lead, Total	SW-846 6010B
Nickel, Total	SW-846 6010B
Silver, Total	SW-846 6010B

Metals II

Antimony, Total	SW-846 6010B
Arsenic, Total	SW-846 6010B
Selenium, Total	SW-846 6010B
	SW-846 7740

Miscellaneous

Hydrogen Ion (pH)	SW-846 9040B
	SW-846 9045C
Lead in Paint	EPA, 1991

Nitroaromatics and Isophorone

2,4-Dinitrotoluene	SW-846 8270C
2,6-Dinitrotoluene	SW-846 8270C
Isophorone	SW-846 8270C
Nitrobenzene	SW-846 8270C

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All approved analytes are listed below:

Phthalate Esters

Benzyl butyl phthalate	SW-846 8270C
Bis(2-ethylhexyl) phthalate	SW-846 8270C
Diethyl phthalate	SW-846 8270C
Dimethyl phthalate	SW-846 8270C
Di-n-butyl phthalate	SW-846 8270C
Di-n-octyl phthalate	SW-846 8270C

Polychlorinated Biphenyls

PCB-1016	SW-846 8082
PCB-1221	SW-846 8082
PCB-1232	SW-846 8082
PCB-1242	SW-846 8082
PCB-1248	SW-846 8082
PCB-1254	SW-846 8082
PCB-1260	SW-846 8082

Polynuclear Aromatic Hydrocarbons

Acenaphthylene	SW-846 8270C
Benzo(b)fluoranthene	SW-846 8270C
Benzo(ghi)perylene	SW-846 8270C
Chrysene	SW-846 8270C
Dibenzo(a,h)anthracene	SW-846 8270C
Naphthalene	SW-846 8270C
Phenanthrene	SW-846 8270C

Priority Pollutant Phenols

2,4-Dichlorophenol	SW-846 8270C
2,4-Dimethylphenol	SW-846 8270C
2,4-Dinitrophenol	SW-846 8270C
2-Chlorophenol	SW-846 8270C
2-Methyl-4,6-dinitrophenol	SW-846 8270C
2-Nitrophenol	SW-846 8270C
4-Chloro-3-methylphenol	SW-846 8270C
4-Nitrophenol	SW-846 8270C
Pentachlorophenol	SW-846 8270C
Phenol	SW-846 8270C

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Page 2 of 2



NEW YORK STATE DEPARTMENT OF HEALTH
WADSWORTH CENTER

Antonia C. Novello, M.D., M.P.H., Dr.P.H. Commissioner



Expires 12:01 AM April 01, 2003
Issued July 05, 2002

CERTIFICATE OF APPROVAL FOR LABORATORY SERVICE

Issued in accordance with and pursuant to section 502 Public Health Law of New York State

MR. ROBERT E. WAGNER
NORTHEAST ANALYTICAL INC
2190 TECHNOLOGY DRIVE
SCHENECTADY NY 12308 USA

NY Lab Id No: 11078
EPA Lab Code: NY00906

*is hereby APPROVED as an Environmental Laboratory for the category
ENVIRONMENTAL ANALYSES SOLID AND HAZARDOUS WASTE
All approved subcategories and/or analytes are listed below:*

Chlorinated Hydrocarbon Pesticides

4,4'-DDE	SW-846 8081A
4,4'-DDT	SW-846 8081A
Aldrin	SW-846 8081A
beta-BHC	SW-846 8081A
delta-BHC	SW-846 8081A
Endosulfan II	SW-846 8270C
	SW-846 8081A
Endrin	SW-846 8081A
Heptachlor	SW-846 8081A
Methoxychlor	SW-846 8081A
Toxaphene	SW-846 8081A

Metals II

Chromium VI	SW-846 7196A
Mercury, Total	SW-846 7471A

Polynuclear Aromatic Hydrocarbons

Acenaphthene	SW-846 8270C
Anthracene	SW-846 8270C
Benzo(a)anthracene	SW-846 8270C
Benzo(a)pyrene	SW-846 8270C
Fluoranthene	SW-846 8270C
Fluorene	Method Not Specified
Indeno(1,2,3-cd)pyrene	SW-846 8270C
Pyrene	SW-846 8270C

Purgeable Aromatics

1,2-Dichlorobenzene	SW-846 8021B
	SW-846 8260B
1,3-Dichlorobenzene	SW-846 8021B
	SW-846 8260B
1,4-Dichlorobenzene	SW-846 8021B
	SW-846 8260B
Benzene	SW-846 8021B
	SW-846 8260B
Chlorobenzene	SW-846 8021B
	SW-846 8260B
Ethyl benzene	SW-846 8021B
	SW-846 8260B
Toluene	SW-846 8021B
	SW-846 8260B
Total Xylenes	SW-846 8021B
	SW-846 8260B

Purgeable Halocarbons

1,1,1-Trichloroethane	SW-846 8021B
	SW-846 8260B
1,1,2,2-Tetrachloroethane	SW-846 8021B
	SW-846 8260B
1,1,2-Trichloroethane	SW-846 8021B
	SW-846 8260B

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SCHENECTADY NY 12308 USA

NY Lab Id No: 11078
EPA Lab Code: NY00906

is hereby APPROVED as an Environmental Laboratory for the category
ENVIRONMENTAL ANALYSES SOLID AND HAZARDOUS WASTE
All approved subcategories and/or analytes are listed below:

