APPENDIX B

SOIL SAMPLING AND ANALYSIS AND QUALITY ASSURANCE PROJECT PLAN

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1.0 INTRODUCTION

This Soil Sampling and Analysis and Quality Assurance Project Plan (SAP/QAPP) has been prepared on behalf of the California State Department of General Services by ENVIRON International Corporation (ENVIRON). The purpose of this SAP/QAPP is to:

(1) describe the scope of work for soil sampling and laboratory analysis;
(2) describe the quality assurance/quality control (QA/QC) procedures the project team will follow during analysis of samples collected at the Former BAREC property; and,
(3) assure reporting of data that are representative of field conditions, and are legally defensible.

The SAP/QAPP is based on guidelines issued by the United States Environmental Protection Agency (USEPA) (USEPA, 1988, 1989, 1994, 1998, 2001), and reflects the selection of STL San Francisco laboratory for analysis of samples.

2.0 SCOPE OF SOIL SAMPLING

2.1 Problem Definition and Background

The problem definition and background details for this project are discussed in Sections 2.1 and 2.2 of the Removal Action Workplan (RAW).

2.2 Sampling Project/Task Description

A summary of work to be performed for this project is provided in detail in Section 5.0 of the RAW. The soil sampling work consists of the following main elements:

- Collection of soil samples below former building foundations to confirm that soil below former buildings have not been adversely affected from prior operations at the BAREC property. The scope of this sampling is described in Section 5.1.1 of the RAW;
- Collection of soil samples to determine the extent of excavation of impacted soils ("Pre-Excavation Sampling"). The scope of this sampling is described in Section 5.1.4 and 5.3.1 of the RAW; and
- Collection of soil samples to verify that impacted soils have been removed ("Post-Excavation Sampling"). The scope of this sampling is described in Section 5.1.4 and 5.3.1 of the RAW

A map showing proposed locations of field tasks is included in the RAW as Figure 7. The schedule for implementation of project tasks is described in Section 5.8 and Table 8 of the RAW.

2.3 Sampling Methods

The samples will be collected in-situ using a standard core sampler attached to a slide hammer. In cases where the excavation depth prevents safe entry, soil will be taken from the selected location using the backhoe. The sample will be collected from the backhoe bucket using the standard core sampler. Soil samples will be collected in factory pre-cleaned brass or stainless steel liners.

2.4 Sample Handling and Custody

Standard EPA procedures to identify, track, monitor and maintain chain-of-custody for all samples will be implemented. Soil samples will be handled using the following procedures:

1. The sampler will don clean gloves appropriate for the chemicals of concern before touching any sample containers, and care will be taken to avoid direct contact with the sample.

2. The sample will be quickly observed for color, appearance, and composition and

recorded in the field soil boring log. The ends of the liners will be immediately covered with Teflon® sheeting, capped with plastic end caps, and sealed with Silicone tape.

3. The sample container will be labeled before or immediately after sampling with a self-adhesive label having the following information written in waterproof ink:

   - Company name
   - Project name
   - Project number
   - Sample ID number
   - Date and time sample was collected
   - Initials of sample collector

4. The sample will be placed in an ice chest kept at 4 °C for transport to the laboratory within 24 hours of collection.

2.5 Analytical Methods

Soil Samples Below Building Foundations

Soil samples collected from beneath the former building foundations will be analyzed for asbestos by EPA Method 600/R-93-116, lead and arsenic by EPA Method 6010B, organochlorine pesticides by EPA Method 8081A, and petroleum hydrocarbons by EPA Method 8015 Modified.

Pre- and Post-Excavation Samples

Soil samples from excavation areas will be analyzed for arsenic by EPA Method 6010B or dieldrin by EPA Method 8081A. Table C-1 lists the chemical analytical methods anticipated for this project and the proposed reporting limits for target analytes.

2.6 Equipment Decontamination

The soil sampler will be washed with a laboratory-grade alconox detergent and water solution to remove residual soil and rinsed with deionized water between sampling.

Construction equipment and transportation vehicles will be decontaminated as described in Section 5.3.3 in the RAW.

2.7 Quality Control

The requirements and procedures for maintaining laboratory quality control for project data are described in Section 4.3 below.

3.0 PROJECT/TASK ORGANIZATION

Personnel assigned to the project will be required to familiarize themselves with pertinent protocols and procedures presented in the SAP/QAPP. The following paragraphs identify and describe the responsibilities of key project positions related to project management, chemical data quality management and subcontractor relationships.

3.1 Key Project Positions

Project Director and Assistant Project Director - The Project Director is responsible for reviewing technical and policy decisions regarding the project, including interaction and coordination with California State Department of General Services, the regulatory agencies, ENVIRON, and subcontractor personnel.

Technical Peer Reviewer - The Technical Peer Reviewer is responsible for reviewing technical aspects of the work including QA/QC, strategies, methods to be used, and key reports.

Project Manager - The Project Manager is responsible for the scope, cost, and technical considerations related to the project; staff and project coordination; and implementation of review of overall project quality to the collection, completeness, and presentation of data.

Project Quality Assurance Officer - The Project Quality Assurance (QA) Officer is responsible for reviewing the project QA program as it relates to the collection and completeness of data from field and laboratory operations, including the training of personnel to follow established protocols and procedures. This individual is also responsible for maintaining the official, approved SAP/QAPP.

Task Leaders - Task Leaders are responsible for formulating a work plan and executing work elements related to an assigned task. Each Task Leader will issue specific instructions for performing assigned work elements and will ensure that work is conducted in compliance with project-specific objectives and applicable QA procedures. Task Leaders will coordinate with the Project Manager and QA Officer to review general work plans and specific work elements.

3.2 Quality Objectives and Criteria for Measurement Data

Measurement performance criteria are outlined in Sections 4.6 through 4.8 in Severn Trent Laboratories (STL) San Francisco Quality Assurance Manual, Revision 10, January 2002 (STL QA Manual). A copy of the STL QA Manual is included as Attachment A to the SAP/QAPP.

3.3 Special Training and Certification

No specialized training of field personnel is required for this project. All personnel involved in field

sampling shall have completed the emergency response and hazardous waste operations training requirements defined in Title 29 Code of Federal Regulations Part 1910.120. Furthermore, fieldwork personnel for this project are appropriately trained for the sampling activities that will be conducted.

The training programs implemented by the laboratory for its personnel are described in Section 8.0 of the STL QA Manual in Attachment A.

3.4 Documentation and Records

The most current, approved version of the SAP/QAPP will be provided to the appropriate project personnel prior to the initiation of field activities.

Documents related to field activities conducted will be submitted with the Report of Sampling Results, which will be completed following field activities. These documents include field investigation daily logs, daily calibration logs, chain-of-custody records and corrective action reports. Laboratory-specific records will be compiled by STL in a "Level III Report" (USEPA report, "Guidance for Data Useability in Risk Assessment (Part A) Final" (DURA)), which is discussed in Section 4.3.3 of the STL Quality Assurance Manual (Attachment A) and includes the following elements:

- Sample data such as sampling date, submission date, extraction and analytical dates, method used, sample results, dilution factors, reporting limits, and GC fingerprint chromatograms
- Sample management records such as cooler receipt forms, chain-of-custody records, and a sample receipt check list
- Test method records such as method summaries, sample preparation logs, run sequences and injection time logs
- QA/QC documents such as calibration summaries, laboratory control sample results, surrogate recoveries, matrix spike results, method blank results, preparation and instrument analysis logs, and QC reports

According to the STL QA Manual Section 12.4, laboratory-specific records will be kept in storage for a period of at least five years. Project-related documents will be retained by ENVIRON in the Emeryville office for a period of five years.

4.0 DATA GENERATION AND ACQUISITION

4.1 Sample Handling and Custody

Standard EPA procedures to identify, track, monitor and maintain chain-of-custody for all samples will be implemented as discussed in Section 2.4.

Laboratory sample handling and custody procedures are described in Section 4.1 of the STL QA Manual (Attachment A).

4.2 Analytical Methods

As discussed above, soil samples collected from beneath the former building foundations will be analyzed for asbestos by EPA Method 600/R-93-116, lead and arsenic by EPA Method 6010B, organochlorine pesticides by EPA Method 8081A, and petroleum hydrocarbons by EPA Method 8015 Modified. Soil samples from excavation areas will be analyzed for arsenic by EPA Method 6010B or dieldrin by EPA Method 8081A. Table C-1 list the chemical analytical methods anticipated for this project and the proposed reporting limits for target analytes. In general, samples will be processed as a batch. Samples will be processed sequentially, and samples to be analyzed by a given method will be generally processed on the same apparatus. Samples will be processed without interruption of samples from other projects. At a minimum, the laboratory will perform matrix spikes on one of each ten project samples, or one per sample delivery batch, per matrix type, whichever is more frequent, and independent of the number of analytical instruments used. Samples will be analyzed so that each detected analyte will be quantified within its respective linear range of calibration of the analytical instrument; if analytes are detected outside the linear range of calibration, the sample will be re-analyzed with an appropriate dilution and within holding times so that the analyte can be properly quantified. Additional information on laboratory analytical procedures is included in Section 3.2 of the STL QA Manual (see Attachment A).

Corrective actions for any failures in the analytical system will be handled by STL San Francisco. Section 6.0 of the STL QA manual identifies the personnel responsible for corrective actions as well as related procedures and documentation.

4.3 Quality Control

The requirements and procedures for maintaining laboratory quality control for project data are described below. More details on QC procedures conducted by the laboratory are provided in Section 4.5 of the STL QA Manual (see Attachment A).

4.3.1 Quality Control Samples

To evaluate the precision and accuracy of analytical data, laboratory quality control samples will be analyzed periodically for this project. The minimum project requirements for collection and analysis of these samples are listed in the subsections below.

4.3.1.1 Matrix Spikes and Matrix-Spike Duplicates

A matrix spike is an aliquot of a project sample, either soil or water, to which the laboratory adds a known quantity of a compound prior to sample extraction/digestion and analysis. The reported percent recovery of the known compound in the sample indicates the presence or absence of any effects of the matrix on the sample analyses. A matrix-spike duplicate is an aliquot of the matrix-spike sample that is analyzed separately; the results indicate the precision of the analytical method. A matrix-spike and matrix-spike duplicate analysis will be performed on at least one of each ten project samples, or one per sample delivery batch, per matrix type, whichever is more frequent, and independent of the number of analytical instruments used.

4.3.1.2 Method Blanks

A method blank consists of a laboratory-prepared sample that is carried through the entire analytical procedure. Method blanks for soil and water analyses consist of deionized and/or organic-free water, while method blanks for soil gas analyses consist of ambient air. The purpose of method blanks is to check for laboratory contamination during preparation and analysis of soil, water or soil gas samples. Method blanks will be prepared and analyzed at least once with each analytical batch, with a minimum of one for every 20 samples.

4.3.1.3 Laboratory Control Sample

A laboratory control sample (LCS), or check sample, is a sample prepared by the laboratory or a reliable source that contains known concentrations of the analytes of concern. It is subjected to the same preparation/extraction procedures as a soil, soil gas or water sample, and is prepared independently of calibration standards. The LCS recovery checks the accuracy of the analytical methods and equipment, and will be prepared and analyzed at least once with each analytical batch, with a minimum of one for every 20 samples. LCS recoveries should fall within the limits set by the laboratory.

4.3.1.4 Laboratory Surrogate Compounds

A surrogate spike is an addition to the soil, soil gas or water sample of a known concentration of an organic compound that is not expected to be a compound of concern in

the sample. Every blank, QC sample, and project sample will be spiked with surrogate compounds if specified in the particular analytical method (they are not required for metals analyses). Surrogate recovery should fall within the limits set by the laboratory in accordance with procedures specified by the method.

4.3.2 Calculation of QC Statistics

The validity of chemical data will be measured in terms of precision, accuracy, completeness, and representativeness. The ways in which these four parameters will be evaluated for project data are described below. These calculations are also discussed in Sections 4.6 and 4.7 of the STL QA Manual in Attachment A.

4.3.2.1 Precision

For chemical data generated by the laboratory, data precision will be estimated by comparing analytical results from duplicate samples and from matrix spikes and matrix-spike duplicates. The comparison will be made by calculating the relative percent difference (RPD) given by the following equation:

$$RPD = \frac{2(S_1 - S_2)}{S_1 + S_2} \; x \; 100$$

Where S_1 = sample
S_2 = duplicate

This information will be calculated and reviewed periodically by the Project Manager and/or Project QA Officer. The goals for data precision are summarized in Table C-2. RPD goals are applicable only for samples with detected concentrations greater than five times the reporting limit.

4.3.2.2 Accuracy

Data accuracy will be assessed for laboratory data only and is based on recoveries (R), expressed as the percentage of the true (known) concentration, from laboratory-spiked samples (i.e., matrix spikes, matrix spike duplicates, and laboratory control samples) generated by the analytical laboratory. The equation for calculating recoveries is:

$$R = \frac{(A - B)}{T} \; x \; 100$$

Where A = measured concentration after spiking
B = background concentration

T = known true value of spike

This information will be reviewed periodically by the Project Manager and/or Project QA Officer. The goals for the recovery of selected target analytes in laboratory-spiked samples are presented in Table C-2. These goals may need to be modified depending upon potential matrix interferences associated with the site samples. Alteration or failure to meet these preliminary goals should not be construed to indicate that the data is unsuitable for site characterization and risk assessment as long as the uncertainty associated with the data is adequately characterized (USEPA, 1992).

4.3.2.3 Completeness

Data generated during the investigation will be evaluated for completeness, that is, the amount of data meeting project precision and accuracy goals presented in Table C-2. If data generated via analytical procedures appear to deviate significantly from observed trends, the Project Manager and/or Project QA Officer will review field or laboratory procedures with the appropriate personnel to evaluate the cause of such deviations. Where data anomalies cannot be explained, resampling may be necessary.

4.3.2.4 Representativeness

The representativeness of the data is the degree to which data represent a characteristic of a population, parameter variations at a sampling point, or an environmental condition. Analytical data should represent the sample analyzed regardless of the heterogeneity of the original sample matrix. Field duplicate samples will be collected as a means to assess field representativeness, in addition to being used to assess precision as described in Section 4.3.2.1. Trip blanks will be included in each sample shipment and will contain water samples for volatile organic analysis to evaluate potential cross contamination during transport. Representativeness will also be ensured by use of proper collection protocols as specified in Section 2.3 and 2.4.

4.3.3 Data Review

The Project Manager, Project QA Officer, or appropriate Task Leader assigned by the Project Manager, will review laboratory data. Section 4.3.2 outlines the procedures for evaluating the precision and accuracy of data. If comparison of data to previous measurements or known conditions at the site indicates anomalies, the laboratory will be instructed to review the submitted data while the methods used to collect and handle the samples is reviewed. If anomalies remain, the laboratory may be asked to re-analyze selected samples; other possible corrective actions are discussed below.

4.3.4 Corrective Actions

Corrective actions may be initiated if the precision or accuracy goals listed in Table C-2 are not achieved. The initial step in corrective action will be to instruct the analytical laboratory to examine its procedures to assess whether analytical or computational errors caused the anomalous results. At the same time, sample collection and handling procedures will be reviewed to assess whether they could have contributed to the anomalous results. Based on this evaluation, the Project Manager, with the Project QA Officer, will assess whether re-analysis or resampling is required or whether any protocol should be modified for future sampling events. Laboratory corrective actions are described in the laboratory quality assurance manuals. Any changes in laboratory methods, or quality assurance parameters or limits require written approval prior to implementation by the laboratory.

4.4 Instrument/Equipment Testing, Inspection and Maintenance

Information regarding testing, inspection and maintenance of laboratory equipment, including preventative maintenance schedules, is provided in Section 5.3 of the STL QA Manual in Attachment A.

4.5 Instrument/Equipment Calibration and Frequency

Details on calibration procedures for laboratory equipment, including frequency and techniques, are provided in Section 5.2 of the STL QA Manual in Attachment A.

4.6 Inspection/Acceptance of Supplies and Consumables

Project Managers have primary responsibility for identifying the types and quantities of supplies and consumables needed for environmental data collection projects. Supplies and consumables will be received in the field. When supplies are received, the Field Task Leader will inspect the supplies to ensure that they meet the inspection and acceptance requirements. All inspection and acceptance requirements for supplies and consumables (including reagents, standards, water and glassware) used by the laboratory are presented in Section 9 of the STL QA Manual in Attachment A.

4.7 Data Management

New analytical data for the project will be generated and reported by the lab. Information regarding data reduction, validation and reporting by the laboratory is provided in Section 4.3 of the STL QA Manual (see Attachment A). Details on the storage of data at the laboratory are presented in Section 12 of the STL QA Manual.

Analytical data will be provided by the laboratory in electronic format via email followed by a mailed hard copy report. The electronic data will be entered and maintained in a project database. Analytical

results in the database will be checked against the hard copy report upon their receipt.

5.0 ASSESSMENT AND OVERSIGHT

5.1 Assessments and Response Actions

Assessments that will be performed for this project include laboratory audits, data reviews and peer reviews of data analysis reports. Section 11 of the STL QA Manual in Attachment A describes laboratory audit procedures and related response actions.

The Project Manager, Project QA Officer, or appropriate Task Leader assigned by the Project Manager, will review laboratory data. If comparison of data to previous measurements or known conditions at the site indicates anomalies, the laboratory will be instructed to review the submitted data while the methods used to collect and handle the samples are reviewed. If anomalies remain, the laboratory may be asked to re-analyze selected samples; other possible corrective actions are discussed in Section 4.3.4. Reports related to this project will be peer-reviewed by the Technical Peer Reviewer.

5.2 Reports to Management

The Project Manager will be provided with monthly status reports that will address any work assignment-specific QA issues. Identification of these issues will be facilitated by communication among all project participants.

6.0 DATA VALIDATION AND USABILITY

6.1 Data Review, Verification, and Validation

The criteria for reviewing and validating data are outlined in Sections 4.3, 4.7 and 4.8 of the STL QA Manual in Attachment A. Precision and accuracy goals for data are presented in Table C-2.

6.2 Verification and Validation Methods

The validity of chemical data will be measured in terms of precision, accuracy, completeness, and representativeness. Methods to determine these parameters are discussed in Section 4.3.2.

6.3 Reconciliation with User Requirements

Reconciliation of the sampling and analysis results with the requirements defined by the decisions makers will be discussed in the Report of Sampling Results, which will be prepared following completion of field activities and receipt of laboratory analytical data.

7.0 REFERENCES

U.S. Environmental Protection Agency (USEPA). 2001. EPA Requirements for Quality Assurance Project Plans, EPA QA/R-5.

U.S. Environmental Protection Agency (USEPA). 2000. Region 9 Preliminary Remediation Goals (PRGs) 2001. San Francisco, CA. November.

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United States Environmental Protection Agency (USEPA) Region IX. 1989. Guidance for Preparing Quality Assurance Project Plans for Superfund Remedial Projects: 9QA-03-89, September.

United States Environmental Protection Agency (USEPA). 1988. Guidance for Conducting Remedial Investigations and Feasibility Studies Under CERCLA, EPA/540/g-89/004, October.

TABLES

Table B-1
ESTIMATED REPORTING LIMITS AND PRELIMINARY REMEDIATION GOALS FOR SOIL

Analytical Parameters and Analytes	Method Reference and Number	RL[(a)] (mg/kg)	Residential PRGs (mg/kg)
Asbestos	600/R-93-116	1%	NA
Organochlorine Pesticides	8081		
4,4'-DDD		0.002	2.4
4,4'-DDE		0.002	1.7
4,4'4-DDT		0.002	1.7
4,4'-Methyoxychlor		0.002	310
Aldrin		0.002	0.029
alpha-BHC		0.002	0.09
alpha-Chlordane		0.002	NA
beta-BHC		0.002	0.32
Chlordane (Technical)		0.050	1.6
delta-BHC		0.002	NA
Dieldrin		0.002	0.03
Endosulfan I		0.002	370
Endosulfan II		0.002	370
Endosulfan sulfate		0.002	370
Endrin		0.002	18
Endrin aldehyde		0.002	NA
Endrin ketone		0.002	NA
gamma-BHC (Lindane)		0.002	0.44
gamma-Chlordane		0.002	NA
Heptachlor		0.002	0.11
Heptachlor epoxide		0.002	0.053
Toxaphene		0.10	0.44
Metals	6010B		
Arsenic		1	0.39
Lead		1	400
Petroleum Hydrocarbons	8015M		
Diesel		1	NA
Gasoline		1	NA
Kerosene		1	NA
Motor Oil		50	NA

Notes:
mg/kg = milligrams per kilogram
NA = not available
PRGs = EPA Region IX Preliminary Remediation Goals, October 2002
(a) Reporting limits (RLs) are highly matrix dependent and the values listed are provided for guidance and may not always be achievable. Sample RLs may be higher for samples that require dilution or if matrix interferences are present.

Table B-2
QUALITY ASSURANCE GOALS FOR FIELD AND LABORATORY ANALYSES

Tests	Compounds	Spike level µg/Kg	Soil Limits (%)	% RPD Limit
8081 Pesticides				
Surrogate	2,4,5,6-Tetrachloro-m-xylene	50	50-125	-
	Decachlorobiphenyl	50	46-242	-
MS/MSD	Aldrin	50	37-136	25
	y-BHC	50	37-137	35
	p,p'-DDT	50	55-132	35
	Dieldrin	50	58-135	35
	Endrin	50	58-134	35
	Heptachlor	50	40-136	20
LCS	Aldrin	50	37-136	25
	y-BHC	50	37-137	35
	p,p'-DDT			20
	Dieldrin	50	58-135	35
	Endrin	50	58-134	35
	Heptachlor	50	40-136	20
6010-Metals				
MS/MSD	Arsenic	100	80-120	20
	Lead	100	80-120	20
8015M - Petroluem Hydrocarbons				
Surrogate	o-Terphenyl	20	60-130	-
	4-Bromofluorobenzene	500	58-124	-
LCS	Diesel	250	60-130	25
	Gasoline	2.5	75-125	35

ATTACHMENT A

Quality Assurance Manual
STL San Francisco

STL San Francisco

1220 Quarry Lane
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Quality Assurance Manual

Tenth Revision

January 2002

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1.0 Introduction, Purpose, and Scope

1.1 Overview

STL San Francisco is a part of Severn Trent Laboratories, owned by Severn Trent Plc., a British water, waste, and utility services company. STL San Francisco is a full service environmental laboratory providing testing services for organic and inorganic analyses in a variety of matrices including soil, wastewater, ground water, hazardous wastes, drinking water and air. The laboratory is equipped with automated gas chromatographs using a variety of detectors, including photoionization, electron capture, flame ionization, and ELCD detectors. GC/MS analyses are performed on ten automated, computer-assisted spectrometers. Metals are analyzed using trace ICP, graphite furnace, AA and an automated mercury analyzer. PNAs and explosives are analyzed using a high performance liquid chromatograph. Laboratory functions are managed by ChromaLIMS, a unique Laboratory Information Management System. STL San Francisco specializes in providing the highest quality analytical testing and data deliverables with fast turn-around services.

STL San Francisco operates in compliance with the guidelines described under the STL Quality Management Plan, M-Q-001, Rev. 4, January 24, 2001.

1.2 Program Definition

Quality is defined as the degree to which a process or service meets or exceeds client requirements and expectations. Quality assurance constitutes those planned and systematic actions which, when carried out, provide adequate reliability of monitoring and measuring data. Quality control as a subset of quality assurance provides for the verification of implementation of the quality assurance system.

1.3 Quality Assurance Policy

The goal of STL San Francisco is to provide a positive environment in which there is a commitment to achieve an ever-improving standard of quality. This environment demands that processes and services including the methods employed to achieve quality be consistently improved.

STL San Francisco's policy is:

- To produce consistent and uniform quality analytical services that meet federal, state, and local regulatory requirements,
- To generate accurate, legally defensible data,

- To meet clients' requirements with the best professional services,
- To provide continuous evaluation and improvement of operational processes and procedures,
- To maintain a working environment that supports open communication with clients and staff.

1.4 Management Commitment to QA

Quality is a commitment, achieved by the desire for excellence and by continuous evaluation and improvement. Through this commitment, STL San Francisco follows a Quality Assurance program that involves every aspect of the laboratory and ensures highest quality sample analysis and highest quality data deliverables in the environmental testing industry.

