Quality Assurance Project Plan

Williamsburg Works
Former Manufactured Gas Plant Site

Brooklyn, New York
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Site #: 224055

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Abbreviations and Acronyms

ASP	Analytical Service Protocols
ASTM	American Society for Testing and Materials
CAS	Chemical Abstract Service
CMS	Chip Measurement System
CLP	Contract Laboratory Protocol
COC	Chain Of Custody
DQO	Data Quality Objective
DO	Dissolved Oxygen
DUSR	Data Usability Summary Report
ELAP	Environmental Laboratory Approval Program
EPA	United States Environmental Protection Agency
FSP	Field Sampling Plan
GC/MS	Gas Chromatography/Mass Spectroscopy
GEI	GEI Consultants, Inc.
KeySpan	KeySpan Corporation
LCS	Labortory Control Sample
LEL	Lower Explosive Limit
MDL	Method Detection Limit
MS	Matrix Spike
MSD	Matrix Spike Duplicate
NYSDEC	New York State Department of Environmental Conservation
NYSDOH	New York State Department of Health
PAH	Polycyclic Aromatic Hydrocarbon
PCB	Polychlorinated Biphenyls
PID	Photoionization Detector
PM	Project Manager
PQL	Practical Quantification Limit
QA	Quality Assurance
QAPP	Quality Assurance Project Plan
QC	Quality Control
RCRA	Resource Conservation Recovery Act
RL	Reporting Limit
RPD	Relative Percent Difference
RSD	Relative Standard Deviation
SD	Standard Deviation
SOP	Standard Operating Procedures
SVOC	Semivolatile Organic Compound
TAL	Target Analyte List
TCL	Target Compound List
TCLP	Toxicity Characteristic Leaching Procedure
TIC	Tentatively Identified Compounds
TOX	Total Organic Halides
TPH	Total Petroleum Hydrocarbons
USDOT	United States Department of Transporation
VOC	Volatile Organic Compound

Quality Assurance Glossary

"Analytical Services Protocol" or "ASP" means the New York State Department of Environmental Conservation (NYSDEC's) compendium of approved EPA and NYSDEC laboratory methods for sample preparation and analysis and data handling procedures.

"Confirmatory Sample" means a sample taken after remedial action is expected to be complete to verify that the cleanup requirements have been met. This term has the same meaning as "post remediation sample."

"Contract laboratory program" or "CLP" means a program of chemical analytical services developed by the United States Environmental Protection Agency (EPA) to support CERCLA.

"Data Usability Summary Report, (DUSR)" is a document that provides a thorough evaluation of the analytical data to determine whether or not the data, as presented, meets the site/project specific criteria for data quality and use.

"Effective solubility" means the theoretical aqueous solubility of an organic constituent in groundwater that is in chemical equilibrium with a separate phase mixed product (product containing several organic chemicals). The effective solubility of a particular organic chemical can be estimated by multiplying its mole fraction in the product mixture by its pure phase solubility.

"Environmental Laboratory Accreditation Program" or "ELAP" means a program conducted by the New York State Department of Health (NYSDOH), which certifies environmental laboratories through on-site inspections and evaluation of principles of credentials and proficiency testing.

"Intermediate Sample" means a sample taken during the investigation process that will be followed by another sampling event to confirm that remediation was successful or to confirm that the extent of contamination has been defined to below a level of concern.

"Method detection limit" or "MDL" means the minimum concentration of a substance that can be measured and reported with a 99 percent confidence that the analyte concentration is greater than zero and is determined from the analysis of a sample in a given matrix containing the analyte.

"Non-targeted compound" means a compound detected in a sample using a specific analytical method that is not a targeted compound, a surrogate compound, a system monitoring compound or an internal standard compound.

"Practical quantitation level" or "PQL" means the lowest quantitation level of a given analyte that can be reliably achieved among laboratories within the specified limits of precision and accuracy of a given analytical method during routine laboratory operating conditions.

"PAH" means polycyclic aromatic hydrocarbon as defined by United States Environmental Protection Agency (USEPA) Method 8270.

"Quality assurance" or "QA" means the total integrated program for assuring the reliability of monitoring and measurement data, which includes a system for integrating the quality planning, quality assessment and quality improvement efforts to meet data end-use requirements.

"Quality assurance project plan" or "QAPP" means a document, which presents in specific terms the policies, organization, objectives, functional activities, and specific quality assurance/quality control activities designed to achieve the data quality goals or objectives of a specific project or operation.

"Quality control" or "QC" means the routine application of procedures for attaining prescribed standards of performance in the monitoring and measurement process.

"Semi volatile organic compound" or "SVOC" means compounds amenable to analysis by extraction of the sample with an organic solvent. For the purposes of this section, semi volatiles are those target compound list compounds identified in the statement of work in the current version of the EPA Contract Laboratory Program.

"Target analyte list" or "TAL" means the list of inorganic compounds/elements designated for analysis as contained in the version of the EPA Contract Laboratory Program Statement of Work for Inorganics Analysis, Multi-Media, and Multi-Concentration in effect as of the date on which the laboratory is performing the analysis. For the purpose of this chapter, a Target Analyte List scan means the analysis of a sample for Target Analyte List compounds/elements.

"Targeted compound," means a hazardous substance, hazardous waste, or pollutant for which a specific analytical method is designed to detect that potential contaminant both qualitatively and quantitatively.

"Target compound list plus 30" or "TCL+30" means the list of organic compounds designated for analysis (TCL) as contained in the version of the EPA "Contract Laboratory Program Statement of Work for Organics Analysis, Multi-Media, Multi-Concentration" in effect as of the date on which the laboratory is performing the analysis, and up to 30 non-targeted organic compounds (plus 30) as detected by gas chromatography/mass spectroscopy (GC/MS) analysis. For the purposes of this chapter, a Target Compound List+30 scan means the analysis of a sample for Target Compound List compounds and up to 10 non-targeted volatile organic compounds and up to 20 non-targeted semi volatile organic compounds using GC/MS analytical methods. Non-targeted compound criteria should be pursuant to the version of the EPA "Contract Laboratory Program Statement of Work for Organics Analysis, Multi-Media, and Multi-Concentration" in effect as of the date on which the laboratory is performing the analysis.

"Tentatively identified compound" or "TIC" means a non-targeted compound detected in a sample using a GC/MS analytical method, which has been tentatively, identified using a mass spectral library search. An estimated concentration of the TIC is also determined.

"Unknown compound" means a non-targeted compound, which cannot be tentatively identified. Based on the analytical method used, the estimated concentration of the unknown compound may or may not be determined.

"Volatile organics" means organic compounds amenable to analysis by the purge and trap technique. For the purposes of this chapter, analysis of volatile organics means the analysis of a sample for either those priority pollutants listed as amenable for analysis using EPA method 624 or those target compounds identified as volatiles in the version of the EPA "Contract Laboratory Program Statement of Work for Organics Analysis, Multi-Media, Multi-Concentration" in effect as of the date on which the laboratory is performing the analysis.

"**Waste oil"** means used and/or reprocessed engine lubricating oil and/or any other used oil, including but not limited to: fuel oil, engine oil, gear oil, cutting oil, transmission fluid, oil storage tank residue, animal oil and vegetable oil, which has not subsequently been refined.

1. Purpose

GEI Consultants, Inc. (GEI) has prepared this Draft Quality Assurance Project Plan (QAPP) to address the investigation of the Williamsburg Works former MGP site located in Brooklyn, New York, New York. The Draft QAPP is a companion document to the *Draft Remedial Investigation Work Plan* Williamsburg Works Former MGP Site dated February 2008 (Work Plan) and the Field Sampling Plan (FSP) dated February 2008. The project location is shown on Figure 1 of the Work Plan. The QAPP presents the project scope and goals, organization, objectives, sample handling procedures and specific QA/QC procedures associated with the Williamsburg Works Former MGP.

Furthermore, this QAPP identifies project responsibilities, prescribes guidance and specifications to make certain that:

- Samples are identified and controlled through sample tracking systems and chain-of-custody (COC) protocols
- Field and laboratory analytical results are valid and usable by adherence to established protocols and procedures
- Laboratory data are validated so they can be applied to developing a conceptual understanding of the nature and extent of contamination of soils, sediment, soil vapor and ground waters at the Williamsburg Works Former MGP site
- All aspects of the investigation, from field to laboratory are documented to provide data that are technically sound and legally defensible

The requirements of this QAPP apply to all contractor activities as appropriate for their respective tasks.

This QAPP was prepared based upon guidance provided by the NYSDEC:

- *Draft DER-10, Technical Guidance for Site Investigation and Remediation.* New York State Department of Environmental Conservation. December 2002.

2. Project Goals and Objectives

KeySpan Corporation (KeySpan) is conducting a Remedial Investigation (RI) at the Williamsburg Works former MGP site (Site) in Brooklyn, New York. This RI was prepared to investigate the extent of impacts potential impacts to the Site from the operation of the Williamsburg Works Former MGP that was used to store manufactured gas from 1850 until prior to 1941.

The scope of the RI is presented in the Draft Williamsburg Works Former Manufactured Gas Plant Work Plan dated February 2008. The RI will include the following tasks:

- Field Investigation Sampling and Analysis
- Qualitative Human Health Exposure Assessment (QHHEA)
- Step 1 Fish and Wildlife Resource Impact Analysis (FWRIA)
- Quality Assurance / Quality Control (QA/QC) and Data Validation
- RI Report Preparation

The RI scope of work described in this work plan is intended to collect sufficient data to evaluate the nature and extent of compounds within soils, sediment, soil vapor and groundwater that may be associated with the Williamsburg Works former MGP site. The RI will assess whether potential pathways exist through which people, flora, or fauna could be exposed to the contaminants.

3. Project Organization and Responsibility

The Consultant is responsible for the implementation of the RI Work Plan scope of work, including the supervision of contractors, field activities, and the evaluation and interpretation of data. The Consultant will direct the sampling activities and coordinate submittal of samples to testing laboratories. The project organization and key personnel for the Consultant are listed below:

Program Manager:
Project Manager:
Field Team Leader:
Quality Assurance Officer:
Corporate Health & Safety Officer:
Data Validator:
Data Manager:

The primary responsibilities of each of these personnel are described in the following table.

Key Project Personnel and Responsibilities		
Position	**Consultant Personnel**	**Areas of Responsibilities**
Program Manager		▪ Overall program oversight ▪ Project management ▪ Project schedule ▪ Client contact regarding project related issues ▪ Personnel and resource management ▪ Review of project submittals ▪ Budgeting
Project Manager		▪ Client contact regarding project related issues ▪ Coordination of contractors ▪ Technical development and implementation of Work Plan and Field Sampling Plan ▪ Personnel and resource management ▪ Preparation and review of project submittals ▪ Preparation of project submittals ▪ Budgeting
Field Team Leader		▪ Client contact regarding project related issues on day to day basis as part of field operations ▪ Coordination of contractors ▪ Implementation of Work Plan and Field Sampling Plan ▪ Personnel and resource management ▪ Preparation of project submittals
Quality Assurance Officer		▪ QA/QC for sampling and laboratory performance

Key Project Personnel and Responsibilities		
Position	**Consultant Personnel**	**Areas of Responsibilities**
Data Validator		▪ Perform data validation activities ▪ Prepare data usability summary reports ▪ Evaluate data with regards to quality objectives
Data Managers		▪ Manage raw data from the laboratory

A New York State Department of Health (NYSDOH) Environmental Laboratory approval Program (ELAP) approved laboratory will be utilized to perform standard analytical chemistry parameters for surface soils, subsurface soil, and groundwater samples including:

- Volatile Organic Compounds (VOCs) according to EPA Method 8260B
- Semi volatile Organic Compounds (SVOCs) according to EPA Method 8270C
- Target Analyte List (TAL) Metals according to EPA Method 6000/7000 series
- Polychlorinated Biphenyls (PCBs) by EPA Method 8082
- Pesticides by EPA Method 8081
- Herbicides by EPA Method 8151A
- Total Cyanide by EPA Method 9012 (groundwater only)
- Free Cyanide [Extraction by EPA Method 9013A/ Analysis by Microdiffusion American Society for Testing and Materials (ASTM) Method D4282-95] (soils only)
- Disposal Parameters (total metals, Toxicity Characteristic Leaching Procedure (TCLP) by EPA 1311, Resource Conservation Recovery Act (RCRA) 8 metals by EPA 6000/ 7000 series, TCLP pesticides EPA 8081A, TCLP herbicides by 8151A, TCLP VOC by EPA 8260B, TCLP SVOC by EPA 8270C, paint filter test, ignitability by EPA 1030 (soils)/EPA 1010 (water), corrosivity by EPA 9040 (water)/ 9045 (soils) , reactivity [cyanide by EPA 7.3.3.2 and sulfide by EPA 7.3.4.2] by , total petroleum hydrocarbons (TPH) by EPA 8015B/ 418.1, total PCBs by EPA 8082, flashpoint, total organic halides (TOX) EPA 450.1, and % solids)

The NYSDOH ELAP's relevant certifications are summarized in the following table.

Table 1 provides a summary of surface soil and subsurface soil analyses, Table 2 provides a summary of groundwater analyses, Table 3 provides a summary of sediment analyses and Table 4 provides a summary of soil vapor and indoor and outdoor air analyses. Table 5 provides a summary of quality assurance samples, holding times and analysis for each media.

Drilling, sediment coring and test pit excavation contractors will be identified once the work plan is approved.

4. Quality Assurance Objectives

This section establishes the QA objectives for measurements that are critical to the project. The QA objectives are developed for relevant data quality indicators. These indicators include the method detection limit, reporting limit, precision, accuracy, completeness, representativeness, and comparability. The data quality objectives (DQOs) are based on project requirements and ensure: (1) that the data generated during the project are of known quality and (2) that the quality is acceptable to achieve the project's technical objectives provided in the Work Plan. All analytical data will be provided by the laboratory using the New York State ASP Category B deliverable format.

Quantitation Limits are laboratory-specific and reflect those values achievable by the laboratory performing the analyses. However, in order to ensure that the analytical methodologies are capable of achieving the DQOs, measurement performance criteria have been set for the analytical measurements in terms of accuracy, precision, and completeness. The analytical methods to be used at this site will provide a level of data quality and can be used to evaluate potential impacts to soil and groundwater from the former MGP operation, compared to NYSDEC Part 375 soil cleanup objectives and New York State Ambient Groundwater Standards, Criteria and Guidance values, and for purposes of risk assessment.

The overall QA objective is to develop and implement procedures for field sampling, chain-of-custody, laboratory analysis, and reporting which will provide results that are scientifically valid, and the levels of which are sufficient to meet DQOs. Specific procedures for sampling, chain of custody, laboratory instruments calibration, laboratory analysis, reporting of data, internal quality control, and corrective action are described in other sections of the QAPP.

The data quality indicators are presented in subsections 4.1 through 4.6. Procedures to assess the data quality indicators are given below in Section 13. Laboratory MDLs and PQLs for soils, groundwater, soil vapor and ambient air are located on Tables 6 through 8, respectively. Soil clean-up objectives and groundwater standards and guidance values are located on Tables 9 and 10.

4.1 Required Quantification Limit

The required quantification limit is the quantitative analytical level for individual analytes needed to make decisions relative to the objectives of the project. Quantitative limits may be expressed as the MDL or some quantitative level defined in terms relative to the program. It should be noted that there is some ambiguity in the definitions and use of terms that define

quantification limits. The MDL presented herein is a well-defined and accepted entity, although attainable only under ideal laboratory conditions.

Method Detection Limit: The MDL is the minimum concentration of a substance that can be measured and reported with 99 percent confidence that the analyte concentration is greater than zero. MDL is determined from analysis of a sample in a given matrix type containing the analyte.

Practical Quantitation Limit: The PQL [also referred to as the reporting limit (RL)] is the concentration in the sample that corresponds to the lowest concentration standard of the calibration curve.

Laboratory MDLs and PQLs for soils, groundwater, soil vapor and ambient air are located on Tables 6 through 8, respectively.

4.2 Accuracy

Accuracy is the closeness of agreement between an observed value and an accepted reference value. The difference between the observed value and the reference value includes components of both systematic error (bias) and random error.

Accuracy in the field is assessed through the adherence to all field instrument calibration procedures, sample handling, preservation, and holding time requirements, and through the collection of equipment blanks prior to the collection of samples for each type of equipment being used (e.g., sample liners, drilling shoe, or stainless–steel sampling implements).

The laboratory will assess the overall accuracy of their instruments and analytical methods (independent of sample or matrix effects) through the measurement of "standards," materials of accepted reference value. Accuracy will vary from analysis to analysis because of individual sample and matrix effects. In an individual analysis, accuracy will be measured in terms of blank results, the percent recovery (%R) of surrogate compounds in organic analyses, or %R of spiked compounds in matrix spikes (MSs), matrix spike duplicates (MSDs) and/or laboratory control samples (LCSs). This gives an indication of expected recovery for analytes tending to behave chemically like the spiked or surrogate compounds. The laboratory accuracy will be evaluated in accordance with laboratory quality assurance plan and standard operating procedures located in Appendix A.

4.3 Precision

Precision is the agreement among a set of replicate measurements without consideration of the "true" or accurate value: i.e., variability between measurements of the same material for the same analyte. In environmental sampling, precision is the result of field sampling and

analytical factors. Precision in the laboratory is easier to measure and control than precision in the field. Replicate laboratory analyses of the same sample provide information on analytical precision; replicate field samples provide data on overall measurement precision. The difference between the overall measurement precision and the analytical precision is attributed to sampling precision. Precision is measured in a variety of ways including statistically, such as calculating variance or standard deviation. The difference between the overall measurement precision and the analytical precision is attributed to sampling precision.

Precision in the field is assessed through the collection and measurement of field duplicates. Field duplicates will be collected at a frequency of one per twenty investigative samples per matrix per analytical parameter, with the exception of the waste characterization parameters. Precision will be measured through the calculation of relative percent differences (RPDs) as described below in subsection 13.2. The resulting information will be used to assess sampling and analytical variability. Field duplicate RPDs must be less than 50% for soil samples and less than 30% for aqueous samples. These criteria apply only if the sample and/or duplicate results are >5x the quantitation limit; if both results are <5x the quantitation limit, the criterion will be doubled. Duplicate samples are described in below in subsection 5.1.5. Table 5 summarizes the number of duplicates per media sampled.

Precision in the laboratory is assessed through the calculation of RPD for duplicate samples. For organic analyses, laboratory precision will be assessed through the analysis of MS/MSD samples and field duplicates. For the inorganic analyses, laboratory precision will be assessed through the analysis of matrix duplicate pairs and field duplicate pairs. MS/MSD samples or matrix duplicate pairs will be performed at a frequency of one per twenty primary samples per matrix. Duplicate samples are described in below in subsection 5.1.5. Table 5 summarizes the number of duplicates per media sampled.

4.4 Completeness

Completeness is a measure of the amount of valid data obtained from a measurement system compared to the amount that was expected to be obtained under normal conditions. "Normal conditions" are defined as the conditions expected if the sampling plan was implemented as planned. The objective for completeness is a sufficient amount of valid data to achieve a predetermined statistical level of confidence. Critical samples must be identified and plans must be formulated to secure requisite valid data for these samples.

Field completeness is a measure of the amount of (1) valid measurements obtained from all the measurements taken in the project and (2) valid samples collected. The field completeness objective is greater than 90 percent.

Laboratory completeness is a measure of the amount of valid measurements obtained from all valid samples submitted to the laboratory. The laboratory completeness objective is greater than 95 percent.

To ensure that these percentages are met, materials for crucial parameters will be retained if re-sampling is required and strict adherence to holding times will be required.

4.5 Representativeness

Representativeness is a qualitative parameter that expresses the degree to which data accurately and precisely represents either a characteristic of a population, parameter variations at a sampling point, a process condition, or an environmental condition within a defined spatial and/or temporal boundary. To ensure representativeness, the sampling locations have been selected to provide coverage over a wide area and to highlight potential trends in the data.

Representativeness is dependent upon the proper design of the sampling program and will be satisfied by ensuring that the Work Plan and FSP are followed and that proper sampling, sample handling, and sample preservation techniques are used.

Representativeness in the laboratory is ensured by using the proper analytical procedures, appropriate methods, and meeting sample-holding times. These are provided in Table 5 and within Appendix A.

4.6 Comparability

Comparability is a qualitative parameter that expresses the confidence with which one data set can be compared to another. Comparability is dependent upon the proper design of the sampling program and will be satisfied by ensuring that the Work Plan and FSP are followed and that proper sampling techniques are used. Maximization of comparability with previous data sets is expected because the sampling design and field protocols are consistent with those previously used.