Purgeable Halocarbons

1,1-Dichloroethane	SW-846 8021B
	SW-846 8260B
1,1-Dichloroethene	SW-846 8021B
	SW-846 8260B
1,2-Dichloroethane	SW-846 8021B
	SW-846 8260B
1,2-Dichloropropane	SW-846 8021B
	SW-846 8260B
2-Chloroethylvinyl ether	SW-846 8021B
	SW-846 8260B
Bromodichloromethane	SW-846 8021B
	SW-846 8260B
Bromoform	SW-846 8021B
	SW-846 8260B
Bromomethane	SW-846 8021B
	SW-846 8260B
Carbon tetrachloride	SW-846 8021B
	SW-846 8260B
Chloroethane	SW-846 8021B
	SW-846 8260B
Chloroform	SW-846 8021B
	SW-846 8260B
Chloromethane	SW-846 8021B
	SW-846 8260B

Purgeable Halocarbons

cis-1,3-Dichloropropene	Method Not Specified
Dibromochloromethane	SW-846 8021B
	SW-846 8260B
Dichlorodifluoromethane	SW-846 8021B
	SW-846 8260B
Methylene chloride	SW-846 8021B
	SW-846 8260B
Tetrachloroethene	SW-846 8021B
	SW-846 8260B
trans-1,3-Dichloropropene	Method Not Specified
Trichloroethene	SW-846 8021B
	SW-846 8260B
Trichlorofluoromethane	SW-846 8021B
	SW-846 8260B
Vinyl chloride	SW-846 8021B
	SW-846 8260B

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NEW YORK STATE DEPARTMENT OF HEALTH
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MR. ROBERT E. WAGNER
NORTHEAST ANALYTICAL INC
2190 TECHNOLOGY DRIVE
SCHENECTADY NY 12308 USA

NY Lab Id No: 11078
EPA Lab Code: NY00906

*is hereby APPROVED as an Environmental Laboratory in conformance with the
National Environmental Laboratory Accreditation Conference Standards for the category
ENVIRONMENTAL ANALYSES AIR AND EMISSIONS
All approved analytes are listed below:*

Polychlorinated Biphenyls

PCB-1016	NYS DOH 311-1
PCB-1221	NYS DOH 311-1
PCB-1232	NYS DOH 311-1
PCB-1242	NYS DOH 311-1
PCB-1248	NYS DOH 311-1
PCB-1254	NYS DOH 311-1
PCB-1260	NYS DOH 311-1

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APPENDIX R

SOUTH CAROLINA-DHEC CERTIFICATION



South Carolina Department of Health and Environmental Control

Environmental Laboratory Certification Program

In accordance with the provisions of Regulation 61 - 81, entitled
"State Environmental Laboratory Certification Regulation,"

NORTHEAST ANALYTICAL INC
2190 TECHNOLOGY DR
SCHENECTADY, NEW YORK 12308

is hereby certified to perform analyses as documented on the attached parameter list(s). This certification does not guarantee validity of data generated, but indicates the laboratory's adherence to prescribed methodology, quality control, records keeping, and reporting procedures. This certificate is the property of S.C. DHEC and must be surrendered upon demand. This certificate is non-transferable and is valid only for the parameters and methodology listed on the attached parameter list(s).

Laboratory Director: ROBERT E WAGNER
Certifying Authority: NY
Date of Issue: August 14, 2002
Date of Expiration: April 01, 2003
Certificate Number: 91008001


Director
Office of Environmental Laboratory Certification

**SOUTH CAROLINA DEPARTMENT OF HEALTH AND ENVIRONMENTAL CONTROL
ENVIRONMENTAL LABORATORY CERTIFICATION PROGRAM**

NORTHEAST ANALYTICAL INC (Laboratory ID 91008)
Laboratory Director: ROBERT E WAGNER
Certifying Authority: NY
Certificate Number: 91008001

Date of Issue: August 14, 2002
Expiration Date: April 01, 2003

CLEAN WATER ACT

PCBS AND PESTICIDES

ORGANOCHLORINE PESTICIDES & PCBS - GC/ECD EPA 608

SOLID & HAZARDOUS WASTES

PCBS AND PESTICIDES

POLYCHLORINATED BIPHENYLS BY GC	EPA 8082	EPA 3540C
POLYCHLORINATED BIPHENYLS BY GC	EPA 8082	EPA 3545

SOUTH CAROLINA DEPARTMENT OF HEALTH AND ENVIRONMENTAL CONTROL
ENVIRONMENTAL LABORATORY CERTIFICATION PROGRAM

NORTHEAST ANALYTICAL INC (Laboratory ID 91008)

Certifying Authority: NY

Certificate Number: 91008001

Date of Issue: August 14, 2002

Expiration Date: April 01, 2003

CLEAN WATER ACT

-----PCBS AND PESTICIDES-----

EPA 608

PCB-1016 (AROCOLOR-1016)
PCB-1221 (AROCOLOR-1221)
PCB-1232 (AROCOLOR-1232)
PCB-1242 (AROCOLOR-1242)
PCB-1248 (AROCOLOR-1248)
PCB-1254 (AROCOLOR-1254)
PCB-1260 (AROCOLOR-1260)

SOUTH CAROLINA DEPARTMENT OF HEALTH AND ENVIRONMENTAL CONTROL
ENVIRONMENTAL LABORATORY CERTIFICATION PROGRAM

NORTHEAST ANALYTICAL INC (Laboratory ID 91008)

Certifying Authority: NY

Date of Issue: August 14, 2002

Certificate Number: 91008001

Expiration Date: April 01, 2003

SOLID & HAZARDOUS WASTES

-----PCBS AND PESTICIDES-----

EPA 8082
EPA 3540C

PCB-1016 (AROCOLOR-1016)
PCB-1221 (AROCOLOR-1221)
PCB-1232 (AROCOLOR-1232)
PCB-1242 (AROCOLOR-1242)
PCB-1248 (AROCOLOR-1248)
PCB-1254 (AROCOLOR-1254)
PCB-1260 (AROCOLOR-1260)