STL San Francisco Mission Statement

STL San Francisco's mission is to provide the client with accurate, legally defensible test results at a reasonable cost.
We specialize in quick turnaround.

Severn Trent Laboratories' Mission Statement

We enable our customers to create safe and environmentally favorable policies and practices, by leading the market in scientific and consultancy services. We provide this support within a customer service framework that sets the standard to which others aspire. This is achieved by people whose professionalism and development is valued as the key to success and through continued investments in science and technology.

1.5 Purpose

The purpose of the Quality Assurance Plan is to provide a description of methods, responsibilities, and quality control systems associated with performing a variety of environmental analytical methods within STL San Francisco and to establish an effective quality management system which assures appropriate controls are implemented based on the complexity of analysis to be provided for each order submission. Roles and responsibilites of management and laboratory staff are also defined.

1.6 Scope

This Manual defines current quality principles and practices that apply to all aspects of the program and uses concepts and methods that have evolved through experience on

environmental analytical methods. STL San Francisco follows the requirements as specified by regulatory agencies. Policies and practices set forth provide a baseline level performance standard. Specific project or client requirements may be used if they do not conflict with regulatory requirements.

2.0 Laboratory Organization and Responsibilities

This section describes the responsibilities for the Quality Assurance System. Each person involved in the generation of analytical data affects STL San Francisco's QA/QC Program. Responsibility of the staff for upholding the standards is described in the quality assurance manual and for implementing procedures is described in the laboratory standard operating procedures (SOPs).

2.1 Responsibility for the Quality Assurance System -

Overall responsibility for quality assurance lies with the Laboratory Director. Within the laboratory, the Laboratory Director is responsible for the implementation of the quality and technical requirements of laboratory analyses and services. The Quality Assurance department is responsible for monitoring the implementation of the QA system, and reporting audit and surveillance findings to management. The Quality Assurance Department, although an independent unit, reports laboratory quality issues directly to the Laboratory Director.

Employees of STL San Francisco are responsible for identifying, reporting, and documenting quality issues and performing the approved corrective action on deviations of laboratory technical and quality requirements.

2.2 Laboratory Director -

The Laboratory Director ensures that the operational requirements of the QA Manual are met. Other responsibilities include the following:

- Reviews and approves the Quality Assurance Manual.
- Manages the on-going requirements of the Quality Assurance and Quality Control activities through the QA Department.
- Has overall responsibility for the development and approval of SOP's, QAP's, and QAPP's and assures that they are technically sound, correct, and meet regulatory requirements.
- Ensures appropriate corrective actions are taken to address non-conformance issues.
- Reviews and approves final data packages to clients.

2.3 Quality Assurance Department -

The Quality Assurance department reports directly to the Laboratory Director and is responsible for monitoring the quality assurance program in the laboratory. The effectiveness and objectivity of the QA/QC program depends on the Quality Assurance

Department being independent of the data-generating process. The primary responsibility of QA is to ensure that the laboratory is operating in compliance with the procedures defined by the EPA, other regulating agencies, and client organizations. This is accomplished through a process of internal audits, surveillances, corrective action, training, and in the development of procedures. The Quality Assurance Department has the authority to perform laboratory audits without notice, submit control samples (performance evaluation samples), and request access to data files and other information necessary to satisfy the goals of an audit. A QA/QC report to management is issued monthly which addresses ongoing QA/QC issues. Additionally, the Quality Assurance Department shall:

- Perform annual audits and periodic surveillances on laboratory activities.
- Coordinate the preparation of QC standards, inserting QC samples into the laboratory sample stream and analyzing resulting data.
- Perform statistical analyses utilizing results of QC sample results.
- Monitor the Quality Assurance program and assure its implementation.
- Provide QA support on quality related issues, including customer/regulatory audits, performance evaluation samples (PEs) and certification activities.
- Review and approve SOPs, QAPs, and QAPPs, to ensure they meet quality control requirements of this Quality Assurance Manual and other applicable quality requirements.
- Assure that a training program is in place and technical personnel have received training to perform their assigned tasks.
- Monitor implementation of laboratory certifications and contract requirements.
- Review 5% of the data produced per sample group for conformance.
- Perform QA training and orientation for laboratory personnel.

2.4 Laboratory Team Leaders -

Team Leaders have the responsibility for laboratory production. Team Leaders coordinate the Project Managers' and analysts' activities including data generation, project management and reporting results. In partnership with the Project Managers, they manage sample work flow to meet customer service objectives and assure that analysts carry out the Quality Assurance Program. Other responsibilities of Team Leaders are to:

- Routinely review and approve analytical reports.
- Identify training needs and recommend training programs for laboratory staff members.
- Train analysts to use methodologies described by approved SOPs.
- Maintain and distribute SOPs, QAP/QAPPs.

- Ensure compliance with approved SOPs, QAP/QAPPs, and quality control.
- Assist analysts in correcting non-conformance issues and reporting them to the Laboratory Director and QA.
- Implement laboratory QA/QC program and participate in determining corrective actions for out-of-control situations.
- Assure compliance with Company Health and Safety program and administer company personnel policies.
- Manage all administrative functions of the laboratory.
- Participate in management teams that plan and problem solve.

2.5 Project Manager -

A Project Manager oversees assigned projects and ensures that all performance requirements are met according to the agreed scope of work. A Project Manager is also responsible for the following:

- Reviewing and approving laboratory data reports and verifying compliance with project requirements.
- Acting as the primary point-of-contact for the client with the laboratory.
- Assuring prompt implementation of project requirements.
- Reviewing specific client requirements and relating these requirements to the laboratory personnel.
- Monitoring samples from receipt through analysis to verifying that proper handling, analysis, and turn-around-time requirements are being met. This includes assuring that hold times are met.
- Coordinating changes in requests.
- Reviewing log-in reports for accuracy and completeness and resolving discrepancies in samples received.
- Providing laboratory management with periodic status reports regarding assigned projects.
- In the final step of document generation, insures that all final data packages are issued to the client complete and on time.

2.6 Analyst -

An analyst produces laboratory test results while following analytical and QC protocol outlined in approved SOPs, QAP/QAPPs. Analysts are responsible for the following:

- Producing quality laboratory data on time. This includes meeting EPA recommended hold times.
- Reviewing of QC data for each batch of samples produced.
- Meeting project data objectives and production goals.
- Performing peer review of raw data.
- Maintaining instruments.
- Correcting non-conformance issues as approved by management.
- Suggesting improvements in methodologies.

2.7 Health & Safety Officer -

The Health & Safety Officer coordinates and oversees the Health & Safety (H&S) Program.

- Presides over H & S issues.
- Together with the Safety Committee, provides H & S training and orientation.
- Together with the Safety Committee, performs H & S inspection/audits of laboratory activities.
- Coordinates with consultant on developing and maintaining laboratory Chemical Hygiene Plan and provides training for the laboratory personnel on Chemical Hygiene.
- Chairs monthly H & S committee meetings.
- Documents all accidents, inspections, and training.
- Inspects all safety equipment and provides safety equipment, goggles, masks, and any other required equipment.

Figure 2-1

STL San Francisco Organization Chart

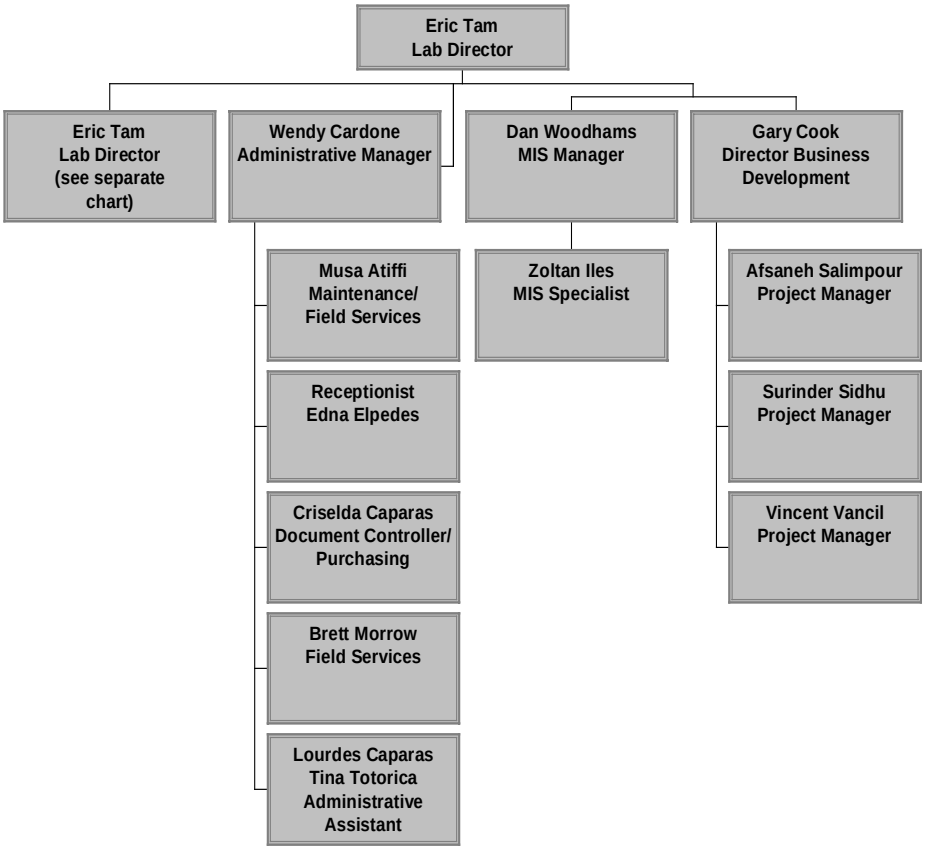
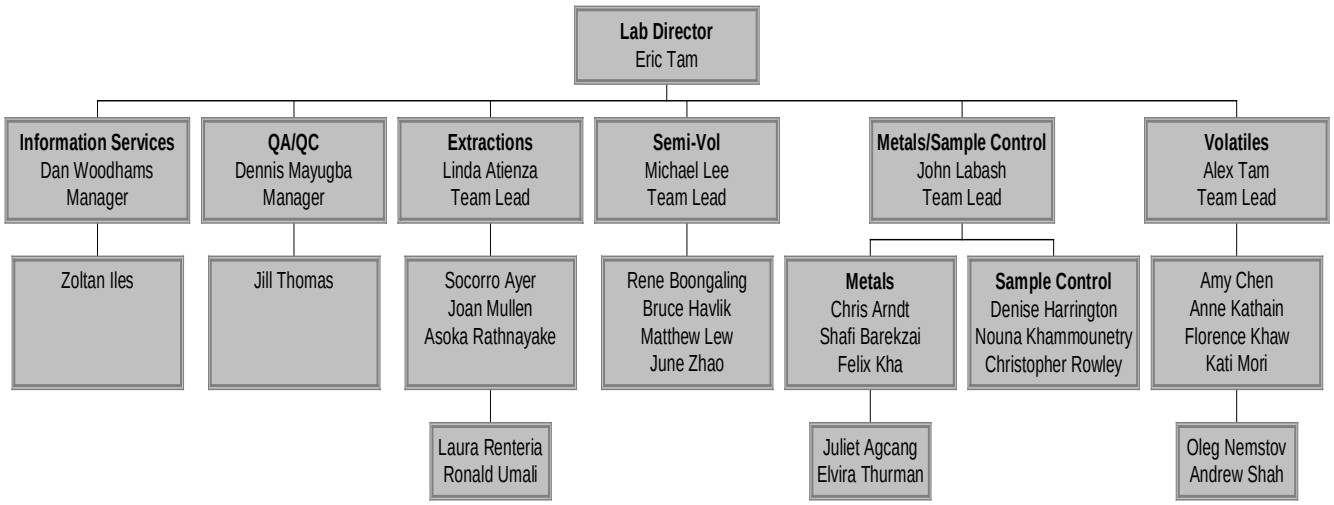


Figure 2-2

Organization Chart Cont.



3.0 Quality Management

3.1 Overview of the Quality Assurance Program -

STL San Francisco's Quality Objective is to provide technically sound and legally defensible data for its customers. To accomplish this objective, STL San Francisco has developed and implemented a comprehensive Quality Assurance program that provides the framework in which all analytical procedures in the laboratory are performed. STL San Francisco has dedicated both the financial and human resources it deems necessary to fully accomplish its Quality Assurance objective.

STL San Francisco's Quality Assurance program is built around three core elements:

1) A written **Quality Assurance Manual (QAM)** describing its capabilities, quality assurance objectives, the systems for meeting those objectives, and the mechanisms for continuously updating and improving those systems. In addition, Quality Assurance Project Plans (QAPP) are developed for specific project or client needs.

2) Written **Standard Operating Procedures (SOPs)** for all aspects of its operations, including instrumentation, analytical procedures, data management and administrative systems.

3) A consistent **Quality Control (QC)** program which includes analysis of blanks, spikes, duplicates, second-source calibration verification standards and other procedures, to assure that no data is reported without meeting all QC requirements mandated by regulatory agencies, clients and STL San Francisco's QC standards. An integral part of the QC program is routine participation in various Performance Evaluation (PE) sample programs, including the EPA mandated WS, WP, and hazardous waste programs.

3.1.1 Quality Assurance Plan

STL San Francisco's Quality Assurance Manual (QAM) was developed to be responsive to requirements and guidelines identified in EPA QA/R2, July, 1993 and SW 846, Chapter 1, Rev.1, July, 1992. The QAM is a controlled document distributed to assigned laboratory personnel in designated positions who perform analytical procedures, supervise those who do, or are responsible for implementing laboratory quality assurance requirements.

The QAM is revised periodically to maintain its relevancy and applicability. In addition, individual sections or pages are added or replaced throughout the year to maintain a current, complete working document. The methods of control are

discussed in Section 7.0, “Document Control & Distribution” and in STL San Francisco SOPs Section 12.13.

3.1.2 Standard Operating Procedures

Written Standard Operating Procedures (SOPs) are developed and used throughout the laboratory. They establish the specific requirements necessary to perform various quality affecting activities and to ensure the consistent performance and resulting data meet the established standard. SOPs are reviewed periodically for continued applicability and are revised as needed. Bench analysts have working copies of all SOPs relevant to their work assignments that serve as training and reference documents.

SOPs are written by the appropriate managers and follow a standard format. After initial drafting, SOPs go through several levels of review before final approval by the Laboratory Director and Quality Assurance. Newly developed SOPs and revisions of existing SOPs receive final approval by the Laboratory Director, Technical Reviewer and Quality Assurance as described in SOP #1.00.

STL San Francisco's SOPs direct the analytical procedures as performed at the bench. No modifications are allowed without complete documentation and approval of the Laboratory Director, Technical Reviewer and Quality Assurance. Should a method modification be necessary, an approval process is established that assures that technical acceptability and client needs are maintained. SOP #1.00 describes the process by which a standard operating procedure is initiated or revised.

3.1.3 Quality Control Program

STL San Francisco maintains a uniform, comprehensive Quality Control program to assure that all analytical data reported is a consistent, known quality that fully meet the requirements of regulatory agencies, clients and STL San Francisco's quality standards.

STL San Francisco's QC program was developed to diagnose and correct out-of-control situations and prevent their reoccurrence. Corrective action for out-of-control situations are identified in the SOPs.

The key elements of STL San Francisco's QC program include:

- **Method Blanks** - to monitor the level of contamination in the analytical process which could lead to reporting of false positives;

- **Laboratory Control Standards (LCS/LCSD)** - to monitor the accuracy (% recovery) and precision (LCSD) of the entire analytical procedure for analytes;
- **Surrogate Standards** - to monitor the recovery of organic compounds that are chemically similar to analyte compounds in order to assess the performance of the analytical system from sample to sample.
- **Matrix Spikes** - to monitor the recovery of known amounts of the analyte compounds to assess the effect of matrix interferences on the accuracy of the analysis;
- **Matrix Spike Duplicates** - to monitor the recovery of known amounts of analyte compounds from separate aliquots of the same sample to assess the effect of matrix interferences on the accuracy and precision of the analysis;
- **Duplicates** - to monitor the recovery of native levels of analyte compounds from separate aliquots of the same sample to monitor the precision of the analysis;
- **Standard Additions** - to correct for matrix effects on the accuracy of analysis by adding a series of known amounts of analytes to the sample (usually for metals or other inorganic compounds);
- **Trip and Field Blanks** - to provide additional QC procedures to monitor contamination introduced during sample collection, transport, or storage.

3.2 Analytical Procedures -

Analytical and other laboratory procedures used by STL San Francisco are described in its STANDARD OPERATING PROCEDURE (SOP) manual which details the proper handling and reporting of samples, performance of analytical and laboratory procedures, proper sample disposal, and safety practices. Reference is made to methods developed by EPA, Standard Methods, instrument manufacturers, and other agencies.

STL San Francisco derives its analytical methods from the following sources:

- "Test Procedures for Analysis of Organic Pollutants", **CODE OF FEDERAL REGULATIONS**, 40 CFR Section 136, Appendix A, B, C, July, 1996 edition: Organics in water EPA Methods 608, 624, 625, and 200.7.
- **METHODS OF CHEMICAL ANALYSIS OF WATER AND WASTE, EPA - 600/4-79-020, USEPA EMSL**, Cincinnati, OH, Revised, March 1983, including Method 300.0, EPA-600/4-84-017, March, 1984: Metals in water, inorganic parameters, oil and grease, and petroleum hydrocarbons.
- **TEST METHODS FOR EVALUATING SOLID WASTE**, SW-846, 3rd edition, USEPA OSW, Washington, D.C., November, 1986, including Update III, December 1996: Metals

and organics in soils and mobility extracts; metals and organics in groundwater for RCRA compliance; hazardous material characterization.

- **STANDARD METHODS FOR EXAMINATION OF WATER AND WASTEWATER**, 18th edition, American Public Health Association, 1992: Pesticides, wet chemistry, and petroleum hydrocarbons in waters, soils, and sludges.
- **METHODS FOR THE DETERMINATION OF ORGANIC COMPOUNDS IN FINISHED DRINKING WATER AND RAW SOURCE WATER,** USEPA EMSL, Cincinnati, OH, September, 1986: Organics in water (drinking water).
- **LEAKING UNDERGROUND FUEL TANK (LUFT) MANUAL**, State of California Water Resources Control Board, August, 1990: Organics, TPH by gas chromatography, and toxics in soil and groundwater.
- **HANDBOOK FOR ANALYTICAL QUALITY CONTROL IN WATER AND WASTEWATER LABORATORIES**, EPA-600/4-79-019, USEPA EMSL, Cincinnati, OH, March, 1979: Laboratory QA/QC practices.
- **CALIFORNIA CODE OF REGULATIONS,** Title 22, Div. 4: Environmental Health, Department of General Services, State of California.
- **FEDERAL REGISTER**, June 29, 1990, 40 CFR Part 261, Appendix II: TCLP.
- **Instruction and operating manuals** of various instrument manufacturers.

STL San Francisco has established Reporting Limits (RLs) for all analyses it performs. These RLs are identified in Section 4 of this document.

3.3 LIMS

STL San Francisco's **Laboratory Information Management System (LIMS)** is the heart of the QA management program, stores information about all samples and requested analysis. It provides the possibility of a nearly paperless system for the management of all sample data in the laboratory.

3.3.1 Samples are logged into ChromaLIMS on arrival (barcode sample tracking on the container level). ChromaLIMS creates an Internal Chain of Custody (ICOC), tracks work scheduling and deadlines, provides automated preparation and run logs, receives results directly from instruments, and prepares reports with full QC documentation. Reports are automatically validated by LIMS against established criteria. Electronic data reporting is routinely available in various custom and standard formats. Database information is under strict security.

3.3.2 ChromaLIMS is used continuously by bench and management personnel as their information base for assuring the quality, timeliness and defensibility of all

analytical data. ChromaLIMS meets all proposed Federal standards for auditability and accountability.

3.4 Quality Assurance Support Programs -

To assure the full performance of its quality assurance programs STL San Francisco maintains on-site technical and administrative support. These are managed by the Laboratory Director and monitored or implemented by the Quality Assurance Department.

3.4.1 STL San Francisco maintains a **Preventive Maintenance (PM)** program to assure timely, cost-effective care and maintenance of all instruments and equipment. The goal of the PM program is the maximization of the operating time for each instrument and the prevention of catastrophic instrument failures. Responsibility for the PM programs rests with department team members (Section 5.3).

3.4.2 **Technical Review** is conducted on data generated in the laboratory to assure that all requirements have been met. The review is conducted following the analyst's calculation and review of results, but before the data is presented for final review and approval. Reviewing analysts are trained in the data review process and must have demonstrated competency to perform that analysis before they perform data reviews. Following review of acceptable data the reviewer initials all reviewed data (Section 10.0).

3.4.3 **Training and Development Programs** are discussed in Section 8.0.

3.4.4 **Health and Safety (H & S)** programs are discussed in Section 3.0.

3.4.5 **Audits** are discussed in Section 11.0.

3.5 A written **Quality Assurance Report to Management** is issued monthly and includes the following:

1) Corrective actions implemented as a result of audit or performance evaluation sample deficiencies.

2) Completed and scheduled audits and the distribution of performance evaluation samples.

3) An account of the corrective action reports issued and the actions and resolutions taken.

4) LIMS status.

5) QA/QC training.

6) Systemic problems and action and resolution taken.

7) Quality achievements.

3.6 Quality Control Meetings -

Quality Control meetings will be held as needed or as required by clients. Orientation to new contracts, assessment of required personnel and equipment, methods, and training will be discussed. These meetings will include the QA Department, Laboratory Director, and Team Leaders. Others may attend these meetings when deemed necessary.

4.0 Laboratory Analytical Activities and Controls

4.1 Sample Custody -

When samples arrive at the laboratory they will be accompanied by **a Chain-of-Custody.** The Chain-of-Custody is a legal document that is rigorously maintained to provide traceability of the samples from their original source to their final disposal. When transferring the possession of samples, the individuals relinquishing and receiving the samples shall sign, date, and note the time on the Chain-of-Custody. The Chain-of-Custody documents all transfers of custody of samples.

The Chain-of-Custody will include date of sampling, sampler, date and time of arrival at the laboratory, who received it, sample ID, preservation, analyses required, matrix, client's project manager, project number, sample location and special requirements (such as turnaround time). It is important that the Chain-of-Custody is correct. Changes after sample receipt will require corrective action and the corrected Chain-of-Custody must be signed and dated by the client before analyses may begin.

Laboratory personnel will be responsible for the care and custody of samples upon receipt by the laboratory. This care and custody responsibility also extends to any samples submitted, but placed on analytical hold for possible future analysis.

4.1.1 Sample Reception.

The designated Sample Controller at the laboratory will accept custody of all samples. The Controller will inspect the sample containers for leakage, breakage or other damage, and verify that the sample identification numbers on the bottles match those on the Chain-of-Custody. The Chain-of-Custody will be signed and dated, an STL San Francisco reference number placed on the form, and a copy immediately returned to the client or other designated party. If samples are received without proper preservation or samples' temperatures are elevated or other discrepancies are noted, they will be documented on the Chain-of-Custody and sample receipt checklist. The project manager will also be immediately notified in order to contact clients who must schedule resampling or take other corrective action.

4.1.2 Sample Log-in.

ChromaLIMS is a unique data management system in which sample login is a significant component for the successful tracking and reporting of client projects. As a sample group is logged into LIMS, it will be assigned a unique STL San Francisco submission ID number, and each container will be assigned its own

tracking number. This tracking number is automatically printed on the container label in barcode format along with other pertinent data, such as client name, client sample ID, analysis required etc. This will initiate an electronic internal chain-of-custody (ICOC). LIMS will keep track of all due dates and holding times and will audit all changes that will be made to the sample records during the laboratory workflow. Project Managers and all lab personnel have access to this information on a view/read only form.

Upon login the samples will be refrigerated in the absence of light and analyzed within the hold times designated for the indicated analyses. A job jacket file will be prepared for each project/submission that includes the original Chain-of-Custody, sample shipping papers, and other project documentation. The job jacket will be given to the Project Manger for review and approval.

4.1.3 Sample Security.

Following log-in, all samples (except aqueous metals) will be stored while awaiting analyses in designated locked refrigerators. Aqueous samples requiring metals analyses (except hexavalent chrome and organo lead) will be stored in locked cabinets at room temperature. Access will be limited to the Sample Controller and designated analysts who record all sample movements on sample custody sheets (Refer to SOP #2.03).