Comparability is dependent on the use of recognized EPA or equivalent analytical methods and the reporting of data in standardized units. To facilitate data comparison, the data-reporting format as presented below will be used:

- Conventions (units reported as): for solids (weight/unit weight [i.e., mg/kg]); for liquids (weight/unit volume [i.e., mg/L]); for air (weight/unit volume [i.e., mg/m3]).
- Use common chemical name with corresponding chemical abstract system (CAS) code.
- Report all data for soils on a dry-weight basis.

5. Sampling Plan

Environmental sampling will include subsurface soil, surface soil, sediment, soil vapor, ambient air, groundwater and waste characterization sampling. Subsurface soil borings and monitoring wells will be installed utilizing drilling methods presented in the FSP. Sediment cores will be installed utilizing methods described in the FSP. Groundwater samples will be collected utilizing low-flow sampling methods, peristaltic pumps, bailers, whale pumps, or bladder pumps. Performing grab or composite sampling by appropriate hand-held sampling equipment will be the preferred method for waste characterization sampling. Analytical samples and analysis methods are described in the Work Plan. Sampling methods and procedures are described in FSP.

5.1 Sample Type, Location, and Frequency

5.1.1 Subsurface Borings Soil Sampling

Thirty-four (4) soil boring locations will be sampled utilizing drilling methods listed in the Field Sampling Plan (FSP). Fifteen of the borings will be completed as permanent monitoring wells. The locations are shown on Plate 1 of the Work Plan. The borings will be drilled to approximately 70 feet below ground surface (bgs) and at least 10 feet below observed visual impacts. The actual number of subsurface soil samples and their location may be modified based upon subsurface utilities and property access. The number and location of samples will vary based upon access and subsurface obstructions. Soils will be evaluated through visual, olfactory, and field screening observations in accordance with the FSP. Soil samples will be collected and submitted for laboratory analysis in general accordance with the Work Plan and the FSP. Monitoring wells will be installed in accordance with the Work Plan and FSP. A summary of subsurface soil samples and analysis are located on Table 1.

5.1.2 Test Pit Sampling

A total of six test pits are proposed to be excavated at the Williamsburg Works former MGP site utilizing a backhoe or other excavation equipment. Soils will be evaluated through visual, olfactory, and field screening observations in accordance with the FSP. Soil samples will be collected and submitted for laboratory analysis in general accordance with the Work Plan and the FSP. A summary of subsurface soil samples and analysis are located on Table 1.

5.1.3 Surface Soil Sampling

Nine (9) surface sample locations will be sampled using hand tools. The samples will be collected from 0 to 2 inches below vegetative cover. The actual number of surface soil samples and their location may be modified based upon field conditions. Soils will be evaluated through visual, olfactory, and field screening observations in accordance with the FSP. Soil samples will be collected and submitted for laboratory analysis in general accordance with the Work Plan and the FSP. A summary of surface soil samples and analysis are located on Table 1.

5.1.4 Groundwater Sampling

The sixteen (16) proposed RI monitoring wells will be gauged and sampled. Groundwater samples will be collected from monitoring wells screened across the water table or targeted intervals at the proposed sample locations. Groundwater samples will be collected and submitted for laboratory analysis in general accordance with the FSP and Work Plan. Water quality parameters including temperature, pH, turbidity, salinity, dissolved oxygen (DO), and specific conductance, will be collected prior to laboratory analysis in general accordance with the Work Plan and the FSP. A summary of groundwater samples and analysis are located on Table 2.

5.1.5 Sediment Sampling

Seven (7) sediment core locations will be sampled from a barge using an electric or pneumatically driven vibracore as described in the FSP. The locations are shown on Plate 1 of the Work Plan. Sediment cores will be advanced to a depth of 20 feet below the sediment water interface or to vibracore refusal. The actual number of sediment samples and their location may be modified based upon field conditions. Sediments will be evaluated through visual, olfactory, and field screening observations in accordance with the FSP. Sediment samples will be collected and submitted for laboratory analysis in general accordance with the Work Plan and the FSP. A summary of sediment samples and analysis are located on Table 3.

5.1.6 Soil Vapor Sampling

Fourteen (14) soil vapor samples will be installed and samples will be collected in general accordance with the *New York State Department of Health's "Guidance for Evaluating Soil Vapor Intrusion in the State of New York"* and KeySpan's *"Draft Standard Operating Procedure- Soil Vapor Intrusion for MGP Sites in New York.* Within buildings, sub-slab soil vapor points will be installed to evaluate the soil vapor conditions. For exterior soil vapor locations, the soil vapor samples will be collected from temporary soil vapor probes, which will be installed, to a depth of approximately five feet below grade. Soil vapor samples will be collected in certified clean SUMMA canisters and submitted for laboratory analysis in

general accordance with the FSP and Work Plan. A summary of soil vapor samples and analysis are located on Table 4.

5.1.7 Ambient Air Samples

Eight (8) indoor air samples and four (4) outdoor ambient air samples are proposed to be collected as part of the Williamsburg Works RI Work Plan. The ambient air samples will be used to assess the potential for soil vapor intrusion into the buildings. The proposed locations are shown on Plate 1 or the Work Plan. A summary of ambient air samples and analysis are located on Table 4.

The proposed ambient air samples will be collected from the approximate breathing height (approximately 3 to 5 feet aboveground). The indoor air and outdoor air samples will be collected utilizing an individually certified 6-Liter SUMMA® canister with a laboratory-supplied flow controller that is calibrated to an 8-hour period. The regulator flow rate will not exceed 0.2 liters per minute. Each SUMMA® canister will be shipped to an approved-NYSDOH ELAP registered laboratory for analysis. The samples will be analyzed for VOCs and naphthalene by the modified EPA Method TO-15. QA/QC samples will include one blind duplicate ambient air sample (indoor or outdoor air sample) will be collected during each sampling event. The ambient air sampling will target the winter heating season between November 15 and March 30 in accordance with NYSDOH Soil Vapor Guidance.

Property information will also be collected in general accordance with the NYSDOH Center of Environmental Health's Indoor Air Quality Questionnaire and Building Form that is provided as Appendix B of the NYSDOH soil vapor guidance and KeySpan's Draft Standard Operating Procedures for Soil Vapor Intrusion for MGP Sites in New York which is located in the FSP.

5.1.8 Investigation-Derived Waste Sample Collection

Waste classification sampling will be conducted for soil and liquid wastes. The purpose of characterizing a waste is for its proper off-site disposal. Composite samples will be collected from the on-site waste storage vessels (drums or roll-off) for parameters required by the approved disposal facility. Soil samples will be collected utilizing stainless steel sampling tools, shovel, or auger that had been decontaminated. Liquid samples will be collected utilizing disposable bailer, peristaltic pump, a pump with tubing, or other similar methods. These samples will be handled in general accordance with sample handling procedures presented in the FSP. Investigation derived waste samples will be analyzed for parameters listed in Section 3 or other analyses that are required by the KeySpan-approved facility.

5.1.9 Field QC Sample Collection

Field QC samples are used to monitor the reproducibility and representativeness of field sampling activities. The field QC samples are handled transported and analyzed in the same manner as the associated field samples. Field QC samples will include equipment blanks, trip blanks, field duplicates and MS/MSDs. The quantity, field QC sample type and analysis is detailed on Table 5.

Equipment Blank Samples are used to monitor the adequacy of decontamination procedures and possible sources of contamination such as potential laboratory methodologies. Equipment blanks will consist of laboratory-supplied, distilled or de-ionized water and will be used to check for potential contamination of the equipment, which may cause sample contamination. Equipment blanks will be collected by routing the distilled water through decontaminated piece of sampling equipment or disposable sampling equipment into laboratory supplied bottles. Non-dedicated field equipment will be decontaminated as specified below in subsection 4.3. Equipment blanks will be submitted to the laboratory at a frequency of one per 20 samples per matrix per type of equipment being used per parameter. Equipment blanks will not be completed for waste characterization sampling activities.

Trip Blank Samples will consist of analyte free water and will be prepared by the laboratory. (Trip blanks are used to assess the potential for VOC contamination of samples due to contaminant migration during sample shipment and storage. Trip blanks will be transported to the project location unopened, stored with the site characterization samples, and kept closed until analyzed by the laboratory. Trip blanks will be submitted to the laboratory at a frequency of one per cooler, which contains samples submitted for VOC analysis.

Field Duplicate Samples, also referred as blind duplicate samples, are two samples that are submitted form the same interval using the same sample procedures. Field duplicates will be used to assess the sampling and analytical reproducibility. Both samples are collected utilizing the same methods and are submitted for the same laboratory analysis however different sample identification numbers are used. Field duplicates will be submitted at a frequency of one per 20 samples for all matrices and all parameters. Field duplicates will not be completed for waste characterization sampling activities.

MS/MSD Samples are two additional aliquots of the same sample submitted for the same parameters as the original sample. However, the additional aliquots are spiked with the compounds of concern. Matrix spikes provide information about the effect of the sample matrix on the measurement methodology. MS/MSDs will be submitted at a frequency of one per 20 investigative samples per matrix for organic and inorganic parameters. MS/MSDs will not be completed for waste characterization sampling activities.

Refer to Table 5 for a summary of QC sample preservation and container requirements.

5.2 Sample Preservation and Containerization

The analytical laboratory will supply the sample containers for the chemical samples. These containers will be cleaned by the manufacturer to meet or exceed all analyte specifications established in the latest United States EPA's Specifications and Guidance for Contaminant-Free Sample Containers. Certificates of analysis are provided with each bottle lot and maintained on file to document conformance to United States EPA specifications. The containers will be pre-preserved, where appropriate (Table 5).

5.3 Equipment Decontamination

All non-dedicated sampling equipment shall be cleaned between each use in the following manner:

- Wash/scrub with a biodegradable degreaser ("Simple Green") if there is oily residue on equipment surface
- Tap water rinse
- Wash and scrub with Alconox (or non-phosphate soap) and water mixture
- Tap water rinse
- All equipment used to collect samples for VOCs and SVOC analysis will then receive a methanol rinse followed by a de-ionized water rinse.
- All equipment used to collect samples for metals analysis will then receive a 10% nitric acid solution rinse followed by a de-ionized water rinse.
- Equipment will be wrapped in polyethylene plastic or aluminum foil for storage or transportation from the designated decontamination area to the sampling location, where appropriate.

The drilling and excavation equipment will be decontaminated in general accordance with methods described in the FSP.

Groundwater sampling pumps will be cleaned by washing and scrubbing with an Alconox/water solution, rinsing with tap water and irrigating with de-ionized water.

Decontamination fluids will be containerized into United States Department of Transportation (USDOT)/UN-approved 55-gallon drums or containment vessels and will be characterized and disposed of by KeySpan at an approved disposal facility.

6. Documentation and COC

6.1 Sample Collection Documentation

6.1.1 Field Notes

Field notes documenting field activities will be maintained in a field notebook in general accordance with subsection 2.2 of the FSP. Field logbooks will provide the means of recording the chronology of data collection activities performed during the investigation. The logbook will be a bound notebook with water-resistant pages. Logbook entries will be dated, legible, and contain accurate and inclusive documentation of the activity. Each page of the logbook will be signed in permanent ink and dated. No erasures or obliterations of field notes will be made. If an incorrect entry is made, the information will be crossed out with a single strike mark, which is signed and dated by the sampler. The correction shall be written adjacent to the error.

Field logbooks will be reviewed at regular intervals by the field team leader, site manager and project manager for completeness and representativeness. Logbooks will be supported by daily activity reports as described in subsection 2.3 of the FSP.

6.1.2 COC Records

Sample custody is discussed in detail below in subsection 6.2. COC records are initiated by the samplers in the field. The field portion of the custody documentation should include:

- The project name
- Signature(s) of sampler (s) responsible for sample custody
- Sample ID number
- Date and time of collection
- Whether the sample is grab or composite
- Names of individuals involved in sampling
- Air bill or other shipping number (if applicable)

On a regular basis (daily or on such a basis that all holding times will be met), samples will be transferred to the custody of the respective laboratories, via third-party commercial carriers or via laboratory courier service. Sample packaging and shipping procedures, and field COC procedures are described below in subsection 6.2.1 of this Plan. Sample receipt and log-in procedures at the laboratory are described below in subsection 6.2.2 of this Plan.

6.1.3 Sample Labeling

Each sample will be labeled with a pre-printed adhesive label using indelible ink. The label should include the date and time of collection, sampler's initials, tests to be performed, preservative (if applicable), and a unique identification. The following identification scheme will be used:

PRIMARY SAMPLES TYPES	QA/QC SAMPLE TYPES
SOIL SAMPLES	**FIELD BLANKS**
Surface Soil-ID (SAMPLE DEPTH-FEET)	SAMPLE-ID – [DATE]
WW-SS-01 (0-0.2)	WW-SS-FB-033107
Boring -ID (SAMPLE DEPTH-FEET)	WW-SB-FB-033107
WW -SB-01 (10-15)	WW-SED-FB-033107
SEDIMENT SAMPLES	WW-MW-FB-033107
Sediment Core-ID (SAMPLE DEPTH-FEET)	**MATRIX SPIKE/DUP**
WW-SED-01 (0-0.5)	SAMPLE [ID] [DEPTH] [EITHER MS OR MSD]
GROUNDWATER SAMPLES	WW-SS-01 (0-0.2) MS/MSD
Monitoring Well-ID	WW-SB-01 (10-15) MS/MSD
WW-MW-01	WW-SED-01 (0-0.5) MS/MSD
SOIL VAPOR SAMPLES	WW-MW-01 (10-15) MS/MSD
Soil Vapor Point-ID	**TRIP BLANKS**
WW -SV-01	SAMPLE- ID [DATE]
AMBIENT AIR SAMPLES	WW-TB-063007
Indoor Air	**BLIND DUPLICATES**
WW -IA-01	SAMPLE -ID[XX][DATE]
Outdoor Air	WW-SS-XX-063007
WW-OA-01	WW-SB-XX-063007
	WW-SED-XX-063007
	WW-MW-XX-063007
	WW-IA-01-063007
	WW-OA-01-063007

This sample label contains the authoritative information for the sample. Inconsistencies with other documents will be settled in favor of the vial or container label unless otherwise corrected in writing from the field personnel collecting samples or the Data Manager and/or the Project QA Officer.

6.1.4 Sample Handling

Samples will be handled in general accordance with Section 12 of the FSP.

6.2 Sample Custody

The COC provides a record of the custody of any environmental field sample from the time of collection to the delivery to the laboratory. Custody is one of several factors that are necessary for the admissibility of environmental data as evidence in a court of law. Custody

procedures help to satisfy the two major requirements for admissibility: relevance and authenticity. Sample custody is addressed in three parts: field sample collection, laboratory analysis, and final evidence files.

A sample is considered to be under a person's custody if:

- The item is in the actual possession of a person
- The item is in the view of the person after being in actual possession of the person
- The item was in the actual physical possession of the person but is locked up to prevent tampering
- The item is in a designated and identified secure area

6.2.1 Field Custody Procedures

Samples will be collected following the sampling procedures indicated in the Work Plan and the FSP. A summary of samples and collection methods are provided above in Section 5 of this QAPP. Documentation of sample collection is described above in subsection 6.1. Sample COC and packaging procedures are summarized below. These procedures will ensure that the samples will arrive at the laboratory with the COC intact.

- The field sampler is personally responsible for the care and custody of the samples until they are transferred or dispatched properly. Field procedures have been designed such that as few people as possible will handle the samples.
- All bottles will be identified by the use of sample labels with sample numbers, sampling locations, date/time of collection, and type of analysis. The sample numbering system is presented above in subsection 6.1.3.
- Sample labels will be completed for each sample using waterproof ink unless prohibited by weather conditions.
- Samples will be accompanied by a completed COC form. The sample numbers and locations will be listed on the COC form. When transferring the possession of samples, the individuals relinquishing and receiving will sign, date, and note the time on the record. This record documents the transfer of custody of samples from the sampler to another person, to a mobile laboratory, and to the laboratory facility.
- All shipments will be accompanied by the COC record identifying the contents. The original record will accompany the shipment, and copies will be retained by the sampler and placed in the project files.
- Samples will be properly packaged for shipment and dispatched to the appropriate laboratory for analysis, with a separate signed custody record enclosed in and secured to the inside top of each sample box or cooler. Shipping containers will be secured with strapping tape and custody seals for shipment to the laboratory. The custody seals will be attached to the cooler and covered with clear plastic tape after being signed by field personnel.
- If the samples are sent by common carrier, the air bill will be used. Air bills will be retained as part of the permanent documentation. Commercial carriers are not

required to sign off on the custody forms since the custody forms will be sealed inside the sample cooler and the custody seals will remain intact.

- Samples remain in the custody of the sampler until transfer of custody is completed. This consists of delivery of samples to the laboratory sample custodian, and signature of the laboratory sample custodian on COC document as receiving the samples and signature of sampler as relinquishing samples.

6.2.2 Laboratory Custody Procedures

After accepting custody of the shipping containers, the laboratory will document the receipt of the shipping containers by signing the COC record. The laboratory will:

- Examine the shipping containers to verify that the custody tape is intact
- Examine all sample containers for damage
- Determine if the temperature required for the requested testing program has been maintained during shipment and document the temperature on the COC records
- Compare samples received against those listed on the COC
- Verify that sample holding times have not been exceeded
- Examine all shipping records for accuracy and completeness
- Determine sample pH (if applicable) and record on COC forms
- Sign and date the COC immediately (if shipment is accepted) and attach the air bill
- Note any problems associated with the coolers and/or samples on the cooler receipt form and notify the laboratory project manager, who will be responsible for contacting the data manager
- Attach laboratory sample container labels with unique laboratory identification and test
- Place the samples in the proper laboratory storage.

Following receipt, samples will be logged in according to the following procedure:

- The samples will be entered into the laboratory tracking system. At a minimum, the following information will be entered: project name or identification, unique sample numbers (both client and internal laboratory), type of sample, required tests, date and time of laboratory receipt of samples, and field ID provided by field personnel.
- The completed COC, air bills, and any additional documentation will be placed in the final evidence file.

7. Calibration Procedure

7.1 Field Instruments

Field instruments will be calibrated according to the manufacturer's specifications. Air monitoring instruments will be calibrated to a known reference gas standard and ambient air outside the work zone. Calibration will be completed daily. If concentrations of VOCs are encountered above the reference gas standard, the soil screening photoionization detector (PIDs) may be calibrated or re-checked against the reference gas standard. Water quality meters will be calibrated with known reference solutions. All calibration procedures performed will be documented in the field logbook and will include the date/time of calibration, name of person performing the calibration, reference standard used, and the readings. The following equipment has been identified for use to implement the Work Plan.

Subsurface Soil Sampling Activities:

- RAE Systems MultiRAE Plus equipped with VOC (10.6 eV lamp), lower explosive limit (LEL), percent oxygen, hydrogen sulfide and hydrogen cyanide
- RAE Systems MiniRAE 2000 (PID) with 10.6 eV lamp
- Drager Chip Measurement System (CMS) and compound specific chips (including benzene, hydrogen sulfide, hydrogen cyanide, etc.)
- MIE pDR 1200 with cyclone and pump [particulate monitor]
- MSA LC Pump or SKC 224-PCXR4 [air pump for dust monitoring]
- BIOS Dry Cal DC Lite Primary Flow Meter Model ML [air pump calibration]

Groundwater Sampling Activities

- In-Situ Multi-Parameter Troll 9000
- YSI 6280 XLM water quality meter

Similar field equipment can be substituted that perform the same functions can be substituted if selected equipment is not available from equipment supplier.

7.2 Laboratory Instruments

Calibration procedures for a specific laboratory instrument will consist of initial calibrations, initial calibration verifications, and/or continuing calibration verification. Detailed descriptions of the calibration procedures for a specific laboratory instrument are included in the laboratory's quality assurance plan, which describe the calibration procedures, their frequency, acceptance criteria, and the conditions that will require recalibration. These

procedures are as required in the respective analytical methodologies summarized in Tables 1 through 4 of this QAPP.

8. Sample Preparation and Analytical Procedures

Analytical samples will be collected in general accordance with the FSP and as specified in the Work Plan. Tables 1 through 4 provide a sample collection matrix that is separated by media. Analytical samples will be collected into laboratory-preserved sample containers and will be preserved as indicated in Table 5.