EPA 8082
EPA 3545

PCB-1016 (AROCOLOR-1016)
PCB-1221 (AROCOLOR-1221)
PCB-1232 (AROCOLOR-1232)
PCB-1242 (AROCOLOR-1242)
PCB-1248 (AROCOLOR-1248)
PCB-1254 (AROCOLOR-1254)
PCB-1260 (AROCOLOR-1260)

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 LABORATORY QUALITY MANUAL for Chemical Analysis

Revision No. 16
January 8, 2003

Approved By:	<u>Thomas Boyden</u>	<u>1-8-2003</u>
	Thomas Boyden, Laboratory Director	Date
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	Stan P. Palmquist, Operations Manager	Date
Approved By:	<u>Dennis L. Bean</u>	<u>1-8-2003</u>
	Dennis L. Bean, IT Manager/Technical Director	Date
Approved By:	<u>Felix R. Zboralski</u>	<u>1-8-2003</u>
	Felix R. Zboralski, Volatiles Department Supervisor	Date
Approved By:	<u>Steve Loague</u>	<u>1-8-2003</u>
	Steve Loague, Semivolatile GC/MS Department Supervisor	Date
Approved By:	<u>Jeff Westerlund</u>	<u>1-8-2003</u>
	Jeff Westerlund, Semivolatile GC/HPLC Dept. Supervisor	Date
Approved By:	<u>Fred Woo</u>	<u>1-8-2003</u>
	Fred Woo, Metals Department Supervisor	Date
Approved By:	<u>Guy Archibald</u>	<u>1-8-2003</u>
	Guy Archibald, General Chemistry Department Supervisor	Date
Approved By:	<u>Darla Powell</u>	<u>1-8-2003</u>
	Darla Powell, Project Manager Supervisor	Date
Approved By:	<u>Kim Presley</u>	<u>1-8-2003</u>
	Kim Presley, Sample Management Supervisor	Date
Approved By:	<u>Terri Howard</u>	<u>1-8-2003</u>
	Terri Howard, Quality Assurance Manager	Date

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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 (QAPjPs) 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 QAPjP. 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 QAPjPs 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, QAPjPs, 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)