4.1.4 Sample Tracking.

Samples, when taken from storage for analysis, are tracked by scanning the container barcode. This scan will relinquish custody of the sample to the chemist/department. Within each department, samples are logged into the appropriate instrument or procedure sample log books by identification number, due date, matrix and analysis requested. Following analysis, samples are again scanned when returned to sample control. Laboratory personnel will be responsible for the care and custody of samples from the time they are received until they are depleted during analyses, no longer suitable for analysis, or as otherwise directed by the Project Manager or by laboratory sample disposal policy.

4.2 Sample Preparation and Analysis

Once samples are received within a department, they will be logged as described under the section “Sample Tracking” and will be prepared according to the method SOP. A prep batch will be created in LIMS based on the ICOC.

When sample preparation is complete, the prep batch will be relinquished to the analyst who must sign for them either electronically or manually. The analyst will

create instrument sequences based on the prep batches by simply referring to the prep batch. For methods without a preparation (example, volatiles), the anlayst will select the samples to be analyzed from LIMS and the sequence file editor creates sequence records for each sample selected.

4.3 Data Reduction, Validation, and Reporting.

4.3.1 Data Reduction.

Data reduction is the process by which raw data is converted into reportable results. It may be either automated or manual.

- **Automated Data Reduction.** Most data produced at STL San Francisco is computer generated from the various analytical instruments and automatically acquired by the LIMS. The analyst is responsible for verifying the integrity of the raw results both before and after the data has been acquired by LIMS. Any editorial changes are documented in LIMS and stored in its "audit trail".

- **Manual Data Reduction.** For non-computerized analyses, particularly those used in many Wet chemistry tests, information is manually entered into LIMS. LIMS calculates results which are reviewed by the analyst. Any calculations made are shown in the analyst's bench workbook.

  Systems performance checks and audits will be performed periodically to verify that all automated instrument and LIMS software programs are performing properly.

4.3.2 Data Validation.

The analyst will be responsible for determining whether the analytical run is in control and will be expected to review all calibration standards, calibration verification standards, LCS, blanks, spikes and duplicates. To be in control both the LCS and RPD must fall within established control limits. If both fall outside the control limits, the entire batch must be re-prepared and rerun. If either the LCS or the RPD, but not both, fall outside control limits, but the MS/MSD are in control, the data may be reportable upon further review.

Quality control checks for specific analyses will be based on EPA performance criteria. If there is a method specified control limit, it is used unless actual laboratory performance supports a more rigorous limit.

Outliers. An outlier is a data point that is not representative of the data set and that

falls outside established control limits. If an outlier is suspected, data results are first checked for an assignable cause such as instrumental or computational errors, contamination, or misidentification. If such an error is found and corrective action brings the data point into control then, generally, the data will be reportable. The corrective action will be fully documented.

STL San Francisco SOPs 12.02.01 & 12.02.02 describe the procedures for determining outliers (out of control data points).

Reporting Limit Multipliers. Matrix interferences and/or high analyte concentrations may necessitate higher reported detection limits.

- If dilutions are made due to a high concentration level of one or more analytes, but the instrument can still see above the interferences at the regular reporting limit level, the reporting limit(s) will remain the same and will not be raised.

- When a dilution must be made due to matrix interferences and the instrument cannot detect the analyte(s) at the regular reporting limit level, then the reporting limit will be raised.

4.3.3 Data Reporting.

Reporting is the process of communicating approved test results to a client. STL San Francisco has established three levels of reporting which differ only in the level of QA/QC data included in the report package. The quality of analytical results is the same in all three reporting levels.

An automatic data validation process is performed for all reports generated by ChromaLIMS based on laboratory and regulatory criteria such as: meeting QC sample requirements, using appropriate qualifiers, reporting all requested compounds, checking consistency of QC batches etc… Results of this validation are presented in all levels of review for corrective action if necessary.

- **Standard STL San Francisco Report includes:**

  Cover letter

  Chain-of-Custody.

  General Project Information: Sample and client information, sampling date, submission date, extraction and analytical dates, method used, sample results in dry weight or wet weight, dilution factors, reporting limits.

  Detailed results of the method blank.

Matrix spike results and recoveries (accuracy) – if analyzed on client's sample.

Matrix spike duplicate results and recoveries (precision) – if analyzed on client's sample.

Precision and accuracy control limits.

Laboratory Control Sample (LCS) results.

Laboratory Control Sample Duplicate (LCSD), if applicable.

Surrogate recoveries (if applicable).

Statement page of conformance or non-conformance issues signed by the Project Manager or qualified representative.

- **Level III Report** includes all items in Standard Report, plus:

  Case Narrative.

  Table of Contents.

  Method Summary.

  Original copies of cooler receipt forms along with the chain-of-custody and sample receipt check list, if applicable.

  Copies of GC fingerprint chromatograms, preparation logs, run logs, and other analytical data as required.

  QC reports.

  Initial and continuing calibration summaries and chromatograms.

  Supporting Data – GC fingerprint chromatograms and inorganic chemistry raw Data. Inorganic chemistry raw data.

  Preparation & Instrument analysis logs.

  GC retention time table for PCBs & pesticides.

  Sample preparation logs and run sequences and logs with injection times. ICAL and CCV data is included.

- **Level IV Report** includes all items in Standard Report & Level III plus:

  Copies of all raw data sheets including reruns, dilutions, QA/QC results, confirmation runs, chromatograms and quantitation report, and tuning and mass calibration report for GC/MS.

  Initial and continuing calibration to include Response Factor, Retention Times, QA/QC.

  Retention time windows for GC, when applicable.

Injection records.

For metals - interference check sample, Method of Standard Additions, serial dilutions, linear ranges, interelement correction factors.

4.4 Laboratory Information Management System (LIMS)

STL San Francisco's Laboratory Information Management System maintains all sample and report-related information at STL San Francisco. Samples arriving will be logged into ChromaLIMS which:

1) Tracks work scheduling and due dates, holding times,
2) Generates instrument sequences, electronic prep and run logbooks with full QC eliminating typos.
3) Records weights directly from the analytical balance,
4) Receives results directly from instruments,
5) Audits bench review, second level approval,
6) Provides electronic validation for bench chemist and Project Management for final approval,
7) Prepares reports with full QC documentation.
8) Electronic data reporting is available in multiple custom and standard formats.
9) All Reports are created in Adobe Acrobat PDF file format and can be delivered from within LIMS by email or fax by a click of mouse…or can be printed.
10) STL San Francisco's LIMS meets all current Federal standards for audit ability and accountability.

4.5 Internal Quality Control Checks.

STL San Francisco maintains a comprehensive program of field and laboratory QC procedures.

Field QA/QC samples may be periodically prepared in the field and submitted for analysis with the regular samples upon client's request. These QA/QC samples will consist of field equipment blanks, travel blanks and replicate samples. QA/QC samples may be given fictitious sample designations. They shall be handled and transported in the same manner as regular samples.

Depending upon project objectives, field travel blanks may be prepared in the field for every organic sampling event using laboratory-grade organic free water. If prepared by

customer or field samplers, the field travel blank will be poured into a bottle at one of the sampling sites, and so noted on the field sampling form. The field travel blank will be analyzed for the complete set of organic parameters requested for the regular samples. Laboratory travel blanks will be prepared in the same way in the laboratory, and travel with containers to the field and back again for analysis. The laboratory travel blank will be analyzed for the complete set of volatile organic parameters requested for the regular samples.

Depending on project objectives, one replicate sample may be collected for every sampling event and submitted for analysis. The replicate will be analyzed for the complete set of parameters requested for the regular sample.

Laboratory Quality Control Tests. In addition to the field QA/QC samples described above, the laboratory will analyze, at a minimum, the following QA/QC samples:

Method Blanks at a frequency of one every 20 samples to monitor laboratory contamination.

Laboratory Control Sample (LCS) at a frequency of one every 20 samples to monitor accuracy of system and preparation. The DI water or clean sand will be spiked prior to extraction, and the results reported as percent recovery.

Laboratory Control Sample Duplicate (LCSD) at a frequency of one every 20 samples to monitor accuracy and precision. LCSD is optional if an MSD is analyzed for the same analytical batch to monitor precision.

Matrix Spikes at a frequency of one every 20 samples to monitor accuracy. The sample will be spiked prior to extraction and the results reported as percent recovery.

Matrix Spike Duplicate at a frequency of one every 20 samples to monitor accuracy and precision. The same sample that was used as a matrix spike will be spiked a second time prior to extraction. The results will be reported as percent recovery.

Sample Duplicates at a frequency of one every 20 samples to monitor precision. (A matrix duplicate is run only upon request by client.)

CCV & CCB, continuing calibration verifications (CCVs) are run at a minimum of one every 12 hours for organic analyses (GC and GC/MS). STL San Francisco follows the guidelines set forth in SW 846, Method 8000B. Continuing calibration blanks, CCBs, (requirement for metals analyses) and CCVs are run at a frequency of one every ten injections for metals analyses.

Surrogate Spikes are run on 100% of organic samples when required per STL San Francisco SOP.

An ICP Interference Check Sample is run at the beginning and end of each ICP analytical run.

The laboratory will maintain on file all laboratory QA/QC documentation, reviewed for completeness. The following administrative QA/QC will be performed:

The dates of sample extraction and analysis will be compared with sample collection dates to ensure that the samples were analyzed within EPA established holding times;

The respective sets of values from duplicate QC samples will be compared for agreement. Results from identified field blanks will be reviewed. Reanalysis will be performed as necessary;

All required quality control samples will be run daily to monitor system performance. If quality control samples indicate a problem with the system, the analyst will evaluate the procedure to determine the source of error. If a repetition of the QC sample does not fall within acceptable limits, the instructions for corrective action in out-of-control situations will be followed;

When required by the method, all positive organics results will be confirmed using a second column or by GC/MS;

Logbooks will be maintained for preparation of all organic and inorganic standards. Information on suppliers, lot numbers, weight/volume of standards used, date prepared, expiration date, and name of analyst will be recorded.

4.6 QA Objectives for Measurement Data -

STL San Francisco maintains a data quality program to ensure that it meets the requirements of its clients for data quality. STL San Francisco's data quality is expressed in terms of precision, accuracy, representativeness, completeness, and comparability.

Precision. The laboratory objective for precision is to equal or exceed the precision demonstrated for given analytical methods as published by the U.S. EPA. Precision is defined as the degree of reproducibility of the measurements under a given set of conditions. Precision will be documented on the basis of replicate analyses.

Accuracy. The laboratory objective for accuracy is to equal or exceed the accuracy demonstrated for given analytical methods and to perform better than the recovery data published by the U.S. EPA. Accuracy is defined as the bias in a measurement system. Accuracy will be documented on the basis of recovery of blank spikes. matrix spikes, and spiked reference materials introduced into selected samples of a particular matrix.

Representativeness. The laboratory objective for representativeness is to provide data which is representative of the sampled medium. Representativeness is defined as the degree to which data represent a characteristic of a set of samples. The representativeness of the analytical data is a function of the procedures and care used in processing the samples. The representativeness will be documented by the difference between separately procured, but otherwise identical samples or sample aliquots.

Completeness. The completeness objective for an analysis is to provide sufficient data of acceptable quality such that the goals of the analytical project can be achieved within the time frame required. The overall project completeness will be expressed as the percentage of qualified data for the entire project.

Comparability. The comparability objective is to provide analytical data for which the accuracy, precision, representativeness, completeness and detection limit are similar to these quality indicators for data generated by other laboratories for similar samples, and for data generated by STL San Francisco over time. The comparability objective will be documented by interlaboratory studies carried out by regulatory agencies or carried out for specific projects or contracts, and by comparison of periodically generated statements of accuracy, precision and detection limits.

4.7 Assessment Procedures for Data Acceptability -

Assessment of data acceptability will be performed primarily by establishing acceptance limits for precision and accuracy through the use of control charts. Reference is made to other sections of this document which discuss related topics, including Section 4.6 on quality assurance objectives, Sections 4.3.1 & 4.3.2 on data reduction, and Section 4.5 on internal quality control checks.

(1) Precision will be assessed at the bench based on the results of paired spiked samples or, where spikes are not feasible, duplicate samples. The analyst calculates the relative percent difference (RPD) according to the following formula:

$$RPD = \frac{D1 - D2}{(D1 + D2)/2} \times 100$$

where,
RPD equals the absolute difference between duplicates, D1 and D2, divided by the mean of the duplicate results.

The result of the calculation will then be compared to the method-specific control limits found in Table II of this document.

If the comparison reveals precision to be outside acceptance windows, the analyst will undertake corrective action as described in Section 6.0 of this document.

In some instances, insufficient sample is provided for use as duplicates or matrix spike duplicates. In this situation, in order to provide a precision assessment for such batches, two Laboratory Control Standards (LCSs) will be prepared and analyzed. The RPD will be calculated as for matrix spikes. While not as indicative as a matrix spike would be, this procedure still provides valuable QC information for the samples in the batch.

(2) **Accuracy.** Method accuracy assesses the short-term control status of the analytical process. LCSs are used to provide this assessment. Matrix spikes assess matrix accuracy. Percent recovery (R) will be calculated according to the following formula and compared with the method limits from the QC limits shown in Table II of this document. Results outside control limits will require corrective action as described in Section 6.

$$R = \left| \frac{SSR - SR}{SA} \right| \times 100$$

where,
R = % Recovery
SSR = Spiked Sample Result
SR = Sample Result
SA = Spike Amount/Conc.

Control Charts will be routinely plotted and instrumental performance, contamination, and analytical error trends will be monitored. The control limit for accuracy is $\pm$ three standard deviations from the mean percent recovery. The warning limit is $\pm$ two standard deviations.

Control limits will be recalculated at least annually. When acceptable control limits have been achieved and calculations completed, the QA Department will review and distribute control limit lists and control charts for use by the analysts. All revisions to control limits will be entered into LIMS and become the new quality control limits of the laboratory.

4.8 Reporting Limit Criteria -

Method Detection Limit (MDL): The minimum concentration of a substance 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 type containing the analyte. STL San Francisco SOP #12.03.01 describes the procedures for determining MDLs for various analytes. MDLs will be performed yearly per method per matrix per analyte. Any relevant change in methodology will require a satisfactory MDL study before it can be accepted. In the case that typical MDLs are listed in published methods (e.g. SW-846), they should be regarded as baseline values. STL San Francisco's experimentally determined MDLs will meet or be below the listed MDLs. If these typical MDLs cannot be achieved, it will be brought to the attention of the QA department immediately. All MDL files will be maintained within the QA department.

Instrument Detection Limit (IDL): The minimum concentration that can be measured and reported with 99% confidence that the analyte concentration is greater than zero and is determined from analysis of a known standard solution. STL San Francisco SOP #12.03.02 describes the procedures for determining IDLs for various analytes. As a minimum, IDLs will be performed before a new instrument is used for production work. Furthermore, any modification of the instrument that may affect its sensitivity (e.g. new detector) will also require an IDL study.

Practical or Estimated Quantitation Limit (PQL/EQL): The lowest concentration that can be reliably achieved within specified limits of precision and accuracy during routine laboratory operating conditions. The EQL is generally 5 to 10 times the MDL. However, it may be nominally chosen within these guidelines to simplify data reporting. For many analytes, the EQL analyte concentration is selected as the lowest non-zero standard in the calibration curve (10X MDL).

Reporting Limit: The lowest concentration that can be reliably achieved for a specific analyte. taking into account of various variables such as dilution and matrix interference. The reporting limit will be the same as or higher than the experimentally determined MDL for the same matrix.

- In cases where samples are diluted, the dilution factor will be applied to the PQL/EQL, **not** the MDL.
- Individual SOPs will address instances where published limits are not practical to achieve.

4.9 Communication of Project Requirements -

Project-specific requirements will be communicated to laboratory personnel in one or more of four procedures, whichever are appropriate:

- One time: Requirements are described in comments in LIMS, and copies of the COC are distributed to affected laboratory personnel.
- Project-specific, short-term: Requirements are described in comments in LIMS, plus a memo written by the Project Manager is distributed to affected personnel.
- Project-specific, long-term: A special project description is created in LIMS, e.g. client specific methods, reporting requirements, test and analyte lists.
- Quality Assurance Project Plan (QAPP), long-term: This occurs when work is performed under different QAPP's. A project "kickoff" meeting is held during which new QA requirements are communicated to section leaders. A summary of QAPP requirements are written by the Project Manager in a form suitable for bench chemist' use. Each QAPP is referenced by site name. When work comes in, the Project Manager describes the data package requirements for each COC by level number (e.g. Standard Report, III, or IV). The "site" designation is assigned for each QAPP as specified by the client.

Table I

Sampling Guide and Holding Times for Solids, Water and Wastewater

Parameters	Hazardous Waste Method Soil & Water	Wastewater/ Water Method	Container Type Solids	Container Type Liquids	Preservative Liquid	Holding Time
CLASSIC CHEMISTRY						
ALKALINITY	***	310.1, SM 2320B	***	500 mL HDPE	None Required	14 Days
AMMONIA	***	350, SM 4500	***	500 mL HDPE	pH<2 H_2S0_4, 4°C	28 Days
BIOCHEMICAL, OXYGEN DEMAND (BOD)	***	SM 5210B	***	1 L HDPE	Cool 4°C	48 Hours
BROMIDE	***	300.0	***	500 mL HDPE	None Required	28 Days
CHLORIDE	***	300.0	***	500 mL HDPE	None Required	28 Days
CHEMICAL OXYGEN DEMAND (COD)	***	410, SM 5520	***	500 mL HDPE	pH<2 H_2S0_4, 4°C	28 Days
COLIFORM, HTP	9131, 9132	SM 9221	***	SPC	(1) 4°C	6 Hours
CYANIDE	9010	335, SM 4500	4 oz CWM	500 ml HDPE	(2) pH>12 NaOH, 4 °C	14 Days
FLUORIDE	***	300.0	***	500 mL HDPE	None Required	28 Days
KJELDAHL NITROGEN, TOTAL (TKN)	***	351, SM 4500	***	500 mL HDPE	pH<2 H_2S0_4, 4°C	28 Days
MBAS	***	425.1, SM 5540C	***	500 mL HDPE	Cool 4°C	48 Hours
NITRATE	***	300.0	***	500 mL HDPE	Cool 4°C	48 Hours
NITRITE	***	300.0	***	500 mL HDPE	Cool 4°C	48 Hours
OIL & GREASE	1664	SM 5520B, 413.1	4 oz CWM	1 L A.J.	pH<2 H_2S0_4 or HCl, 4°C	28 Days
pH	9040, 9045	150.1, SM 4500	4 oz CWM	500 mL HDPE	None Required	Anal. Immed.
PETROLEUM HYDROCARBONS (TRPH)	1664	418.1	4 oz CWM	1 L Glass	pH<2 HCl, 4°C	28 Days
PHOSPHORUS, ORTHO	***	300.0	***	500 mL HDPE	Cool 4°C	48 Hours
PHOSPHORUS, TOTAL	***	365, SM 4500	***	500 mL HDPE	pH<2 H_2S0_4, 4°C	28 Days
RESIDUE, TOTAL	***	160.3, SM 2540B	***	500 mL HDPE	Cool 4°C	7 Days
RESIDUE, FILTERABLE (TDS)	***	160.1, SM 2540C	***	500 mL HDPE	Cool 4°C	7 Days
RESIDUE, NON-FILTERABLE (TSS)	***	160.2, SM 2540D	***	500 mL HDPE	Cool 4°C	7 Days
RESIDUE, SETTLEABLE	***	160.5, SM 2540F	***	2 1/2 L A.J.	Cool 4°C	48 Hour
SPECIFIC CONDUCTANCE	9050A	120.1, SM 2510B	***	500 mL HDPE	Cool 4°C	28 Days
SULFATE	***	300.0	***	500 mL HDPE	Cool 4°C	28 Days
SULFIDE	9030	376, SM 4500	4 oz CWM	500 mL HDPE	(3) pH>9 NaOH, ZnOAc, 4 °C	7 Days
TOTALORGANIC CARBON (TOC)	9060	415.1, SM 5310	4 oz CWM	500 mL HDPE	pH<2 H_2S0_4, 4°C	28 Days
METALS						
CHROMIUM VI	7196	SM 3500-Cr D	4 oz CWM	500 mL HDPE	Cool 4°C	W-24 Hours
MERCURY	7470, 7471	245.2	4 oz CWM	250 mL HDPE	pH<2 HNO_3	28 Days
METALS (Except Cr^{+6} & Hg)	6010 / 7000 Series	200.7/200 Series	4 oz CWM	250 mL HDPE	pH<2 HNO_3	6 Months
VOLATILE ORGANICS						
METHANE, CO_2	3810M		***	x3 - 40 ml VOA	Cool 4°C	30 Days
PURGEABLE AROMATICS	8020, 8021	602	4 oz CWM	x3 - 40 ml VOA	(1) pH<2 HCl,4°C	14 Days
PURGEABLE HALOCARBONS	8021, 8260	601	4 oz CWM	x3 - 40 ml VOA	(1) pH<2 HCl,4°C	14 Days
VOLATILE ORGANICS, FUEL OXYGENATES	8260	624	4 oz CWM	x3 - 40 ml VOA	(1) pH<2 HCl,4°C	14 Days
SEMI-VOLATILE ORGANICS						
PCB'S	8082	608	8oz CWM	1 L A.J.	Cool 4°C	S-14 Days, W-7 Days (4)
PESTICIDES, CHLORINATED	8081	608	8oz CWM	1 L A.J.	(1) pH-5-9, 4°C	S-14 Days, W-7 Days (4)
PHENOLS	8270	625	8oz CWM	1 L A.J.	(1) 4°C	S-14 Days, W-7 Days (4)
POLYNUCLEAR AROMATIC HYDROCARBONS,	8310, 8270	610, 625	8oz CWM	1 L A.J.	(1) 4°C	S-14 Days, W-7 Days (4)
SEMI-VOLATILE ORGANICS	8270	625	8oz CWM	1 L.A.J	(1) 4°C	S-14 Days, W-7 Days (4)
EXPLOSIVES						
NITROAROMATICS & NITRAMINES BY HPLC	8330		8oz CWM	1 L.A.J	(1) 4°C	S-14 Days, W-7 Days (4)
VOLATILE & EXTRACTABLE HYDROCARBONS						
NONHALOGENATED VOLATILE ORGANICS	8015, 8260	8015, 624	4 oz CWM	40 ml Glass Vial	(1) pH<2 HCl,4°C	14 Days
TPH AS GASOLINE	Mod 8015	Mod 8015	4 oz CWM	40 ml Glass Vial	pH<2 HCL, 4°C,	14 Days
TPH AS DIESEL	Mod CA LUFT/8015	Mod CA LUFT/8015	Brass Tube	x2-1 L.A.J.	None Required	S, W-14 Days (4)
TEPH	Mod CA LUFT/8015	Mod CA LUFT/8015	Brass Tube	x2-1 L.A.J.	None Required	S, W-14 Days (4)
CHARACTERISTIC DETERMINATION						
TCLP EXTRACTION	1311	***	16 oz CWM	4 L.A.J.	None Required	
IGNITABILITY, FLASHPOINT	1010, CA Title 22	***	4 oz CWM	500 ml B.R.	None Required	

SEVERN TRENT SERVICES

STL San Francisco
Chain of Custody

1220 Quarry Lane ● Pleasanton CA 94566-4756
Phone: (925) 484-1919 ● Fax: (925) 484-1096

Figure 4-1

Reference #: _____

Date _____ Page _____ of _____

Report To					Analysis Request																							
Attn:					TPH EPA - ☐ 8015/8021 ☐ 8260B ☐ Gas w/ ☐ BTEX ☐ MTBE	Purgeable Aromatics BTEX EPA - ☐ 8021 ☐ 8260B	TEPH EPA 8015M ☐ Silica Gel ☐ Diesel ☐ Motor Oil ☐ Other ___	Fuel Tests EPA 8260B ☐ Gas ☐ BTEX ☐ Five Oxygenates ☐ DCA, EDB ☐ Ethanol	Purgeable Halocarbons (HVOCs) EPA 8021	Volatile Organics GC/MS (VOCs) ☐ EPA 8260B ☐ 624	Semivolatiles GC/MS ☐ EPA 8270 ☐ 625	Oil and Grease (EPA 1664) ☐ Petroleum ☐ Total	Pesticides PCBs ☐ EPA 8081 ☐ 608 ☐ EPA 8082 ☐ 608	PNAs by ☐ 8270 ☐ 8310	CAM17 Metals (EPA 6010/7470/7471)	Metals: ☐ Lead ☐ LUFT ☐ RCRA ☐ Other: _____	☐ W.E.T (STLC) ☐ TCLP	Hexavalent Chromium pH (24h hold time for H_2O) ☐ ☐	☐ Alkalinity ☐ Spec Cond. ☐ TDS ☐ TSS	Anions : ☐ Cl ☐ SO_4 ☐ NO_3 ☐ F ☐ Br ☐ NO_2 ☐ PO_4					Number of Containers
Company:																												
Address:																												
Phone:	Email:																											
Bill To:		Sampled By:																										
Attn:		Phone:																										
Sample ID	Date	Time	Mat rix	Pres erv.																								