9. Data Reduction, Validation, and Reporting

Appropriate QC measures will be used to ensure the generation of reliable data from sampling and analysis activities. Proper collection and organization of accurate information followed by clear and concise reporting of the data is a primary goal in this project. Complete data packages suitable for data validation to support the generation of a DUSR according to NYSDEC requirements will be provided by the analytical laboratory.

9.1 Field Data Evaluation

Measurements and sample collection information will be transcribed directly into the field logbook or onto standardized forms. If errors are made, results will be legibly crossed out, initialed and dated by the person recording the data, and corrected in a space adjacent to the original (erroneous) entry. Reviews of the field records by the field team leader, site manager, and project manager will ensure that:

- Logbooks and standardized forms have been filled out completely and that the information recorded accurately reflects the activities that were performed.
- Records are legible and in accordance with good record keeping procedures, i.e., entries are signed and dated, data are not obliterated, changes are initialed, dated, and explained.
- Sample collection, handling, preservation, and storage procedures were conducted in accordance with the protocols described in the FSP and Work Plan, and that any deviations were documented and approved by the appropriate personnel.

9.2 Analytical Data Validation

The consultant will be responsible for performing an independent validation of the analytical data. Project-specific procedures will be used to validate analytical laboratory data. The basis for the validation will be the USEPA CLP National Functional Guidelines for Organic Data Review (February 2005) and the USEPA CLP National Functional Guidelines for Inorganic Data Review (October 2004), modified to accommodate the criteria in the analytical methods used in this program, and Region II Standard Operating Procedures (SOPs) for CLP Organic Data review (Revision 11, June 1996) and Evaluation of Metals for the CLP Program (Revision 11, February 1992). Critical functions for determining the validity of generated data are: (1) strict adherence to the analytical methods, (2) assurance that the instrumentation employed was operated in accordance with defined operating procedures, (3) assurance that quality parameters built into the analytical procedures have been adhered to, and (4) confirmation that the DQOs have been met.

Table 5 highlights the QC criteria and holding time requirements for all analyses conducted under this program. These criteria will be used to evaluate and qualify the data during validation.

The consultant or qualified contracted personnel will validate all analytical samples collected as part of the Williamsburg Works Former MGP RI. Samples collected for waste classification will not be validated. Validation will include all technical holding times, as well as QC sample results (blanks, surrogate spikes, laboratory duplicates, MS/MSDs, and LCSs), tunes, internal standards, calibrations, target compound identification, and results calculations.

For all analyses, the laboratory will report results, which are below the laboratory's reporting limit; these results will be qualified as estimated (J) by the laboratory. The laboratory may be required to report TICs for the VOC and SVOC analyses; this will be requested by the consultant on an as-needed basis

The overall completeness of the data package will also be evaluated by the data validator. Completeness checks will be administered on all data to determine whether full data deliverables were provided. The reviewer will determine whether all required items are present and request copies of missing deliverables.

Upon completion of the validation, a report will be prepared. This report will summarize the samples reviewed, elements reviewed, any nonconformance with the established criteria, and validation actions. Data qualifiers will be consistent with EPA National Functional Guidelines. This report will be in a format consistent with NYSDEC's DUSR.

9.3 Analytical Data Validation

Laboratory deliverables will consist of an original hard copy data package that is in general accordance with NYSDEC ASP Category B data deliverable requirements.

10. Internal Quality Control

Laboratory and field quality internal control checks will be used to ensure the data quality objectives. At a minimum, this will include:

- Matrix spike and/or matrix spike duplicate samples
- Matrix duplicate analyses
- Laboratory control spike samples
- Instrument calibrations
- Instrument tunes for VOC 8260B and SVOC 8270C analyses
- Method and/or instrument blanks
- Surrogate spikes for organic analyses
- Internal standard spikes for VOC 8260B and SVOC 8270C analyses
- Detection limit determination and confirmation by analysis of low-level calibration standard

The laboratory quality plan for the selected ELAP is located in Appendix A.

Field quality control samples will include:

- Equipment blanks as outlined in Table 5
- Field duplicate samples as outlined in Table 5
- Trip blanks as outlined in Table 5
- MS/MSDs as outlined in Table 5

11. Performance and System Audits

Audits are an independent means of: 1) evaluating the operation or capability of a measurement system, and 2) documenting the use of QC procedures designed to generate data of know and acceptable quality.

Field audits may be completed to assess sample collection protocols, determine the integrity of COC procedures, and evaluate sample documentation and data handling procedures. Field audits may be scheduled by the QA officer, Project Manager (PM), site manager or in-house consultant, at their discretion. Written records of audits and any recommendations for corrective action will be submitted to the PM.

The QA officer is the interface between management and project activities in matters of project quality. The QA officer will review the implementation of the QAPP. Reviews will be conducted at the completion of field activities and will include the results of any audits and an evaluation of the data quality.

12. Preventative Maintenance

Preventative maintenance will be performed on field equipment in accordance with the manufacturer's recommendations. Preventative maintenance to field will be provided by the equipment vendor. The following equipment has been identified for use to implement the Work Plan.

Subsurface Soil Sampling Activities:

- RAE Systems MultiRAE Plus equipped with VOC (10.6 eV lamp), LEL, percent oxygen, hydrogen sulfide and hydrogen cyanide
- RAE Systems MiniRAE 2000 PID with 10.6 eV lamp.
- RAE Systems VRAE Surveying Monitor with LEL, hydrogen cyanide, hydrogen sulfide, carbon monoxide, and percent oxygen.
- Drager CMS and compound specific chips.
- MIE pDR 1200 with cyclone and pump
- MSA LC Pump
- BIOS DCL-5k pump calibrator

Groundwater Sampling Activities

- In-Situ Troll 9000
- YSI 600 XLM

Similar equipment will be substituted that perform the same functions can be substituted if selected equipment is not available from equipment supplier.

Laboratory equipment calibration and maintenance procedures are specified in the ELAP laboratory quality manual located in Appendix A.

13. Specific Procedures to Assess Data Quality Indicators

QC analyses conducted as a part of the testing program will provide a quantitative quality assessment of the data generated and their adherence to the data quality indicators. The data quality indicators ensure that the quality assurance objectives for the project are met.

13.1 Detection Limits

13.1.1 Method Detection Limit

The MDL is defined as follows for all measurements:

$$MDL = (t[n-1,1-a=0.99]) \times (s)$$

where: s = standard deviation of the replicate analysis,
t(n-1, 1-a=0.99) = student's t-value for a one-sided, 99 percent confidence level and a standard deviation estimate with n-1 degrees of freedom

The MDLs calculated by the laboratory are determined under ideal conditions. MDLs for environmental samples are dependent on the sample aliquot, the matrix, the concentration of analyte, and interference present in the matrix, the percent of moisture, dilution factor, etc. The MDL for each sample analysis will be adjusted accordingly.

13.1.2 *Reporting Limit*

The RL is the concentration of an analyte in the sample that corresponds to the lowest concentration standard of the calibration curve. As with the MDLs, the RLs are dependent on the sample aliquot, the final sample volume, the percent of moisture, dilution factor, etc.

The RL is determined as follows:

$$RL = \frac{Lowest\ conc.\ std\ (ng)}{Volume\ injected\ (uL)} \ x \ \frac{Sample\ aliquot\ (mL\ or\ g)}{Final\ volume\ (mL)} \ x\ DF\ x \ \frac{100}{(100 - \%M)}$$

where: DF = dilution factor, including all dilutions or lost samples not accounted for in a sample aliquot/final volume ratio
%M = percent moisture for solid samples.

13.2 Precision

Variability will be expressed in terms of the RPD when only two data points exist. The RPD is calculated as:

$$RPD = \frac{(Larger\ Value - Smaller\ Value)}{[(Larger\ Value + Smaller\ Value)/2]} \ x\ 100\%$$

For data sets greater than two points, the percent relative standard deviation (percent RSD) is used as the precision measurement. It is defined by the equation:

$$Percent\ RSD = \frac{Standard\ Deviation}{Mean} \ x\ 100\%$$

Standard deviation (SD) is calculated as follows:

$$SD = \sqrt{\sum_{i=1}^{n} \frac{(y_i - y)^2}{n - 1}}$$

where: SD = standard deviation
yi = measured value of the ith replicate
y = mean of replicate measurements
n = number of replicates

For measurements such as pH, where the absolute variation is more appropriate, precision is usually reported as the absolute range (D) of duplicate measurements:

D = | first measurement - second measurement |

or as the absolute standard deviation previously given. RPD, %RSD, and D are independent of the error of the analyses and reflect only the degree to which the measurements agree with each other, not the degree to which they agree with the true value for the parameter measured.

13.3 Accuracy

Accuracy is related to the bias in a measurement system. Accuracy describes the degree of agreement of a measurement with a true value. Accuracy will be expressed as percent recovery for each matrix spike analyte by using the following equation:

$$\%\ Recovery = \frac{Css - Cus}{Csa}\ X\ 100\%$$

where: Css = measured concentration in spiked sample
Cus = measured concentration in unspiked sample
Csa = known concentration added to the sample

Accuracy for a measurement such as pH is expressed as bias in the analysis of a standard reference sample according to the equation:

$$Bias = pH_m - pH_t$$

where: pH_m = measured pH
pH_t = the true pH of the standard reference sample

13.4 Completeness

Data completeness is a measure of the amount of usable data resulting from a measurement effort. For this program, completeness will be defined as the percentage of valid data obtained compared to the total number of measurements necessary to achieve our required statistical level of confidence for each test. The confidence level is based on the total number of samples proposed in the Work Plan.

Data completeness is calculated as:

$$Completeness = \frac{Number\ of\ valid\ data\ points}{Number\ of\ data\ points\ necessary\ for\ confidence\ level} \ x\ 100\%$$

The completeness goal is to generate a sufficient amount of valid data. It is anticipated that 95 percent of the data will be complete. Data validation criteria discussed in the work plan and Section 10 of this QAPP will be used to determine data completeness. Any data deficiencies and their effect on project goals will be evaluated in the DUSR.

13.5 Representativeness

Representativeness is a qualitative statement that expresses the extent to which the sample accurately and precisely represents the characteristics of interest of the study. Representativeness is primarily concerned with the proper design of the sampling program and is best ensured by proper selection of sampling locations and the taking of a sufficient number of samples. It is addressed by describing the sampling techniques, the matrices sampled, and the rationale for the selection of sampling locations, which are discussed in the field sampling plan and Work Plan

13.6 Comparability

Comparability is a qualitative parameter expressing the confidence that one set of data can be compared to another. Comparability is possible only when standardized sampling and analytical procedures are used.

14. Corrective Action

If unacceptable conditions are identified as a result of audits or are observed during field sampling and analysis, the PM, Field Team Leader, and QA officer will document the condition and initiate corrective procedures. The specific condition or problem will be identified, its cause will be determined, and appropriate action will be implemented.

The entire sampling program will be under the direction of the PM and QA officer. The emphasis in this program is on preventing problems by identifying potential errors, discrepancies, and gaps in the data collection, laboratory analysis, and interpretation process. Any problems identified will be promptly resolved. Likewise, follow-up corrective action is always an option in the event that preventative corrective actions are not effective.

The acceptance limits for the sampling and analyses to be conducted in this program will be those stated in the method or defined by other means in the Work Plan and FSP. Corrective actions are likely to be immediate in nature and most often will be implemented by the contracted laboratory analyst or the PM. The corrective action will usually involve recalculation, reanalysis, or repeating a sample run.

14.1 Immediate Corrective Action

Corrective action in the field may be needed when the sample requirements are changed (i.e., more/less samples, sampling locations other than those specified in the Work Plan), or when sampling procedures and/or field analytical procedures require modification, etc. due to unexpected conditions. The field team may identify the need for corrective action. The Field Team Leader, Site Manager, and PM will approve the corrective action and notify the QA officer. The PM and QA officer will approve the corrective measure. The Field Team Leader and Site Manager will ensure that the corrective measure is implemented by the field team.

Corrective actions will be implemented and documented in the field record book. Documentation will include:

- A description of the circumstances that initiated the corrective action
- The action taken in response
- The final resolution
- Any necessary approvals

No staff member will initiate corrective action without prior communication of findings through the proper channels.

Corrective action in the laboratory will be completed in accordance with the quality assurance procedures located in the Appendix A. Any corrective actions completed by the laboratory will be documented in both the laboratory's corrective action files, and the narrative data report sent from the laboratory to the PM. If the corrective action does not rectify the situation, the laboratory will contact the PM, who will determine the action to be taken and inform the appropriate personnel.

If potential problems are not solved as an immediate corrective action, the contractor will apply formalized long-term corrective action if necessary.

Tables

Table 1
Soil Field Sampling Matrix
Williamsburg Works MGP Site
Remedial Investigation
Brooklyn, New York

Sample I.D.	Sample Location	SAMPLE SELECTION PROTOCOL: 1. Shallow soils within observed impacts (0 to 5' bgs); 2. Subsubface soils within heaviest observed impacts below 5 feet (if present); 3. Subsurface soils below depest observed viual impacts. IF NO IMPACTS ARE OBSERVED: 1. Shallow soils (0 to 5' bgs); 2. Water table interface; 3. Completion depth of boring.								Analysis (Method[1])						
		Sample Number			Sample Zone Depths											
		Number Samples Proposed	Number Samples Collected	Date Collected	0 to 5' bgs	Heaviest Impacted Zone below 5 feet (if Present)	Water Table Interface	Subsurface soils below depest observed viual impacts	Completion depth of boring	VOCs (8260B)	SVOCs (8270C)	TAL Metals (6000/7000	Free Cyanide (EPA 9013A/ Micro-diffusion ASTM D4282-02)	Herbicides (8151A)	PCBs (8082)	Pesticides (8081A)
Surface Soils																
WW-SS-01	North 12th Street, adjacent to the site	1								X	X	X	X	X	X	X
WW-SS-02	North 11th Street, adjacent to the site	1								X	X	X	X	X	X	X
WW-SS-03	North 12th Street, adjacent to the site	1								X	X	X	X	X	X	X
WW-SS-04	North 11th Street, adjacent to the site	1								X	X	X	X	X	X	X
WW-SS-05	North 12th Street, adjacent to the site	1								X	X	X	X	X	X	X
WW-SS-06	North 11th Street, adjacent to the site	1								X	X	X	X	X	X	X
WW-SS-07	North 12th Street, adjacent to the site	1								X	X	X	X	X	X	X
WW-SS-08	North 11th Street, adjacent to the site	1								X	X	X	X	X	X	X
WW-SS-09	North 12th Street, adjacent to the site	1								X	X	X	X	X	X	X
Subsurface Soils																
WW-TP-01	Block 2287, Lot 1, within the gas holder footprint	1								X	X	X	X	X	X	X
WW-TP-02	Block 2287, Lot 1, within the gas holder footprint	1								X	X	X	X	X	X	X
WW-TP-03	Block 2287, Lot 1, within the gas holder footprint	1								X	X	X	X	X	X	X

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Sample I.D.	Sample Location	SAMPLE SELECTION PROTOCOL: 1. Shallow soils within observed impacts (0 to 5' bgs); 2. Subsubface soils within heaviest observed impacts below 5 feet (if present); 3. Subsurface soils below depest observed viual impacts. IF NO IMPACTS ARE OBSERVED: 1. Shallow soils (0 to 5' bgs); 2. Water table interface; 3. Completion depth of boring.								Analysis (Method[1])						
		Sample Number			Sample Zone Depths											
		Number Samples Proposed	Number Samples Collected	Date Collected	0 to 5' bgs	Heaviest Impacted Zone below 5 feet (if Present)	Water Table Interface	Subsurface soils below depest observed viual impacts	Completion depth of boring	VOCs (8260B)	SVOCs (8270C)	TAL Metals (6000/7000	Free Cyanide (EPA 9013A/ Micro-diffusion ASTM D4282-02)	Herbicides (8151A)	PCBs (8082)	Pesticides (8081A)
WW-TP-04	Block 2287, Lot 1, within the gas holder footprint	1								X	X	X	X	X	X	X
WW-TP-05	Block 2287, Lot 1, within the gas holder footprint	1								X	X	X	X	X	X	X
WW-TP-06	Block 2287, Lot 1, within the gas holder footprint	1								X	X	X	X	X	X	X
WW-SB-01	North 11th Street, south of the site	3								X	X	X	X	X[2]	X[2]	X[2]
WW-SB-02	North 12th Street, north of the site	3								X	X	X	X	X[2]	X[2]	X[2]
WW-SB-03	Block 2287, Lot 1, within the gas holder footprint	3								X	X	X	X	X[2]	X[2]	X[2]
WW-SB-04	Block 2287, Lot 1, within the gas holder footprint	3								X	X	X	X	X[2]	X[2]	X[2]
WW-SB-05	Block 2287, Lot 1, within the gas holder footprint	3								X	X	X	X	X[2]	X[2]	X[2]
WW-SB-06	Block 2287, Lot 1, within the gas holder footprint	3								X	X	X	X	X[2]	X[2]	X[2]
WW-SB-07	Block 2287, Lot 1, within the gas holder footprint	3								X	X	X	X	X[2]	X[2]	X[2]
WW-SB-08	Block 2287, Lot 1, within the gas holder footprint	3								X	X	X	X	X[2]	X[2]	X[2]
WW-SB-09	North 12th Street, north of the site	3								X	X	X	X	X[2]	X[2]	X[2]
WW-SB-10	North 11th Street, south of the site	3								X	X	X	X	X[2]	X[2]	X[2]

Table 1
Soil Field Sampling Matrix
Williamsburg Works MGP Site
Remedial Investigation
Brooklyn, New York

Sample I.D.	Sample Location	SAMPLE SELECTION PROTOCOL: 1. Shallow soils within observed impacts (0 to 5' bgs); 2. Subsubface soils within heaviest observed impacts below 5 feet (if present); 3. Subsurface soils below depest observed viual impacts. IF NO IMPACTS ARE OBSERVED: 1. Shallow soils (0 to 5' bgs); 2. Water table interface; 3. Completion depth of boring.								Analysis (Method[1])						
		Sample Number			Sample Zone Depths											
		Number Samples Proposed	Number Samples Collected	Date Collected	0 to 5' bgs	Heaviest Impacted Zone below 5 feet (if Present)	Water Table Interface	Subsurface soils below depest observed viual impacts	Completion depth of boring	VOCs (8260B)	SVOCs (8270C)	TAL Metals (6000/7000	Free Cyanide (EPA 9013A/ Micro-diffusion ASTM D4282-02)	Herbicides (8151A)	PCBs (8082)	Pesticides (8081A)
WW-SB-11	North 12th Street, north of the site	3								X	X	X	X	X[2]	X[2]	X[2]
WW-SB-12	Block 2287, Lot 16, within the purifying house footprint	3								X	X	X	X	X[2]	X[2]	X[2]
WW-SB-13	North 11th Street, south of the site	3								X	X	X	X	X[2]	X[2]	X[2]
WW-SB-14	North 12th Street, north of the site	3								X	X	X	X	X[2]	X[2]	X[2]
WW-SB-15	North 12th Street, north of the site	3								X	X	X	X	X[2]	X[2]	X[2]
WW-SB-16	North 12th Street, north of the site	3								X	X	X	X	X[2]	X[2]	X[2]
WW-SB-17	North 11th Street, south of the site	3								X	X	X	X	X[2]	X[2]	X[2]
WW-SB-18	Kent Avenue, north of the site	3								X	X	X	X	X[2]	X[2]	X[2]
WW-MW-01	Wythe Avenue, east and upgradient of the site	3								X	X	X	X	X[2]	X[2]	X[2]
WW-MW-02	North 11th Street, south of the site	3								X	X	X	X	X[2]	X[2]	X[2]
WW-MW-03	North 12th Street, north of the site	3								X	X	X	X	X[2]	X[2]	X[2]
WW-MW-04	Block 2287, Lot 1, downgradient of the gas holder	3								X	X	X	X	X[2]	X[2]	X[2]

Table 1
Soil Field Sampling Matrix
Williamsburg Works MGP Site
Remedial Investigation
Brooklyn, New York