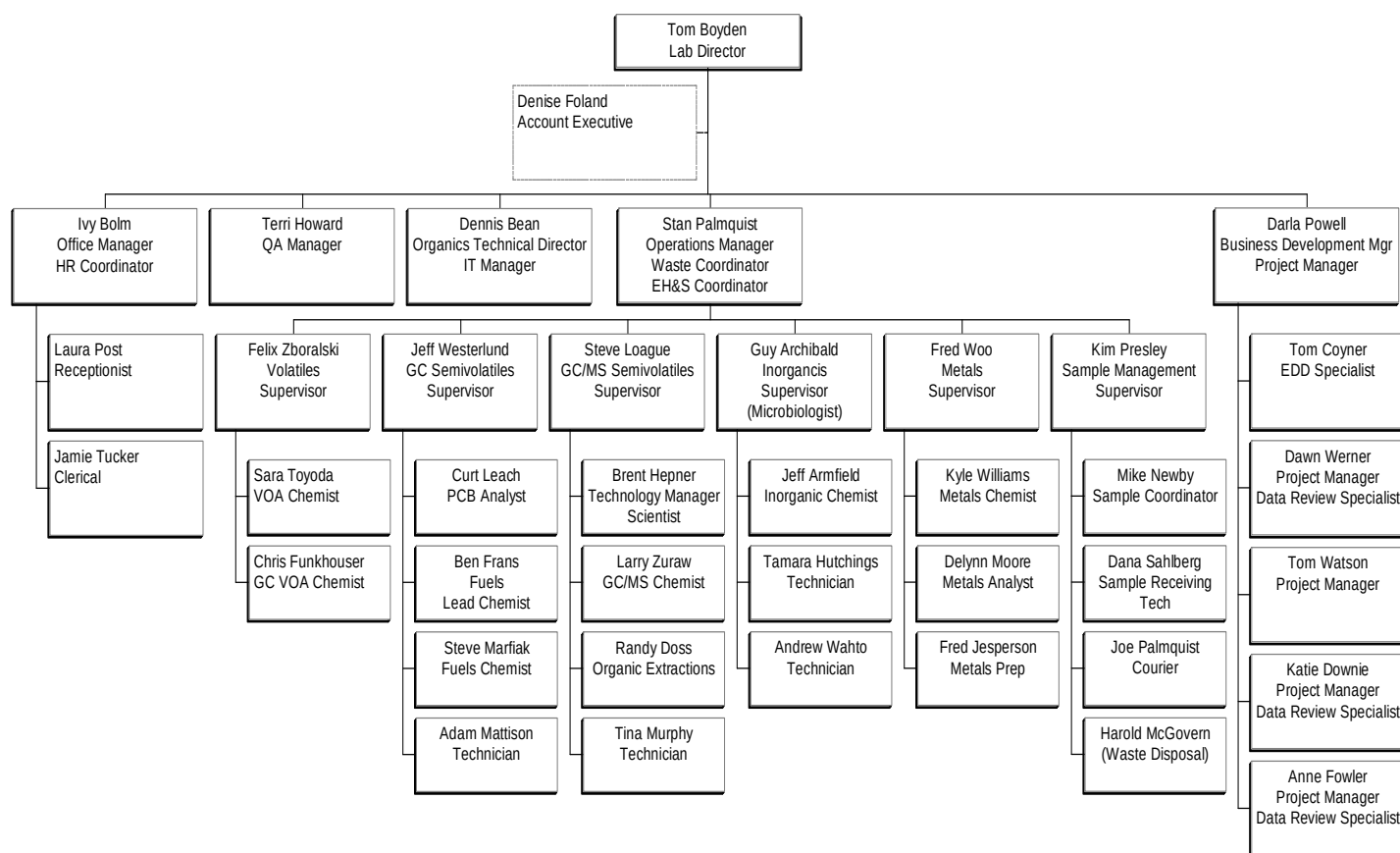


Table 4-2. STL Seattle Key Personnel

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 Health 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

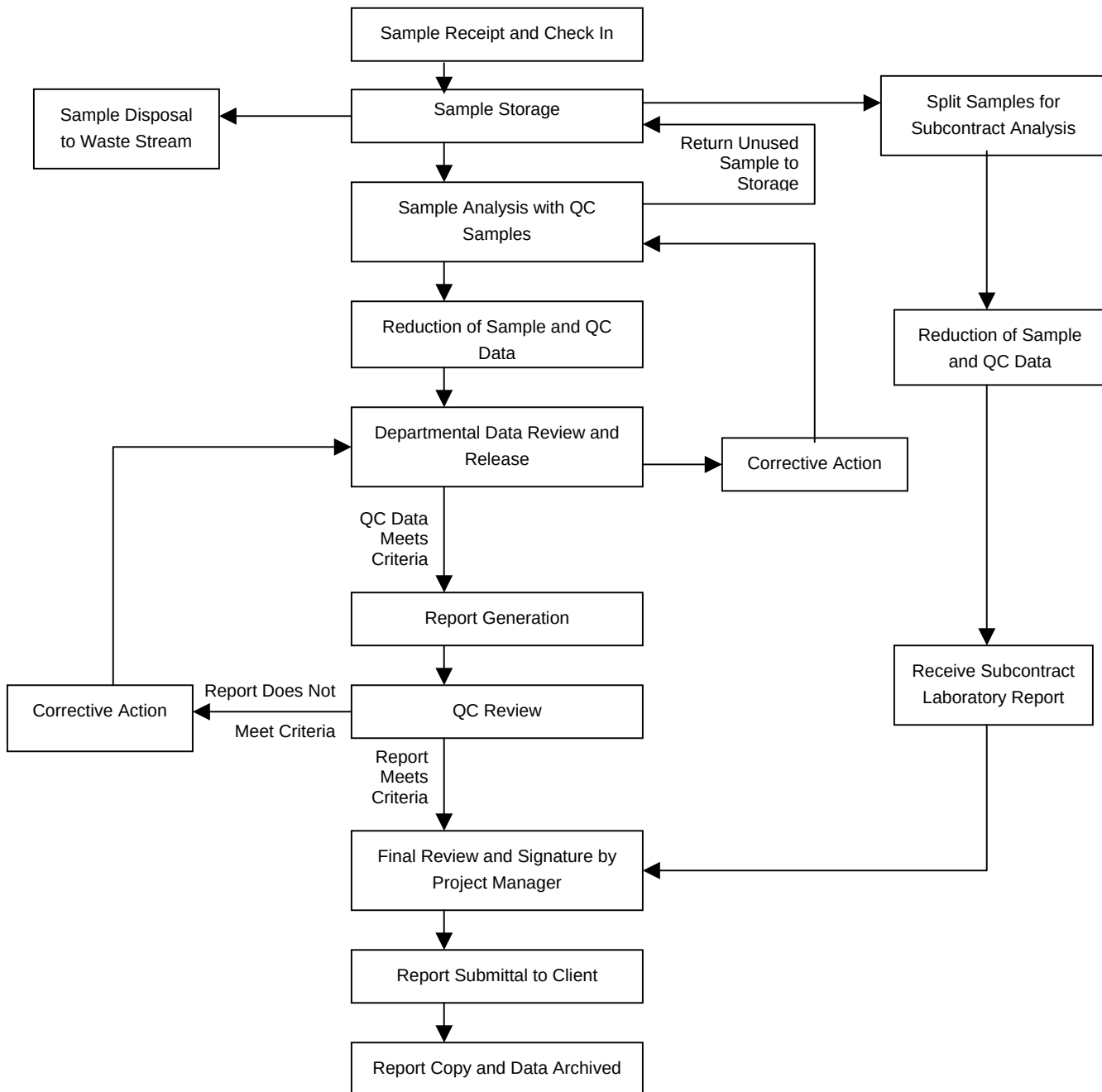
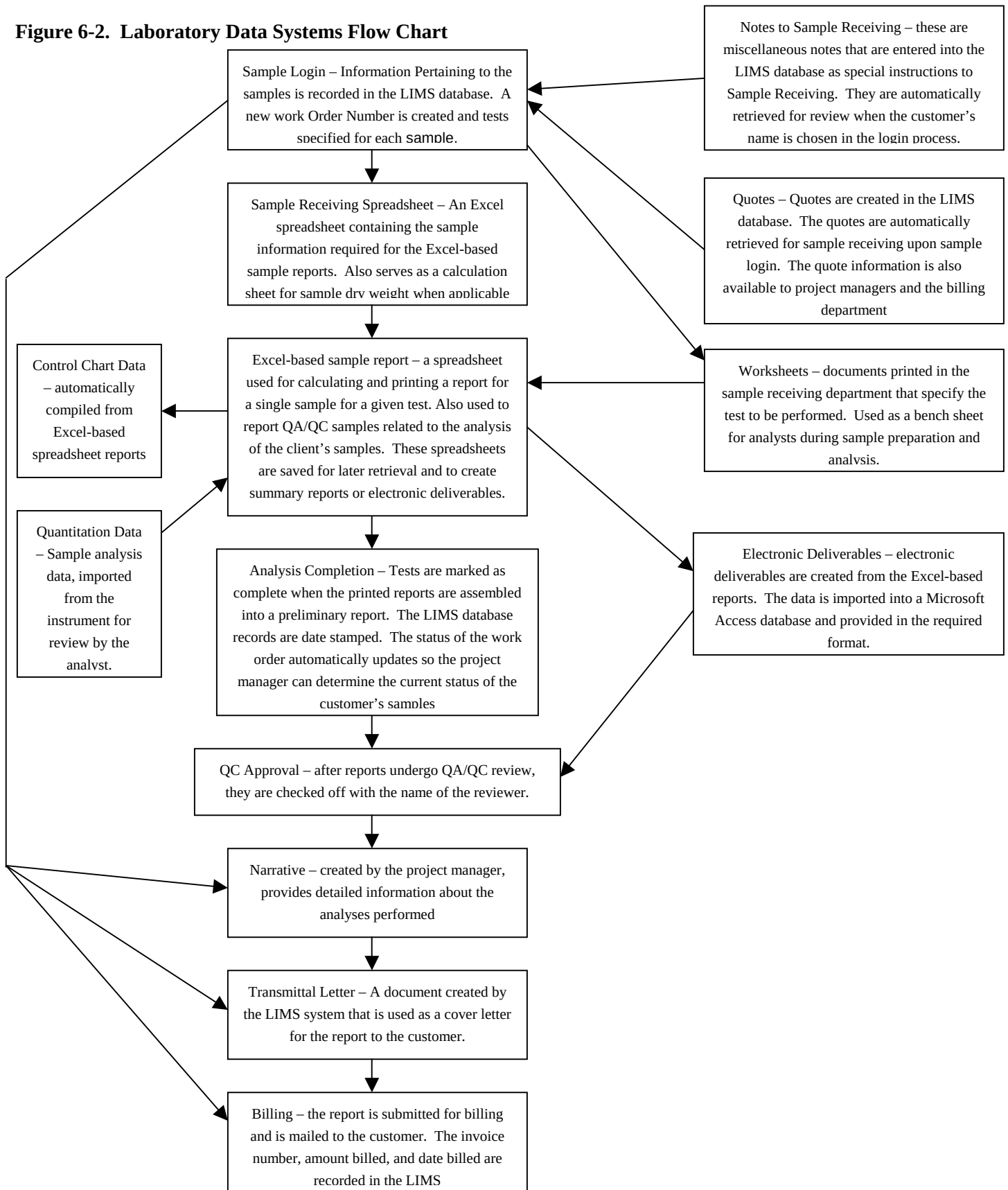