Project Info.	Sample Receipt
Project Name:	# of Containers:
Project#:	Head Space:
PO#:	Temp:
Credit Card#:	Conforms to record:

TAT	Std 5 Day	72h	48h	24h	Other:

Report: ☐ Routine ☐ Level 3 ☐ Level 4 ☐ EDD ☐ State Tank Fund EDF ☐ Global ID _____
Special Instructions / Comments:

1) Relinquished by:	2) Relinquished by:	3) Relinquished by:
Signature Time	Signature Time	Signature Time
Printed Name Date	Printed Name Date	Printed Name Date
Company	Company	Company

1) Received by:	2) Received by:	3) Received by:
Signature Time	Signature Time	Signature Time
Printed Name Date	Printed Name Date	Printed Name Date
Company	Company	Company

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Figure 4-2
Sample Receipt Checklist

Client Name: _____ Date/Time Received: _____
Date / Time

Reference/Subm #: _____ Received by:_____

Checklist completed by: _____ Reviewed By:_____
Signature / Date Initial/Date

Matrix: ☐ Soil ☐ Water ☐ Other _____ Carrier name: Client – STL SF_____

Shipping container/cooler in good condition? Yes ____ No____ Not Present____

Custody seals intact on shipping container/cooler? Yes____ No____ Not Present____

Custody seals intact on sample bottles? Yes____ No____ Not Present____

Chain of custody present? Yes____ No_____

Chain of custody signed when relinquished and received? Yes____ No_____

Chain of custody agrees with sample labels? Yes____ No_____

Samples in proper container/bottle? Yes____ No_____

Sample containers intact? Yes_____No_____

Sufficient sample volume for indicated test? Yes_____No_____

All samples received within holding time? Yes_____No_____

Container/Temp Blank temperature in compliance? Temp:_____°C Yes_____No_____

Water - VOA vials have zero headspace?

No VOA vials submitted_____ Yes_____ No_____

Water - **pH acceptable upon receipt?** ☐ Yes ☐ No ☐ Checked by Voa chemist

☐ **pH adjusted**– Preservative used:
☐ HNO_3 ☐ HCl ☐ H_2SO_4 ☐ NaOH ☐ ZnOAc **Lot#**(s)_____
Any No and/or NA (not applicable) response must be detailed in the comments section below.

==========

Client contacted: _____ Date contacted: _____ Person contacted: _____

Contacted by: _____ Regarding: _____

Comments: _____

Corrective Action: _____

Table II

QA Objectives for Measurement Data

1. Liquid Matrices

METALS BY ICP (6010B)	Precision (% RPD)	Accuracy (%) LSC/LCSD and	MS/MSD	Rep.Limit (mg/L)
Aluminum	<20	80-120	75-125	0.20
Antimony	<20	80-120	75-125	0.005
Arsenic	<20	80-120	75-125	0.005
Barium	<20	80-120	75-125	0.005
Beryllium	<20	80-120	75-125	0.005
Cadmium	<20	80-120	75-125	0.002
Calcium	<20	80-120	75-125	0.20
Chromium	<20	80-120	75-125	0.005
Cobalt	<20	80-120	75-125	0.005
Copper	<20	80-120	75-125	0.005
Iron	<20	80-120	75-125	0.20
Lead	<20	80-120	75-125	0.005
Magnesium	<20	80-120	75-125	0.20
Manganese	<20	80-120	75-125	0.005
Molybdenum	<20	80-120	75-125	0.005
Nickel	<20	80-120	75-125	0.005
Potassium	<20	80-120	75-125	1.0
Selenium	<20	80-120	75-125	0.005
Silver	<20	80-120	75-125	0.005
Sodium	<20	80-120	75-125	1.0
Thallium	<20	80-120	75-125	0.005
Vanadium	<20	80-120	75-125	0.005
Zinc	<20	80-120	75-125	0.01

MERCURY BY COLD VAPOR (7470A)	Precision (% RPD)	Accuracy (%) LSC/LCSD and	MS/MSD	Rep.Limit (mg/L)
Mercury	<20	85-115	85-115	0.0002

METALS BY GFAA (7000 Series)	Precision (% RPD)	Accuracy (%) LSC/LCSD and	MS/MSD	Rep.Limit (mg/L)
Arsenic	<20	85-115	85-115	0.002
Lead	<20	85-115	85-115	0.002
Selenium	<20	85-115	85-115	0.002
Thallium	<20	85-115	85-115	0.002

QA Objectives for Measurement Data

HALOGENATED VOLATILE ORGANIC COMPOUNDS BY GC (8021B)	Precision (% RPD)	Accuracy (%) LSC/LCSD and MS/MSD		Rep.Limit (ug/L)
Bromodichloromethane				0.5
Bromoform				2
Bromomethane				1
Carbon tetrachloride				0.5
Chlorobenzene	<20	70-130	70-130	0.5
Chloroethane				0.5
2-Chloroethylvinylether				0.5
Chloroform				0.5
Chloromethane				1
Dibromochloromethane				0.5
1,2-Dichlorobenzene				0.5
1,3-Dichlorobenzene				0.5
1,4-Dichlorobenzene				0.5
Dichlorodifluoromethane				1
1,1-Dichloroethane				0.5
1,2-Dichloroethane				0.5
1,1-Dichloroethene	<20	70-130	70-130	0.5
cis-1,2-Dichloroethene				0.5
trans-1,2-Dichloroethene				0.5
1,2-Dichloropropane				0.5
cis-1,3-Dichloropropene				0.5
trans-1,3-Dichloropropene				0.5
Methylene chloride				5
1,1,2,2-Tetrachloroethane				0.5
Tetrachloroethene				0.5
1,1,1-Trichloroethane				0.5
1,1,2-Trichloroethane				0.5
Trichloroethene	<20	70-130	70-130	0.5
Trichlorofluoromethane				0.5
Trichlorotrifluroethane				2
Vinyl chloride				0.5
1-Chloro-2-fluorobenzene (surr.)		70-130	70-130	

QA Objectives for Measurement Data

VOLATILE AROMATIC COMPOUNDS BY GC (8021B)	Precision (% RPD)	Accuracy (%) LSC/LCSD and	MS/MSD	Rep.Limit (ug/L)
MTBE				5
Benzene	<20	77-123	65-135	0.5
Chlorobenzene				0.5
1,2-Dichlorobenzene				0.5
1,3-Dichlorobenzene				0.5
1,4-Dichlorobenzene				0.5
Ethylbenzene	<20	70-130	65-135	0.5
Toluene	<20	78-122	65-135	0.5
Xylenes, total	<20	75-125	65-135	0.5
4-Bromofluorobenzene (surr)		50-150	50-150	
Trifluorotoluene (surr)		58-124	58-124	

PETROLEUM HYDROCARBONS (8015 Modified)	Precision (% RPD)	Accuracy (%) LSC/LCSD and	MS/MSD	Rep.Limit (ug/L)
Diesel	<25	60-130	60-130	50
o-Terphenyl (surr)		60-130	60-130	
Motor Oil				500
Kerosene				50
Gasoline	<20	75-125	65-135	50

GLYCOLS (8015 Modified)	Precision (% RPD)	Accuracy (%) LSC/LCSD and	MS/MSD	Rep.Limit (mg/L)
Diethylene Glycol	<35	60-130	60-130	10
Ethylene Glycol	<35	60-130	60-130	10
Tetraethylene Glycol	<35	60-130	60-130	10
Triethylene Glycol	<35	60-130	60-130	10
2-(2-Butoxyethoxy) Ethanol (surr)		60-130	60-130	

QA Objectives for Measurement Data

VOLATILE ORGANIC COMPOUNDS BY GC/MS (624)	Precision (% RPD)	Accuracy (%) LSC/LCSD and MS/MSD		Rep.Limit (ug/L)
Benzene	<20	69-129	69-129	0.5
Bromodichloromethane				0.5
Bromoform				0.5
Bromomethane				1
Carbon tetrachloride				0.5
Chlorobenzene	<20	61-121	61-121	0.5
Chloroethane				0.5
2-Chloroethylvinyl ether				1
Chloroform				0.5
Chloromethane				0.5
Dibromochloromethane				0.5
1,2-Dichlorobenzene				0.5
1,3-Dichlorobenzene				0.5
1,4-Dichlorobenzene				0.5
1,1-Dichloroethane				0.5
1,2-Dichloroethane				0.5
1,1-Dichloroethene	<20	65-125	65-125	0.5
cis-1,2-Dichloroethene				1
trans-1,2-Dichloroethene				0.5
1,2-Dichloropropane				0.5
cis-1,3-Dichloropropene				0.5
trans-1,3-Dichloropropene				0.5
Ethylbenzene				0.5
Methylene chloride				0.5
MTBE				0.5
1,1,2,2-Tetrachloroethane				0.5
Tetrachloroethene				0.5
Toluene	<20	70-130	70-130	0.5
1,1,1-Trichloroethane				0.5
1,1,2-Trichloroethane				0.5
Trichloroethene	<20	74-134	74-134	0.5
Trichlorofluoromethane				1
Vinyl chloride				0.5
Total Xylenes				0.5
4-Bromofluorobenzene (surr)		86-115	86-115	
1,2-Dichloroethane-d4 (surr)		76-114	76-114	
Toluene-d8 (surr)		88-110	88-110	

QA Objectives for Measurement Data

VOLATILE ORGANIC COMPOUNDS BY GC/MS (8260B)	Precision (% RPD)	Accuracy (%) LSC/LCSD and MS/MSD		Rep.Limit (ug/L)
Acetone				50
Benzene	<20	69-129	69-129	1
Bromobenzene				1
Bromochloromethane				1
Bromodichloromethane				1
Bromoform				1
Bromomethane				5
2 Butanone (MEK)				50
n-Butylbenzene				1
sec-Butylbenzene				1
tert-Butylbenzene				1
Carbon disulfide				5
Carbon tetrachloride				1
Chlorobenzene	<20	61-121	61-121	1
Chloroethane				1
2-Chloroethylvinyl ether				5 (1)
Chloroform				1
Chloromethane				1
2-Chlorotoluene				1
4-Chlorotoluene				1
Dibromochloromethane				1
1,2-Dibromo-3-chloropropane				1
1,2-Dibromoethane				1
Dibromomethane				1
1,2-Dichlorobenzene				1
1,3-Dichlorobenzene				1
1,4-Dichlorobenzene				1
Dichlorodifluormethane				1
1,1-Dichloroethane				1
1,2-Dichloroethane				1
1,1-Dichloroethene	<20	65-125	65-125	1
cis-1,2-Dichloroethene				1
trans-1,2-Dichloroethene				1
1,2-Dichloropropane				1
1,3-Dichloropropane				1
2,2-Dichloropropane				1
1,1-Dichloropropene				1
cis-1,3-Dichloropropene				1
trans-1,3-Dichloropropene				1

QA Objectives for Measurement Data

VOLATILE ORGANIC COMPOUNDS BY GC/MS (8260B) – Continued

Ethylbenzene				1
Hexachlorobutadiene				1
2-Hexanone				50
Isopropylbenzene				1
p-Isopropyltoluene				1
Methylene chloride				5
4-Methyl-2-pentanone (MIBK)				50
MTBE				5
Naphthalene				1
n-Propylbenzene				1
Styrene				1
1,1,1,2-Tetrachloroethane				1
1,1,2,2-Tetrachloroethane				1
Tetrachloroethene				1
Toluene	<20	70-130	70-130	1
1,2,3-Trichlorobenzene				1
1,2,4-Trichlorobenzene				1
1,1,1-Trichloroethane				1
1,1,2-Trichloroethane				1
Trichloroethene	<20	74-134	74-134	1
Trichlorofluoromethane				1
1,2,3-Trichloropropane				1
Trichlorotriflouroethane				5
1,2,4-Trimethylbenzene				1
1,3,5-Trimethylbenzene				1
Vinyl acetate				25
Vinyl chloride				1
Xylenes, total				1
4-Bromofluorobenzene (surr)		86-115	86-115	
1,2-Dichloroethane-d4 (surr)		76-114	76-114	
Toluene-d8 (surr)		88-110	88-110	

QA Objectives for Measurement Data

ORGANOCHLORINE PESTICIDES & PCBs BY GC (608)	Precision (% RPD)	Accuracy (%) LSC/LCSD and MS/MSD		Rep.Limit (ug/L)
Aldrin	<25	65-135	65-135	0.005
A-BHC				0.01
B-BHC				0.005
Γ-BHC	<20	65-135	65-135	0.02
Δ-BHC				0.005
Technical Chlordane				0.1
P,p'-DDD				0.05
P,p'-DDE				0.05
p.p'-DDT	<20	65-135	65-135	0.01
Dieldrin	<20	65-135	65-135	0.01
Endosulfan I				0.02
Endosulfan II				0.01
Endosulfan Sulfate				0.05
Endrin	<20	65-135	65-135	0.01
Endrin aldehyde				0.01
Heptachlor	<20	65-135	65-135	0.01
Heptachlor epoxide				0.01
Toxaphene				0.5
PCB-1016	<30	65-135	65-135	0.5
PCB-1221				0.5
PCB-1232				0.5
PCB-1242				0.5
PCB-1248				0.5
PCB-1254				0.5
PCB-1260	<30	65-135	65-135	0.5
2,4,5,6-Tetrachloroxylene (surr)		62-123	62-123	
Decachlorobiphenyl (surr)		56-136	56-136	

QA Objectives for Measurement Data

ORGANOCHLORINE PESTICIDES BY GC (8081A)	Precision (% RPD)	Accuracy (%) LSC/LCSD and MS/MSD		Rep.Limit (ug/L)
Aldrin	<25	65-135	65-135	0.06
α-BHC				0.06
β-BHC				0.06
γ-BHC	<20	65-135	65-135	0.06
δ-BHC				0.06
Alpha-Chlordane				0.06
Gamma-Chlordane				0.06
Technical Chlordane				1
p,p'-DDD				0.06
p,p'-DDE				0.08
p.p'-DDT	<20	65-135	65-135	0.06
Dieldrin	<20	65-135	65-135	0.06
Endosulfan I				0.06
Endosulfan II				0.06
Endosulfan Sulfate				0.06
Endrin	<20	65-135	65-135	0.06
Endrin aldehyde				0.06
Endrin Ketone				0.06
Heptachlor	<20	65-135	65-135	0.06
Heptachlor epoxide				0.06
p,p'-Methoxychlor				0.06
Toxaphene				1
2,4,5,6-Tetrachloro-m-xylene (surr)		62-123	62-123	
Decachlorobiphenyl (surr)		56-136	56-136	

PCBs BY GC (8082)	Precision (% RPD)	Accuracy (%) LSC/LCSD and MS/MSD		Rep.Limit (ug/L)
PCB-1016	<30	65-135	65-135	0.5
PCB-1221				0.5
PCB-1232				0.5
PCB-1242				0.5
PCB-1248				0.5
PCB-1254				0.5
PCB-1260	<30	65-135	65-135	0.5
2,4,5,6-Tetrachloroxylene (surr)		62-123	62-123	
Decachlorobiphenyl (surr)		56-136	56-136	

QA Objectives for Measurement Data

SEMIVOLATILE ORGANIC COMPOUNDS BY GC/MS (625)	Precision (% RPD)	Accuracy (%) LSC/LCSD and MS/MSD		Rep.Limit (ug/L)
Acenaphthene	<30	56-118	56-118	1
Acenaphthylene				2
Azobenzene				1
Benzo(a)anthracene				2
Benzo(b)fluoranthene				2
Benzo(k)fluoranthene				2
Benzo(g,h,i)perylene				2
Benzo(a)pyrene				2
Bis(2-chloroethyl)ether				1
Bis(2-chloroethoxy)methane				5
Bis(2-chloroisopropyl)ether				2
Bis(2-ethylhexyl)phthalate				5
4-Bromophenyl phenyl ether				5
Butyl benzyl phthalate				5
4-Chloro-3-methylphenol	<31	22-147	22-147	5
2-Chloronaphthalene				2
2-Chlorophenol	<25	23-134	23-134	2
4-Chlorophenyl phenyl ether				2
Chrysene				2
Dibenzo(a,h)anthracene				2
1,2-Dichlorobenzene				2
1,3-Dichlorobenzene				2
1,4-Dichlorobenzene	<30	36-97	36-97	2
3,3-Dichlorobenzidine				5
2,4-Dichlorophenol				1
Diethyl phthalate				5
2,4-Dimethylphenol				1
Dimethyl phthalate				5
Di-n-butyl phthalate				5
4,6-Dinitro-2-methylphenol				10
2,4-Dinitrophenol				5
2,4-Dinitrotoluene	<35	39-139	39-139	2
2,6-Dinitrotoluene				5
Di-n-octyl phthalate				5
Fluoranthene				2
Fluorene				5
Hexachlorobenzene				2
Hexachlorobutadiene				2
Hexachlorocyclopentadiene				5

QA Objectives for Measurement Data

SEMIVOLATILES BY GC/MS (625) – Continued

Hexachloroethane				2
Indeno(1,2,3-cd)pyrene				2
Isophorone				2
Naphthalene				2
Nitrobenzene				2
2-Nitrophenol				10
4-Nitrophenol	<35	1-51	1-51	10
N-Nitroso-di-n-propylamine	<34	10-130	10-130	2
N-Nitrosodiphenylamine				1
Pentachlorophenol	<35	45-125	45-125	5
Phenanthrene				2
Phenol	<35	12-89	12-89	1
Pyrene	<35	52-115	52-115	2
1,2,4-Trichlorobenzene	<35	44-142	44-142	1
2,4,6-Trichlorophenol				2
Nitrobenzene - d5 (surr)		35-114	35-114	
2-Fluorobiphenyl (surr)		43-116	43-116	
p-Terphenyl-dl4 (surr)		33-141	33-141	
Phenol-d6 (surr)		10-110	10-110	
2-Fluorophenol (surr)		25-100	25-100	
2,4,6-Tribromophenol (surr)		10-123	10-123	

QA Objectives for Measurement Data

SEMIVOLATILE ORGANIC COMPOUNDS BY GC/MS (8270C)	Precision (% RPD)	Accuracy (%) LSC/LCSD and MS/MSD		Rep.Limit (ug/L)
Acenaphthene	<30	56-118	56-118	2
Acenaphthylene				2
Anthracene				2
Benzoic acid				10
Benzo(a)anthracene				2
Benzo(b)fluoranthene				2
Benzo(k)fluoranthene				2
Benzo(g,h,i)perylene				2
Benzo(a)pyrene				2
Benzyl alcohol				5
Bis(2-chloroethoxy)methane				5
Bis(2-chloroethyl)ether				2
Bis(2-chloroisopropyl)ether				2
Bis(2-ethylhexyl)phthalate				10
4-Bromophenyl phenyl ether				5
Butyl benzyl phthalate				5
4-Chloroaniline				2
4-Chloro-3-methylphenol	<31	22-147	22-147	5
2-Chloronaphthalene				2
2-Chlorophenol	<25	23-134	23-134	2
4-Chlorophenyl phenyl ether				5
Chrysene				2
Dibenzo(a,h)anthracene				2
Dibenzofuran				2
Di-n-butyl phthalate				5
1,2-Dichlorobenzene				2
1,3-Dichlorobenzene				2
1,4-Dichlorobenzene	<30	36-97	36-97	2
3,3'-Dichlorobenzidine				5
2,4-Dichlorophenol				2
Diethyl phthalate				5
2,4-Dimethylphenol				2
Dimethyl phthalate				5
4,6-Dinitro-2-methylphenol				10
2,4-Dinitrophenol				10
2,4-Dinitrotoluene	<35	39-139	39-139	2
2,6-Dinitrotoluene				5
Di-n-octyl phthalate				5
Fluoranthene				2

QA Objectives for Measurement Data

SEMIVOLATILES BY GC/MS (8270C) – Continued

Fluorene				2
Hexachlorobenzene				2
Hexachlorobutadiene				2
Hexachlorocyclopentadiene				5
Hexachloroethane				2
Indeno(1,2,3-cd)pyrene				2
Isophorone				2
2-Methylnaphthalene				2
2-Methylphenol				2
4-Methylphenol				2
Naphthalene				2
2-Nitroaniline				10
3-Nitroaniline				2
4-Nitroaniline				10
Nitrobenzene				2
2-Nitrophenol				2
4-Nitrophenol	<35	1-51	1-51	10
N-Nitroso-di-n-phenylamine				2
N-Nitroso-di-n-propylamine	<34	10-130	10-130	2
Pentachlorophenol	<35	45-125	45-125	10
Phenanthrene				2
Phenol	<35	12-89	12-89	2
Pyrene	<35	52-115	52-115	2
1,2,4-Trichlorobenzene	<35	44-142	44-142	2
2,4,5-Trichlorophenol				2
2,4,6-Trichlorophenol				2
Nitrobenzene - d5 (surr)		35-114	35-114	
2-Fluorobiphenyl (surr)		43-116	43-116	
p-Terphenyl-dl4 (surr)		33-141	33-141	
Phenol-d6 (surr)		10-110	10-110	
2-Fluorophenol (surr)		25-100	25-100	
2,4,6-Tribromophenol (surr)		10-123	10-123	

QA Objectives for Measurement Data

POLYNUCLEAR AROMATIC HYDROCARBONS BY GC/MS (8270C-SIM)	Precision (% RPD)	Accuracy (%) LSC/LCSD and MS/MSD		Rep.Limit (ug/L)
Acenaphthene	<30	50-150	50-150	0.1
Acenaphthylene				0.1
Anthracene				0.1
Benzo(a)anthracene				0.1
Benzo(b)fluoranthene				0.1
Benzo(k)fluoranthene				0.1
Benzo(a)pyrene	<30	50-150	50-150	0.1
Benzo(g,h,i)perylene				0.1
Chrysene	<30	50-150	50-150	0.1
Dibenzo(a,h)anthracene				0.1
Fluoranthene				0.1
Fluorene				0.1
Indeno(1,2,3-cd)pyrene				0.1
Naphthalene				0.1
Phenanthrene	<30	50-150	50-150	0.1
Pyrene	<30	50-150	50-150	0.1
2-Fluorobiphenyl (surr)		43-116	43-116	
p-Terphenyl-d14 (surr)		33-141	33-141	

QA Objectives for Measurement Data

POLYNUCLEAR AROMATIC HYDROCARBONS BY HPLC (8310)	Precision (% RPD)	Accuracy (%) LSC/LCSD and	MS/MSD	Rep.Limit (ug/L)
Acenaphthene				0.1
Acenaphthylene				0.1
Anthracene				0.05
Benzo(a)anthracene				0.1
Benzo(b)fluoranthene				0.1
Benzo(k)fluoranthene				0.05
Benzo(a)pyrene	<35	50-150	50-150	0.1
Benzo(g,h,i)perylene				0.1
Chrysene	<35	50-150	50-150	0.1
Dibenzo(a,h)anthracene				0.1
Fluoranthene				0.15
Fluorene				0.1
Indeno(1,2,3-cd)pyrene				0.1
Naphthalene	<35	50-150	50-150	0.15
Phenanthrene	<35	50-150	50-150	0.1
Pyrene	<35	50-150	50-150	0.15
1-Methylnaphthalene (surr)		50-150	50-150	