Sample I.D.	Sample Location	**SAMPLE SELECTION PROTOCOL:** 1. Shallow soils within observed impacts (0 to 5' bgs); 2. Subsubface soils within heaviest observed impacts below 5 feet (if present); 3. Subsurface soils below depest observed viual impacts. **IF NO IMPACTS ARE OBSERVED:** 1. Shallow soils (0 to 5' bgs); 2. Water table interface; 3. Completion depth of boring.								Analysis (Method[1])						
		Sample Number			Sample Zone Depths											
		Number Samples Proposed	Number Samples Collected	Date Collected	0 to 5' bgs	Heaviest Impacted Zone below 5 feet (if Present)	Water Table Interface	Subsurface soils below depest observed viual impacts	Completion depth of boring	VOCs (8260B)	SVOCs (8270C)	TAL Metals (6000/700	Free Cyanide (EPA 9013A/ Micro-diffusion ASTM D4282-02)	Herbicides (8151A)	PCBs (8082)	Pesticides (8081A)
WW-MW-05	Block 2287, Lot 1, adjacent to the gas holders	3								X	X	X	X	X[2]	X[2]	X[2]
WW-MW-06	North 11th Street, south of the site	3								X	X	X	X	X[2]	X[2]	X[2]
WW-MW-07	North 12th Street, north of the site	3								X	X	X	X	X[2]	X[2]	X[2]
WW-MW-08	North 11th Street, south of the site	3								X	X	X	X	X[2]	X[2]	X[2]
WW-MW-09	Block 2287, Lot 16, downgradient of the gas holders, condensers and purifying house	3								X	X	X	X	X[2]	X[2]	X[2]
WW-MW-10	North 12th Street, north of the site	3								X	X	X	X	X[2]	X[2]	X[2]
WW-MW-11	North 11th Street, south of the site	3								X	X	X	X	X[2]	X[2]	X[2]
WW-MW-12	North 11th Street, south of the site	3								X	X	X	X	X[2]	X[2]	X[2]
WW-MW-13	North 12th Street, north of the site	3								X	X	X	X	X[2]	X[2]	X[2]
WW-MW-14	North 11th Street, downgradient of and south of the site	3								X	X	X	X	X[2]	X[2]	X[2]
WW-MW-15	North 12th Street, downgradient of and north of the site	3								X	X	X	X	X[2]	X[2]	X[2]

Table 1
Soil Field Sampling Matrix
Williamsburg Works MGP Site
Remedial Investigation
Brooklyn, New York

Sample I.D.	Sample Location	SAMPLE SELECTION PROTOCOL: 1. Shallow soils within observed impacts (0 to 5' bgs); 2. Subsubface soils within heaviest observed impacts below 5 feet (if present); 3. Subsurface soils below depest observed viual impacts. IF NO IMPACTS ARE OBSERVED: 1. Shallow soils (0 to 5' bgs); 2. Water table interface; 3. Completion depth of boring.								Analysis (Method[1])						
		Sample Number			Sample Zone Depths											
		Number Samples Proposed	Number Samples Collected	Date Collected	0 to 5' bgs	Heaviest Impacted Zone below 5 feet (if Present)	Water Table Interface	Subsurface soils below depest observed viual impacts	Completion depth of boring	VOCs (8260B)	SVOCs (8270C)	TAL Metals (6000/700	Free Cyanide (EPA 9013A/ Micro-diffusion ASTM D4282-02)	Herbicides (8151A)	PCBs (8082)	Pesticides (8081A)
WW-MW-16	Kent Avenue, north of the site	3								X	X	X	X	X [2]	X [2]	X [2]

Notes:
VOCs - volatile organic compounds
SVOCs - semivolatile organic compounds
TAL - target analyte list
PCBs - polychlorinated biphenols
ASTM - American Society for Testing and Materials
1. Chemical analysis test methods specified are from U.S. EPA SW-846 test methods.
2. One sample from within the fill in each soil boring

Table 2
Groundwater Field Sampling Matrix
Williamsburg Works MGP Site
Remedial Investigation
Brooklyn, New York

Sample I.D.	Sample Location	SAMPLE SELECTION PROTOCOL: Collect one groundwater sample at the water table or installed monitoring well depth.				Water Quality Measurements						Analysis (Method[1])						
		Sample Number			Sample Zone													
		Number Samples Proposed	Number Samples Collected	Date Collected	Water Table	pH	Specific Conductance	Temperature	Oxidation Reduction Potential (ORP)	Turbidity	Dissolved Oxygen	VOCs (8260B)	SVOCs (8270C)	TAL Metals (6000/7000)	Total Cyanide (9012)	Herbicides (8151A)	PCBs (8082)	Pesticides (8081A)
WW-SB-03	Block 2287, Lot 1, within the gas holder footprint	1										X	X	X	X	X	X	X
WW-SB-05	Block 2287, Lot 1, within the gas holder footprint	1										X	X	X	X	X	X	X
WW-SB-07	Block 2287, Lot 1, within the gas holder footprint	1										X	X	X	X	X	X	X
WW-MW-01	Wythe Avenue, east and upgradient of the site	1										X	X	X	X	X	X	X
WW-MW-02	North 11th Street, south of the site	1										X	X	X	X	X	X	X
WW-MW-03	North 12th Street, north of the site	1										X	X	X	X	X	X	X
WW-MW-04	Block 2287, Lot 1, downgradient of the gas holder	1										X	X	X	X	X	X	X
WW-MW-05	Block 2287, Lot 1, adjacent to the gas holders	1										X	X	X	X	X	X	X
WW-MW-06	North 11th Street, south of the site	1										X	X	X	X	X	X	X
WW-MW-07	North 12th Street, north of the site	1										X	X	X	X	X	X	X
WW-MW-08	North 11th Street, south of the site	1										X	X	X	X	X	X	X
WW-MW-09	Block 2287, Lot 16, downgradient of the gas holders, condensers and purifying house	1										X	X	X	X	X	X	X
WW-MW-10	North 12th Street, north of the site	1										X	X	X	X	X	X	X
WW-MW-11	North 11th Street, south of the site	1										X	X	X	X	X	X	X
WW-MW-12	North 12th Street, north of the site	1										X	X	X	X	X	X	X
WW-MW-13	North 12th Street, north of the site	1										X	X	X	X	X	X	X

Table 2
Groundwater Field Sampling Matrix
Williamsburg Works MGP Site
Remedial Investigation
Brooklyn, New York

Sample I.D.	Sample Location	SAMPLE SELECTION PROTOCOL: Collect one groundwater sample at the water table or installed monitoring well depth.				Water Quality Measurements						Analysis (Method[1])						
		Sample Number			Sample Zone													
		Number Samples Proposed	Number Samples Collected	Date Collected	Water Table	pH	Specific Conductance	Temperature	Oxidation Reduction Potential (ORP)	Turbidity	Dissolved Oxygen	VOCs (8260B)	SVOCs (8270C)	TAL Metals (6000/7000)	Total Cyanide (9012)	Herbicides (8151A)	PCBs (8082)	Pesticides (8081A)
WW-MW-14	North 11th Street, downgradient of and south of the site	1										X	X	X	X	X	X	X
WW-MW-15	North 12th Street, downgradient of and north of the site	1										X	X	X	X	X	X	X
WW-MW-16	Kent Avenue, north of the site	1										X	X	X	X	X	X	X

Notes:
VOCs - volatile organic compounds
SVOCs - semivolatile organic compounds
TAL - target analyte list
PCBs - polychlorinated biphenols
1. Chemical analysis test methods specified are from U.S. EPA SW-846 test methods.

Table 3
Sediment Field Sampling Matrix
Williamsburg Works MGP Site
Remedial Investigation
Brooklyn, New York

Sample I.D.	Sample Location	SAMPLE SELECTION PROTOCOL: 1. Shallow sediment (0 to 6" below sediemnt/water interface); 2. Sediment within heaviest observed impacts (if present); 3. Sediment below depest observed viual impacts or at the completion depth of the core. IF NO IMPACTS ARE OBSERVED: 1. Shallow sediment (0 to 6" below sediemnt/water interface); 2. Sediment/water interface;							Analysis (Method[1])						
		Sample Number			Sample Zone Depths									
		Number Samples Proposed	Number Samples Collected	Date Collected	Shallow sediment (0 to 6" below sediemnt/ water interface)	Sediment within heaviest observed impacts (if present)	Sediment/ water interface	Sediment below depest observed viual impacts or at the completion depth of the core	VOCs (8260B)	SVOCs (8270C)	TAL Metals (6000/7000	Free Cyanide (EPA 9013A/ Micro-diffusion ASTM D4282-02)	Herbicides (8151A)	PCBs (8082)	Pesticides (8081A)
WW-SED-01	East River, adjacent to the site	3							X	X	X	X	X	X	X
WW-SED-02	East River, adjacent to the site	3							X	X	X	X	X	X	X
WW-SED-03	East River, adjacent to the site	3							X	X	X	X	X	X	X
WW-SED-04	East River, adjacent to the site	3							X	X	X	X	X	X	X
WW-SED-05	East River	3							X	X	X	X	X	X	X
WW-SED-06	East River	3							X	X	X	X	X	X	X
WW-SED-07	East River	3							X	X	X	X	X	X	X

Notes:
VOCs - volatile organic compounds
SVOCs - semivolatile organic compounds
TAL - target analyte list
PCBs - polychlorinated biphenols
ASTM - American Society for Testing and Materials
1. Chemical analysis test methods specified are from U.S. EPA SW-846 test methods.

Table 4
Soil Vapor and Ambient Air Field Sampling Matrix
Williamsburg Works MGP Site
Remedial Investigation
Brooklyn, New York

Sample I.D.	Sample Location	**SAMPLE SELECTION PROTOCOL:** **1. Collect one soil vapor sample at the installed soil vapor point depth.** **2. Collect indoor air and outdoor air samples from the height of the breathing zone, approximately 3-5 feet above the ground surface.**			Analysis (Method)
		Sample Number			VOCs (expanded) (modified TO-15)
		Number Samples Proposed	Number Samples Collected	Date Collected	
WW-SV-01	Block 2288, Lot 1, within the footprint of the former gas holder	1			X
WW-SV-02	Block 2288, Lot 1, within the footprint of the former gas holder	1			X
WW-SV-03	Block 2287, Lot 1, within the footprint of the former gas holder	1			X
WW-SV-04	Block 2287, Lot 1, within the footprint of the former gas holder	1			X
WW-SV-05	Block 2287, Lot 1, within the footprint of the former gas holder	1			X
WW-SV-06	Block 2287, Lot 1, within the footprint of the former condenser house	1			X
WW-SV-07	Block 2287, Lot 1, within the footprint of the former purifyer house	1			X
WW-SV-08	Block 2287, Lot 1, within the footprint of the former purifyer	1			X
WW-SV-09	Block 2287, Lot 16, within the footprint of the former gas tank	1			X
WW-SV-10	Block 2287, Lot 16, within the footprint of the former condenser house	1			X

Table 4
Soil Vapor and Ambient Air Field Sampling Matrix
Williamsburg Works MGP Site
Remedial Investigation
Brooklyn, New York

Sample I.D.	Sample Location	**SAMPLE SELECTION PROTOCOL:** **1. Collect one soil vapor sample at the installed soil vapor point depth.** **2. Collect indoor air and outdoor air samples from the height of the breathing zone, approximately 3-5 feet above the ground surface.**			Analysis (Method)
		Sample Number			VOCs (expanded) (modified TO-15)
		Number Samples Proposed	Number Samples Collected	Date Collected	
WW-SV-11	Block 2287, Lot 16, within the footprint of the former retort house and generator house	1			X
WW-SV-12	Block 2287, Lot 30, within the footprint of the former oil seperators	1			X
WW-SV-13	Block 2287, Lot 30, within the footprint of the former tar tank	1			X
WW-SV-14	Block 2287, Lot 30, within the footprint of the former tar tank	1			X
WW-IA-01	Block 2288, Lot 1	1			X
WW-IA-02	Block 2288, Lot 1	1			X
WW-IA-03	Block 2287, Lot 1	1			X
WW-IA-04	Block 2287, Lot 1	1			X
WW-IA-05	Block 2287, Lot 16	1			X
WW-IA-06	Block 2287, Lot 16	1			X
WW-IA-07	Block 2287, Lot 30	1			X
WW-IA-08	Block 2287, Lot 30	1			X
WW-OA-01	North 12th Street, adjacent to Block 2288, Lot 1	1			X
WW-OA-02	North 12th Street, adjacent to Block 2287, Lot 1	1			X
WW-OA-03	North 11th Street, adjacent to Block 2287, Lot 16.	1			X
WW-OA-04	North 12th Street, adjacent to Block 2287, Lot 30	1			X

Notes:
VOCs - volatile organic compounds

Table 5
Analytical Methods/Quality Assurance Summary Table
Williamsburg Works MGP Site
Remedial Investigation
Brooklyn, New York

Media	Number of Primary Samples	QA/QC Samples				Total Number of Samples	Analytical Parameters	Method	Preservative	Holding Time	Container
		TB	FB[2]	DUP	MS/MSD						
Surface Soil	9	1	1	1	1	13	VOCs	8260B	Cool to 4°C	14 days to analysis	Wide mouth 2-oz. VOA, clear glass jar
	9	0	1	1	1	12	SVOCs	8270C	Cool to 4°C	14 days to extraction; 40 days from extraction to analysis	Wide mouth 8-oz. and 4oz. clear glass jars[1]
	9	0	1	1	1	12	TAL Metals	6000/7000	Cool to 4°C	28 days to analysis for mercury; 6 months to analysis for other metals	Wide mouth 8-oz. and 4oz. clear glass jars[1]
	9	0	1	1	1	12	Free Cyanide	9013A/ ASTM Method D4282-02	Cool to 4° C	14 days	Wide-mouth amber 8-oz.
	9	0	1	1	1	12	Herbicides	8151A	Cool to 4°C	14 days to extraction; 40 days from extraction to analysis	Wide mouth 8-oz. and 4oz. clear glass jars[1]
	9	0	1	1	1	12	PCBs	8082	Cool to 4°C	7 days to extraction; 40 days from extraction to analysis	Wide mouth 8-oz. and 4oz. clear glass jars[1]
	9	0	1	1	1	12	Pesticides	8081A	Cool to 4°C	7 days to extraction; 40 days from extraction to analysis	Wide mouth 8-oz. and 4oz. clear glass jars[1]
Subsurface Soil	108	22	6	6	6	148	VOCs	8260B	Cool to 4°C	14 days to analysis	Wide mouth 2-oz. VOA, clear glass jar
	108	0	6	6	6	126	SVOCs	8270C	Cool to 4°C	14 days to extraction; 40 days from extraction to analysis	Wide mouth 8-oz. and 4oz. clear glass jars[1]
	108	0	6	6	6	126	TAL Metals	6000/7000	Cool to 4°C	28 days to analysis for mercury; 6 months to analysis for other metals	Wide mouth 8-oz. and 4oz. clear glass jars1
	108	0	6	6	6	126	Free Cyanide	9013A/ ASTM Method D4282-02	Cool to 4° C	14 days	Wide-mouth amber 8-oz.
	40	0	2	2	2	46	Herbicides	8151A	Cool to 4°C	14 days to extraction; 40 days from extraction to analysis	Wide mouth 8-oz. and 4oz. clear glass jars[1]
	40	0	2	2	2	46	PCBs	8082	Cool to 4°C	7 days to extraction; 40 days from extraction to analysis	Wide mouth 8-oz. and 4oz. clear glass jars[1]
	40	0	2	2	2	46	Pesticides	8081A	Cool to 4°C	7 days to extraction; 40 days from extraction to analysis	Wide mouth 8-oz. and 4oz. clear glass jars[1]
Soil Vapor	14	0	0	2	0	16	VOCs (including naphthalene)	TO-15	None	14 Days to analysis	2.7-Liter Summa Canister
Indoor Air	8	0	0	1	0	9	VOCs (including naphthalene)	TO-15	None	14 Days to analysis	6-Liter Summa Canister
Outdoor Air	4	0	0	1	0	5	VOCs (including naphthalene)	TO-15	None	14 Days to analysis	6-Liter Summa Canister

Table 5
Analytical Methods/Quality Assurance Summary Table
Williamsburg Works MGP Site
Remedial Investigation
Brooklyn, New York

Media	Number of Primary Samples	QA/QC Samples				Total Number of Samples	Analytical Parameters	Method	Preservative	Holding Time	Container
		TB	FB[2]	DUP	MS/MSD						
Ground Water	18	5	2	2	2	29	VOCs	8260B	pH<2 with HCl, Cool to 4°C	14 days to analysis	(2) 40 mL VOA vials
	18	0	2	2	2	24	SVOCs	8270C	Cool to 4°C	7 days to extraction; 40 days from extraction to analysis	(2) 1 L amber glass jar
	18	0	2	2	2	24	TAL Metals	6000/7000	pH<2 with HNO_3; Cool to 4°C	28 days to analysis for mercury; 6 months to analysis for other metals	(1) 500 mL polyethylene container
	18	0	2	2	2	24	Total Cyanide	9012	NaOH to pH>12/Cool to 4°C	14 days to analysis	(1) 500 mL polyethylene container
	18	0	2	2	2	24	Herbicides	8151A	Cool to 4°C	7 days to extraction; 40 days from extraction to analysis	(1)-1 L amber glass jar
	18	0	2	2	2	24	PCBs	8082	Cool to 4°C	7 days to extraction; 40 days from extraction to analysis	(1)-1 L amber glass jar
	18	0	2	2	2	24	Pesticides	8081A	Cool to 4°C	7 days to extraction; 40 days from extraction to analysis	1)-1 L amber glass jar
Sediment	21	2	2	2	2	29	VOCs	8260B	pH<2 with HCl, Cool to 4°C	14 days to analysis	Wide mouth 2-oz. VOA, clear glass jar
	21	0	2	2	2	27	SVOCs	8270C	Cool to 4°C	14 days to extraction; 40 days from extraction to analysis	Wide mouth 8-oz. and 4oz. clear glass jars[1]
	21	0	2	2	2	27	TAL Metals	6000/7000	pH<2 with HNO_3; Cool to 4°C	28 days to analysis for mercury; 6 months to analysis for other metals	Wide mouth 8-oz. and 4oz. clear glass jars[1]
	21	0	2	2	2	27	Free Cyanide	9013A/ ASTM Method	Cool to 4° C	14 days	Wide-mouth amber 8-oz.
	21	0	2	2	2	27	Herbicides	8151A	Cool to 4°C	14 days to extraction; 40 days from extraction to analysis	Wide mouth 8-oz. and 4oz. clear glass jars[1]
	21	0	2	2	2	27	PCBs	8082	Cool to 4°C	7 days to extraction; 40 days from extraction to analysis	Wide mouth 8-oz. and 4oz. clear glass jars[1]
	21	0	2	2	2	27	Pesticides	8081A	Cool to 4°C	7 days to extraction; 40 days from extraction to analysis	Wide mouth 8-oz. and 4oz. clear glass jars[1]

[1]: SVOC, TAL metals, herbicides, pesticides and PCBs will be collected from the (1)- 8 oz jar and the (1)- 4 oz jar
[2]: Soil field blanks will include bottles listed in groundwater section of the table.
VOCs - volatile organic compounds
SVOCs - semivolatile organic compounds
TAL - target analyte list
PCBs - polychlorinated biphenols
ASTM - American Society for Testing and Materials
°C- Degrees Celsius
L - Liter
oz. - ounce
mL - Milliliter
HNO3 - Nitric acid
HCl - Hydrochloric Acid
NAOH-Sodium Hydroxide

Table 6
Quantification Limits for Soils
Williamsburg Works MGP Site
Remedial Investigation
Brooklyn, New York