Figure 6-2. Laboratory Data Systems Flow Chart



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 $4^{\circ}\text{C} \pm 2^{\circ}\text{C}$ (-10 to -25°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 $\pm 20\%$ D or RPD =20, for water matrix, and $\pm 30\%$ 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

<u>Agency/Client</u>	<u>Scope</u>	<u>Term</u>	<u>Expiration</u>	<u>Audit Status</u>	<u>PE samples</u>
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

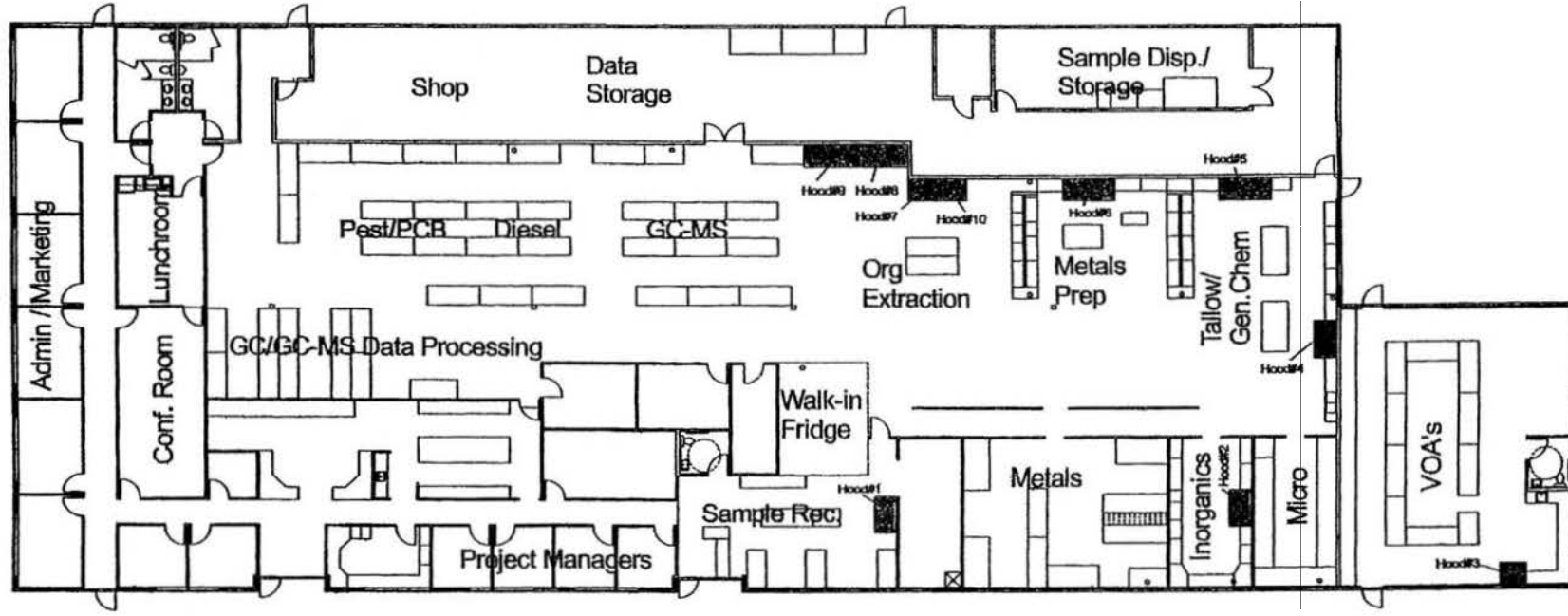
The STL Seattle quality assurance manager prepares a monthly quality assurance/quality control summary. This report is submitted to laboratory department supervisors, laboratory general and operations managers, and the STL Corporate QA manager at the beginning of the following month. The report includes, 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