NITROAROMATICS and NITRAMINES BY HPLC (8330)	Precision (% RPD)	Accuracy (%) LSC/LCSD and	MS/MSD	Rep.Limit (ug/L)
1,3,5-TNB	<25	70-130	70-130	0.25
1,3-DNB	<25	70-130	70-130	0.1
2,4,6-TNT	<25	70-130	70-130	0.17
2,4-DNT	<25	70-130	70-130	0.1
2,6-DNT	<25	70-130	70-130	0.3
2-Am-DNT	<25	70-130	70-130	1
2-NT	<25	70-130	70-130	1
3-NT	<25	70-130	70-130	1
4-Am-DNT	<25	70-130	70-130	1
4-NT	<25	70-130	70-130	1
HMX	<25	70-130	70-130	1
NB	<25	70-130	70-130	0.5
RDX	<25	70-130	70-130	0.5
TETRYL	<25	70-130	70-130	1
3,4-DNT (surr)		70-130	70-130	

QA Objectives for Measurement Data

GENERAL CHEMISTRY	Precision (% RPD)	Accuracy (%) LCS/LCSD and MS/MSD		Rep.Limit (mg/L)
Alkalinity, Total (310.1)	<20	80-120		5.0
Bromide (300.0)	<20	80-120	80-120	1.0
Chloride (300.0)	<20	80-120	80-120	1.0
Conductivity (9050A)				
Flash Point (1010)				
Fluoride (300.0)	<20	80-120	80-120	1.0
Hexavalent Chromium (7196A)	<20	80-120	80-120	0.01
Nitrate (300.0)	<20	80-120	80-120	1.0
Nitrite (300.0)	<20	80-120	80-120	1.0
Oil & Grease, gravimetric (SM 5520B/1664)	<18	79-114	79-114	1.0
Orthophosphate (300.0)	<20	80-120	80-120	1.0
pH (9040B)				
RCI (CA Title 22)				
Residue, Total (160.3)	<20	80-120		10
Settleable Solids (160.5)	<20	80-120		0.1 (ml/L)
Sulfate (300.0)	<20	80-120	80-120	1.0
Total Dissolved Solids (160.1)	<20	80-120		10
Total Suspended Solids (160.2)	<20	80-120		10
Total Suspended Solids, low level (160.2)	<20	80-120		1.0

QA Objectives for Measurement Data **2. Solid Matrices**

METALS BY ICP (6010B)	Precision (% RPD)	Accuracy (%) LSC/LCSD and	MS/MSD	Rep.Limit (mg/Kg)
Aluminum	<20	80-120	75-125	5
Antimony	<20	80-120	75-125	2
Arsenic	<20	80-120	75-125	1
Barium	<20	80-120	75-125	1
Beryllium	<20	80-120	75-125	0.5
Cadmium	<20	80-120	75-125	0.5
Calcium	<20	80-120	75-125	5
Chromium	<20	80-120	75-125	1
Cobalt	<20	80-120	75-125	1
Copper	<20	80-120	75-125	1
Iron	<20	80-120	75-125	1
Lead	<20	80-120	75-125	1
Magnesium	<20	80-120	75-125	5
Manganese	<20	80-120	75-125	1
Molybdenum	<20	80-120	75-125	1
Nickel	<20	80-120	75-125	1
Potassium	<20	80-120	75-125	25
Selenium	<20	80-120	75-125	2
Silver	<20	80-120	75-125	1
Sodium	<20	80-120	75-125	25
Thallium	<20	80-120	75-125	1
Vanadium	<20	80-120	75-125	1
Zinc	<20	80-120	75-125	1

MERCURY BY COLD VAPOR (7471)	Precision (% RPD)	Accuracy (%) LSC/LCSD and	MS/MSD	Rep.Limit (mg/Kg)
Mercury	<20	85-115	85-115	0.05

METALS BY GFAA (7000 Series)	Precision (% RPD)	Accuracy (%) LSC/LCSD and	MS/MSD	Rep.Limit (mg/Kg)
Arsenic	<20	85-115	85-115	0.2
Lead	<20	85-115	85-115	0.2
Selenium	<20	85-115	85-115	0.2
Thallium	<20	85-115	85-115	0.2

METALS BY FLAME AA (7000 Series)	Precision (% RPD)	Accuracy (%) LSC/LCSD and	MS/MSD	Rep.Limit (mg/Kg)
Lead	<20	85-115	85-115	5

QA Objectives for Measurement Data

HALOGENATED VOLATILE ORGANIC COMPOUNDS BY GC/MS (8260B)	Precision (% RPD)	Accuracy (%) LSC/LCSD and	MS/MSD	Rep.Limit (ug/Kg)
Bromodichloromethane				5
Bromoform				5
Bromomethane				10
Carbon tetrachloride				5
Chlorobenzene	<20	61-121	61-121	5
Chloroethane				10
2-Chloroethylvinylether				50
Chloroform				5
Chloromethane				10
Dibromochloromethane				5
1,2-Dichlorobenzene				5
1,3-Dichlorobenzene				5
1,4-Dichlorobenzene				5
Dichlorodifluoromethane				10
1,1-Dichloroethane				5
1,2-Dichloroethane				5
1,1-Dichloroethene	<20	65-125	65-125	5
cis-1,2-Dichloroethene				5
trans-1,2-Dichloroethene				5
1,2-Dichloropropane				5
cis-1,3-Dichloropropene				5
trans-1,3-Dichloropropene				5
Methylene chloride				5
1,1,2,2-Tetrachloroethane				5
Tetrachloroethene				5
1,1,1-Trichloroethane				5
1,1,2-Trichloroethane				5
Trichloroethene	<20	74-134	74-134	5
Trichlorofluoromethane				5
Trichlorotrifluroethane				5
Vinyl chloride				5
4-Bromofluorobenzene (surr)		74-121	74-121	
1,2-Dichloroethane-d4 (surr)		70-121	70-121	
Toluene-d8 (surr)		81-117	81-117	

QA Objectives for Measurement Data

VOLATILE AROMATIC COMPOUNDS BY GC (8021B)	Precision (% RPD)	Accuracy (%) LSC/LCSD and	MS/MSD	Rep.Limit (ug/Kg)
MTBE				5
Benzene	<35	77-123	65-135	5
Chlorobenzene				5
1,2-Dichlorobenzene				5
1,3-Dichlorobenzene				5
1,4-Dichlorobenzene				5
Ethylbenzene	<35	70-130	65-135	5
Toluene	<35	78-122	65-135	5
Xylenes, total	<35	75-125	65-135	5
4-Bromofluorobenzene (surr)		58-124	58-124	
Trifluorotoluene (surr)		53-125	53-125	

PETROLEUM HYDROCARBONS (8015 Modified)	Precision (% RPD)	Accuracy (%) LSC/LCSD and	MS/MSD	Rep.Limit (mg/Kg)
Diesel	<25	60-130	60-130	1
o-Terphenyl (surr)		60-130	60-130	
Motor Oil				50
Kerosene				1
Gasoline	<35	75-125	65-135	1

GLYCOLS (8015 Modified)	Precision (% RPD)	Accuracy (%) LSC/LCSD and	MS/MSD	Rep.Limit (mg/Kg)
Diethylene Glycol	<35	60-130	60-130	25
Ethylene Glycol	<35	60-130	60-130	25
Tetraethylene Glycol	<35	60-130	60-130	25
Triethylene Glycol	<35	60-130	60-130	25
2-(2-Butoxyethoxy) Ethanol (surr)		60-130	60-130	

QA Objectives for Measurement Data

VOLATILE ORGANIC COMPOUNDS BY GC/MS (8260B)	Precision (% RPD)	Accuracy (%) LSC/LCSD and	MS/MSD	Rep.Limit (ug/Kg)
Acetone				50
Benzene	<20	69-129	69-129	5
Bromobenzene				5
Bromochloromethane				20
Bromodichloromethane				5
Bromoform				5
Bromomethane				10
2 Butanone (MEK)				50
n-Butylbenzene				5
sec-Butylbenzene				5
tert-Butylbenzene				5
Carbon disulfide				5
Carbon tetrachloride				5
Chlorobenzene	<20	61-121	61-121	5
Chloroethane				10
2-Chloroethylvinyl ether				50
Chloroform				5
Chloromethane				10
2-Chlorotoluene				5
4-Chlorotoluene				5
Dibromochloromethane				5
1,2-Dibromo-3-chloropropane				50
1,2-Dibromoethane				10
Dibromomethane				10
1,2-Dichlorobenzene				5
1,3-Dichlorobenzene				5
1,4-Dichlorobenzene				5
Dichlorodifluormethane				10
1,1-Dichloroethane				5
1,2-Dichloroethane				5
1,1-Dichloroethene	<20	65-125	65-125	5
cis-1,2-Dichloroethene				5
trans-1,2-Dichloroethene				5
1,2-Dichloropropane				5
1,3-Dichloropropane				5
2,2-Dichloropropane				5
1,1-Dichloropropene				5
cis-1,3-Dichloropropene				5
trans-1,3-Dichloropropene				5

QA Objectives for Measurement Data

VOLATILE ORGANICS BY GC/MS (8260B) – Continued

Ethylbenzene				5
Hexachlorobutadiene				5
2-Hexanone				50
Isopropylbenzene				5
p-Isopropyltoluene				5
Methylene chloride				5
4-Methyl-2-pentanone (MIBK)				50
MTBE				5
Naphthalene				10
n-Propylbenzene				5
Styrene				5
1,1,1,2-Tetrachloroethane				5
1,1,2,2-Tetrachloroethane				5
Tetrachloroethene				5
Toluene	<20	70-130	70-130	5
1,2,3-Trichlorobenzene				5
1,2,4- Trichlorobenzene				5
1,1,1-Trichloroethane				5
1,1,2-Trichloroethane				5
Trichloroethene	<20	74-134	74-134	5
Trichlorofluoromethane				5
1,2,3-Trichloropropane				5
Trichlorotriflouroethane				5
1,2,4-Trimethylbenzene				5
1,3,5-Trimethylbenzene				5
Vinyl acetate				50
Vinyl chloride				5
Xylenes, total				5
4-Bromofluorobenzene (surr)		74-121	74-121	
1,2-Dichloroethane-d4 (surr)		70-121	70-121	
Toluene-d8 (surr)		81-117	81-117	

QA Objectives for Measurement Data

ORGANOCHLORINE PESTICIDES BY GC (8081A)	Precision (% RPD)	Accuracy (%) LSC/LCSD and MS/MSD		Rep.Limit (ug/Kg)
Aldrin	<25	37-136	37-136	2
α-BHC				2
β-BHC				2
γ-BHC	<35	37-137	37-137	2
δ-BHC				2
alpha-Chlordane				2
gamma-Chlordane				2
Technical Chlordane				50
p,p'-DDD				2
p,p'-DDE				2
p,p'-DDT	<35	55-132	55-132	2
Dieldrin	<35	58-135	58-135	2
Endosulfan I				2
Endosulfan II				2
Endosulfan sulfate				2
Endrin	<35	58-134	58-134	2
Endrin aldehyde				2
Endrin ketone				2
Heptachlor	<20	40-136	40-136	2
Heptachlor epoxide				2
p,p'-Methoxychlor				2
Toxaphene				100
2,4,5,6-Tetrachloro-m-xylene (surr)		50-125	50-125	
Decachlorobiphenyl (surr)		46-142	46-142	

PCBs BY GC (8082)	Precision (% RPD)	Accuracy (%) LSC/LCSD and MS/MSD		Rep.Limit (ug/Kg)
PCB-1016	<30	65-135	65-135	50
PCB-1221				50
PCB-1232				50
PCB-1242				50
PCB-1248				50
PCB-1254				50
PCB-1260	<30	65-135	65-135	50
2,4,5,6-Tetrachloroxylene (surr)		50-125	50-125	
Decachlorobiphenyl		46-142	46-142	

QA Objectives for Measurement Data

SEMIVOLATILE ORGANIC COMPOUNDS BY GC/MS (8270C)	Precision (% RPD)	Accuracy (%) LSC/LCSD and MS/MSD		Rep.Limit (mg/Kg)
Acenaphthene	<30	49-102	49-102	0.067
Acenaphthylene				0.067
Anthracene				0.067
Benzoic acid				0.33
Benzo(a)anthracene				0.067
Benzo(b)fluoranthene				0.067
Benzo(k)fluoranthene				0.067
Benzo(g,h,i)perylene				0.067
Benzo(a)pyrene				0.067
Benzyl alcohol				0.17
Bis(2-chloroethoxy)methane				0.17
Bis(2-chloroethyl)ether				0.067
Bis(2-chloroisopropyl)ether				0.067
Bis(2-ethylhexyl)phthalate				0.33
4-Bromophenyl phenyl ether				0.17
Butyl benzyl phthalate				0.17
4-Chloroaniline				0.067
4-Chloro-3-methylphenol	<33	26-103	26-103	0.17
2-Chloronaphthalene				0.067
2-Chlorophenol	<35	27-123	27-123	0.067
4-Chlorophenyl phenyl ether				0.17
Chrysene				0.067
Dibenzo(a,h)anthracene				0.067
Dibenzofuran				0.067
Di-n-butyl phthalate				0.17
1,2-Dichlorobenzene				0.067
1,3-Dichlorobenzene				0.067
1,4-Dichlorobenzene	<30	28-104	28-104	0.067
3,3'-Dichlorobenzidine				0.17
2,4-Dichlorophenol				0.067
Diethyl phthalate				0.17
2,4-Dimethylphenol				0.067
Dimethyl phthalate				0.17
4,6-Dinitro-2-methylphenol				0.33
2,4-Dinitrophenol				0.33
2,4-Dinitrotoluene	<38	39-139	39-139	0.067
2,6-Dinitrotoluene				0.067
Di-n-octyl phthalate				0.17
Fluoranthene				0.067

QA Objectives for Measurement Data

SEMIVOLATILE ORGANICS BY GC/MS (8270C) – Continued

Fluorene				0.067
Hexachlorobenzene				0.067
Hexachlorobutadiene				0.067
Hexachlorocyclopentadiene				0.17
Hexachloroethane				0.067
Indeno(1,2,3-cd)pyrene				0.067
Isophorone				0.067
2-Methylnaphthalene				0.067
2-Methylphenol				0.067
4-Methylphenol				0.067
Naphthalene				0.067
2-Nitroaniline				0.33
3-Nitroaniline				0.067
4-Nitroaniline				0.33
Nitrobenzene				0.067
2-Nitrophenol				0.067
4-Nitrophenol	<35	17-109	17-109	0.33
N-Nitroso-di-n-phenylamine				0.067
N-Nitroso-di-n-propylamine	<39	25-114	25-114	0.067
Pentachlorophenol	<35	11-114	11-114	0.33
Phenanthrene				0.067
Phenol	<35	26-90	26-90	0.067
Pyrene	<35	25-117	25-117	0.067
1,2,4-Trichlorobenzene	<35	38-107	38-107	0.067
2,4,5-Trichlorophenol				0.067
2,4,6-Trichlorophenol				0.067
Nitrobenzene - d5 (surr)		23-120	23-120	
2-Fluorobiphenyl (surr)		30-115	30-115	
p-Terphenyl-dl4 (surr)		18-137	18-137	
Phenol-d6 (surr)		24-113	24-113	
2-Fluorophenol (surr)		25-121	25-121	
2,4,6-Tribromophenol (surr)		19-122	19-122	

QA Objectives for Measurement Data

POLYNULCLEAR AROMATIC HYDROCARBONS BY 8270C-SIM	Precision (% RPD)	Accuracy (%) LSC/LCSD and MS/MSD		Rep.Limit (ug/Kg)
Acenaphthene	<30	50-150	50-150	5
Acenaphthylene				5
Anthracene				5
Benzo(a)anthracene				5
Benzo(b)fluoranthene				5
Benzo(k)fluoranthene				5
Benzo(a)pyrene	<30	50-150	50-150	5
Benzo(g,h,i)perylene				5
Chrysene	<30	50-150	50-150	5
Dibenzo(a,h)anthracene				5
Fluoranthene				5
Fluorene				5
Lndeno(1,2,3 cd)pyrene				5
Napthalene				5
Phenanthrene	<30	50-150	50-150	5
Pyrene	<30	50-150	50-150	5
2-Fluorobiphenyl (surr)		30-115	30-115	
p-Terphenyl-d14 (surr)		18-137	18-137	

POLYNULCLEAR AROMATIC HYDROCARBONS BY HPLC 8310	Precision (% RPD)	Accuracy (%) LSC/LCSD and MS/MSD		Rep.Limit (ug/Kg)
Acenaphthene				10
Acenaphthylene				10
Anthracene				5
Benzo(a)anthracene				5
Benzo(b)fluoranthene				5
Benzo(k)fluoranthene				5
Benzo(a)pyrene	<35	50-150	50-150	5
Benzo(g,h,i)perylene				10
Chrysene	<35	50-150	50-150	5
Dibenzo(a,h)anthracene				10
Fluoranthene				5
Fluorene				5
Lndeno(1,2,3 cd)pyrene				10
Napthalene	<35	50-150	50-150	15
Phenanthrene	<35	50-150	50-150	5
Pyrene	<35	50-150	50-150	5
1-Methylnaphthalene (surr)		50-150	50-150	

QA Objectives for Measurement Data

NITROAROMATICS and NITRAMINES BY HPLC (8330)	Precision (% RPD)	Accuracy (%) LSC/LCSD and	MS/MSD	Rep.Limit (mg/Kg)
1,3,5-TNB	<35	65-135	65-135	0.25
1,3-DNB	<35	65-135	65-135	0.25
2,4,6-TNT	<35	65-135	65-135	0.25
2,4-DNT	<35	65-135	65-135	0.25
2,6-DNT	<35	65-135	65-135	0.25
2-Am-DNT	<35	65-135	65-135	0.25
2-NT	<35	65-135	65-135	0.25
3-NT	<35	65-135	65-135	0.25
4-Am-DNT	<35	65-135	65-135	0.25
4-NT	<35	65-135	65-135	0.25
HMX	<35	65-135	65-135	1
NB	<35	65-135	65-135	0.25
RDX	<35	65-135	65-135	1
TETRYL	<35	65-135	65-135	1
3,4-DNT (surr)		65-135	65-135	

GENERAL CHEMISTRY	Precision (% RPD)	Accuracy (%) LSC/LCSD and	MS/MSD	Rep.Limit (mg/Kg)
Alkalinity, Total (310.1)	<20	80-120		20
Bromide (300.0)	<20	80-120	80-120	10
Chloride (300.0)	<20	80-120	80-120	10
Conductivity (9050)				
Fluoride (300.0)	<20	80-120	80-120	10
Hexavalent Chromium (7196)	<20	80-120	80-120	0.2
Nitrate (300.0)	<20	80-120	80-120	10
Nitrite (300.0)	<20	80-120	80-120	10
Oil & Grease, gravimetric (SM 5520E/1664)	<20	80-120	80-120	50
Orthophosphate (300.0)	<20	80-120	80-120	10
pH (9045)				
Residue, Total	<20	80-120		10 (mg)
Sulfate (300.0)	<20	80-120	80-120	10

5.0 Calibration and Standardization Procedures and Equipment Maintenance

5.1 Standards Preparation -

STL San Francisco will prepare its analytical calibration standards using only chemicals that are ACS reagent grade or better or purchase commercially prepared standards from reputable sources, which furnish certificates of analyses with each standard. Whenever possible, only standards or reagents that are traceable to EPA, NIST or other federal standards will be used. If traceable standards are not available, the basis for calibration will be fully documented and approved by the Team Leader and the QA Department.

In each analytical run, all calibration standards will be verified against second-source control standards. A standards logbook will be maintained for all standards purchased or prepared by STL San Francisco. For purchased standards, date received, source, manufacturer's specifications, and date opened will be logged into the standards logbook. Dates received and opened will also be written on the standard container.

As in-house and/or working standards are prepared, preparation work sheets will be completed which contain the following information: analyst's name, date prepared, manufacturer and lot number, concentrations and dilutions, weights and volumes used, solvents used, storage instructions, expiration date and safety precautions.

Information sheets on new standards will be distributed with the standards. Expired standards will be immediately disposed.

5.1.1 Expiration Criteria of Standard Quality Control Materials and Reagents -

For standards, quality control materials, and reagents, all expiration dates as suggested by various manufacturers are honored by STL San Francisco's personnel. No expiration date for subsequent standards or reagents generated from these sources will extend beyond the original expiration date. Furthermore, organic and inorganic sections each have its expanded rules for these materials (Refer to SOPs 3.03.01 & 3.03.02).

1) For organic analysis

a) Neat material that does not have a recommended expiration date (e.g. diesel fuel, motor oil, other fuel hydrocarbons) will be assigned an expiration date of five years from the date it was acquired.

b) Intermediate stock solutions will be assigned an expiration date of one year or the actual expiration date stated by the manufacturer, if it is less than one year.

c) Laboratory prepared standards will be assigned an expiration date of six months from the date prepared. However, if the parent solution has a shorter expiration date, the shorter period must be honored.
2) For inorganic analysis

a) For standards that have concentration levels less than 0.1 mg/L, the expiration period is 24 hours.

b) For standards that have concentration levels higher than 0.1 mg/L, the expiration date is six months from the date it is prepared unless the parent solution has a shorter expiration date. In that case, the shorter period will be honored.

3) For volatile and /or unstable compounds, refer to specific SOPs for information on shelf-life (e.g. gaseous compounds in standard mixture).

5.2 Calibration -

Calibration procedures are method dependent. Each method SOP specifically describes calibration procedures that will be followed. The general procedures summarized below are guidelines only. The detailed procedures contained in the method-specific SOPs will take precedence. Project-specific quality requirements may necessitate greater or lesser rigor in calibration requirements.

5.2.1 Calibration Criteria for GC/MS:

- **Tuning.** Every 12 hours, before calibration and analyses, the GC/MS will meet the standard mass spectral abundance criteria with a 50 ng injection of a system performance check compound, DFTPP for acid/base/neutrals and BFB for volatiles.
- **Initial Calibration via Internal Standard.** A blank and a minimum of five levels of standards will be required. The RSD requirement of less than 15% for each target analyte and less than 30% for each individual CCC is required as evidence of sufficient linearity to employ an average response factor.
- **System Performance Check Compound (SPCC) Response.** SPCCs will be monitored run with the initial calibration and continuing calibration.
- **Calibration Check Compounds (CCC) Response Factor Variation with Concentration.** The %RSD of the response factors over the working range of concentrations of the initial calibration will not exceed 20% for either volatiles or semi-volatiles (EPA SW 846, Update III, December, 1996).

- **Continuing Calibration.** Analyses of continuing calibration standards containing all volatile or semi-volatile Hazardous Substance List analytes will be performed daily.
- **Internal Standard Response and Retention Time Monitoring** Retention times for internal standards will not vary over 30 seconds from the last calibration check. The total area of the extracted ion chromatographic profile for internal calibration standards will not change more than a factor of two (-50% to +100%) from the last daily calibration check. If the above criteria are not met, the system will be checked for malfunctions and corrected.

5.2.2 Calibration Criteria for Gas Chromatography:

GC/PID/FID, GC/ELCD, GC/FID. The calibration standards for the methods involved in these analyses will go through full sample preparation and extraction procedures. A minimum of five standards and a blank will be required.

- An initial 5-point calibration (6-point for non-linear) will be performed on an as needed basis - when the instrument is shut down, or maintenance is performed. A linearity criteria required for GC and HPLC methods (other than GC/MS) will be 20% RSD.
- A mid-point continuing calibration verification (CCV) will be run at a minimum of one every twelve hours.
- One calibration standard will be at or below the reporting limit.
- The blank will be below the reporting limit for all analytes.
- For analyses of volatiles in solids, soil, and sludge, the calibration standards will be prepared in the same manner as for water. The standards will not go through the extra sample extraction of high level soils.
- End calibration verifications (CCV) will be run at a minimum of one every twelve hours.

Gas Chromatograph/Electron Capture Detector. A minimum of five calibration standards and a blank will be required. A mid-range CCV or a check sample and solvent blank will be run after every 10 samples. Specific calibration procedures are contained in individual analytical SOPs.

5.2.3 Calibration Criteria for Metals:

Atomic Absorption/ICP. AA and ICP spectrometers will be calibrated daily or after each start up according to manufacturers' specifications, with a minimum of one blank and one calibration standard for ICP and a minimum of one blank and three calibration standards for AA.

- Calibration acceptance criteria for FAA and GFAA will be linear –correlation coefficient $\geq$0.995; CVAA $\geq$0.997.
- CCBs and CCVs will be run at a rate of 10%.