	Reporting Detection Limit	Method Detection Limit	Units
Metals by EPA Method 6000/7000 series			
Aluminum	258	20	mg/Kg
Antimony	11.7	1.14	mg/Kg
Arsenic	8	1.22	mg/Kg
Barium	2	0.18	mg/Kg
Beryllium	2	0.5	mg/Kg
Cadmium	3	1	mg/Kg
Calcium	85	11.6	mg/Kg
Chromium	3	0.34	mg/Kg
Cobalt	2	0.42	mg/Kg
Copper	5	0.8	mg/Kg
Iron	145	10.2	mg/Kg
Lead	9	0.76	mg/Kg
Magnesium	35	9.2	mg/Kg
Manganese	2.5	0.64	mg/Kg
Mercury	0.05	0.02	mg/Kg
Nickel	6.25	0.44	mg/Kg
Potassium	200	40	mg/Kg
Selenium	16	1.6	mg/Kg
Silver	3	0.32	mg/Kg
Sodium	94	20	mg/Kg
Thallium	20	4.17	mg/Kg
Vanadium	4	0.36	mg/Kg
Zinc	20	3.8	mg/Kg
Semivolatile Organic Compounds (SVOCs) by EPA Method 8270C			
1,2,4-Trichlorobenzene	333	55.96	ug/Kg
1,2-Dichlorobenzene	333	56.43	ug/Kg
1,2-Diphenylhydrazine	333	32.86	ug/Kg
1,3-Dichlorobenzene	333	50.49	ug/Kg
1,4-Dichlorobenzene	333	52.75	ug/Kg
2,2-oxybis (1-chloropropane)	333	47.18	ug/Kg
2,4,5-Trichlorophenol	1667	120.96	ug/Kg
2,4,6-Trichlorophenol	333	85.18	ug/Kg
2,4-Dichlorophenol	333	108.95	ug/Kg
2,4-Dimethylphenol	333	172.3	ug/Kg
2,4-Dinitrophenol	1667	114.87	ug/Kg
2,4-Dinitrotoluene	333	60.09	ug/Kg
2,6-Dinitrotoluene	333	60.57	ug/Kg
2-Chloronaphthalene	333	48.46	ug/Kg
2-Chlorophenol	333	86.27	ug/Kg
2-Methylnaphthalene	333	52.92	ug/Kg
2-Methylphenol	333	89.03	ug/Kg
2-Nitroaniline	1667	42.32	ug/Kg
2-Nitrophenol	333	115.71	ug/Kg
3,3-Dichlorobenzidine	667	88.96	ug/Kg
3-Nitroaniline	1667	68.54	ug/Kg
4,6-Dinitro-2-methylphenol	1667	239.28	ug/Kg
4-Bromophenyl phenyl ether	333	51.16	ug/Kg
4-Chloro-3-methylphenol	333	112.76	ug/Kg

Table 6
Quantification Limits for Soils
Williamsburg Works MGP Site
Remedial Investigation
Brooklyn, New York

	Reporting Detection Limit	Method Detection Limit	Units
Semivolatile Organic Compounds (SVOCs) by EPA Method 8270C (Continued)			
4-Chloroaniline	333	107.34	ug/Kg
4-Chlorophenyl phenyl ether	333	45.74	ug/Kg
4-Methylphenol	333	179.39	ug/Kg
4-Nitroaniline	667	48.17	ug/Kg
4-Nitrophenol	1667	141.69	ug/Kg
Acenaphthene	333	55.32	ug/Kg
Acenaphthylene	333	40.59	ug/Kg
Aniline	333	73.83	ug/Kg
Anthracene	333	54.55	ug/Kg
Benzidine	3333	1134.9	ug/Kg
Benzo(a)anthracene	333	45.31	ug/Kg
Benzo(a)pyrene	333	41.16	ug/Kg
Benzo(b)fluoranthene	333	93.11	ug/Kg
Benzo(ghi)perylene	333	36.99	ug/Kg
Benzo(k)fluoranthene	333	37.12	ug/Kg
Benzoic acid	1667	90.33	ug/Kg
Benzyl alcohol	333	62.93	ug/Kg
Bis(2-chloroethoxy)methane	333	57.03	ug/Kg
Bis(2-chloroethyl)ether	333	44.86	ug/Kg
Bis(2-ethylhexyl)phthalate	333	44.37	ug/Kg
Butyl benzyl phthalate	333	43.04	ug/Kg
Carbazole	333	48.63	ug/Kg
Chrysene	333	41.6	ug/Kg
Dibenzo(a,h)anthracene	333	36.71	ug/Kg
Dibenzofuran	333	52.67	ug/Kg
Diethyl phthalate	333	48.88	ug/Kg
Dimethyl phthalate	333	51.27	ug/Kg
Di-n-butyl phthalate	333	43.98	ug/Kg
Di-n-octyl phthalate	333	34.97	ug/Kg
Fluoranthene	333	41.87	ug/Kg
Fluorene	333	43.39	ug/Kg
Hexachlorobenzene	333	48.52	ug/Kg
Hexachlorobutadiene	333	67.85	ug/Kg
Hexachlorocyclopentadiene	333	247.96	ug/Kg
Hexachloroethane	333	59.22	ug/Kg
Indeno(1,2,3-cd)pyrene	333	33.74	ug/Kg
Isophorone	333	60.02	ug/Kg
Naphthalene	333	56.66	ug/Kg
Nitrobenzene	333	40.4	ug/Kg
n-Nitrosodimethylamine	333	48.87	ug/Kg
n-Nitroso-di-n-propylamine	333	44.63	ug/Kg
n-Nitrosodiphenylamine	333	49.76	ug/Kg
Pentachlorophenol	1667	287.85	ug/Kg
Phenanthrene	333	38.58	ug/Kg
Phenol	333	96.98	ug/Kg
Pyrene	333	45.56	ug/Kg
Pyridine	667	39.9	ug/Kg

Table 6
Quantification Limits for Soils
Williamsburg Works MGP Site
Remedial Investigation
Brooklyn, New York

	Reporting Detection Limit	Method Detection Limit	Units
Volatile Organic Compounds (VOCs) by EPA Method 8260B			
1,1,1-Trichloroethane	5	0.84	ug/Kg
1,1,2,2-Tetrachloroethane	5	1.21	ug/Kg
1,1,2-Trichloroethane	5	1.04	ug/Kg
1,1-Dichloroethane	5	0.81	ug/Kg
1,1-Dichloroethene	5	1.09	ug/Kg
1,2,3-Trichloropropane	5	1.62	ug/Kg
1,2,4-Trichlorobenzene	5	0.61	ug/Kg
1,2-Dichloroethane	5	0.99	ug/Kg
1,2-Dichloropropane	5	1.06	ug/Kg
2-Butanone (MEK)	10	1.78	ug/Kg
2-Chloroethylvinylether	5	1.37	ug/Kg
2-Hexanone	10	2.53	ug/Kg
4-Methyl-2-pentanone (MIBK)	5	1.18	ug/Kg
Acetone	20	3.15	ug/Kg
Acrolein	20	3.1	ug/Kg
Acrylonitrile	5	1.19	ug/Kg
Benzene	5	0.86	ug/Kg
Bromodichloromethane	5	0.84	ug/Kg
Bromoform	5	0.99	ug/Kg
Bromomethane	5	0.82	ug/Kg
Carbon disulfide	5	0.61	ug/Kg
Carbon tetrachloride	5	0.78	ug/Kg
Chlorobenzene	5	0.79	ug/Kg
Chloroethane	5	1.89	ug/Kg
Chloroform	5	0.53	ug/Kg
Chloromethane	5	0.9	ug/Kg
cis-1,2-Dichloroethene	5	1.04	ug/Kg
cis-1,3-Dichloropropene	5	0.78	ug/Kg
Dibromochloromethane	5	0.41	ug/Kg
Dichlorodifluoromethane	5	1.25	ug/Kg
Ethylbenzene	5	0.79	ug/Kg
Isopropyl ether	5	0.44	ug/Kg
Methylene chloride	20	2.21	ug/Kg
Methyl-tert-butyl-ether (MTBE)	5	0.93	ug/Kg
Styrene	5	1.06	ug/Kg
tert-Butyl alcohol	20	4.69	ug/Kg
Tetrachloroethene	5	0.7	ug/Kg
Toluene	5	0.84	ug/Kg
trans-1,2-Dichloroethene	5	0.58	ug/Kg
trans-1,3-Dichloropropene	5	0.92	ug/Kg
Trichloroethene	5	0.68	ug/Kg
Trichlorofluoromethane	5	0.6	ug/Kg
Trichlorotrifluoroethane	5	0.63	ug/Kg
Vinyl acetate	10	2.7	ug/Kg
Vinyl chloride	5	0.87	ug/Kg
Xylenes (total)	5	1.96	ug/Kg

Table 6
Quantification Limits for Soils
Williamsburg Works MGP Site
Remedial Investigation
Brooklyn, New York

	Reporting Detection Limit	Method Detection Limit	Units
Free Cyanide by EPA Method 9013/ ASTM D4282-02			
Cyanide	TBD	TBD	ug/Kg

Notes:
mg/kg - miligrams per killogram
ug/Kg - micrograms per killogram
TBD - To Be Determined
EPA - Environmental Protection Agency
ASTM - American Standard for Testing and Materials

Table 7
Quantification Limits for Groundwater
Williamsburg Works MGP Site
Remedial Investigation
Brooklyn, New York

	Reporting Detection Limit	Method Detection Limit	Units
Cyanide by EPA Method 9012			
Cyanide, Total	10	1	ug/L
Metals by EPA Method 6000/7000 series			
Aluminum	500	92	ug/L
Antimony	20	5.4	ug/L
Arsenic	40	3.9	ug/L
Barium	5	0.74	ug/L
Beryllium	5	0.54	ug/L
Cadmium	10	1.1	ug/L
Calcium	300	56	ug/L
Chromium	10	1.3	ug/L
Cobalt	10	1.8	ug/L
Copper	10	4.3	ug/L
Iron	100	54	ug/L
Lead	10	3	ug/L
Magnesium	100	26	ug/L
Manganese	15	6.9	ug/L
Mercury	0.4	0.07	ug/L
Nickel	10	1.9	ug/L
Potassium	400	191	ug/L
Selenium	30	5	ug/L
Silver	6	1.1	ug/L
Sodium	400	98	ug/L
Thallium	40	10	ug/L
Vanadium	6	1.5	ug/L
Zinc	50	11	ug/L
Semivolatile Organic Compounds (SVOCs) by EPA Method 8270C			
1,2,4-Trichlorobenzene	10	0.68	ug/L
1,2-Dichlorobenzene	10	0.74	ug/L
1,2-Diphenylhydrazine	10	0.84	ug/L
1,3-Dichlorobenzene	10	0.68	ug/L
1,4-Dichlorobenzene	10	0.46	ug/L
2,2-oxybis (1-chloropropane)	10	0.62	ug/L
2,4,5-Trichlorophenol	50	0.78	ug/L
2,4,6-Trichlorophenol	10	0.79	ug/L
2,4-Dichlorophenol	10	0.84	ug/L
2,4-Dimethylphenol	10	0.73	ug/L
2,4-Dinitrophenol	50	5.13	ug/L
2,4-Dinitrotoluene	10	0.8	ug/L
2,6-Dinitrotoluene	10	0.59	ug/L
2-Chloronaphthalene	10	0.73	ug/L
2-Chlorophenol	10	0.6	ug/L
2-Methylnaphthalene	10	0.64	ug/L
2-Methylphenol	10	0.59	ug/L
2-Nitroaniline	50	1.12	ug/L
2-Nitrophenol	10	0.75	ug/L
3,3-Dichlorobenzidine	10	0.98	ug/L

Table 7
Quantification Limits for Groundwater
Williamsburg Works MGP Site
Remedial Investigation
Brooklyn, New York

	Reporting Detection Limit	Method Detection Limit	Units
Semivolatile Organic Compounds (SVOCs) by EPA Method 8270C (Continued)			
3-Nitroaniline	50	0.67	ug/L
4,6-Dinitro-2-methylphenol	50	4.24	ug/L
4-Bromophenyl phenyl ether	10	0.91	ug/L
4-Chloro-3-methylphenol	10	0.51	ug/L
4-Chloroaniline	10	0.43	ug/L
4-Chlorophenyl phenyl ether	10	0.82	ug/L
4-Methylphenol	10	0.33	ug/L
4-Nitroaniline	20	1.05	ug/L
4-Nitrophenol	50	1.85	ug/L
Acenaphthene	10	0.8	ug/L
Acenaphthylene	10	0.75	ug/L
Aniline	10	0.63	ug/L
Anthracene	10	0.99	ug/L
Benzidine	100	2.15	ug/L
Benzo(a)anthracene	10	1.19	ug/L
Benzo(a)pyrene	10	1.08	ug/L
Benzo(b)fluoranthene	10	1.54	ug/L
Benzo(ghi)perylene	10	1.04	ug/L
Benzo(k)fluoranthene	10	0.91	ug/L
Benzoic acid	50	5.88	ug/L
Benzyl alcohol	10	0.99	ug/L
Bis(2-chloroethoxy)methane	10	0.87	ug/L
Bis(2-chloroethyl)ether	10	0.87	ug/L
Bis(2-ethylhexyl)phthalate	10	1.31	ug/L
Butyl benzyl phthalate	10	0.96	ug/L
Carbazole	10	1.11	ug/L
Chrysene	10	0.97	ug/L
Dibenzo(a,h)anthracene	10	1.34	ug/L
Dibenzofuran	10	0.82	ug/L
Diethyl phthalate	10	0.82	ug/L
Dimethyl phthalate	10	0.63	ug/L
Di-n-butyl phthalate	10	1.14	ug/L
Di-n-octyl phthalate	10	1.3	ug/L
Fluoranthene	10	1.08	ug/L
Fluorene	10	0.77	ug/L
Hexachlorobenzene	10	1.07	ug/L
Hexachlorobutadiene	10	0.84	ug/L
Hexachlorocyclopentadiene	10	2.21	ug/L
Hexachloroethane	10	1.06	ug/L
Indeno(1,2,3-cd)pyrene	10	1.17	ug/L
Isophorone	10	0.66	ug/L
Naphthalene	10	0.66	ug/L
Nitrobenzene	10	0.79	ug/L
n-Nitroso-di-n-propylamine	10	0.7	ug/L
n-Nitrosodiphenylamine	10	1.08	ug/L
n-Nitrosomethylethylamine	10	0.5	ug/L

Table 7
Quantification Limits for Groundwater
Williamsburg Works MGP Site
Remedial Investigation
Brooklyn, New York

	Reporting Detection Limit	Method Detection Limit	Units
Semivolatile Organic Compounds (SVOCs) by EPA Method 8270C (Continued)			
Pentachlorophenol	50	5.04	ug/L
Phenanthrene	10	0.66	ug/L
Phenol	10	0.35	ug/L
Pyrene	10	1.01	ug/L
Pyridine	20	2.31	ug/L
Volatile Orangic Compounds (VOCs) by EPA Method 8260B			
1,1,1-Trichloroethane	5	0.4	ug/L
1,1,2,2-Tetrachloroethane	5	0.4	ug/L
1,1,2-Trichloroethane	5	0.6	ug/L
1,1-Dichloroethane	5	0.6	ug/L
1,1-Dichloroethene	5	0.7	ug/L
1,2,3-Trichloropropane	5	1.1	ug/L
1,2,4-Trichlorobenzene	5	0.9	ug/L
1,2-Dichloroethane	5	0.6	ug/L
1,2-Dichloropropane	5	0.9	ug/L
1,3-Dichloropropane	5	0.4	ug/L
2-Butanone (MEK)	5	1.2	ug/L
2-Chloroethylvinylether	5	0.6	ug/L
2-Hexanone	5	0.8	ug/L
4-Methyl-2-pentanone (MIBK)	5	0.7	ug/L
Acetone	5	1.4	ug/L
Acrolein	10	7.8	ug/L
Acrylonitrile	5	1.6	ug/L
Benzene	5	0.4	ug/L
Bromodichloromethane	5	0.4	ug/L
Bromoform	5	0.8	ug/L
Bromomethane	5	1.2	ug/L
Carbon disulfide	5	0.9	ug/L
Carbon tetrachloride	5	1	ug/L
Chlorobenzene	5	0.4	ug/L
Chloroethane	5	0.8	ug/L
Chloroform	5	0.7	ug/L
Chloromethane	5	0.5	ug/L
cis-1,2-Dichloroethene	5	0.6	ug/L
cis-1,3-Dichloropropene	5	0.5	ug/L
Dibromochloromethane	5	0.5	ug/L
Dichlorodifluoromethane	5	0.6	ug/L
Ethylbenzene	5	1	ug/L
Isopropyl ether	5	N/A	ug/L
Methylene chloride	5	0.4	ug/L
Methyl-tert-butyl-ether (MTBE)	5	0.3	ug/L
Styrene	5	0.5	ug/L
Tetrachloroethene	5	0.5	ug/L
Toluene	5	0.3	ug/L
trans-1,2-Dichloroethene	5	0.5	ug/L
trans-1,3-Dichloropropene	5	0.3	ug/L

Table 7
Quantification Limits for Groundwater
Williamsburg Works MGP Site
Remedial Investigation
Brooklyn, New York

	Reporting Detection Limit	Method Detection Limit	Units
Volatile Orangic Compounds (VOCs) by EPA Method 8260B (continued)			
Trichloroethene	5	0.7	ug/L
Trichlorofluoromethane	5	0.6	ug/L
Trichlorotrifluoroethane	5	0.5	ug/L
Vinyl acetate	5	0.2	ug/L
Vinyl chloride	5	0.8	ug/L
Xylenes (total)	5	1	ug/L

Notes:
ug/L - micrograms per liter
EPA - Environmental Protection Agency

Table 8
Quantification Limits for Soil Vapor and Ambient Air
Williamsburg Works MGP Site
Remedial Investigation
Brooklyn, New York

Analyte	CAS Number	Molecular Weight	Reporting Limit (ppbv)	Reporting Limit (µg/m3)
NYSDEC DER TO-15 TCL				
Benzene	71-43-2	78.11	0.20	0.64
Benzyl chloride	100-44-7	140.57	0.40	2.3
Bromodichloromethane	75-27-4	163.83	0.20	1.3
Bromoform	75-25-2	252.75	0.20	2.1
Bromomethane (Methyl bromide)	74-83-9	94.95	0.20	0.78
2-Butanone (Methyl ethyl ketone)	78-93-3	72.11	1.0	2.9
Carbon Tetrachloride	56-23-5	153.84	0.20	1.3
Chlorobenzene	108-90-7	112.56	0.20	0.92
Chloroethane	75-00-3	64.52	0.20	0.53
Chloroform	67-66-3	119.39	0.20	0.98
Chloromethane (Methyl chloride)	74-87-3	50.49	0.50	1
Cyclohexane	110-82-7	84.16	0.50	1.7
Dibromochloromethane	124-48-1	208.29	0.20	1.7
1,2-Dibromoethane	106-93-4	187.88	0.20	1.5
1,2-Dichlorobenzene	95-50-1	147.01	0.20	1.2
1,3-Dichlorobenzene	541-73-1	147.01	0.20	1.2
1,4-Dichlorobenzene	106-46-7	147.01	0.20	1.2
Dichlorodifluoromethane (Freon 12)	75-71-8	120.92	0.20	0.99
1,1-Dichloroethane	75-34-3	98.97	0.20	0.81
1,2-Dichloroethane	107-06-2	98.96	0.20	0.81
1,1-Dichloroethene	75-35-4	96.95	0.20	0.79
1,2-Dichloroethene (cis)	156-59-2	96.95	0.20	0.79
1,2-Dichloroethene (trans)	156-60-5	96.95	0.20	0.79
1,2-Dichloropropane	78-87-5	112.99	0.20	0.92
cis-1,3-Dichloropropene	10061-01-5	110.98	0.20	0.91
trans-1,3-Dichloropropene	10061-02-6	110.98	0.20	0.91
1,2-Dichlorotetrafluoroethane (Freon 114)	76-14-2	170.93	0.20	1.4
1,4-Dioxane	123-91-1	88.11	0.50	1.8
Ethanol *	64-17-5	46.07	0.20	0.38
Ethylbenzene	100-41-4	106.16	0.20	0.87
Hexachlorobutadiene	87-68-3	260.76	1.0	10.7
n-Hexane	110-54-3	86.18	0.50	1.8
Methylene Chloride	75-09-2	84.94	0.50	1.7
4-Methyl-2-pentanone (MIBK)	108-10-1	100.16	0.50	2
MTBE (Methyl tert-butyl ether)	1634-04-4	88.15	1.0	3.6
Styrene	100-42-5	104.14	0.20	0.85
Tertiary Butyl Alcohol (TBA)	76-65-0	74.12	2.00	6.1
1,1,2,2-Tetrachloroethane	79-34-5	167.86	0.20	1.4

Table 8
Quantification Limits for Soil Vapor and Ambient Air
Williamsburg Works MGP Site
Remedial Investigation
Brooklyn, New York

Analyte	CAS Number	Molecular Weight	Reporting Limit (ppbv)	Reporting Limit (µg/m3)
Tetrachloroethene (PCE)	127-18-4	165.85	0.20	1.4
Toluene	108-88-3	92.13	0.20	0.75
1,2,4-Trichlorobenzene	120-82-1	181.46	1.0	7.4
1,1,1-Trichloroethane	71-55-6	133.42	0.20	1.1
1,1,2-Trichloroethane	79-00-5	133.42	0.20	1.1
1,1,2-trichloro-1,2,2-trifluoroethane (Freon 113)	76-13-1	187.38	0.20	1.5
Trichloroethene (TCE)	79-01-6	131.4	0.20	1.1
Trichlorofluoromethane (Freon 11)	75-69-4	137.38	0.20	1.1
1,2,4-Trimethylbenzene	95-63-6	120.19	0.20	0.98
1,3,5-Trimethylbenzene	108-67-8	120.19	0.20	0.98
2,2,4-Trimethylpentane	540-84-1	114.23	0.50	2.3
Vinyl Chloride	75-01-4	62.5	0.20	0.51