APPENDIX B
STL Seattle
Capital Equipment Inventory

STL SEATTLE CAPITAL EQUIPMENT INVENTORY

<u>Equipment or Instrument System</u>	<u>Instrument ID</u>	<u>Serial Number</u>	<u>Date of Purchase</u>

Semivolatile Organics:

(4) Finnigan MAT Magnum GC/MS/DS System Varian 3400 GC; Varian SPI Injector Electron Impact or Chemical Ionization CTC A200S Autosampler Pentium Data System NIST mass spectral library	SEA009 SEA012 SEA010 SEA011	004122 000273 003294 003624	August, 2002 August, 1994 January, 1992 August, 2002
Finnigan MAT Model ITS40 GC/MS/DS System Varian 3400 GC; ATAS Large Volume Injector Electron Impact or Chemical Ionization CTC A200S Autosampler Pentium Data System NIST mass spectral library	SEA008	003281	December, 1998
Finnigan MAT Polaris Q GC/MS/DS System Thermoquest Trace GC; ATAS Large Volume Injector Electron Impact or Chemical Ionization Thermoquest 2000 Autosampler Pentium Data System NIST mass spectral library	SEA031	110029	July, 2000
Waters 717 Plus GPC Cleanup System Dual Wavelength Absorption Detector Waters 746 Integrator System	SEA030	M98719656R	July, 1999

Volatile Organics:

(2) Finnigan MAT Model ITS40 GC/MS/DS System Varian 3400 GC 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	SEA005 SEA004	IS00262 IS003775	January, 1992 Upgraded March, 1999
Hewlett Packard HP5973N-6890 Plus GC-FID/MS/DS System 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	SEA002	US01160155	August, 2000
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 Archon 51 Position Autosampler for water and soil samples Pentium III with Hewlett Packard ChemStation data system NBA75K.1 Mass Spectral Library	SEA001	US10452041	January, 2002

<u>Equipment or Instrument System</u>	<u>Instrument ID</u>	<u>Serial Number</u>	<u>Date of Purchase</u>
<u>Pesticides/PCBs:</u>			
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
<u>Explosives/PAHs:</u>			
(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
<u>Volatile Fuels:</u>			
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

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

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 Digester	July, 1999 February, 2000
Labconco Block Digester	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
Equipment or Instrument System

December, 1991
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

<u>Parameter</u>	<u>Method</u>
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

<u>Parameter</u>	<u>Method</u>
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

<u>Parameter</u>	<u>Method</u>	<u>Instrumentation</u>
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

<u>Parameter</u>	<u>Method</u>
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)

<u>Parameter</u>	<u>EPA Method</u>
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)

<u>Parameter</u>	<u>Method</u>
Extraction (non-volatile)	California Code of Regulations, Title 22

ANALYTICAL CAPABILITIES

PUGET SOUND DREDGED DISPOSAL ANALYSIS (PSDDA)

<u>Parameter</u>	<u>Method</u>
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

<u>Parameter</u>	<u>Method</u>
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

<u>Parameter</u>	<u>Method</u>
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

<u>Parameter</u>	<u>Method</u>
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

<u>Parameter</u>	<u>Method</u>
Complete Inorganics	Various
Volatile Organic Compounds (VOCs)	EPA 524.2

MICROBIOLOGY

<u>Parameter</u>	<u>Method</u>
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 ₂ SO 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 ₂ SO 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 ₂ SO 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 ₂ SO 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 ₂ SO ₄ < 2.0
Nitrite	50 mls	125 mls HDPE	Cool 4°C
Oil & Grease/TPH	1 liter	2 1L BR	Cool 4°C, H ₂ SO ₄ < 2.0
Organic Carbon	25 mls	125 ml HDPE	Cool 4°C,HCL/H ₂ SO 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 ₂ SO ₄ < 2.0
Phosphorus (Elemental)	50 mls	1L BR	Cool 4°C
Phosphorus (Total)	50 mls	125 ml HDPE	Cool 4°C, H ₂ SO 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 °C
Benzidines	125 ml	2-125 ml BR	Cool 4°C, 4 °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 °C
Chlorinated Herbicides	125 ml	2-125 ml BR	Cool 4 °C
Dioxins & Furans	1 liter	2-1L BR?	Cool 4°C
TX Total Halogens	250 mls	1L BR	Cool 4°C, H ₂ SO 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 ₂ S ₂ O ₃ , 4 °C
Fecal Streptococci	100 mls	250 ml HDPE	008% NA ₂ S ₂ O ₃ , 4 °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; Crescent 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; Crescent 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 ≥ 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 ≥ 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 $\leq 20\%$. 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 $\leq 20\%$, 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 ≤ 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)