5.2.4 Calibration Criteria for Wet Chemistry Methods:

pH Meter. Daily calibration with a pH 7 buffer and one of pH 4 or 10 will be required. Acceptance criteria for pH calibration is $\pm$0.05 pH units.

Conductivity Meter. Conductivity cells with platinum electrodes will be calibrated annually using a minimum of five concentrations of a KCl solution to establish the cell constant. Daily check with 0.01M KCl will be required. Statistical limits at 95% confidence level may be used.

Balances, Thermometers, and Conductivity Cells. Analytical balances will be checked daily with two Class S certified weights.

- Thermometers will be calibrated against an NIST certified thermometer once a year. The thermometer are checked at ice point and boiling point.

5.3 Equipment and Facility -

An integral part of STL San Francisco's quality assurance program is the internal support system which assures that equipment, facilities and supplies will be maintained and kept performing to specification at all times.

5.3.1 Equipment and Supplies.

Overall analytical system quality will begin with the timely acquisition of high quality equipment to assure efficient operation of the laboratory. STL San Francisco will purchase equipment and supplies that meet or exceed the specifications of the analytical methods. Glassware, reagents, gases and replacement parts for analytical instruments will be purchased from reputable suppliers with a history of quality customer service. All supplies will meet or exceed the specifications set forth in the method or of recognized professional groups such as the American Chemical Society (ACS), American Society for Testing and Materials (ASTM), and the Association of Official Analytical Chemists (AOAC).

5.3.2 Facilities, Safety, and Environmental Factors.

Factors in the environment of the laboratory affect the proper and safe functioning of equipment and the performance of analytical procedures. STL San Francisco's facility is designed and maintained such that the environmental specifications of the respective instrument manufacturers will be met. Safety and design features provide an environment conducive to efficient and effective work on the part of analysts.

5.3.3 Prevention of Cross-Contamination.

Design features which are intended to control cross contamination include the physical separation of extractable and volatile organics operations, the installation of hoods and air handling equipment in order to vent vapors out of solvent and sample handling areas, separate HV/AC systems for each operation, and segregated sample storage areas.

5.3.4 Sample and Reagent Storage Temperature Monitoring.

For storage of aqueous reagents and samples requiring refrigeration, all refrigerators will normally maintain an internal temperature of 1° to 4°C (34° to 40°F) throughout the compartment. For storage of organics dissolved in flammable materials, an explosion proof model will be used. Freezers used to store volatile organic standards will maintain an internal temperature of -10° to -20°C throughout their compartments. The temperature of each refrigeration unit will be recorded daily from in-place thermometers.

5.3.5 Reagent Water Quality.

Reagent, analyte-free or laboratory pure water means distilled or deionized water meeting the specifications of ASTM Type II reagent water and will have a conductivity of 100 µmho/cm or less. This water will be free of contaminants that may interfere with analytical test results.

5.3.6 Glassware Cleaning.

Glassware cleaning procedures will be posted in the glassware cleaning area. The glassware cleaning procedure will be documented in an SOP and meet EPA requirements. Only phosphate free, laboratory grade detergents will be used for the cleaning of glassware.

5.3.7 Cleaning of Sample Containers.

STL San Francisco normally purchases pre-cleaned sample containers for use by clients. These will be obtained from reputable container manufacturers. All sample

containers and sample container cleaning procedures will meet EPA criteria, as certified by analysis.

5.3.8 Instrumentation.

Instrumentation will be continually upgraded in order to provide state-of-the-art technology. Instruments will be monitored through the use of daily calibration, sensitivity, and background checks to determine when nonscheduled maintenance is required. Preventative maintenance will be performed regularly to reduce the occurrence of instrument failure. In the event that an instrument does fail, every effort will be made to meet obligations to clients concerning holding times and analysis due dates.

5.3.9 Maintenance Log Books.

Dedicated logbooks will be used to document all instrument repairs and maintenance. The preventive maintenance procedures recommended by individual instrument manufacturers will be strictly followed (See Preventative Maintenance Schedule Table III). Maintenance log books will be kept for major pieces of equipment in the laboratory. Routine (preventative maintenance) and non-routine maintenance will be documented in these logs for future reference and will be kept near the instrument in order to keep track of scheduled maintenance. The minimum entry includes the date, task performed, and the initials of the person who performed the task. If an inspection leads to some further action, that will also be included in the entry. In the case of non-routine maintenance, troubleshooting, or repairs, the entry will include the problem, action, and resolution. Service records will be kept for all repairs and maintenance performed by outside technicians.

Table III
PREVENTATIVE MAINTENANCE SCHEDULE
METALS

Instrument	Frequency	Activity	Whom	Downtime
AA	as needed	clean up spill (asap)	analyst	
	daily (startup)	clean burner	analyst	
	daily (startup)	clean nebulizer w/50ml DI	analyst	
	daily (startup)	check acetylene tank (>100 psi)	analyst	
	daily (startup)	check acetylene pressure (8psi)	analyst	
	daily (startup)	check air pressure (60 psi)	analyst	
	daily (startup)	check waste receptacle	analyst	
	weekly	inspect hoses, leak test connectors	analyst	
	weekly	check nebulizer rate (4-6 mi/min)	analyst	
	monthly	wipe AA case down w/damp cloth	analyst	
	monthly	clean all optical windows w/ lens tissue & MEOH	analyst	
	monthly	check and clean all intake filters	analyst	
	yearly	replace O-ring in nebuilzer & burner head	analyst	
	yearly	PM visit from PE	PE Service	
Hg Analyzer	as needed	clean up spill (asap)	analyst	
	as needed	replace spent drying tube	analyst	
	daily (startup)	install fresh drying tube	analyst	
	daily (startup)	check pump tubing for wear	analyst	
	daily (startup)	check waste receptacle	analyst	
	daily (finish)	use overnight macro after use	analyst	
	daily	maintain supply of spare drying tube in air-tight container	analyst	
	monthly	lubricate auto sampler	analyst	
	monthly	wipe case down w/damp cloth	analyst	
ICP	as needed	clean up spill (asap)	analyst	
	daily (startup)	check nebulizer transfer line	analyst	
	daily (startup)	check argon and nitrogen tanks	analyst	
	daily (startup)	check gas flows on ICP	analyst	
	daily (startup)	check nebulizer aerosol	analyst	
	daily (startup)	check nebu. operating temperature	analyst	
	daily (startup)	check nebulizer cooling fluid level	analyst	
	daily (startup)	check waste receptacle	analyst	
	weekly	monitor Cu intensity and clean lens	analyst	
	weekly	clean torch	analyst	
	weekly	check and/or set up torch w/Y bullet	analyst	
	weekly	check and/or replace pump tubing	analyst	
	weekly	check intake screen on nebulizer cooling fluid	analyst	
	monthly	flush nebulizer	analyst	
	monthly	leak test all connectors	analyst	
	monthly	check ICP cooling water level	analyst	
	semi-annually	PM visit from PE technician	PE Service	
	semi-annually	clean all intake vents on ICP	analyst	

Table III con't
PREVENTATIVE MAINTENANCE SCHEDULE
GENERAL CHEMISTRY

Instrument	Frequency	Activity	Whom	Downtime
Balances	daily	calibration	analyst	
	annually	certify performance	outside service	
refrigerator	daily	check & record air flow	analyst	
hoods	monthly	measure & record air flow	analyst	
pH probe	daily	check electrolyte level	analyst	
IR spectro.	daily	clean cell window	analyst	
	4-6 weeks	archive data	service dept.	no effect
LIMS	as needed	re-indexing	service dept.	no effect
	as needed	network maintenance	service dept.	no effect
network	bi-weekly	backup data and run speed-disk	analyst	no effect
PE Nelson	daily	check gas tank pressure	service dept.	none
gases	daily	check gas delivery pressure	service dept.	none
	bi-weekly	drain condensation	service dept.	none
compressor	monthly	visual inspection + leak check (roof)	service dept.	none
	daily	check indicator lights	service dept.	none
DI water	daily	monitor resistivity reading	analyst	none
Millpore				

Table III con't
PREVENTATIVE MAINTENANCE SCHEDULE
SEMI-VOLATILES

Instrument	Frequency	Activity	Whom	Downtime
Diesel	as needed	replace column	analyst	
	as needed	replace carrier gas filter	analyst	
	weekly	wipe down syringe	analyst	
	weekly	flush waste drain line	analyst	
	weekly	replace septum (injector + a/s)	analyst	
	weekly	monitor flow rate, adjust or update	analyst	
	monthly	replace injector insert	analyst	
Pest/ECD	as needed	replace column	analyst	
	as needed	replace carrier gas filter	analyst	
	as needed	clean ECD foil	outside service	
	weekly	monitor flow rate, adjust or update	analyst	
	weekly	check & record column pressure	analyst	
	weekly	check & record detector noise level	analyst	
	weekly	flush waste drain line	analyst	
	weekly	replace septum (injector + a/s)	analyst	
	monthly	replace guard column	analyst	
	tri-annually	wipe (leak) test of ECD	analyst	
GC/MS semi	as needed	replace column	analyst	
	weekly	check/replace carrier gas filter	analyst	
	weekly	check air/water ration	analyst	
	weekly	flush waste drain line	analyst	
	as needed	replace septum	analyst	
	monthly	replace insert, clean injector	analyst	
	semi-annually	clean source and ion trap	analyst	
	semi-annually	change pump oil	service dept.	
	semi-annually	lubricate turbo pump bearing	service dept.	
	semi-annually	clean/replace a/s sealing disc	service dept.	

Table III con't
PREVENTATIVE MAINTENANCE SCHEDULE
VOLATILES

Instrument	Frequency	Activity	Whom	Downtime
Gas/BTEX	as needed	replace column	analyst	
	as needed	clean/replace PID lamp	analyst	
	as needed	replace carrier gas filter	analyst	
	weekly	check & record column pressure	analyst	
	weekly	monitor flow rate, adjust or update	analyst	
	bi-weekly	purge system w/MeOH solution	analyst	1 weekend
	quarterly	replace Tekmar trap	analyst	
GC/MS vol.	as needed	replace column	analyst	
	weekly	check/replace carrier gas filters	analyst	
	weekly	monitor air/water ratio	analyst	
	bi-weekly	purge system w/MeOH solution	analyst	1 weekend
	as needed	check "septem"	analyst	
	quarterly	clean source and rods	analyst	
	quarterly	replace Tekmar trap	analyst	
	semi-annually	replace "septem"	analyst	
	semi-annually	change vacuum pump oil	service Dept.	

6.0 Corrective Action: Analytical /Systematic

STL San Francisco has established and implements systematic procedures when analytical performance does not meet defined standards and data quality objective is not achieved. These procedures are called Corrective actions that restore proper functioning to the analytical systems and are categorized as either **analytical** or **systematic**. An essential part of the corrective action process is communication and awareness of the problem, the cause, and the action taken to prevent future occurrences and/or rectify the immediate problem.

6.1 If the corrective action is **analytical**, the analyst will initiate the action and correct the error within the department. These are common everyday occurrences, such as instrument drift or QC outliers. The corrective action steps will be documented on a "Corrective Action" report (Figure 6-1) by the chemist who initiated the corrective action. Validation of the report is indicated when dated signatures of the chemist, the Team Leader and a member of the QA department are obtained. Signatures of Project Managers are required for Level III and IV data packages or when the Project Manager is directly involved in the corrective action process. The original corrective action report will be maintained within the QA Department and assessed for trend analysis and verification of a closed loop: corrective actions have been implemented, confirmed as effective and communicated. A copy of the corrective action report will be filed in each applicable project folder.

Corrective action for analytical deficiencies is supplemented by QC narration in LIMS during data entry and QA narration using the Laboratory's internal e-mail.

6.1.1 Corrective action involving analytical **QC sample outliers** is defined in individual method SOPs. Typically, the following procedures will be implemented whenever quality control samples fall outside limits:

- **Method Blank.** When an analyte is detected above the reporting limit in the method blank, each sample in that batch is reviewed for the particular analyte(s). If the sample analyte is less than the reporting limit or greater than ten times concentration of the method blank level, the sample result is reported. If the analyte is between the reporting limit and ten times the method blank level, the sample is re-prepared and reanalyzed. Corrective action is amendable for Project specific requirement (i.e., detectable levels of target compounds that warrant corrective action may vary).

  When contamination occurs, immediate measures are taken to locate, correct and eliminate the source of contamination. Additionally, samples that are known to have

high levels of target analytes as a result of analysis or profile are removed from the general population and placed in an auxiliary, controlled sample receptacle.

- **Laboratory Control Standard (LCS) and Matrix Spikes.** Corrective action for failure of LCS sample or matrix spike recoveries depends on the relationship between accuracy and precision. Failure of the LCS for accuracy will require re-preparation and reanalysis. Failure of duplicate samples for precision will be evaluated on a case by case basis in terms of prep batch verification of precision and data usability. For example, if a prep batch includes both an LCS/LCSD and MS/MSD, accuracy and precision can be verified by either set with the stipulation that the acceptance criteria (control limits) are identical for both.

  Accuracy and precision achieved by MS/MSD analysis will also be evaluated on a case by case basis in terms of difficult matrices, exceeded spike concentration, or sample heterogeneity. If analytical results indicate either of such conditions and provides reasonable explanation for QC failure, re-preparation is not warranted; however, corrective action documentation is required. Matrix spike analysis and criteria is amendable to project specific requirement.

- **Surrogates (Organic analysis).** Corrective action for surrogate recovery that does not meet acceptance criteria must be evaluated for effect indicated for field and QC samples. Recovery for surrogate spikes in matrix specific-samples that fail to meet stipulated acceptance criteria may indicate a potential matrix effect. It is the policy of the laboratory to confirm matrix effect by reprep and reanalysis of the sample(s) in question, especially for surrogate recovery that fails low. If the presence of significant non-target interference yields failed surrogate recovery, reprep may not be warranted (e.g., high surrogate recovery due to co-elution). Analytical corrective action for matrix interference may include additional clean up (e.g., copper clean up for the presence of sulfur in PCB extracts) or diluted analysis. Since surrogates are chosen and used to reflect the chemistries of the targeted compounds of the method, LIMS flagging conventions and corrective action documentation are required when reporting sample data with surrogate recovery outside of control limits. Client profile and sample history must also be taken in consideration.

  Failed surrogate recovery for any QC sample requires reprep and reanalysis of the samples associated with the prep batch. Additionally, reprep and reanalysis is required for those samples that fail surrogate recovery and matrix interference is not indicated.

6.1.2 Corrective action involving analytical continuing calibration verification (CCV) during the analysis of QC and field samples will be evaluated against current methodology established by the EPA guidance or Project specific requirement. All

CCVs that do not meet method requirement shall result in review of the calibration, rerun of the calibration standard, and, if necessary, reanalysis of all samples affected.

Data can be reported under the following conditions when CCV criterion has been exceeded:

- The closing CCV demonstrates increased sensitivity and bracketed samples are non detect.
- Limited sample volume or holding time has exceeded which prevents re-prep/reanalysis.

In both cases, corrective action documentation and narration is required. If reprep/reanalysis cannot be performed, it is imperative to contact the responsible Project Manager prior to data reporting; who must contact the client for data reporting options.

An analysis of an initial calibration may be necessary, and documentation of maintenance for restoring the instrument to optimal running condition is essential and required.

6.2 If the Corrective action is **systematic**, the nature of the errors or deficiencies is more complex and may require the immediate attention of the Lab Director. Examples of systematic errors or non-conformances are listed below:

- Deviation from Standard Operating Procedures or Method guidance as determined by technical or systematic audit conducted internally or externally
- Instrument or equipment issues
- Consecutive failure of Performance Evaluation samples.
- Repeated failure of QC samples and measurement quality objectives or undesirable trends are indicated by analytical corrective action trend analysis.

The corrective action objective of systematic discrepancy or non-conformance is resolution by identification of root cause and prevention of recurrence: successful implementation of corrective action steps and robust documentation. When the root cause of a persistent problem cannot be immediately identified, it is essential that the corrective action process embarked upon must be a collective, problem solving, constructive effort where all parameters are examined. Once the root cause of the problem is identified, pertinent staff and department(s) examine potential actions that will rectify the problem, and prevent recurrence of future or similar occurrences. Description of problem, identification of root cause, steps of corrective action and measures to prevent recurrence is documented on STL San Francisco's Non-Conformance report (figure 6-2).

The non-conformance report is dated and signed by the following personnel: the chemist who initiated the non-conformance, Team Leader(s), and Lab Director. QA will acknowledge the date when corrective action has been implemented. After implementation of corrective actions, QA will monitor their effect to determine if the actions taken have been effective in overcoming the non-conformance identified. Target audits and surveillance will accomplish monitoring. Verification of non-conformance closure will be acknowledged and dated by QA. Copies of the verified non-conformance report will be distributed to applicable personnel and project file. The original report will be retained in QA as a quality record.

6.3 Stop Work Authority -

The Quality Assurance Department has the authority to stop activities that in the opinion of the Quality Assurance Department are uncontrolled or nonconforming and could affect the quality of the overall project or jeopardize quality objectives if not corrected. Stop work actions will be coordinated through the Laboratory Director and the Team Leader. Stop work actions will be implemented when nonconformance issues cannot be resolved or when conditions become unsafe and dangerous.

Figure 6-1

STL-San Francisco Corrective Action Report

Initiator: _____

Date: _____/_____/_____

Parameter/Analysis: _____
Matrix: ☐ Soil ☐ Water ☐ Other: _____
Submission #(s): _____
Sample #(s)_____
_____
_____
Batch-#(s) _____
_____
_____

Category of discrepancy
☐ Sample Prep
☐ Sample analysis
☐ Data Reporting
☐ Identify Instrument if applicable:
_____
☐ Other (describe below):

Discrepancy Description:
Sample Prep: ☐ Hold Time Exceeded ☐ Wrong Sample pulled ☐ Wrong Spike ☐ Other (describe below)
Sample Analysis ☐ CCV failed- O Initial O Mid O End ___High/___Low
☐ Method blank- O Contamination greater than ___RL/___MDL
☐ Surrogate Recovery (Identify/narrate below if more than 1 surr.)-O High O Low O Missing
☐ LCS/LCSD Recovery- O High O Low O RPD out O Missing
☐ MS/ MSD Recovery - O High O Low O RPD out O Missing O Spk. Conc. exceeded
☐ MS/MSD not performed due to insufficient sample volume O LCS/LCSD verified P/A
☐ Other (describe): _____
_____
_____
_____
(use space on back if more text is needed and indicate with: → over)

Corrective Action taken:
☐ None- O Insufficient sample/extract volume O Out of hold O Co-elution indicated O Narrate below
☐ Reanalyzed extract/sample- O Similar results yielded / ___ Matrix effects indicated
☐ Re-extraction/Re-prep
☐ Other (describe): _____
_____
_____

Preventative Action/Recommendation: _____
_____
_____
(use space on back if more text is needed and indicate with: → over)

Approval and Distribution of Completed Corrective Action Report:
Initiator _____ Date: _____/____/____
Team Leader _____ Date: _____/____/__
Project Manager _____ Date: ____/____/ ___
Quality Assurance (original) _____ Date: ____/____/ ____

Figure 6-2
STL San Francisco
Nonconformance Report

Submission # :	**Department:**	**Date:**	**NCR #:**
Nonconformance Description (include specific discrepancy and requirement reference) **Identified by:**			
Root Cause of Nonconforming Condition (included applicable trend or reference to drift)			
Corrective action to be taken (include applicable training and reference; dates of action and completion)			
Action or measures to be taken to preclude recurrence: **Department (Team):** _____ **Date:** _____ **Acknowledgement {** **Team Leader:** _____ **Date:** _____ **Laboratory Director:** _____ **Date:** _____ **Quality Assurance:** _____ **Date:** _____			

Corrective action Completed by/Date	**Verification Completed by/Date**

forms\ncr temp 2002.doc

7.0 Document Control and Distribution

Documents developed to direct, instruct, and/or guide technical or quality affecting activities will be maintained and controlled. Documents such as QAMs, QAPPs, and SOPs will be uniquely numbered and distributed to individuals or groups that have been identified as copy holders. The documents will be controlled and distributed in accordance with SOP #12.13.

7.1 Quality Assurance Manual and Standard Operating Procedures (SOPs) -

Distribution of these documents will be authorized by the Laboratory Director or Project Managers and coordinated through the Quality Assurance Department.

Distribution of the Quality Assurance Manual and SOPs will be performed using "Document Receipt Acknowledgment" forms (Figures 7-1 & 7-2) which require receipt acknowledgment by an individual or organization of the controlled document or subsequent revisions. The distribution of controlled documents will be tracked on a Document Distribution list. All documentation and correspondance regarding controlled documents will be maintained within the Quality Assurance Department.

7.2 Client and Laboratory Communication

The laboratory establishes a requirement of maintaining a formal system for documenting project/program specific needs provided by the client, and communicating pertinent information to the laboratory for successful execution of analytical methods. The objective of the laboratory is to provide clients valid, defensible data. STL San Francisco recognizes that meeting this goal begins with efficient, timely, and organized project management. Section 2.5 details the responsibilities of the project manager. The laboratory is aware of the availability of numerous methods and analytical techniques, and that continued communication between the laboratory and the client is fundamental to assure that correct, justified methods are used. Project management will also ensure that any communicated client concerns or changes in requirement during sample receipt and the span of the project are conveyed and properly addressed by the measures and tools of communication. SOP 02.12: Sample Handling - Client and Laboratory Communication Protocol, describes a formal system of this subject.

Figure 7-1

DOCUMENT RECEIPT ACKNOWLEDGMENT

THE FOLLOWING CONTROLLED COPY
Copy No.:_____

OF DOCUMENTS WHICH COMPRISE THE STL SAN FRANCISCO QUALITY PROGRAM OR PORTIONS THEREOF ARE BEING TRANSMITTED FOR YOUR IMPLEMENTATION AND USE. PLEASE SIGN/DATE THIS DOCUMENT TRANSMITTAL ACKNOWLEDGING YOUR RECEIPT OF THE DOCUMENT(S) LISTED BELOW AND TO ENSURE YOUR STATUS ON THE CONTROLLED DOCUMENTS HOLDERS LIST.

DOCUMENT NAME: QUALITY ASSURANCE MANUAL

DOCUMENT REVISION:_____

NOTE: PLEASE DESTROY REVISION _____ IN ITS ENTIRETY AND REPLACE WITH ATTACHED REVISION.

ISSUED TO - DEPARTMENT / ORGANIZATION:_____

I HAVE RECEIVED THE ABOVE LISTED DOCUMENTS

Name (Printed):_____

Name (Signed):_____

Company Name/Office:_____

Date Received:_____

PLEASE COMPLETE THIS RECEIPT AND RETURN TO:

STL San Francisco
Quality Assurance Department
1220 Quarry Lane
Pleasanton, CA 94566

Figure 7-2

Acknowledgment of Receipt for Standard Operating Procedures (SOPs)

SOP #	TITLE	REV	DATE

Fill in name of person receiving SOP *Fill in control #*

Issued To: Control #:

The signature below confirm that the SOPs listed above have been received:

Fill in signature of person receiving SOP *Fill in date signed*

_____ Date_____

8.0 Personnel Training and Qualifications

Training is provided to all new employees in their fields of assignment to ensure their ability to carry out job functions. Trainers are designated by the Laboratory Director. The program consists of two phases, Initial Training and Continuing Training. Training will be documented and maintained in an employee training records file as part of the Quality Assurance Program (Fig. 8-1, Method or Task Training Form, Fig. 8-2, Technical Training Form, Fig. 8-3, Certification Form for analysis of Performance Sample).

8.1 Initial Training and Development Programs

All employees must demonstrate initial competency prior to assumption of their assigned duties based on the following criteria:

- Orientation of job functions and how it interacts with the overall organization.
- Receive training or supervision in the method by a qualified person prior to performing technical work.
- Passing a written and/or oral examination by a qualified analyst or manager.
- Perform and pass an appropriate Performance Evaluation(PE) sample.
- Perform an appropriate Method Detection Limit Study (MDL).
- Receive an orientation of the QA program.
- Receive an orientation of the Health & Safety program.

8.2 Continuing Training -

Continuing Training is performed at scheduled times to assure certification revisions are current and changes to laboratory SOPs and other protocols are communicated. All analysts must be **recertified** annually for all analyses they run routinely by passing an in-house performance evaluation sample at a minimum and must also be certified before performing commercial analyses for any method they have not run routinely for a period of one year or longer.