Notes:

a. Actual reporting limits of field samples may be higher due to sample dilution by the laboratory to quantify compounds at elevated concentrations. (see note b)

b. The laboratory must notify KeySpan prior to sample dilution.

c. ppbv = part per billion by volume

d. ug/m 3 = microgram per cubic meter

Table 9
Soil Cleanup Objectives
Williamsburg Works Former MGP Site
Remedial Investigation
Brooklyn, New York

Analytes	Unrestricted Use (ppm)	Residential Use (ppm)	Restricted-Residential Use (ppm)	Restricted-Commercial Use (ppm)	Restricted-Industrial Use (ppm)	Protection of Groundwater (ppm)	Protection of Ecological Resources (ppm)
Volatile Organic Compounds							
Acetone	0.05	100	100	500	1,000	0.05	2.2
Benzene	0.06	2.9	4.8	44	89	0.06	70
Butanone, 2-	0.12	100	100	500	1,000	0.12	100
Butylbenzene, n-	12	100	100	500	1,000	12	NE
Butylbenzene, tert-	5.9	100	100	500	1,000	5.9	NE
Butylbenzene,sec-	11	100	100	500	1,000	11	NE
Carbon tetrachloride	0.76	1.4	2.4	22	44	0.76	NE
Chlorobenzene	1.1	100	100	500	1,000	1.1	40
Chloroform	0.37	10	49	350	700	0.37	12
Dichlorobenzene,1,2-	1.1	100	100	500	1,000	1.1	NE
Dichlorobenzene,1,3-	2.4	17	49	280	560	2.4	NE
Dichlorobenzene,1,4-	1.8	9.8	13	130	250	1.8	20
Dichloroethane,1,1-	0.27	19	26	240	480	0.27	NE
Dichloroethane,1,2-	0.02	2.3	3.1	30	60	0.02	10
Dichloroethene, cis-1,2-	0.25	59	100	500	1,000	0.25	NE
Dichloroethene,1,1-	0.33	100	100	500	1,000	0.33	NE
Dioxane,1,4-	0.1	9.8	13	130	250	0.1	0.1
Ethylbenzene	1	30	41	390	780	1	NE
Methyl tert-butyl ether	0.93	62	100	500	1,000	0.93	NE
Methylene chloride	0.05	51	100	500	1,000	0.05	12
Naphthalene	12	100	100	500	1,000	12	NE
Propylbenzene, n-	3.9	100	100	500	1,000	3.9	NE
Tetrachloroethene	1.3	5.5	19	150	300	1.3	2
Toluene	0.7	100	100	500	1,000	0.7	36
Trans-1,2-dichloroethene	0.19	100	100	500	1,000	0.19	NE
Trichloroethane, 1,1,1-	0.68	100	100	500	1,000	0.68	NE
Trichloroethene	0.47	10	21	200	400	0.47	2
Trimethylbenzene, 1,2,4-	3.6	47	52	190	380	3.6	NE
Trimethylbenzene, 1,3,5-	8.4	47	52	190	380	8.4	NE
Vinyl chloride	0.02	0.21	0.9	13	27	0.02	NE
Xylene, total	0.26	100	100	500	1,000	1.6	0.26

Table 9
Soil Cleanup Objectives
Williamsburg Works Former MGP Site
Remedial Investigation
Brooklyn, New York

Analytes	Unrestricted Use (ppm)	Residential Use (ppm)	Restricted-Residential Use (ppm)	Restricted-Commercial Use (ppm)	Restricted-Industrial Use (ppm)	Protection of Groundwater (ppm)	Protection of Ecological Resources (ppm)
Semivolatile Organic Compounds							
Acenaphthene	20	100	100	500	1,000	98	20
Acenaphthylene	100	100	100	500	1,000	107	NE
Anthracene	100	100	100	500	1,000	1,000	NE
Benz[a]anthracene	1	1	1	5.6	11	1	NE
Benzo[a]pyrene	1	1	1	1	1.1	22	2.6
Benzo[b]fluoranthene	1	1	1	5.6	11	1.7	NE
Benzo[g,h,i]perylene	100	100	100	500	1,000	1,000	NE
Benzo[k]fluoranthene	0.8	1	3.9	56	110	1.7	NE
Chrysene	1	1	3.9	56	110	1	NE
Dibenz[a,h]anthracene	0.33	0.33	0.33	0.56	1.1	1,000	NE
Dibenzofuran	7	14	59	350	1,000	210	NE
Fluoranthene	100	100	100	500	1,000	1,000	NE
Fluorene	30	100	100	500	1,000	386	30
Hexachlorobenzene	0.33	0.33	1.2	6	12	3.2	NE
Indeno[1,2,3-cd]pyrene	0.5	0.5	0.5	5.6	11	8.2	NE
Methylphenol, 4-	0.33	34	100	500	1,000	0.33	NE
Cresol, m (methylphenol, 3-)	0.33	100	100	500	1,000	0.33	NE
Methylphenol,2-	0.33	100	100	500	1,000	0.33	NE
Pentachlorophenol	0.8	2.4	6.7	6.7	55	0.8	0.8
Phenanthrene	100	100	100	500	1,000	1,000	NE
Phenol	0.33	100	100	500	1,000	0.33	30
Pyrene	100	100	100	500	1,000	1,000	NE
Pesticides							
Aldrin	0.005	0.019	0.097	0.68	1.4	0.19	0.14
Alpha-bhc	0.02	0.097	0.48	3.4	6.8	0.02	0.04
Alpha-chlordane	0.094	0.91	4.2	24	47	2.9	1.3
Beta-BHC	0.036	0.072	0.36	3	14	0.09	0.6
DDD,4,4-	0.0033	2.6	13	92	180	14	0.0033
DDE,4,4-	0.0033	1.8	8.9	62	120	17	0.0033
DDT,4,4-	0.0033	1.7	7.9	47	94	136	0.0033
Delta-BHC	0.04	100	100	500	1,000	0.25	0.04
Dieldrin	0.005	0.039	0.2	1.4	2.8	0.1	0.006
Endosulfan I	2.4	4.8	24	200	920	102	NE
Endosulfan II	2.4	4.8	24	200	920	102	NE
Endosulfan sulfate	2.4	4.8	24	200	920	1,000	NE

Table 9
Soil Cleanup Objectives
Williamsburg Works Former MGP Site
Remedial Investigation
Brooklyn, New York

Analytes	Unrestricted Use (ppm)	Residential Use (ppm)	Restricted-Residential Use (ppm)	Restricted-Commercial Use (ppm)	Restricted-Industrial Use (ppm)	Protection of Groundwater (ppm)	Protection of Ecological Resources (ppm)
Endrin	0.014	2.2	11	89	410	0.06	0.014
Gamma-BHC	0.1	0.28	1.3	9.2	23	0.1	6
Heptachlor	0.042	0.42	2.1	15	29	0.38	0.14
Silvex	3.8	58	100	500	1,000	3.8	NE
Polychlorinated Biphenyls (PCBs)							
Total PCBs	0.1	1	1	1	25	3.2	1
Metals							
Arsenic	13	16	16	16	16	16	13
Barium	350	350	400	400	10,000	820	433
Beryllium	7.2	14	72	590	2700	47	10
Cadmium	2.5	2.5	4.3	9.3	60	7.5	4
Chromium (VI)	1	22	110	400	800	19	1
Chromium (III)	30	36	180	1500	6800		41
Copper	50	270	270	270	10,000	1720	50
Lead	63	400	400	1000	3900	450	63
Manganese	1600	2000	2,000	10,000	10,000	2,000	1600
Mercury	0.18	0.81	0.81	2.8	5.7	0.73	0.18
Nickel	30	140	310	310	10,000	130	30
Selenium	3.9	36	180	1500	6800	4	3.9
Silver	2	36	180	1500	6800	8.3	2
Zinc	109	2200	10,000	10,000	10,000	2480	109
Cyanide							
Cyanide, Total	27	27	27	27	10,000	40	NE

Notes:
ppm - parts per million

Table 10
Groundwater Standards /Guidance Values
Williamsburg Works MGP Site
Remedial Investigation
Brooklyn, New York

Parameter	DQL[1]
Volatile Organic Compounds	
Acetone	50
Benzene	1
2-Butanone	50
Carbon Disulfide	NE
Carbon Tetrachloride	5
Chlorobenzene	5
Chloroethane	5
Chloroform	7
Dibromochloromethane	50
1,2-Dichlorobenzene	3
1,3-Dichlorobenzene	3
1,4-Dichlorobenzene	3
1,1-Dichloroethane	5
1,2-Dichloroethane	**0.6**
1,1-Dichloroethene	5
trans-1,2-Dichloroethene	5
1,3-Dichloropropane	5
Ethylbenzene	5
Freon 113	5
Methylene chloride	5
4-Methyl-2-pentanone	503
Tetrachloroethene	5
1,1,1-Trichloroethane	5
1,1,2,2-Tetrachloroethane	5
1,2,3-Trichloropropane	**0.04**
1,2,4-Trichlorobenzene	5
Toluene	5
Trichloroethene	5
Vinyl chloride	2
Xylenes	5
Isopropylbenzene	5
n-Propylbenzene	5
p-Isopropyltoluene	5
1,2,4-Trimethylbenzene	5
1,3,5-Trimethylbenzene	5
n-Butylbenzene	5
sec-Butylbenzene	5
t-Butylbenzene	5
MTBE	10

Table 10
Groundwater Standards /Guidance Values
Williamsburg Works MGP Site
Remedial Investigation
Brooklyn, New York

Parameter	DQL[1]
Pesticides	
Aldrin	ND
alpha-BHC	**0.01**
beta-BHC	0.04
delta-BHC	0.04
Chlordane	**0.05**
4,4'-DDD	0.3
4,4'-DDE	0.2
4,4'-DDT	0.2
Dieldrin	**0.004**
Endosulfan I	NE
Endosulfan II	NE
Endosulfan sulfate	NE
Endrin	ND
Endrin ketone	5
gamma-BHC (Lindane)	0.05
gamma-Chlordane	NE
Heptachlor	0.04
Heptachlor epoxide	0.03
Methoxychlor	35
2,4'-DDD	NE
Aniline	5
Semivolatile Organic Compounds	
Acenaphthene	20
Acenaphthylene	NS
Anthracene	50
Benzo(a)anthracene	**0.002**
Benzo(a)pyrene	ND
Benzo(b)fluoranthene	**0.002**
Benzo(g,h,i)perylene	NE
Benzo(k)fluoranthene	**0.002**
Bis(2-ethylhexyl)phthalate	5
Butylbenzylphthalate	50
Chrysene	**0.002**
4-Chloroaniline	5
4-Chloro-3-methylphenol	**1**
2-Chlorophenol	**1**
Dibenzofuran	NE
Dibenz(a,h)anthracene	NE
3,3'-Dichlorobenzidine	5
2,4-Dichlorophenol	5

Table 10
Groundwater Standards /Guidance Values
Williamsburg Works MGP Site
Remedial Investigation
Brooklyn, New York

Parameter	DQL[1]
2,4-Dinitrophenol	**10**
2,6-Dinitrotoluene	5
Diethylphthalate	50
Dimethylphthalate	50
Di-n-butylphthalate	50
Di-n-octylphthalate	50
Fluoranthene	50
Fluorene	50
Hexachlorobenzene	**0.04**
Indeno(1,2,3-cd)pyrene	**0.002**
Isophorone	50
2-Methylnaphthalene	NE
2-Methylphenol	**1**
4-Methylphenol	**1**
Naphthalene	10
Nitrobenzene	**0.4**
2-Nitroaniline	5
2-Nitrophenol	**1**
4-Nitrophenol	**1**
3-Nitroaniline	5
Pentachlorophenol	**1**
Phenanthrene	50
Phenol	**1**
Pyrene	50
2,4,5-Trichlorophenol	**1**
Total Metals	
Aluminum	NE
Antimony	**3**
Arsenic	25
Barium	1000
Beryllium	3
Cadmium	5
Calcium	NE
Chromium	50
Cobalt	NE
Copper	200
Iron	300
Lead	25
Magnesium	35,000
Manganese	300
Mercury	0.7

Table 10
Groundwater Standards /Guidance Values
Williamsburg Works MGP Site
Remedial Investigation
Brooklyn, New York

Parameter	DQL[1]
Nickel	100
Potassium	NE
Selenium	10
Silver	50
Sodium	20,000
Thallium	**0.5**
Vanadium	NE
Zinc	2000
Polychlorinated Biphenyls (PCBs)	
Aroclor 1016	**0.09**
Aroclor 1221	**0.09**
Aroclor 1232	**0.09**
Aroclor 1242	**0.09**
Aroclor 1248	**0.09**
Aroclor 1254	**0.09**
Aroclor 1260	**0.09**
Cyanide	
Cyanide	200

[1] DQL based on TOGS Ambient Water Quality Standards and Guidance Values and Groundwater Effluent Limitations (June, 1998)
[2] DQL listed is for total PCBs
DQL = Data Quality Level
NE = None established
ND = Not detected when analyzed by method listed in Table 7
Compounds which will not achieve the DQL are highlighted

Appendix A

Laboratory Quality Manual (electronic only)

SEVERN TRENT LABORATORIES - CONNECTICUT
LABORATORY QUALITY MANUAL
Revision: 6

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Approved by:

Peter Frick, Laboratory Director — Date: March 22, 2005

Marsha K. Culik, Quality Assurance Manager — Date: March 22, 2005

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1. Introduction, Purpose, and Scope

1.1. Severn Trent Laboratories (STL) Overview

Severn Trent Plc is a leading environmental services group providing water, waste and utility services. The businesses include Severn Trent Water, Biffa, Severn Trent Laboratories (STL) and Severn Trent Services.

The corporate vision is to be at the forefront of the environmental services industry. The corporate values of environmental leadership, service and quality define the business culture and strategic direction.

STL offers a broad range of environmental testing services provided by over two thousand professionals in the US. STL's testing capabilities include chemical, physical, and biological analyses of a variety of matrices, including aqueous, solid, drinking water, waste, tissue, air and saline/estuarine samples. Specialty capabilities include air toxics, radiological testing, tissue preparation and analysis, aquatic toxicology, microbiology, Mycology, asbestos, microscopy services, and on-site technologies including mobile laboratory services.

This plan is intended to describe the quality assurance program of the STL-Connecticut facility located at 128 Long Hill Cross Roads, Shelton, Connecticut. STL operates a corporate wide quality assurance program and this facility QA program complies with the requirements set forth in the corporate program.

1.2. Quality Assurance Policy

It is STL's policy to:

- Provide high quality, consistent, and objective environmental testing services that meet all federal, state, and municipal regulatory requirements.
- Generate data that are scientifically sound, legally defensible, meet project objective, and are appropriate for their intended use.
- Provide STL clients with the highest level of professionalism and the best service practices in the industry.
- Build continuous improvement mechanisms into all laboratory, administrative and managerial activities.
- Maintain a working environment that fosters open communication with both clients and staff and ensures data integrity.

1.3. Management Commitment to Quality Assurance

STL management is committed to providing the highest quality data and the best overall service in the environmental testing industry. To ensure that the data produced and reported by STL meet the requirements of its clients and comply with the letter and spirit of municipal, state and federal regulations, STL maintains a Quality System that is clear, effective, well communicated, and supported at all levels in the company.

STL Vision and Mission Statement

Vision

STL will be the recognized industry leader for environmental analysis.

Mission

Through the innovation and dedication of our people, together with the quality of our systems, we will deliver levels of performance that delight our clients, retain the confidence of our stakeholders and enable the profitable growth of our business.

1.4. Purpose

The purpose of this Laboratory Quality Manual (LQM) is to describe the STL-Connecticut Quality System and to outline how that system enables all employees of STL-Connecticut to meet the Quality Assurance (QA) policy. The LQM also describes specific QA activities and requirements and prescribes their frequencies. Roles and responsibilities of management and laboratory staff in support of the Quality System are also defined in the LQM. In some cases, the requirements in the facility QA program may be more stringent than the corporate program, but in no case can they be less stringent.

1.5. Scope

The requirements set forth in this document are applicable to the STL-Connecticut quality systems and laboratory operations.

STL operates under the regulations and guidelines of the following federal programs:

US Army Corp of Engineers, Hazardous, Toxic and Radioactive Waste (USACE HTRW)
Clean Air Act (CAA)
Clean Water Act (CWA)

Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA)
New York State Department of Environmental Conservation (NYSDEC)
National Pollution, Discharge, and Elimination System (NPDES, NJPDES)
Resource Conservation and Recovery Act (RCRA)
Safe Drinking Water Act (SDWA)
US Army Corps of Engineers, Hazardous, Toxic and Radioactive Waste (USACE HTRW)

STL also provides services under various state and local municipal guidelines. A current list of Analytical Services and certifications can be provided by the laboratory or viewed on the MySTL webpage at www.MySTL-inc.com.

This QMP was written to comply with the National Environmental Laboratory Accreditation Conference (NELAC) standards and the STL corporate Quality Management Plan, M-Q-001.

1.6 **Servicing**

Project Managers are the direct client contact and they ensure resources are available to meet project requirements. Although Project Managers do not have direct reports or staff in production, they coordinate opportunities and work with laboratory management and supervisory staff to ensure available resources are sufficient to perform work for the client's project. Project Managers provide a link between the client and laboratory resources.

The laboratory has established procedures for performing and verifying that client servicing meets requirements. Typical services provided are:

- Sample Containers/Supplies – *Container Management: Process Operation* (VCM-001)
- Project QAP preparation – *Project Planning Process* (VPM-002)
- Regulatory advisory functions – *Project Planning Process* (VPM-002)
- Consulting -- *Project Planning Process* (VPM-002)

Regulatory and advisory functions are addressed under the same procedures used for project planning.

2. References

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

EPA Requirements For Quality Management Plans, EPA QA/R-2, United States Environmental Protection Agency Management Staff, Washington, DC, Draft Interim Final, March 2001.

EPA Quality Manual for Environmental Programs, 5360, US EPA Office of Research and Development, National Center for Environmental Research and Quality Assurance, Quality Assurance Division, July 1998.

Good Automated Laboratory Practices, EPA 2185, 1995.

National Environmental Laboratory Accreditation Conference, Constitution, Bylaws, and Standards, EPA600/R-98/151, US EPA Office of Research and Development, July 2000.

Shell for Analytical Chemistry Requirements, US Army Corps of Engineers, 2001.

DOD Quality Systems manual (QSM) for Environmental Laboratories, Version 2

3. *Terms and Definitions*

Accuracy: the degree of agreement between an observed value and an accepted reference value.

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 the same 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.

Chain of Custody (COC): an unbroken trail of accountability that ensures the physical security of samples, data and records.

Clean Air Act: legislation in 42 U.S.C. 7401 et seq., Public Law 91-604, 84 Stat. 1676 Pub. L. 95-95, 91 Stat., 685 and Pub. L. 95-190, 91 Stat., 1399, as amended.

Comprehensive Environmental Response, Compensation and Liability Act (CERCLA/Superfund): legislation (42 U.S.C. 9601-9675 et seq., as amended by the Superfund Amendments and reauthorization Act of 1986 (SARA), 42 U.S.C. 9601et seq.

Compromised Sample: a sample received in a condition that jeopardizes the integrity of the results. See Section 4.7.1 for a description of these conditions.

Confidential Business Information (CBI): information that an organization designates as having the potential of providing a competitor with inappropriate insight into its management, operation or products.

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.

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.

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

Document Control: the act of ensuring that documents (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.

Federal Water Pollution Control Act (Clean Water Act, CWA): legislation under 33 U.S.C. 1251 et seq., Public Law 92-50086 Stat. 816.

Field Blank: a blank matrix brought to the field and exposed to field environmental conditions.

Field of Testing (FOT): a field of testing is based on NELAC's categorization of accreditation based on program, matrix, analyte.

Good Laboratory Practices (GLP): formal regulations for performing basic laboratory operations outlined in 40 CFR Part 160 and 40 CFR Part 729 and required for activities performed under FIFRA and TSCA.

Holding Time: the maximum time that a sample may be held before preparation and/or analysis and still be considered valid as promulgated in the method.

Initial Demonstration of Capability (IDC): procedure to establish the ability to generate acceptable accuracy and precision. Also referred to as Initial Demonstration of Proficiency.