- o Surrogate compound percent recoveries are calculated and compared to the acceptable limits specified for the method and matrix.
- o 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.
- o 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.
- o For Method 524.2, the LFB and the LCS are evaluated against method criteria.
- o For Method 624, the LCS and the LCSD are evaluated against method criteria.
- o 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.
- o The relative retention time of a quantitated analyte that has closely eluting targeted or non-targeted isomers is checked to assure its identity.
- o The mass spectrum of each quantitated target analyte is evaluated against a known reference spectrum of the compound according to standard EPA rules.
- o The reported value for each analyte is flagged with any applicable QC qualifiers.
- o 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)

- o The surrogate standard percent recoveries are calculated and compared to the acceptable limits specified for the method and matrix.
- o 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.
- o Method blanks are examined for analytes that have concentrations above the PQL or MDL (or 5x the PQL for EPA designated phthalate esters).
- o 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.
- o The relative retention time of a quantitated analyte that has closely eluting targeted or non-targeted isomers is checked to assure its identity.
- o The mass spectrum of each quantitated target analyte is evaluated against a known reference spectrum of the compound according to standard EPA rules.
- o The reported value for each analyte is flagged with any applicable QC qualifiers.
- o 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)

- o The surrogate standard percent recoveries are calculated and compared to the acceptable limits specified for the method and matrix.
- o 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.
- o Method blanks are examined for analytes that have concentrations above the PQL or MDL.
- o 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.
- o The relative retention time of a quantitated analyte that has closely eluting targeted or non-targeted isomers is checked to assure its identity.
- o The mass spectrum of each quantitated target analyte is evaluated against a known reference spectrum of the compound according to standard EPA rules.
- o The reported value for each analyte is flagged with any applicable QA/QC qualifiers.
- o 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)

- o The surrogate standard percent recoveries are calculated and compared to the acceptable limits specified for the method and matrix.
- o Peak patterns and retention times are evaluated by the analyst to determine the presence of Aroclors based on an established multicomponent library.
- o 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.
- o Method blanks are examined for detectable levels of target analytes.
- o 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.
- o The reported value for each analyte is flagged with any applicable QC qualifiers.
- o 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)

- o The surrogate standard percent recoveries are calculated and compared to the acceptable limits specified for the method and matrix.
- o 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.

STL SEATTLE SAMPLE DATA EVALUATION PROCEDURES

- o 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.
- o Method blanks are examined for detectable levels of target analytes.
- o 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.
- o The reported value for each analyte is flagged with any applicable QC qualifiers.
- o 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)

- o The surrogate standard percent recoveries are calculated and compared to the acceptable limits specified for the method and matrix.
- o 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.
- o 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.
- o Method blanks are examined for detectable levels of target analytes.
- o 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.
- o The reported value for each analyte is flagged with any applicable QC qualifiers.
- o 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)

- o The surrogate standard percent recoveries are calculated and compared to the acceptable limits specified for the method and matrix.
- o Peak patterns and retention times are evaluated by the analyst to determine the presence of target analytes based on an established multicomponent library.
- o 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.
- o Method blanks are examined for detectable levels of target analytes.

STL SEATTLE SAMPLE DATA EVALUATION PROCEDURES

- o 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.
- o The reported value for each analyte is flagged with any applicable QC qualifiers.
- o 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

- o If matrix interferences are suspected for any element, the sample scan for that element is reviewed by the analyst prior to reporting results.
- o The concentrations of the target elements are reviewed to determine if concentrations exceed the instrument linear range.
- o 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.
- o Method blanks are examined for the presence of target elements above the reporting limit.
- o The reported value for each element is flagged with any applicable QC qualifiers.
- o 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)

- o The concentrations of the target elements are reviewed to determine if concentrations exceed the instrument calibration range.
- o 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.
- o Method blanks are examined for the presence of target elements above the reporting limit.
- o The reported value for each element is flagged with any applicable QC qualifiers.
- o 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)

- o 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.
- o 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.
- o Method blanks are examined for detectable levels of target analytes.
- o Samples are examined for analytes with concentrations that exceed the instrument calibration range.
- o The reported value for each analyte is flagged with any applicable QC qualifiers.
- o 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

- o Instrument response is evaluated for signs of matrix interferences or poor integration.
- o 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.
- o Method blanks are examined for detectable levels of target analytes.
- o Samples are examined for analytes with concentrations that exceed the instrument calibration range.
- o The reported value for each analyte is flagged with any applicable QC qualifiers.
- o 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

- o 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.
- o The sample concentration is reviewed to determine if concentrations exceed the instrument calibration range.
- o 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.
- o Method blanks are examined for the presence of target elements above the reporting limit.
- o The reported value for each sample is flagged with any applicable QC qualifiers.
- o 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

- o 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.
- o The sample concentration is reviewed to determine if concentrations exceed the instrument calibration range.
- o 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.
- o Method blanks are examined for the presence of target elements above the reporting limit.
- o The reported value for each sample is flagged with any applicable QC qualifiers.
- o 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

- o The surrogate standard percent recoveries are calculated and compared to the acceptable limits specified for the method and matrix.
- o 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.
- o 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.
- o Method blanks are examined for detectable levels of target analytes.