Continuing training is based on two criteria, in-house training and off-site training:

8.2.1 In-house Training

- Acceptable review of the method with an experienced analyst or Operations Manager.
- Acceptable performance on an appropriate PE sample.

8.2.2 Off-site Training includes seminars, workshops, job related academic classes.

8.3 Health & Safety Training -

STL San Francisco maintains a Health and Safety (H & S) training program that is required of all employees. New employees are instructed in basic H & S policies and practices during orientation. Scheduled H & S meetings reinforce good safety practices and expand all employees awareness of H & S issues. Employees (such as sample disposal technicians and couriers) who may be exposed to potentially serious Health and Safety issues may be required to participate in additional OSHA training. The Safety Officer maintains written safety records for each employee who has been trained on safety issues.

8.4 Quality Assurance Training -

STL San Francisco maintains a Quality Assurance (QA) training program that is required of all employees. New employees are instructed in basic QA policies and practices during orientation. Weekly department meetings are held to review Quality issues, new methodologies, or upcoming audits.

Figure 8-1

EMPLOYEE TRAINING RECORD

ASSIGNMENT:_____
(Method or General Task)

REFERENCES:_____

_____
(List all SOPs pertaining to Method or Task)

EMPLOYEE NAME (TRAINEE): _____

TRAINER(s) NAME: _____

Training Assignment			
As each assignment is completed for the task listed above, fill in date and initial. When training is completed, return this form to the QA/QC Dept. for record updating.	**Date Complete**	**Trainee Initials**	**Trainer Initials**
Has received all references listed above.			
Has read all references listed above.			
Can correctly answer oral and/or written questions for the references listed above.			
Knows proper documentation procedures for recording information for this task, including reporting of data generated.			
Can demonstrate preventive maintenance techniques for equipment used in task.			
Can operate the required instrumentation as prescribed by the Manufacturers' Manuals and SOPs.			
Knows all Quality Control requirements, including Corrective Actions. Can demonstrate these steps.			
Has satisfactorily performed the task in accordance with SOPs or specified Policy Directives.			

Figure 8-2

EMPLOYEE TRAINING RECORD

ASSIGNMENT: _____

(Method or General Task)

REFERENCES: _____

(List all SOPs pertaining to Method or Task)

EMPLOYEE NAME (TRAINEE): _____

TRAINER(s) NAME: _____

Training Assignment			
As each assignment is completed for the task listed above, fill in date and initial. When training is completed, return this form to the QA/QC Dept. for record updating.	Date Complete	Trainee Initials	Trainer Initials
Has received all references listed above.			
Has read all references listed above.			
Can correctly answer oral and/or written questions for the references listed above.			
Knows proper documentation procedures for recording information for this task, including reporting or data generated.			
Can demonstrate preventive maintenance techniques for equipment used in task.			
Can operate/properly calibrate the required instrumentation as prescribed by the Manufacturers' Manuals and SOPs.			
Can demonstrate traceability and preparation of all standard solutions and reagents used.			
Knows calibration/quality control requirements, including corrective actions. Can demonstrate these steps.			
Has received Health and Safety training, and can demonstrate proper techniques of waste disposal as required and documented in QAM and laboratory Chemical Hygiene Manual.			
Has correctly and accurately analyzed Reference Materials (PE/PA samples) in accordance with methodology.			

Figure 8-3

Performance Evaluation Study (PES) Summary

Next Certification Due:

Analyst Name: Date:

EPA Method/No.: SOP No.:

Instrument: Standard:

Submission No.: Sample No./Type:

PES CLASSIFICATION: ☐Initial Continuing

PERFORMANCE:	Accept ?	Yes	No
Calibration Run		_____	_____
Sample Prep By:	Date:	_____	_____
SOP Available		_____	_____
Standard Record Correct		_____	_____
Start-Up Procedure		_____	_____

EVALUATION:

Compound	Reported Result	Certified Value	Acceptance Limits

(See addendum for multi-component tests)

Performance Results Pass ____ Fail____

Comments / Corrective Action (if applicable):

_____

_____

_____ _____

QA Signature Date

9.0 Control of Purchased Items and Services

9.1 Procurement -

The procurement of items and services are controlled to meet the following quality requirements set by the Corporate Management:

- Appropriate technical and quality requirements are adequately specified in purchase orders (PO).
- Sufficient reviews and approvals are received prior to procurement to verify project objectives are reflected in the procurement
- The procurement process accurately transmits requirements to suppliers and subcontractors
- Selected suppliers and subcontractors are qualified.
- Items and services conform to quality assurance, commercial, and technical procurement requirements.

9.1.1 Procurement Document Control -

Procurement documents issued by STL San Francisco including bid requests, purchase orders, and contracts will be prepared, reviewed, and approved as described in STL San Francisco Standard Operating Procedures. Bids and contracts will be reviewed and documented by the Laboratory Director, Project Manager, Quality Assurance Department, and/or MIS Manager, as appropriate, prior to initiation of documents.

9.1.2 Purchase Requisitions -

The Department Team Members will be responsible for requesting items or services affecting their department. The Quality Assurance Department and Laboratory Director will review and approve the technical and quality requirements for the item(s) or service(s) to be supplied. All Laboratory purchases will be controlled by logging, numbering, and monitoring revisions so that the information issued and used is current.

Vendors will furnish appropriate documentation of chemicals, equipment, and supplies that must be submitted upon delivery of merchandise. Subcontractors will be prequalified and required to furnish documented evidence of their capabilities to perform laboratory analyses prior to commencing work. The

Quality Assurance Department or Laboratory Director are responsible for auditing subcontract laboratories.

9.1.3 Procurement Documentation Revision

Revision(s) to procurement documents which have been issued will be initiated using the same method as the original procurement and will be approved

9.2 Reagents -

All chemicals will be inspected for container integrity upon receipt. The date of receipt and lot number will be recorded in a log book within each department. All chemical certificates will be kept on file within each department.

A control system for batch testing chemicals is followed. The lot numbers will be recorded and the solvents tested for the analytes of concern. The tests must meet the purity criteria before the chemicals are distributed within the laboratory. Whenever possible, STL Corporate will arrange with the manufacturer to reserve those lots of solvent already tested and approved.

To ensure freedom from contamination, all reagents used will be the purest grade required for a particular analysis. For most analyses, Analytical Grade is satisfactory. All organic solvents are pesticide-grade or equivalent. Preparation of reagents is documented and includes preparer, lot number or documented reference code, dilutions, date prepared, and expiration date. Solvents and reagents are routinely checked for contamination by analyzing them as method or instrument blanks for the analytical methods for they are used.

Reagents will be stored in accordance to manufacturer's directions, in appropriate containers and conditions to maintain safety and integrity.

9.3 Standards -

All standards - calibration, spiking, surrogate and internal - will be purchased from suppliers with certification of purity and concentration and stored in each department by receipt dates. They will be inspected and tested against previously validated standards. Suspect standards will be returned to the vendor. The date of receipt, source, lot number, expiration, assigned lab ID number, and person receiving it will be recorded in a standards logbook maintained within the Quality Assurance department. The lab ID number and the expiration date will be recorded on the standard container.

All working standards will be traceable to the neat standards by documenting the neat ID number in the standard preparation logbook. Additionally, the logbook will include the preparation date, amount of neat standard used, final volume, concentration of each compound used, solvent used, expiration date, and preparer. The working standard will be given a lab ID number which is entered on the container label along with the standard name, date prepared, preparer, and expiration date.

Organic standards will be stored in dedicated freezer/refrigerators maintained at -10°C to -20°C for volatile standards and 4° ± 2°C for all others. Refrigerator temperatures will be monitored and documented in a logbook daily. Metals standards will be kept at room temperature.

9.4 Sample Bottles -

Each lot of sample bottles purchased will have a certificate of analysis which is logged in a binder and maintained in Sample Control. Sample bottles will meet EPA specifications and will not be reused.

9.5 Glassware Cleaning -

Glassware cleaning procedures are documented in SOP #13.03. All glassware will be washed with phosphate-free detergent and stored in a closed, contaminant-free area.

9.5.1 Volatile Organic Glassware will be scrubbed in detergent and hot water. It will be rinsed thoroughly with hot tap water, then three times with DI water. The glassware will be oven dried at 150° C. Syringes and small items will be cleaned by rinsing with methanol.

9.5.2 Extractable Organic Glassware will be rinsed with acetone only if samples left an oily residue or other residue that cannot be cleaned with detergent and water. It will be rinsed with hot tap water, scrubbed with detergent and water, rinsed with hot tap water, then rinsed three times with DI water. It will be oven dried at 150°C. Prior to use, it will be rinsed with the solvent to be used for extraction.

9.5.3 Inorganic Glassware will be rinsed with hot tap water, scrubbed with detergent and hot water, rinsed with hot tap water, then three times with DI water, oven dried at 150°C, and stored. Prior to use, metals glassware will be rinsed with 2% nitric acid.

9.6 Laboratory Water -

Deionized water (ASTM Level II) will be used throughout the laboratory. Milli Q water treatment systems will be used in the volatile organic and metals preparation areas for increased purity.

The quality of water will be monitored routinely against acceptance criteria and will be referenced in an appropriator standard operating procedure. Minimum monitoring will consist of conductivity measurement and analysis of method blanks.

Maintenance of the water system will be performed on an "as needed" basis through monitoring. Logbooks will be maintained for recording all monitoring results and maintenance work performed.

9.7 Subcontracted Laboratory Work -

Only approved laboratories will be used for subcontracted analyses. For certain projects, subcontracted laboratories must be approved by the program

Instructions will be documented on a chain-of-custody that is sent with the samples to the subcontracted laboratory. When the subcontracted work is completed, the report will go through the same review and approval process as is conducted for in-house data evaluation.

9.8 Inventory Tracking -

Inventories of purchased items will be monitored and maintained by the accounting department. Each department will be responsible for maintaining an adequate inventory.

10.0 Laboratory Procedures and Reviews

10.1 Standard Operating Procedures (SOPs) -

The process for the preparation, review, approval, issuance, and revision of these documents is contained in STL San Francisco SOP #1.00. All SOPs will be assigned a unique number, revision date, and title. Prior to issuance, the document will be reviewed and approved by the Laboratory Director, Technical Reviewer, and Quality Assurance Department. The reviewers will verify that the following criteria are met:

- The procedure conforms with the department and laboratory process.
- Regulatory requirements are met.
- Client requirements are met.

Final approval requires the date and signatures of the Technical Reviewer, Laboratory Director, and Quality Assurance.

10.2 Method Performance Policy

Method performance data will be determined before each method is used in the laboratory and will be completed within thirty working days (However, some methods may require a longer period.). The Quality Assurance Department will be notified if a new method is to be implemented to STL-San Francisco's list of analyses. The Quality Assurance Department will recommend appropriate procedures to be evaluated by the Laboratory Director. Following evaluation, an SOP based on approved methods, such as EPA, will be drafted and sent in for review by the QA Department. If the draft SOP is in order, the analyst will be trained. The performance evaluation will proceed in the laboratory.

Initially, the analyst will generate a calibration curve for the analytes of interest. The concentration levels of the calibration standards will demonstrate the ability to meet the method detection limit (MDL). Furthermore, a second source standard will be analyzed to verify the standard used for calibration. If the calibration curve meets method requirements, an MDL study will then be carried out in accordance with SOP #12.03.01. Precision and accuracy studies will be run in accordance with SOP #12.03.03, followed by a performance sample, if applicable. Once the studies have been completed with all the data compiled and accepted, all summary results with supporting raw data will be submitted to QA for final review and approval. Only following approval by QA will the new method be considered acceptable, ready for analysis of samples, and will be submitted for certification/validation from certifying agencies, if applicable.

10.3 Data Review -

Data review involves the checking of data quality and documentation. It also requires dated and signed entries on worksheets and logs used for samples, use of sample numbering systems to track samples through the process, and the use of quality control criteria to accept or reject specific data. All data are reviewed, signed, and dated by the analyst and a qualified chemist prior to issuing a final report. Data review procedures are discussed in SOPs #11.02 & 11.03. Additionally, Level III & IV data packages are reviewed, signed, and dated by the Project Manager and the Quality Assurance Department.

Non-compliance issues will be returned to the applicable department analyst where appropriate action will be taken. Changes will be marked-through with one line, initialed, and dated.

10.4 Computerized Data -

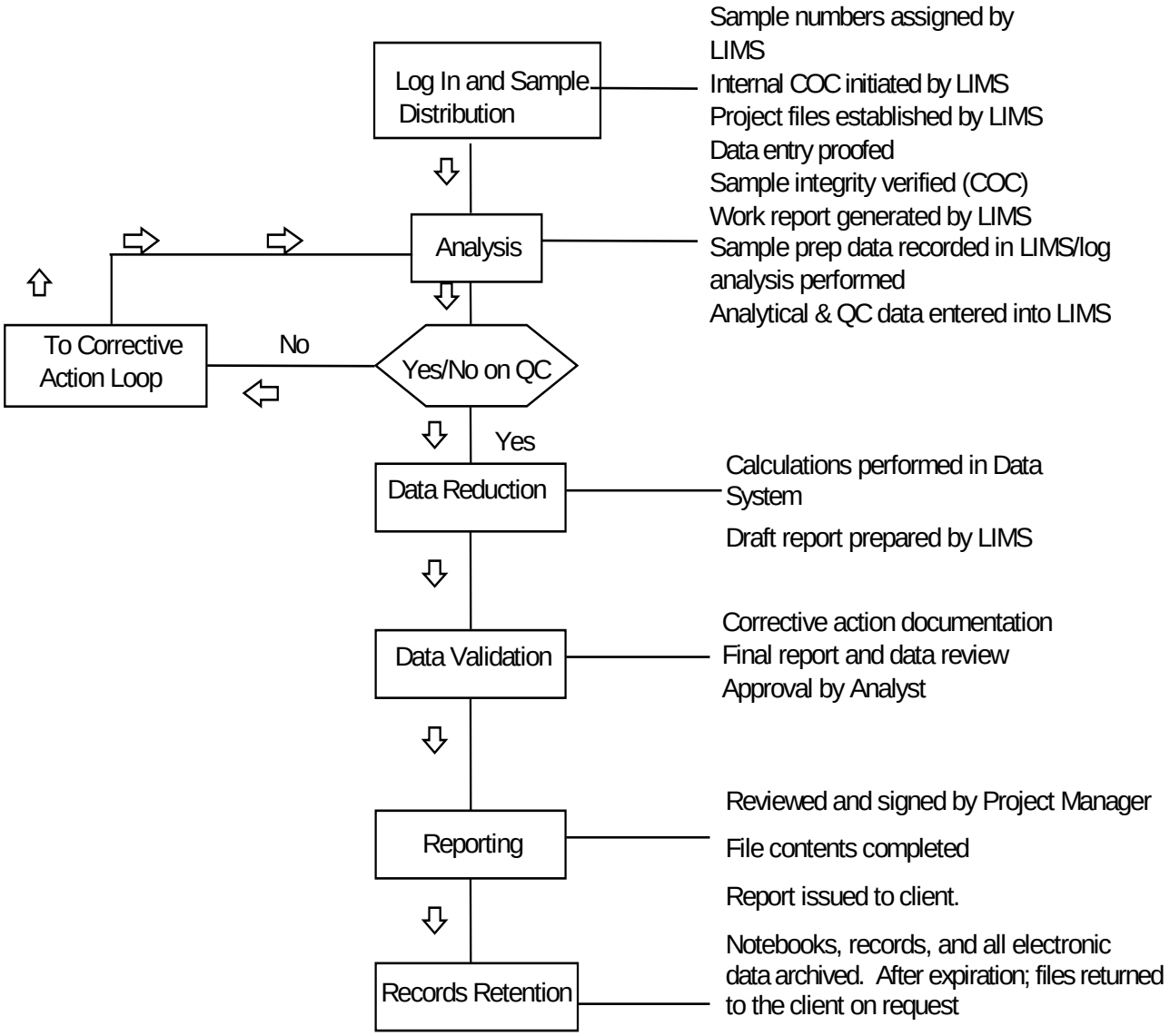
Computerized data collection and handling systems used by STL San Francisco will assure that each data entry and file is uniquely identified so that data can be reliably stored and retrieved without loss. In addition, all data files will be supported by hard copies.

It is the responsibility of the Laboratory Director to ensure that computer personnel are sufficiently trained in order to prevent data corruption, that computer software is validated, and that levels of security clearance for software access are implemented.

It is the responsibility of the Quality Assurance Department to assure that processes are being implemented and upheld through laboratory system audits.

Figure 10-1

STL SAN FRANCISCO DATA FLOW CHART



11.0 Laboratory Audits

Audits measure the laboratory's quality performance, determine the effectiveness of the implemented quality system elements in meeting specified quality objectives, and ensure compliance with the various certification programs.

Audit assessment serves as a management tool by providing important information to ensure that collected data are defensible. Overall, audits lend to the continuous improvement and dynamics of the Laboratory's Quality System.

The laboratory undergoes and is subjected to **Internal** (System, Data, and Special) and **External** audit process.

11.1 Internal Audits

11.1.1 Systems Audits

Systems audits are technical by nature and are used to verify by examination and evaluations of objective evidence, that applicable elements of the quality system have been developed, documented, and effectively implemented in accordance and in conjunction with the requirements specified within this QA manual.

Systems audits are conducted on an ongoing basis. Audits for each department, both operational and support, shall be performed not less than annually.

Upon completion of the audit, the QA Manager will issue an audit report addressed to the Team Leader of the audited department within 21 working days. A copy of the report is sent to the Lab Director.

Written audit responses are required within 21 calendar days of audit report issue. The audit response follows the format of the audit report, and corrective actions and time frames for their implementation are included for each deficiency. The audit response is directed to all individuals copied on the audit report. Where a corrective action requires longer than 21 days to complete, the target date for the corrective action implementation is stated and evidence of the corrective action is submitted to the QA Department in the agreed upon time frame. Closure of the audit is verified by QA.

11.1.2 Data Audits

Data audits are focussed to assess the level of customer service, method compliance, regulatory compliance, accuracy and completeness of test results and reports, documentation, and adherence to established QC criteria, laboratory SOPs, technical policy, and project specific QC criteria.

A data auditing frequency target of 10% has been established. Level III and IV data packages are subjected to 100% QA review. The QA Department provides feedback and/or corrections and revisions to project reports where necessary. Data audits must include electronic reproducibility of selected raw data (e.g., reproducing area at selected retention time); LIMS data entry review; adherence to graphic edit or manual integration policy; approach to the analytical sequence conforms to guidance and SOP; verify demonstration of secondary and peer review, and confirm that Project specific requirement have been met.

Records of the data audits shall be kept, and the frequency of data audits shall be included in the monthly QA report. In performing data audits, it is essential that data be assessed in terms of differentiating between systematic and isolated errors. Upon noting anomalous data or occurrences in the data audits, the QA Department is responsible for seeking clarification from the appropriate personnel, ascertaining whether the error is systematic or an isolated error, and overseeing correction and/or revision of the project report if necessary. Errors found in client project reports are revised and the revision sent to the client. The QA Department is also responsible for assisting in the corrective action process where a data audit leads to identification of the need for permanent corrective action.

11.1.3 Special Audits

Special audits are conducted on an as needed basis, generally as a follow up to specific issues such as client complaints or data concerns, corrective actions, proficiency testing results, data audits, systems audits, validation comments, or regulatory audits. Special audits are focussed on a specific issue. Report format, distribution, and timeframes are designed to address the nature of the issue. Audits of this nature may also serve to accelerate or augment personnel training.

11.2 External Audits

STL San Francisco is routinely audited by clients and external regulatory authorities. The lab is available for these audits and makes every effort to provide the auditors with the personnel, documentation, and assistance required by the auditors. The auditing agency will arrange on-site schedules, and set timeframes for the laboratory's response to findings

or comments. STL San Francisco recommends that the audits be scheduled with the QA Department so that all necessary personnel are available on the day of the audit.

12.0 Records Management

Accurate records on a project are essential for current and historical purposes and must meet regulatory and liability issues. STL San Francisco's documents are retained and stored in such a manner that meets client, project, and legal requirements. To demonstrate that quality has been achieved, STL San Francisco will maintain a records management system that includes documents that are specific to a project or a group of samples within an ongoing project and those that demonstrate overall laboratory operations. The records management system implemented will provide data that is secure, complete, and easily retrievable. All laboratory records from the time of sample receipt through reporting and disposal of samples will be available and stored in a manner that safeguards their integrity from tampering or physical damage or loss. All documentation that is associated with a given project will be available for review by STL San Francisco and its clients. This documentation includes associated operational and project specific data generated by the laboratory.

12.1 Current Records -

The laboratory will assign a Document Controller responsible for the records management system. This individual will initiate new project files, update files as necessary with additional information, and assist laboratory personnel in withdrawing and returning records. To maintain control of these records within the laboratory, an "archival request" file will be maintained. This file will contain at a minimum the project file check-out, file designation, date check-out, person borrowing records, and date returned to files. Retention of records will be in accordance with contract or appropriate regulatory requirements.

12.2 Laboratory Logbooks -

The Quality Assurance Department shall issue a control number for every laboratory notebook, log, and working record used by the laboratory and maintain a record of the use and archival of such documents. These documents include instrument logs, calibration logs, refrigerator temperature logs, deionized water logs, instrument maintenance logs, extraction and run logs, and standard logs.

In most cases, laboratory logbooks will be bound and given a control number upon disbursement. Each page will be numbered. When these logs are completely filled and no longer used, they will be returned to and archived by the Quality Assurance Department.

12.3 Telephone Logbooks -

Telephone logbooks will be dispersed to those employees who have contact with project management, such as Project Managers, Laboratory Director, Quality Assurance Department, and Business Development. Notebooks will be bound and given a control number upon disbursement. Each page will be numbered. When these logs are completely filled and no longer used, they will be returned to and archived by the Quality Assurance Department.

12.4 Records Storage -

12.4.1 All **analytical records** will be kept for at least **five years**. They will be kept in files in the work area as long as they are actively used, after which they will be stored in secure central storage. Electronic results of chromatograms and test results in LIMS will be archived and stored in the computer room.

12.4.2 Client's reports and project files will be stored for at least **five years**. They will be kept by Client name in secured central office files for one year, and then in secure central storage. They will be disposed of in a confidential manner. Prior to disposal of records, key clients will be contacted and given the option of transferring the records to their possession.

12.4.3 All **Quality Assurance records** will be stored in the Quality Assurance Department. Documents detailing custody of instrument logbooks and bench sheets, QA Manuals, and the like will be stored with the Quality Assurance Department.

12.4.4 Accounting documents will be retained for five years. Ledgers will be kept both in hard copy and in electronic format. Accounting records will be held in a separate storage area reserved for the Accounting Department.

Retention periods, type of archival, location, and responsible party of all records are listed on the "Document Storage" (Table IV, page 12-3).

Table IV
Document Storage

	Hardcopy Records		Electronic Records		
	Retention Period	**Location**	**Retention Period**	**Medium**	**Location**
Laboratory Reports					
Chromatograms	5 Years	Central Storage	5 Years	Optical Disk	Computer room
Chemists' Bench Sheets	5 Years	Central Storage			
Chemists' Lab Notebooks	5 Years	Central Storage			
Instruction & Run Logs	5 Years	Central Storage			
Sample Control					
Technician Sample Requests	6 Months	Sample Control			
Internal Sample Logs	5 Years	Central Storage			
Job check Review Forms	2 Months	Project Manager			
Clients' Reports & Project Files					
Reports	5 Years	Central Storage	5Years/LIMS	Optical Disk	Computer Room
Project Records	5 Years	Central Storage	5 Years/MS Word & WP	Floppy Disk	Record file
Electronic Deliverables			5 Years/Military	Floppy Disk	
			5 Years/Commercial	Floppy disk	Network Backups
Chains of Custody	5 Years	Central Storage			
QA Records					
Bench Sheet Check Out Log	5 Years	Central Storage			
QA Manual Check Out Log	5 Years	Central Storage			
QA Charts	5 Years	Central Storage			
SOPs-All Revisions	5 Years	Central Storage			
Accounting					
Payroll	5 Years	Accounting Storage	7 Years	Floppy Disk	Accounting Department
Checks, Receipts	5 Years	Accounting Storage	7 Years	Floppy Disk	Accounting Department
Invoices	5 Years	Accounting Storage	7 Years	Floppy Disk	Accounting Department
Ledgers	5 Years	Accounting Storage	7 Years	Floppy Disk	Accounting Department
Human Resources					
Personnel Files	7 Years	Human Resources			
Building Key/Security code Log	7 Years	Human Resources			

References

The following references were used in preparation of this document and as the basis of the STL San Francisco Quality System:

California Code of Regulations, Title 22, Div. 4, Article 8, “Quality Assurance Documents”, Section 64815.