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 on specific instrument, with a specified degree of confidence that the amount is greater than zero. The IDL is associated with the instrumental portion of a specific method only, and specific sample preparation steps are not considered in its derivation.

A calculated IDL, by definition, has an uncertainty of +100% with 99% confidence, and is the point at which the possibility of detection of false negatives is 50 % and false positives is 1%. The IDL thus represents a range where qualitative detection occurs on a specific instrument. Quantitative results are not produced in this range.

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

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 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. (see MDL)

Matrix: The substrate of a test sample. For purposes of batch and QC requirements determination, the matrix descriptions in Table 1 are used.

Table 1 Matrix Descriptions

Matrix	Description
Air	Air samples as analyzed directly or as adsorbed into a solution or absorption matrix and desorbed.
Aqueous	Aqueous sample excluded from the definition of Drinking Water or Saline/Estuarine source. Includes surface water, groundwater and effluents.
Drinking Water	Aqueous sample that has been designated a potable water source.
Saline	Aqueous sample from an ocean or estuary, or other salt-water source such as the Great Salt Lake.
Liquid	Liquid with <15% settleable solids.
Solid	Soil, sediment, sludge or other matrices with ≥15% settleable solids.
Waste	A product or by-product of an industrial process that results in a matrix not previously defined.
Tissue	Sample of a biological origin such as fish tissue, shellfish, or plant material. Such samples shall be grouped according to origin.

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

Matrix Spike (MS): field sample to which a known amount of target analyte(s) is added.

Matrix Spike Duplicate (MSD): a replicate matrix spike.

Method Blank: a blank matrix 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 method. An MDL, by definition, has an uncertainty of +100% with 99% confidence, and is the point as which the possibly of detection of false negative is 50% and false positive is 1%. The MDL thus represents a range where qualitative detection occurs using a specific method. Quantitative results are not produced in this range. Also referred to as Limit of Detection.

Non-conformance: an indication, judgment, or state of not having met the requirements of the relevant specifications, contract, or regulation.

Precision: the degree to which a set of observations or measurements of the same property, usually obtained under similar conditions, conform to themselves; a data quality indicator.

Preservation: refrigeration and or reagents added at the time of sample collection to maintain the chemical and or biological integrity of the sample.

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

Proficiency Test (PT) Sample: a sample, the composition of which is unknown to the analyst, that is provided to test whether the analyst/laboratory can produce analytical results within specified performance limits. Also referred to as Performance Evaluation (PE) sample.

Proprietary: belonging to a private person or company.

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

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 whose purpose is to measure and control the quality of a product or service so that it meets the needs of users.

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

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 lowest point at which a substance can be quantitatively measured with a specified degree of confidence using a specific method. 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 a Practical Quantitation Level (PQL), Estimated Quantitation Level (EQL), or Limit of Quantitation (LOQ).

Raw Data: any original information from a measurement activity or study recorded in a laboratory notebook, 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 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 report 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.

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.

Resource Conservation and Recovery Act (RCRA): legislation under 42 USC 321 et seq. (1976).

Safe Drinking Water Act (SDWA): legislation under 42 USC 300f et seq. (1974), (Public Law 93-523).

Sampling and Analysis Plan (SAP): A formal document describing the detailed sampling and analysis procedures for a specific project.

Selectivity: The capability of a method or instrument to respond to a target substance or constituent in the presence of non-target substances.

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

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

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

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.

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

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

Test Method: defined technical procedure for performing a test.

Toxic Substances Control Act (TSCA): legislation under 15 USC 2601 et seq., (1976).

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.

Verification: confirmation by examination and provision of evidence that specified requirements have been met.

4. Management Requirements

4.1. Organization and Management

4.1.1. Organization

The STL-Connecticut organizational structure is presented on the organizational chart as outlined in the appendix. A QA Manager is designated at the STL facility and reports to the Laboratory Director. The facility QA Manager has an indirect reporting relationship to the Corporate QA Director.

4.1.2. Roles and Responsibilities

President

The President of STL, Inc. has overall management responsibility and authority for Severn Trent's laboratory division, including responsibility for budgeting, resource allocation, long term planning, sales, marketing, and final approval on all management and administrative policies and management plans. The President authorizes the STL Corporate LQM and as such, sets the standards for the Quality System.

Chief Operating Officer (COO)
The COO is responsible for daily management of all STL facilities. The COO's responsibilities include allocation of personnel and resources, long term planning, and development of technical policies and management plans. The COO authorizes the STL Corporate LQM and is responsible for ensuring that business operations are conducted in accordance with its requirements.

Vice President Client and Operations Services (VP COS)
The VP of Operations Services is responsible for all essential elements of offerings to clients, including risk management, legal compliance and contract administration, quality assurance, information technology, and environmental health and safety. The VP COS authorizes the QMP and responsibilities include authorization of Manuals, Policies and Procedures, providing support and direction to the Managers of these areas, and supporting the COO in decisions regarding long term planning, resource allocation, and capital expenditures.

QA Director
The QA Director is responsible for establishing, implementing and communicating STL's quality system. The QA Director monitors compliance with the QMP, provides regulatory and technical updates to the STL facilities, assists in development of management plans and technical policies to be approved by the COO, and coordinates training within STL. The QA Director is available to any employee in STL to resolve data quality or ethical issues. The QA Director is independent of operational functions.

Director of Technical Services
The Director of Technical Services is responsible for establishing, implementing and communicating STL's Technical Policies, Standard Operating Procedures, and Manuals. Other responsibilities include conducting technical assessments as required, acting as a technical resource in national contracts review, coordinating new technologies, establishing best practices throughout STL, advising STL staff on technology advances, innovations, and applications, and organizing and running STL's technical committee.

Chief Information Officer (CIO)
The CIO is responsible for establishing, implementing and communicating STL's IT Policies, Standard Operating Procedures, and Manuals. Other responsibilities include coordinating new technologies, development of electronic communication tools such as STL's intranet and internet sites, ensuring data security and documentation of software, ensuring compliance with Good Automated Laboratory Practices (GALP), and assistance in establishing, updating, and maintaining Laboratory Information Management Systems (LIMS) at the various STL facilities.

Environmental Health and Safety (EH&S) Director
The Health and Safety Coordinator is responsible for the safety and well-being of all employees while at the laboratory. This includes, but is not limited to, administering the Corporate Safety Manual that complies with federal regulations, MSDS training and review, conducting laboratory safety orientation and tours for all new employees, providing instructions on safety equipment, cleaning up laboratory spills, and instructing personnel of laboratory procedures for emergency situations. The Health and Safety Coordinator is on-call 24-hours a day, 7-days a week for all laboratory situations.

The Health and Safety Coordinator responsibilities additionally include waste management of laboratory generated hazardous waste in accordance with appropriate regulations. This includes maintenance of required documentation, such as waste manifests, segregation of waste in accordance with requirements, and training of personnel in proper segregation of waste and preparation of Safety related SOPs.

General Manager (GM)
The GM is directly responsible for the daily operations of one or more operating facilities within STL. The GM's responsibilities include allocation of personnel and resources, long term planning, setting goals, and achieving the financial, business, and quality objectives of STL. The GM ensures timely compliance with corporate management directives, policies, and management systems reviews.

Laboratory Director
The Laboratory Director oversees the daily operations of the laboratory. The Laboratory Director's responsibilities include supervision of staff, setting goals for the employees, and achieving the financial, business, and quality objectives of the facility. The Laboratory Director is to maintain technical understanding of analytical methodology for

the laboratory operations, development of procedural improvements and investigation of non-conformances.

QA Manager

The Quality Assurance Manager (QAM) has the full-time responsibility to evaluate the adherence to policies and to assure that systems are in place to produce the level of quality defined in this LQM. The QAM is responsible for:

- Ensures IDL/MDL studies are completed and documented
- Ensures method validation studies are completed and documented
- Periodically performs data package inspections
- Performs data authenticity audits on 100% of analysts and instruments
- Assist in the preparation, compilation, and submittal of quality assurance project plans
- Reviews program plans for consistency with organizational and contractual requirements and advises appropriate personnel of deficiencies
- Maintains QA records
- Maintains certifications and accreditations
- Initiates and oversees both internal and external audits; documents root cause investigations for all noted deficiencies; and ensures timely audit closure
- Maintains a corrective action process for internally identified issues and ensures timely closure
- Manages the laboratory's PT Program and performs/documents root cause investigations for all failures
- Monitors to ensure the documentation of training and method demonstration are current
- Facilitates SOP development and document control

The QA Manager shall have the final authority to accept or reject data, and to stop work in progress in the event that procedures or practices compromise the validity and integrity of analytical data. The QAM is available to any employee at the facility to resolve data quality or ethical issues. The QA Manager shall be independent of laboratory operations and has an indirect reporting relationship to the QA Director.

Project Managers

The laboratory recognizes the importance of efficient project management. The laboratory Project Managers (PM) are responsible for preparing the project technical profile which summarizes QA/QC requirements for the project, maintaining the laboratory schedule, communicating technical requirements to the laboratory, and advising the Laboratory, QA and Technical Managers of all variances. The laboratory Project Manager will provide technical guidance and the necessary laboratory-related information to the preparer of project-specific QAPPs and provide peer review of the final document to ensure accuracy of the laboratory information.

Technical Managers (Laboratory Departmental Group Leader/Supervisor)

The Laboratory Supervisor oversees the daily operations of their particular laboratory department. The supervisor's responsibilities include supervision of staff, setting goals and objectives for their employees, and achieving the business and quality objectives of the facility.

4.2. Quality System

4.2.1. Objectives of STL-Connecticut Quality System

The goal of the STL-Connecticut Quality System is to ensure that business operations are conducted with the highest standards of professionalism in the industry.

To achieve this goal, it is necessary to provide our clients with scientifically sound, well documented, regulatory compliant data, and to ensure that we provide the highest quality service available in the industry with uncompromising data integrity. A well-structured, organized and communicated quality system is essential in meeting this goal. The laboratory's quality system is designed to minimize systematic error, encourage constructive, documented problem solving, and provides a framework for continuous improvement.

This LQM, Work Instructions and the SOPs are the basis and outline for our quality and data integrity system and contain requirements and general guidelines under which the laboratory conducts operations. In addition, other documents may be used by the laboratory to clarify compliance with quality system or other client requirements. Within the LQM, SOP or Work Instruction numbers are noted in parenthetic text. These numbers refer to the laboratory procedure(s) associated with the subject item. A table listing these quality system policies and procedures is appended to this document.

The QA Manager is responsible for implementing and monitoring the Quality System. The QA Manager reports to the Laboratory Director on the performance of the quality system for review and continuous improvement. The QA Manager has sufficient authority, access to work areas, and organizational freedom (including sufficient independence from cost and schedule considerations) to:

- Initiate action to prevent the occurrence of any nonconformities related to product, process and quality system,
- Identify and record any problems affecting the product, process and quality system,
- Initiate, recommend, or provide solutions to problems through designated channels,
- Verify implementation of solutions, and
- Assure that further work is stopped or controlled until proper resolution of a non-conformance, deficiency, or unsatisfactory condition has occurred and the deficiency or unsatisfactory condition has been corrected.

The QA Manager identifies opportunities for continual improvement. When a situation arises where acceptable resolution of identified issues cannot be agreed upon at the laboratory, direct access to STL's Corporate Quality Director is available. This provides laboratory QA personnel independence, where needed, to ensure that QA policies and procedures are enforced.

The Laboratory Quality Manual is the basis and outline for the STL-Connecticut Quality System and contains guidelines under which the STL-Connecticut facility conducts operations in accordance with the STL Corporate Quality Management Plan (QMP).

4.2.2. Laboratory Quality Manual (LQM)

The following elements are addressed in the STL-Connecticut facility's LQM:

1. Table of Contents, lists of references and glossaries, and appendices.
2. Quality policy statement, including objectives and commitments, by facility management.
3. Organization and management structure of the laboratory, its place in the STL organization and relevant organizational charts.
4. Relationship between management, technical operations, support services and the quality system.
5. Record retention procedure.
6. Document control procedure.
7. Job descriptions of essential staff and reference to job descriptions of other staff.
8. Identification of the laboratory's approved signatories.
9. Procedure for achieving traceability of measurements.
10. List of test methods under which the laboratory performs its testing.
11. Procedure for reviewing new work.
12. Reference to the calibration and/or verification test procedures used.
13. Sample handling procedure.
14. Reference to the major equipment, reference standards, facilities and services used by the laboratory in conducting tests.
15. Reference to procedures for calibration, verification and maintenance of equipment.
16. Reference to verification practices including inter-laboratory comparisons, proficiency testing programs, use of reference materials and internal QC practices.
17. Procedures for feedback and corrective action when testing discrepancies are detected, or departures from policies and procedures occur.
18. Procedure for exceptionally permitting departures from documented policies and procedures or from standard specifications.
19. Procedure for dealing with client complaints.
20. Procedure for protecting client confidentiality and proprietary rights.
21. Procedure for audits and data review.

22. Procedure for establishing that personnel are adequately experienced and trained.
23. Reference to procedures for reporting analytical results.

4.3. Document Control

A system of document control is essential to provide the framework necessary to ensure that methods and procedures are followed in a consistent manner.

The STL-Connecticut laboratory has developed a centralized document control system and is administered by the QA department. The document control system provides for the following:

- A unique document control number for each document
- A central location for all documents
- A systematic method for distribution of approved documents
- A tracking system for existing documents
- Identification of document revisions
- A mechanism for periodic review of documents
- Archival of outdated material
- A focal point for information exchange
- Facilitates the establishment of standardized methods and procedures

4.3.1. Document Control Procedure

Security and control of documents is necessary to ensure that confidential information is not distributed and that all current copies of a given document are from the latest applicable revision. Unambiguous identification of a controlled document is maintained by identification of the following items in the document header: Document Name, Document Number, Effective Date, Number of Pages. Controlled documents are authorized by Management and/or the QA Department. Controlled documents are marked as such and records of their distribution are kept by the QA Department. Controlled documents, such as SOPs will be stamped in red with "Controlled Document #". If this writing is not in red, then that copy will not be considered a controlled document.

4.3.2. Document Revision

Changes to documents occur when a procedural change warrants a revision of the document. When an approved revision of a controlled document is ready for distribution, obsolete copies of the document are replaced with the current version of the document. The previous revision of the controlled document is archived by the QA Department. Laboratory SOPs and quality documents are required to be reviewed annually and updated as needed.

A detailed description of the document control system is contained in STL-Connecticut SOP for Document Control. This document is available for inspection and review during a site visit. The Quality Assurance Manager is responsible for ensuring that the document control system is properly managed. Any new or revised document must be submitted to the QA Manager for review and distribution.

4.4. Request, Tender, and Contract Review

4.4.1. Contract Review

For many environmental sampling and analysis programs, testing design is site or program specific and does not necessarily "fit" into a standard laboratory service or product. It is STL's intent to provide both standard and customized environmental laboratory services to our clients. To ensure project success, technical staff perform a thorough review of technical and QC requirements contained in contracts. Contracts are reviewed for adequately defined requirements and STL's capability to meet those requirements.

Contract review shall include a review of the client's requirements in terms of compound lists, test methodology requested, sensitivity, accuracy, and precision requirements. The STL representative ensures that the laboratory's test methods are suitable to achieve these requirements and must ensure that the laboratory holds the appropriate certifications and approvals to perform the work. The review also includes the laboratory's capabilities in terms of turnaround time, capacity, and resources to provide the services requested, as well the laboratory's ability to provide the documentation, whether hardcopy or electronic. If the laboratory cannot provide all services but intends to subcontract such services, whether to another STL facility or to an outside firm, this must be documented and discussed with the client prior to contract approval.

All contracts entered into by STL are reviewed and approved by the appropriate personnel at the facility or facilities performing the work. Any contract requirement or amendment to a contract communicated to STL verbally is documented and confirmed with the client in writing. Any discrepancy between the client's requirements and STL's capability to meet those requirements is resolved in writing before acceptance of the contract. Contract amendments, initiated by the client and/or STL, are documented in writing for the benefit of both the client and STL.

All contracts, Quality Assurance Project Plans (LQMPs), Sampling and Analysis Plans (SAPs), contract amendments, and documented communications become part of the permanent project record as defined in Section 4.12.1.

4.4.2. Project Specific Quality Planning

Communication of contract specific technical and QC criteria is an essential activity in ensuring the success of site specific testing programs. To achieve this goal, STL assigns a Project Manager (PM) to each client. The PM is the first point of contact for the client. It is the PM's responsibility to ensure that project specific technical and QC requirements are effectively communicated to the laboratory personnel before and during the project. The labnet LIMS system used at STL-CT requires that project information be entered prior to samples being logged into the laboratory.

The STL - Connecticut facility has established many procedures in order to ensure that communication is inclusive and effective. These include project memos, designation and meetings of project teams, and meetings between the laboratory staff and the client. STL has found it very effective to invite the client into this process. STL strongly encourages our clients to visit the laboratories and hold formal or informal sessions with employees in order to effectively communicate client needs on an ongoing basis, as well as project specific details for customized testing programs.

4.4.3. Data Quality Objectives

Data Quality Objectives (DQO) are qualitative and quantitative statements used to ensure the generation of the type, quantity, and quality of environmental data that will be appropriate for the intended application. Typically, DQOs are identified before project initiation, during the development of QAPPs and SAPs. The analytical DQOs addressed in this section are precision, accuracy, representativeness, completeness, and comparability.

The components of analytical variability (uncertainty) can be estimated when QC samples of the right types and at the appropriate frequency are incorporated into measurement process at the analytical laboratory. STL incorporates numerous QC samples to obtain data for comparison with the analytical DQOs and to ensure that the measurement system is functioning properly. The QC samples and their applications, described in Section 5.8.2, are selected based on regulatory, method- or client-specific requirements. Analytical laboratory QC samples for inorganic, and organic analyses may include calibration blanks, instrument blanks, method blanks, LCS, calibration standards, MS, MSD, and surrogate spikes.

The DQOs discussed below ensure that data are gathered and presented in accordance with procedures appropriate for its intended use, that the data is of known and documented quality, and are able to withstand scientific and legal scrutiny.

Precision is an estimate of variability. It is an estimate of agreement among individual measurements of the same physical or chemical property, under prescribed similar conditions. Precision is expressed either as Relative Standard Deviation (RSD) for greater than two measurements or as Relative Percent Difference (RPD) for two

measurements. Precision is determined, in part, by analyzing data from aggregate LCS results, MS, MSD, and MD.

Precision also refers to the measurement of the variability associated with the entire process, from sampling to analysis. Total precision of the process can be determined by analysis of duplicate or replicate field samples and measures variability introduced by both the laboratory and field operations.

Accuracy is the degree of agreement between a measurement and the true or expected value, or between the average of a number of measurements and the true or expected value. It reflects the total error associated with a measurement.

Both random and systematic errors can affect accuracy. For chemical properties, accuracy is expressed either as a percent recovery (R) or as a percent bias (R - 100). Accuracy is determined, in part, by analyzing data from LCS, MS, and MSD.

Representativeness is the degree to which data accurately and precisely represent a characteristic of a population, a variation in a physical or chemical property at a sampling point, or an environmental condition. Data representativeness is primarily a function of sampling strategy; therefore, the sampling scheme must be designed to maximize representativeness. Representativeness also relates to ensuring that, through sample homogeneity, the sample analysis result is representative of the constituent concentration in the sample matrix. STL makes every effort to analyze an aliquot that is representative of the original sample, and to ensure the homogeneity of the sample before sub-sampling.

Completeness is defined as the percentage of measurements that are judged valid or useable. Factors negatively affecting completeness include the following: sample leakage or breakage in transit or during handling, loss of sample during laboratory analysis through accident or improper handling, improper documentation such that traceability is compromised, or sample result is rejected due to failure to conform to QC specifications. A completeness objective of 95% of the data specified by the statement of work is the goal established for most projects.

Comparability is a measure of the confidence with which one data set can be compared to another. Only data of known quality such as precision and bias be readily compared. To ensure comparability, all laboratory analysts are required to use uniform procedures (e.g., SOPs) and a uniform set of units and calculations for analyzing and reporting environmental data.

4.5. Subcontracting

STL Connecticut may find the need to send selected analyses to a subcontract laboratory either within the STL network or outside of the STL organization. The most common reason for utilization of a subcontract facility is that the procedure is not routinely

performed by the STL Connecticut laboratory and the subcontractor has greater experience in day-to-day execution of the method. All subcontract laboratories utilized by STL on a continuing basis require approval of the QA department prior to use, either on a corporate level or locally.