STL SEATTLE SAMPLE DATA EVALUATION PROCEDURES

- o 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.
- o The reported value for each analyte is flagged with any applicable QC qualifiers.
- o 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 Department



Washington 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 CaCO ₃)	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	

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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)	

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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 CaCO ₃)	EPA	130.2	
Hexane Extractable Material	EPA	1664	
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	

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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	

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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	

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Laboratory Accreditation Section

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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

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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	

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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

Washington State Department of Ecology

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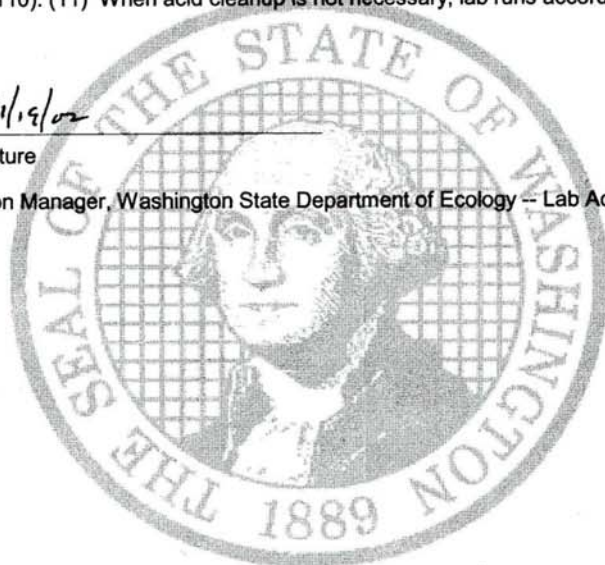
Matrix Type/Parameter Name**Reference****Method Number****Notes****Accredited Parameter Note Detail**

(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 derivatization. (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



Washington State Department of Ecology

Date Printed: 11/19/2002

Scope of Accreditation Report for STL Seattle

Scope Expires: 1/31/2003

Laboratory Accreditation Section

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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-O22** 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
CS LAB APPROVAL OFFICER


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 **December 4, 2002 to February 4, 2003.**

Ms. Transue
Page 2
4 April 2002

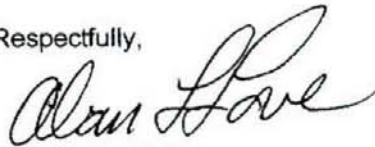
We must receive your application, fees, acceptable performance evaluation results, and the latest revision of your quality assurance manual during this window. You may download a copy of the application from the following site:
<http://www.state.ak.us/dec/deh/laboratories/UST.htm>

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, Ph.D.
Approval Authority



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

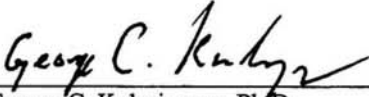
Scope of accreditation is limited to the
"NELAP Accredited Fields of Testing"
which accompanies this Certificate.

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.

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STL SEATTLE

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

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

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.

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STL SEATTLE

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

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

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.

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STL SEATTLE

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

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

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.

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Renew Date: 11/30/2003

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 Chapter 11, 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

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.

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STL SEATTLE

Certificate No: 01170CA
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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.

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STL SEATTLE

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

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

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.

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Certificate No: 01170CA
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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-Nitroaniline
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

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.

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STL SEATTLE

Certificate No: 01170CA
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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

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Customers: Please verify the current accreditation standing with the State.

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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 8 th 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.

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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-Tetrachloroethane
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]anthracene
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	Endosulfan I
CWA	608	Endosulfan II
CWA	608	Endosulfan Sulfate
CWA	608	Endrin
CWA	608	Endrin aldehyde
CWA	608	Heptachlor
CWA	608	Heptachlor 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	Diesel 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-pentanone (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	Trichlorofluoromethane
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	Benidine
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-Chloroethyl)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[fa,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-Dinitrophenol
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	Idenol [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.

Page 13 of 13



REPLY TO
ATTENTION OF:

DEPARTMENT OF THE ARMY
CORPS OF ENGINEERS
HTRW CENTER OF EXPERTISE
12565 WEST CENTER ROAD
OMAHA, NEBRASKA 68144-3852

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.

- 3 -

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, 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⁾

NFESC 413
January 25, 2002

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,



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

<u>SOP Number</u>	<u>Revision Number</u>	<u>SOP Title</u>	<u>Author</u>	<u>Revision Date</u>	<u>Document Name</u>
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

<u>SOP Number</u>	<u>Revision Number</u>	<u>SOP Title</u>	<u>Author</u>	<u>Revision Date</u>	<u>Document Name</u>
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
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0134	3	Determination of Corrosivity by Method 9045C	Janie McAninch	1/25/2002	0134_3.pdf
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0150	3	Total and Amenable Cyanide, Method 9012A/9013 Modified	Matthew Scott	2/8/2002	0150_3.pdf
0154	8	Ignitability, EPA Method 1020A	Guy Archibald	1/30/2002	0154_8.pdf
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0210	4	Toxicity Characteristic Leaching Procedure, EPA Method 1311	Mike Newby	4/3/2002	0210_4.pdf
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0221	6	TCLP Digestion Procedure for ICP Metal Analysis	Stan Palmquist	8/16/2002	0221_6.pdf
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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
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0339	4	Semivolatile Petroleum Products Method for Soil and Water by NWTPH-Dx	Robert Frans	2/20/2002	0339_4.pdf
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0376	2	BTEX and Gasoline Range Organics by GC/MS, 8260B Modified	Felix Zboralski	9/26/2002	0376_2.pdf
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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 sorbent 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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