Code of Federal Regulations, "Test Procedures for Analysis of Organic Pollutants", 40 CFR Section 136, Appendix A, B, C, July 1996 edition: Organics in water EPA Methods 608, 624, 625, and 200.7.

EPA Guidance for the Preparation of Standard Operating Procedures (SOPs) for Quality Related Documents, US EPA, Office of Research and Development, EPA QA/G-6, November 1995.

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Navy Installation Restoration Chemical Data Quality Manual, Navy IR CDQM, June 1998.

Shell for Analytical Chemistry Requirements, US Army Corps of Engineers, December 1998.

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Standard Methods for Examination of Water and Wastewater, 18th edition, American Public Health Association, 1992: Pesticides, wet chemistry, and petroleum hydrocarbons in waters, soils, and sludges.

Test Methods for Evaluating Solid Waste, SW-846, 3rd edition, USEPA OSW, Washington, D.C., November, 1986, including Update III, December 1996: Metals and organics in soils and mobility extracts; metals and organics in groundwater for RCRA compliance; hazardous material characterization.

Test Methods for Evaluating Solid Waste, “Quality Control”, SW-846, Chapter 1, Revision 1, July 1992.

Personnel

ERIC T. TAM

Education: **Bachelor of Science in Chemistry, May 1985**
University of California, Berkeley

Professional Experience:

11/87-present **Laboratory Director, STL San Francisco, Pleasanton, CA**
Responsible for overall management and direction of the laboratory operation. Includes hiring and managing chemists to carry out chemical analysis of environmental samples. Overseeing Chemists perform analysis using gas chromatographs, mass spectrometer, ICP, and other sophisticated techniques. Counsel chemists in developing methods used in the laboratory, trouble-shooting and maintaining instrument and preparing final reports to clients. Together with the Quality Assurance Department, responsible for obtaining and maintaining laboratory certifications and approvals.

11/85-11/87 **Senior Chemist, Anresco, Inc., San Francisco, CA**
Responsible for the day-to-day operation of the gas chromatography section of the laboratory. Duties include carrying out chemical analysis of environmental samples and food products using gas chromatograph and other instruments, supervising, developing new procedures to fit the needs of clients, etc.

8/85-11/85 **Chemist I, Anatec Laboratory, Santa Rosa, CA**
Responsible for carrying out routine wet chemistry procedures for environmental samples, analyzing soil gas samples using gas chromatograph, preparing and testing gas bombs, analyzing air samples for radon, running bacterial studies of water samples, etc.

DENNIS MAYUGBA

Education: **B.A. Biology, University of the Pacific, Stockton, CA**
Two year graduate course work in Biology, U.O.P.

Professional Experience:

6/95-present **Quality Assurance Manager, STL San Francisco, Pleasanton, CA**
Design and manage the implementation and maintenance of the laboratory's Quality Assurance Program. Semivolatiles GC and HPLC chemist II.

8/91-4/95 **Quality Assurance/Semivolatiles Chemist, Roy F. Weston, Inc.**
QA/QC practices includes data review and validation of organic and inorganic analysis: AFCEE; USACE; NEESA and CLP. Employee orientation and training, coordination of Performance Evaluation Studies, State Certification requirements, internal auditing of lab units, corrective action implementation, preparation of annual QA/QC reports, SOP generation and implementation and document control. GC operation and maintenance using FID and ECD detectors, HPLC operation and maintenance.

6/85-6/91 **Adjunct Instructor, University of the Pacific, Stockton, CA**
Designed and instructed Science Programs for Life Long Learning.

8/81-4/85 **Laboratory QA Technician, Diamond Walnut Growers, Stockton, CA**
Responsibilities included microbiological techniques and Wet chemistry analysis.

JILL THOMAS

Education: **B.A. Honors Chemistry, Mills College**
Minor Mathematics

Professional Experience:

11/92-present **Quality Assurance, STL San Francisco, Pleasanton, CA**
Responsible for the control and review of documents, preparation of the QA Manual, coordination of SOP's with Team Leaders. Assist in developing and maintaining laboratory Information Management System. Train and counsel chemists and technicians in techniques necessary to provide quality test results. Together with the QA Manager, obtain and maintain laboratory certifications and approvals.

5/90-11/92 **QA/QC Manager, GTEL Environmental Lab, Concord, CA**
Developed and operated quality assurance program. Trained chemists and technicians in proper analytical technique. Overall responsibility for GTEL's report production and quality. Responsible for obtaining and maintaining certification in thirteen states.

5/89-5/90 **Chemist, GTEL Environmental Lab, Concord, CA**
Performed all inorganic analysis. Trained and supervised chemists in inorganic analysis section.

10/86-5/89 **Chemist, Kennedy-Jenks Labs, San Francisco, CA**
Performed all gas chromatography analysis using EPA methods. Trained and supervised chemists in organics analysis section. Provided QA support for the laboratory.

GARY COOK

Education: **B.A. Chemistry, Dartmouth College, 1971**
M.A. Chemistry, University of Oregon, 1974
M.B.A. Marketing, Cal State University, Hayward, 1981

Professional Experience:

1990-Present **Director, Business Dev., STL San Francisco, Pleasanton, CA**
Responsible for customer accounts, customer satisfaction and the development of ChromaLab's business. Act as Project Manager for accounts.

1988-1990 **Technical Services Manager, Nuclepore Corp, Pleasanton, CA**
Provide technical support for customers, lead customer service department and developed business for specialty filter lines.

1982-1988 **Technical Manager, McKesson Chem. & Water Division, CA**
Lead technical support and research programs to two divisions of McKesson Corp.. Managed technical programs of $2MM/yr., operation programs of $5MM/yr. and capital programs of $1MM/yr..

1978-1982 **Laboratory Manager, Analytical Services, McKesson Corp., Dublin, CA**
Lead analytical service group providing support to $6 billion company, including environmental, product and process analysis. Also provided contract analysis worth $600,000 per year.

1974-1978 **Analytical Chemist, Formost-McKesson and Shaklee, CA**
Provided chemical analysis to support company operation and contract analysis for clients needing environmental and other testing.

AFSANEH SALIMPOUR

Education: B.S. Environmental Health

Professional Experience:

1998-Present **Project Manager, STL San Francisco, Pleasanton, CA**
Responsible for customer accounts, customer satisfaction and the development of ChromaLab's business.

1992-1998 **Project Manager/Marketing, Superior Precision Analytical**
Served as an interface between client and laboratory. Assisted clients with result interpretation. Advised chemists regarding data delivery requirements for their projects. Reviewed data packages and certifies analysis for accuracy. Provided sales staff with technical support.

1989-1992 **Senior Chemist, Superior Precision Analytical**
Responsible for managing the organic section of the environmental laboratory. Duties included; sampling management, tracking from sample log-in through reporting of results and utilizing computer based systems. Performed Gas Chromatography analysis of both soil and water in accordance with SWA methods. Performed maintenance and trouble shooting of analytical instrumentation including instrument set up. Interpreted reduction and data validation of chromatographs. Interacted and followed up with clients to alleviate and resolve potential problems. Supervised and trained new chemists.

1985-1989 **Chemist, Engineering Science, Inc.**
Duties included utilizing gas chromatography in determining presence of PCB, pesticides, aromatic and halogenated hydrocarbon in environmental water and soil samples. GC maintenance and trouble shooting, data entry and analysis using personal computers.

SURINDER SIDHU

Education: **M.S. Botany Major, Biochemistry Minor**
B.S. Chemistry

Professional Experience:

1995-Present **Project Manager, STL San Francisco, Pleasanton, CA**
Responsible for customer accounts, customer satisfaction, and the development of ChromaLab's business.

1991-1995 **Organic Lab Supervisor, Precision Analytical Laboratory**
Analysis for Volatiles and Semi-volatiles by GC/MS.
Supervised laboratory staff, result interpretation and trouble shooting in GC and GC/MS. Helped clients with technical questions on all analysis. Trained all new chemists in the lab. Responsible for QA/QC for laboratory data and graphs.

1987-1991 **Senior Organic Chemist, Clayton Environmental Consultants**
Analyzed hazardous waste on routine basis using EPA method for volatile and semi-volatile by mass spectra. Method validation studies for EPA mass spectra and gas chromatography.

1985-1987 **Senior Chemist, International Technology Corporation**
Analyzed hazardous waste by gas chromatography using EPA methods 601 through 613. Involved at various steps of plant treatment trouble shooting processes, reaction mechanism, rate reaction and allied kinetics. Analyzed hazardous waste using classical wet chemistry methods. Metals by ICP and AA. Instrumental experience on gas chromatography, deonex anion separation UV and IR spectrophotometer.

VINCENT VANCIL

Education: Los Positas College, Livermore, CA

Professional Experience:

1999-Present **Project Manager, STL San Francisco, Pleasanton, CA**
Responsible for customer accounts, customer satisfaction and the development of ChromaLab's business.

1995-1999 **Analyst, STL San Francisco (formerly ChromaLab, Inc.), Pleasanton, CA**
Responsible for extracting, loading and data reduction for in the Gas/BTEX department. Maintained equipment and coordinated the workload in for Gas/BTEX making sure that the results were on time and accurate.
Trained and showed proficiency in analyzing PCB's and Pesticides.

DANIEL WOODHAMS

Education: California State University, Long Beach, CA

Professional Experience:

11/95-Present **MIS Manager, STL San Francisco, Pleasanton, CA**
Responsible for design, purchase, installation, training and maintenance of Novel network and Laboratory Information Management Systems; creation of custom data packages to meet individual client needs.

12/88-10/95 **Corp. Manager of Information Systems, Resna Industries**
Managed staff of four direct and ten indirect personnel. Responsible for design, purchase, installation, training and maintenance of Novell based LAN/WAN, VAX cluster based accounting systems and all network and plant security.

6/86-12/88 **Owner, Woodhams Computer Consultants**
Sales, software DBMS developer, post-sale training and maintenance. Serviced client base of 100 plus PC systems. Directed the design team of DBMS software development corporation. Clients included: Hubbell Corporation, Dublin computer Systems, BMW-North America and Space Control Systems.

ZOLTAN ILES

Education: **University of Zabrab, Faculty of Geodesy, Zagreb, Croatia, 1991**
Data Tech Institute, San Jose, CA

Professional Experience:

02/98-Present **LIMS Specialist, STL San Francisco, Pleasanton, CA**
Responsible for design, programming and maintenance of ChromaLab's Laboratory Information Management System (LIMS). Integrates laboratory instruments into LIMS for direct data downloading.

1993-1998 **IS Manager and Senior Programmer/Analyst, Superior Analytical Laboratory, Inc., Martinez, CA**
Designed, coded, tested and implemented a Laboratory Information Management System (LIMS). Designed and developed a data validation application and transfer protocol for several Gas Chromatograph methods.

1986-1993 **Programmer/Analyst, University of Zagreb, Faculty of Technology, Zagrebg, Croatia**
Performed data analysis and graphical presentation of data for ongoing water pollution monitoring projects for the United Nations pollution monitoring program. Responsible for the design and development of application for controlling small intel8085 based units utilizing PCs and data transfer by modem to a remote computer

Group Team Leaders

Linda Atienza

03/97-Present **Team Lead for Organic Extractions Department, STL San Francisco, Pleasanton, CA**

B.S. Chemistry, University of Santo Tomas, Manila, Phils.
Thirteen years experience in the environmental field.

John Labash

07/94-Present **Team Lead for Metals, Classic Chemistry, and Sample Control Departments, STL San Francisco, Pleasanton, CA**

B.S. Wildlife Biology and Environmental Chemistry, Juniata College, Huntingdon, PA
Seventeen years experience as supervisor and analytical chemist focused on metals. Experience in running ICP, GC, FAA and CVAAS. Experience also includes scheduling work flow, supervising and training chemists and technicians, implementing QA/QC procedures, maintaining and troubling shooting instruments.

Michael Lee

12/95-Present **Team Lead for Semi-volatile Department, STL San Francisco, Pleasanton, CA**

B.S. Chemistry, Glassborn State, Glassborn, NJ
Ten years of laboratory experience with IT Corporation and GTEL. Responsibilities included wet chemistry techniques and general supervision of activities for the GC/MS group. Responsibilities included maintenance, method modifications and trouble shooting in the Volatile and Semi-volatile labs.

Group Team Leaders (continued)

Alex Tam

07/89-Present **Team Lead for Volatile Department, STL San Francisco, Pleasanton, CA**

B.S. Chemistry, San Jose State University, San Jose, CA
Twelve years analytical experience with ChromaLab, Inc., including EPA methods 8015, 8020, 8080, 8240, 8260 and 8270.

Glossary

Acceptance Limits – Limits of acceptable performance based on statistical studies of EPA Performance Evaluation samples.

Accuracy – The degree of agreement between a measurement and true or expected value, or between the average of a number of measurements and the true or expected value.

Action Limit – A control limit on a control chart which, if exceeded, requires corrective action to ve taken. Action limits are usually placed at ±3 standard deviations from the expected or mean value.

Analyte – A component measured in a chemical analysis.

Assignable Cause – An event believed to have caused a change in precision or accuracy in a measurement process.

Audit - A systematic evaluation to determine the conformance to specifications of an operational function or activity.

Batch - Environmental samples, which are prepared and/or analyzed together with the same process, using the same lot(s) of reagents. A **preparation batch** is composed of one to 20 environmental samples of a similar matrix, meeting the above mentioned criteria. Where no preparation method exists (example, volatile organics, water) the batch is defined as environmental samples that are analyzed together with the same process and personnel, using the same lots of reagents, not to exceed 20 environmental samples. An **analytical batch** is composed of prepared environmental samples, extracts, digestates or concentrates that are analyzed together as a group. An **analytical batch** can include prepared samples originating from various environmental matrices and can exceed 20 samples.

Blank – Organic or aqueous solution, free of analytes under analysis.

Blind Sample – A proficiency sample submitted for analysis which has known values to the person submitting the sample, but unknown to the analyst. For internal continued proficiency studies, a blind sample may be purchased from a vendor or prepared internally from a second source standard which contains the analyte(s) of interest for a particular analytical method.

Bias – A systemic error that may occur within a method or that may be caused by an irregularity of the measurement system.

Calibration – Comparison of a measurement standard or instrument with another standard or instrument to eliminate by adjustment any variation from the true value.

Calibration Check Sample – A standard, from a source other than that prepared for calibration, and at a concentration midway on the calibration curve.

Certification – A formal evaluation and acceptance of a laboratory with respect to its competence in performing specified analyses.

Chain-of-Custody (COC) – A legal document which identifies samples collected and traces their source, dates, times, relinquishing and receival history and defines all analytical parameters to be measured; an unbroken trail of accountability that ensures the physical security of samples, data and records.

Check Standard – A calibration standard used to evaluate the measurement process of an instrument.

Comparability – Ability to provide analytical data comparable to other agencies and to provide similar data within the same laboratory over a period of time.

Composite Sample – A sample composed of two or more portions, mixed together.

Compromised Sample - A sample received in a condition that jeopardizes the integrity of the results.

Confirmation - Verification of the presence of a component using an additional analytical technique. These may include second column confirmation, alternate wavelength, derivatization, mass spectral interpretation, alternative detectors, or additional cleanup procedures.

Continuing Calibration Blank (CCB) – Organic or aqueous solution, free of analytes under analysis, unprepared, but containing the same volumes and reagents as calibration standards. It is run after the CCV to check the null reading for the calibration curve. The first CCB of a run may be referred to as an Initial Calibration Blank (ICV).

Continuing Calibration Verification (CCV) – A standard, from the same source used to prepare the calibration standard, and at a concentration midway on the calibration curve. The CCV is run to check that the instrument remains calibrated.

Control Chart – A graph plotting time against sequences of measurement results and including control limits. Results are expected to fall within these control limits in order to be statistically in control.

Control Limit – The limits on a control chart which are set by laboratory method studies. Points falling between these limits are considered statistically in control. Two kinds of control limits are usually used: warning limits and action limits.

Control Sample – A sample of known composition that is measured along with test samples in order to evalutate the measurement process.

Corrective Action - Action taken to eliminate the causes of an existing non-conformance, defect or other undesirable situation in order to prevent recurrence.

Data Audit - A qualitative and quantitative evaluation of the documentation and procedures associated with environmental measurements to verify that the resulting data are of acceptable quality.

Demonstration of Capability (DOC) - Procedure to establish the ability to generate acceptable accuracy and precision.

Detection Limit – The minimum concentration an analyte can be detected with confidence.

Document Control - The act of ensuring that documents (electronic or hardcopy and revisions thereto) are proposed, reviewed for accuracy, approved for release by authorized personnel, distributed properly and controlled to ensure use of the correct version at the location where the prescribed activity is performed.

Double Blind Sample – A type of proficiency sample where the analyst is unaware that it is a test sample.

Equipment Blank - A portion of the final rinse water used after decontamination of field equipment; also referred to as Rinsate Blank and Equipment Rinsate.

Field Blank - A blank matrix brought to the field and exposed to field environmental conditions.

Holding Time - The maximum time that a sample may be held before preparation and/or analysis as promulgated by regulation or as specified in a test method.

Instrument Blank - A blank matrix that is the same as the processed sample matrix (i.e. extract, digestate, condensate) and introduced onto the instrument for analysis.

Internal Chain of Custody - An unbroken trail of accountability that ensures the physical security of samples, data and records. Internal Chain of Custody refers to additional documentation procedures implemented within the laboratory that includes special sample storage requirements, and documentation of all signatures and/or initials, dates, and times of personnel handling specific samples or sample aliquots.

Instrument Detection Limit (IDL) - The minimum amount of a substance that can be measured with a specified degree of confidence that the amount is greater than zero using a specific instrument. The IDL is associated with the instrumental portion of a specific method only, and sample preparation steps are not considered in its derivation. The IDL is a statistical estimation at a specified confidence interval of the concentration at which the relative uncertainty is ±100%. The IDL represents a range where qualitative detection occurs on a specific instrument. Quantitative results are not produced in this range.

Laboratory Control Sample (LCS) - A blank matrix spiked with a known amount of analyte(s), processed simultaneously with, and under the same conditions as, samples through all steps of the analytical procedure.

Laboratory Control Sample Duplicate (LCSD) – A replicate LCS.

Laboratory Quality Manual (LQM) - A document stating the quality policy, quality system and quality practices of the laboratory. The LQM may include by reference other documentation relating to the laboratory's quality system.

Limit of Detection (LOD) - The minimum amount of a substance that an analytical process can reliably detect.

Matrix - The substrate of a test sample.

Matrix Duplicate (MD) - Duplicate aliquot of a sample processed and analyzed independently; under the same laboratory conditions; also referred to as Sample Duplicate; Laboratory Duplicate.

Matrix Spike (MS) – A sample that is prepared along with its batch, but is spiked with a known amount of analytes from a stock solution before extraction and analysis.

Matrix Spike Duplicate (MSD) – A replicate MS.

Method – A description of sequential measurement procedures.

Method Blank – Organic or aqueous solution, free of analytes under analysis, that is processed simultaneously with, and under the same conditions as, samples through all steps of the analytical procedure.

Method Detection Limit (MDL) - The minimum amount of a substance that can be measured with a specified degree of confidence that the amount is greater than zero using a specific measurement system. The MDL is a statistical estimation at a specified confidence interval of the concentration at which the relative uncertainty is ±100%. The MDL represents a range where qualitative detection occurs using a specific method. Quantitative results are not produced in this range.

Non-conformance - An indication, judgement, or state of not having met the requirements of the relevant specifications, contract, or regulation.

Outlier – A data point that is not representative of the data set. It falls outside the control limits.

Performance Audit – A proficiency evaluation of an analyst or laboratory by assessing the results of known test-sample results.

Performance Evaluation (PE) Samples – A sample, the composition of which is unknown to the analyst and which has known values to the person or agency submitting the sample, submitted for analysis to test whether the analyst/laboratory can produce analytical results within specified performance limits. Also referred to as Proficiency Test (PT) Sample.

Precision – Agreement of replicate results, such as sample duplicates or spike duplicates. Precision will be expressed as percent relative standard deviation (RSD) or relative percent difference (RPD).

Preservation - Refrigeration and/or reagents added at the time of sample collection to maintain the chemical, physical and/or biological integrity of the sample.

Procedure – A set of systematic instructions for using a method of measurement or sampling.

Proficiency Testing - Determination of the laboratory calibration or testing performance by means of inter-laboratory comparisons.

Proprietary - Belonging to a private person or company.

Quality Assurance – A system consisting of quality assessment and quality control with the purpose of providing the assurance that defined standards of quality are met.

Quality Assurance Project Plan (QAPP) - A formal document describing the detailed quality control procedures by which the quality requirements defined for the data and decisions pertaining to a specific project are to be achieved.

Quality Control (QC) - The overall system of technical activities, the purpose of which is to measure and control the quality of a product or service.

Quality Control Sample - A control sample, generated at the laboratory or in the field, or obtained from an independent source, used to monitor a specific element in the sampling and/or testing process.

Quality Management Plan (QMP) - A formal document describing the management policies, objectives, principles, organizational authority, responsibilities, accountability, and implementation plan of an agency, organization or laboratory to ensure the quality of its product and the utility of the product to its users.

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/QC.

Quantitation Limit (QL) - The minimum amount of a substance that can be quantitatively measured with a specified degree of confidence and within the accuracy and precision guidelines of a specific measurement system. The QL can be based on the MDL, and is generally calculated as 3-5 times the MDL, however, there are analytical techniques and methods where this relationship is not applicable. Also referred to as Practical Quantitation Level (PQL), Estimated Quantitation Level (EQL), Limit of Quantitation (LOQ).

Raw Data - Any original information from a measurement activity or study recorded in laboratory notebooks, worksheets, records, memoranda, notes, or exact copies thereof and 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/optical media, including dictated observations, and recorded data from automated instruments. Reports specifying inclusion of “raw data” do not need all of the above included, but sufficient information to create the reported data.

Record Retention - The systematic collection, indexing and storing of documented information under secure conditions.

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

Relative Standard Deviation – The coefficient of variation expressed as a percentage.

Replicate – Two or more identical samples or measurements.

Reporting Limit (RL) - The level to which data is reported for a specific test method and/or sample. The RL is generally related to the QL. The RL must be minimally at or above the MDL.

Representativeness – Ability to provide data which is representative of the sampled medium.

Selectivity - The capability of a measurement system to respond to a target substance or constituent.

Sensitivity - The difference in the amount or concentration of a substance that corresponds to the smallest difference in a response in a measurement system using a certain probability level.

Significant figure(s) – Figure(s) that remains to a number or decimal after the ciphers to the right or left are canceled.

Spike - A known amount of an analyte added to a blank, sample or sub-sample.

Standard – A solution or substance prepared by an analyst to establish a calibration curve or analytical response function of the instrument.

Standard Operating Procedure – A procedure developed for repetitive use when performing a specific measurement of sampling operation.

Storage Blank - A blank matrix stored with field samples of a similar matrix.

Subsample – A representative portion taken from a sample.

Surrogate – Organic compounds similar to compounds being analyzed. Used in GC and GC/MS analyses for spiking.

Systems Audit - A thorough, systematic, on-site, qualitative review of the facilities, equipment, personnel, training, procedures, record keeping, data validation, data management, and reporting aspects of a total measurement system.

Test Method – A defined technical procedure for performing a test.

Traceability - The property of a result of a measurement that can be related to appropriate international or national standards through an unbroken chain of comparisons.

Trip Blank - A blank matrix placed in a sealed container at the laboratory that is shipped, held unopened in the field, and returned to the laboratory in the shipping container with the field samples.

Verification - Confirmation by examination and provision of evidence against specified requirements.

Warning Limits – A control limit on a control chart, usually ± 2 standard deviations from the expected or mean value. Action is required when results fall outside the warning limits too frequently. A single value outside a warning limit does not necessarily require action, but should alert one to a possible problem.

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4.08	PCBS - OIL	EPA 3580A
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