Subcontracting is arranged with the documented consent of the client, in a timely response which shall not be unreasonably refused. All QC guidelines specific to the client's analytical program are transmitted to the subcontractor and agreed upon before sending the samples to the subcontract facility. Proof of required certifications from the subcontract facility are maintained in STL project records. Where applicable, specific QC guidelines, LQMPs, and/or SAPs are transmitted to the subcontract laboratory. Samples are subcontracted under formal Chain of Custody (COC).

Subcontract laboratories may receive an on-site audit by a representative of the STL network's QA staff if it is deemed appropriate by the QA Manager. The audit involves a measure of compliance with the required test method, QC requirements, as well as any special client requirements.

Project reports from external subcontract laboratories are not altered and are included in original form in the final project report provided by STL.

Subcontracting may also occur between STL facilities. Subcontracting within STL is subject to the same requirements as detailed above.

4.6. Purchasing Services and Supplies

Evaluation and selection of suppliers and vendors is done, in part, on the basis of the quality of their products, their ability to meet the demand for their products on a continuous and short term basis, the overall quality of their services, their past history, and competitive pricing. This is achieved through evaluation of objective evidence of quality furnished by the supplier, which can include certificates of analysis, recommendations, and proof of historical compliance with similar programs for other clients. To ensure that quality critical consumables and equipment conform to specified requirements, all purchases from specific vendors are approved by a member of the supervisory or management staff. A list of current vendors used by the lab is on file with the QA dept along with any documented quality issues.

Chemical reagents, solvents, glassware, and general supplies are ordered as needed to maintain sufficient quantities on hand. Purchasing guidelines for equipment and reagents meet with the requirements of the specific method and testing procedures for which they are being purchased. Solvents and Acids are pretested in accordance with the SOP, S-T-001, Testing Solvents and Acids, at a predefined STL laboratory. Documentation of lot certification is communicated to the QAMs and posted on the STL intranet.

4.6.1 Solvent and Acid Lot Verification

Pre-purchase approval is performed for solvents and acids purchased in large quantities unless a certificate of conformance has been furnished. These may include acetone, ethyl ether, hexane, methylene chloride, nitric acid, hydrochloric acid, sulfuric acid, and hydrogen peroxide. Each lot of incoming supplies requiring pre-approval is checked against the previously approved lot number. If the lot number is not approved, the lot is refused. If the lot number is an approved lot number, it is accepted and documented. Solvents and acids are pre-tested in accordance with STLs Corporate *Testing Solvents and Acids* procedure (S-T-001) for all of the STL laboratories. A Certificate of Analysis is requested for all standards and reagents as applicable and kept on file at the laboratory.

4.7. Service to the Client

Each client is assigned a Project Manager . The PM is the focal point for setting up projects, placing bottle orders, reviewing sample receipts, monitoring jobs within the lab, communicating any analytical issues and reviewing the final report.

4.7.1. Sample Acceptance Policy

Samples are considered "compromised" if the following conditions are observed upon sample receipt:

- Cooler and/or samples are received outside of temperature specification.
- Samples are received broken or leaking.
- Samples are received beyond holding time.
- Samples are received without appropriate preservative.
- Samples are received in inappropriate containers.
- COC does not match samples received.
- COC is not properly completed or not received.
- Breakage of any Custody Seal.
- Apparent tampering with cooler and/or samples.
- Headspace in volatiles samples.
- Seepage of extraneous water or materials into samples.
- Inadequate sample volume.
- Illegible, impermanent, or non-unique sample labeling.

When "compromised" samples are received, it is documented in the project records and the client is contacted for instructions. If the client decides to proceed with analysis, the project report will clearly indicate any of the above conditions and the resolution.

4.7.2. Client Confidentiality and Proprietary Rights

Data and sample materials provided by the client or at the client's request, and the results obtained by STL, shall be held in confidence (unless such information is generally available to the public or is in the public domain or client has failed to pay STL for all services rendered or is otherwise in breach of the terms and conditions set forth in the STL and client contract) subject to any disclosure required by law or legal process. STL's reports, and the data and information provided therein, are for the exclusive use and benefit of client, and are not released to a third party without written consent from the client.

4.8. Complaints

STL believes that effective client complaint handling processes have important business and strategic value. Listening to and documenting client's concerns captures 'client knowledge' that helps to continually improve processes and outpace the competition. Implementing a client complaint handling process also provides assurance to the data user that the laboratory will stand behind its data, service obligations and products.

Client complaints or noted discrepancies are documented, communicated to management, and addressed promptly and thoroughly. Client complaints are documented by the employee receiving the complaint. The documentation can take the form of a corrective action report (as described in Section 4.10) or in a format specifically designed for that purpose. The Laboratory Director, PM, Customer Service Manager, and QA Manager are informed of all client complaints, and assist in resolving the complaint.

The nature of the complaint is identified, documented, and investigated, and an appropriate action is determined and taken. In cases where a client complaint indicates that an established policy or procedure was not followed, the QA department is required to conduct a special audit to assist in resolving the issue. A written confirmation, or letter to the client, outlining the issue and response taken is strongly recommended as part of the overall action taken.

The number and nature of client complaints is reported to the Corporate QA Manager in the QA Monthly report submitted by each facility. The overall number of complaints received per facility is tracked and the appropriateness of the response to client complaints is assessed. Monitoring and addressing the overall level and nature of client complaints and the effectiveness of the solutions is part of the Management Systems Review.

4.9. Control of Non-conformances

Non-conformances include any out of control occurrence. Non-conformances may relate to client specific requirements, procedural requirements, or equipment issues. All non-conformances in the laboratory are documented at the time of their occurrence.

All non-conformances that affect a sample and/or sample data become part of the affected project's permanent record. When appropriate, reanalysis is performed where QC data falls outside of specifications, or where data appears anomalous. If the reanalysis comes back within established tolerances, the results are approved. If the reanalysis is still outside tolerances, further reanalysis or consultation with the Supervisor, Manager, PM, Laboratory Director, or QA Manager for direction may be required. All records of reanalysis are kept with the project files.

Where non-conformances specifically affect a client's sample and/or data, the client is informed and action must be taken. Action can take the form of reporting and flagging the data, and including the non-conformance in the project narrative or cover letter.

4.10. Corrective Action

4.10.1. General

The STL-Connecticut facility has an established, documented corrective action process. Each corrective action is thoroughly investigated, and the investigation, outcome of the investigation, action taken, and follow-up is documented. Corrective action reports are reviewed, approved, and maintained by the QA department.

All corrective actions, whether immediate or long-term, will comprise the following steps to ensure a closed-loop corrective action process:

- Define the problem.
- Assign responsibility for investigating the problem.
- Determine a corrective action to eliminate the problem.
- Assign, and obtain commitment to, responsibility for implementing the corrective action.
- Implement the correction.
- Assess the effectiveness of the corrective action and verify that the corrective action has eliminated the problem.

4.10.1.1 Immediate Corrective Action

Immediate corrective actions to correct or repair non-conforming equipment and systems are generally initiated in response to adverse conditions identified through QC procedures. The analyst has relatively quick feedback that a problem exists, e.g., calibration does not meet or QC check samples exceed allowable criteria, and can take immediate action to repair the system.

The initial responsibility to monitor the quality of a function or analytical system lies with the individual performing the task or procedure. DQOs are evaluated against laboratory-established or against method or client specified QA/QC requirements. If the assessment reveals that any of the QC acceptance criteria are not met, the analyst must immediately assess the analytical system to correct the problem. When the appropriate corrective action

measures have been defined and the analytical system is determined to be "in-control" or the measures required to put the system "in-control" have been identified and scheduled, the problem and resolution or planned action is documented in the appropriate logbook or NCM. Data generated by an analytical system that is determined to be out-of-control must never be released without approval of the Section Manager, QA Manager, Laboratory Director and client notification.

4.10.1.2 Long-term Corrective Action

Long-term corrective action is generally initiated due to QA issues, which are most often identified during internal and external audits. Typically, a deeper investigation into the root cause of the nonconformance is warranted, and the problem may take much longer to identify and resolve. Staff training, method revision, replacement of equipment, and LIMS reprogramming are examples of long-term corrective action.

4.10.2. Initiation

Any employee in STL is authorized to initiate a corrective action. The initial source of corrective action can also be external to STL (i.e. corrective action because of client complaint, regulatory audit, or proficiency test). When a problem that requires corrective action is identified, the following items are identified by the initiator on the corrective action report: the nature of the problem, the name of the initiator, and the date. If the problem affects a specific client project, the name of the client and laboratory project number is recorded, and the PM is informed immediately.

4.10.3. Cause analysis

The corrective action process must be embarked upon as a joint, problem solving and constructive effort. Identification of systematic errors, or errors that are likely to occur repetitively due to a defect or weakness in a system, is particularly valuable in maintaining an environment of continuous improvement in laboratory operations.

When a corrective action report is initiated, the initiator works with the affected employee(s) and/or department(s) to identify the root cause of the problem. An essential part of the corrective action process is to identify whether the problem occurred due to a systematic or isolated error.

If the initiator of the corrective action report is uncertain as to what would constitute appropriate corrective action or is unable to resolve the situation, the problem is identified to the Supervisor, Manager, Laboratory Director or the QA Manager who provides assistance in the corrective action process.

The root cause of the problem and associated cause analysis is documented on the corrective action form.

4.10.4. Corrective Action

Once the root cause of a problem is identified, the initiator and affected employee(s) and/or department(s) examine potential actions that will rectify the present problem to the extent possible, and prevent recurrence of future, similar occurrences. An appropriate corrective action is then recommended. The corrective action must be appropriate for the size, and nature of the issue.

Implementation of the corrective action and the date of implementation are documented on the corrective action report.

Copies of the corrective action form are given to the appropriate department(s) and, if related to a specific project report, included in the project file. 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.

4.10.5. Monitoring Corrective Action

All corrective action reports are forwarded to the QA Department. The QA department reviews all corrective actions and selects one or more of the more significant corrective actions for inclusion in the annual systems audit. The QA Department also may implement a special audit. The purpose of inclusion of the corrective action process in both routine and special audits is to monitor the implementation of the corrective action and to determine whether the action taken has been effective in overcoming the issue identified.

4.11. Preventative Action

Preventative action is defined as noting and correcting a problem before it happens, because of a weakness in a system, method, or procedure. Preventative action includes analysis of the Quality System to detect, analyze, and eliminate potential causes of non-conformances. When potential problems are identified, preventative action is initiated to effectively address the problem to eliminate or reduce the risk identified. The preventative action process takes the same format as the corrective action process.

4.12. Records

It is the responsibility of all members of the laboratory to maintain complete records of all operations performed. All records shall be neat and organized. All laboratory records are the property of the laboratory and shall not be removed from the premises without permission from supervisors. All records are considered confidential and must be safeguarded. Unauthorized changes, loss or destruction of records can be grounds for dismissal from the laboratory. Consult the Severn Trent Laboratories Ethics Policy regarding integrity of data and employee conduct.

Measurement records must be recorded in pre-printed electronic record logs or pre-printed measurement logs. This policy will facilitate the organization and archival of all laboratory data for future reference. In some departments records maybe kept electronically using the labnet LIMS system. This may include standard prep, reagent prep or sample prep. Electronic records are backed up and safeguarded as per STL's IT policies.

All injection forms, instrumentation forms, sample prep forms, QC forms, etc. which are used to process samples and measurement results are described and attached to each analytical SOP. The SOP specifies where these records and forms are cataloged and stored.

All measurement data is recorded in pre-numbered, bound, logbooks in permanent ink. Transcriptions will be avoided whenever possible. The record will reflect the measurement performed and all appropriate details for conclusions related to the measurement. The record must be initialed and dated by the individual performing the measurement on the day the measurement is performed. Corrections shall be made by drawing a single line through the error, initialing and dating the error. All forms will be reviewed by the QA Manager annually. If it is found that the document does not meet the requirements of the SOP, the discrepancy is forwarded to the group/section leader through the corrective action process (reference SOP on Corrective Action Reports). Further detail on laboratory document control is found in the SOP on Document Control.

4.12.1. Record Types

Record types are described in Table 2.

Table 2 STL Record Types

Raw Data	Controlled Documents	QC Records	Project Records	Administrative Records
Calibration	LQM	Audits/ Responses	COC Documentation	Accounting
Computer Tapes/Disks	LQM	Certifications	Contracts and Amendments	EH&S, Manual, Permits, Disposal Records
QC Samples	SOPs	Corrective Action	Correspondence	Employee Handbook
Sample data		Logbooks*	QAPP	OSHA 29 CFR Part 1910
Software (Version control)		Method & Software Validation, Verification	SAP	Personnel files, Employee Signature & Initials, Training Records
		Standards Certificates	Telephone Logbooks	Technical and Administrative Policies

*Examples of Logbooks: Maintenance, Instrument Run, Preparation (standard and samples), Standard and Reagent Receipt, Archiving, Balance Calibration, Temperature,

4.12.2. Record Retention

Table 3 outlines STL's standard record retention time. For raw data and project records, record retention is calculated from the date the project report is issued. For other records, such as Controlled Documents, QC, or Administrative Records, the retention time is calculated from the date the document is formally retired. Drinking Water records are required to be stored for 10 years.

Table 3 STL Record Retention

Record Type	Department	Archival Requirement
Raw Data	All	5 Years from project completion
Controlled Documents	All	5 Years from document retirement date
QC	All	5 Years from archival
Project	All	5 Years from project completion
Administrative	Personnel/Training	7 years
	Accounting	See Accounting and Control Procedures Manual

4.12.3. Programs with Longer Retention Requirements

Specific client projects and regulatory programs have longer record retention requirements than the STL standard record retention length. In these cases, the longer retention requirement is noted in the archive. If special instructions exist such that client data cannot be destroyed prior to notification of the client, the container or box containing that data is marked as to who to contact for authorization prior to destroying the data.

4.12.4. Archives and Record Transfer

Archives are indexed such that records are accessible on either a project or temporal basis. Archives are protected against fire, theft, loss, deterioration, and vermin. Electronic records are protected from deterioration caused by magnetic fields and/or electronic deterioration. Access to archives is controlled and documented.

STL ensures that all records are maintained as required by the regulatory guidelines and per the LQM upon facility location change or ownership transfer.

Stored information may consist of hardcopy or electronic data stored on a magnetic media.

All hardcopy information is stored at the laboratory that generated the data or off-site at a commercial document storage facility equipped with a professional security system.

All electronic data is stored on-site at the laboratory that generated the data or off-site at a commercial document storage facility equipped with a professional security system and a controlled environment suitable for storage of magnetic media.

Access to archived information is controlled by the appropriate data management custodian or facility manager.

At STL-Connecticut, reports for the current year are filed by the data management department. The report files along with any data package are then stored in numbered boxes. The number of the box is recorded into the cross reference logs and then stored in the designated storage area. The previous year's data is stored off-site at a secure storage facility. All jobs must be signed out in a logbook if being removed from the data management area.

STL ensures that all records are maintained as required by the regulatory guidelines and per the LQM upon facility location change or ownership transfer. Upon STL facility location change, all archives are retained by STL in accordance with the LQM. Upon ownership transfer, record retention requirements are addressed in the ownership transfer agreement and the responsibility for maintaining archives is clearly established without disclosing client confidentiality. Clients shall be notified in the case of ownership transfer.

In the event that the laboratory is closed, all final test reports generated by the laboratory will be submitted to the clients if not previously provided. All records will then be transferred to STL's corporate record storage location. All boxes and contents will be appropriately labeled with the dates of destruction (Refer to Tables 5 and 6) and managed in accordance their policies.

4.13. Internal Audits

4.13.1. Audit Types and Frequency

A number of types of audits are performed at STL. Audit type and frequency are categorized in Table 4.

Table 4. Audit Types and Frequency

Audit Type	Performed by	Frequency
Systems	QA Department or Designee	Annual

Audit Type	Performed by	Frequency
Data	QA Department or Designee	**Data Report Review:** As necessary to ensure an effective secondary review process
		Analyst Data Audits: 100% of all analysts annually
		Electronic Data Audits: 100% of all organic instruments
Special	QA Department or Designee	As Needed

4.13.2. Systems Audits

Facility systems audits are technical in nature and are conducted on an ongoing basis by the QA Manager or his/her designee at each facility. Systems audits cover all departments of the facility, both operational and support.

The audit report is issued by the Internal Auditor of the facility within 30 calendar days of the audit. The audit report includes the following elements: Introduction, Scope of Audit, Type of Audit, Improvements and Innovations, Deficiencies, and a timeframe within which the audit must be addressed. The audit report is addressed to the Laboratory Director and copied to the General Manger. If the internal audit is performed by someone other than the facility QA Manager, the report must also be addressed to that QA Manger.

Written audit responses are required within 30 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 30 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.

4.13.3. Data Audits

Data audits are focused 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. Data audits may be accomplished through electronic instrument data audits, analyst data authenticity audits or final project report review.

A data auditing frequency target of 5% has been established. The QA Department provides feedback and/or corrections and revisions to project reports where necessary.

Data audits include spot-checking of manual integrations by QA personnel in order to determine that the manual integration is appropriate and documented according to Section 5.3.6.

Records of the data audits are kept, and the frequency of data audits is 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 process evaluation and change.

Where specific clients and regulatory programs require more frequent data auditing, the individual facility meets the data auditing frequency for that program. For projects falling under the DOD QSM, a 10% data audit frequency shall be followed.

4.13.3.1 Data Authenticity Audits

Data authenticity audits shall be performed on 100% of all analysts by the QA department or a designee independent from the operations. Performing data authenticity checks will typically include verifying raw data, evaluating calculation tools and independently reproducing the final results and comparing it to the hardcopy on randomly selected batches of data. The QA manager will report the percentage of analysts reviewed (for the year) in the monthly QA report and should average about 8% per month.

4.13.3.2 Electronic Data Audits

Electronic data audits are performed on 100% of all organic instruments by the QA department or a designee independent from the operations. This may include Mint Miner® scanning of randomly selected batches of electronic data followed by a chromatography system review. The QA manager will report the percentage of instruments reviewed (for the year) in the monthly QA report and should average about 8% of instruments per month. Electronic data audits include spot-checking of manual integrations by QA personnel in order to determine that the manual integration is appropriate and documented.

4.13.3.3 Final Reports Reviews

The frequency of auditing final reports depends on the effectiveness of the laboratory's secondary review process. If the laboratory infrequently finds report errors or there is a low percentage of revised reports due to analytical error, audits may be less frequent.

4.13.4. Special Audits

Special audits are conducted on an as needed basis, generally as a follow up to specific issues such as client complaints, corrective actions, proficiency testing results, data audits, systems audits, validation comments, or regulatory audits. Special audits are focused on a specific issue, and report format, distribution, and timeframes are designed to address the nature of the issue.

4.13.5. External Audits

STL facilities are routinely audited by clients and external regulatory authorities. STL is available for these audits and makes every effort to provide the auditors with the personnel, documentation, and assistance required by the auditors. STL recommends that the audits be scheduled with the QA Department so that all necessary personnel are available on the day of the audit.

4.14. Management Reviews

4.14.1. QA Reports to Management

A monthly QA report is prepared by QA Manager and forwarded to the Laboratory Director, the GM, and the Corporate QA Manager. The reports include statistical results that are used to assess the effectiveness of the Quality System. The format of the monthly report is shown in Figure 1.

4.14.2. Management Systems Review

A Quality Management Systems review of the facility is performed at least annually by either the Laboratory Director, QAM or his/her designee. The management systems review ensures that the laboratory's quality system is adequate to satisfy the laboratory's policies and practices, government requirements, certification, accreditation, approval requirements, and client expectations. Management systems reviews are accomplished through monthly quality assurance reporting, goal setting and an annual LQM review and revision.

4.14.3 Monthly QA Report and Metrics

By the 3rd day of the month, the QA manager prepares a monthly QA report. The report is sent to the Laboratory Director, General Manager and Corporate Quality Director. The report contains a narrative summary and metrics spreadsheet . At a minimum, the report content contains the items listed below (Figure 1). During the course of the year, the Laboratory Director, General Manager or Corporate Quality Director may request that additional information be added to the report.

Figure 1. Monthly QA Report Format

1	Audits
	Internal System Audits External System Audits
2	Revised Reports / Client Feedback
	Revised Reports Client Complaints Client Compliments
3	Certification Changes
	Changes Losses / Revocations
4	Proficiency Testing
	Study participation and scores Combined PT scores Repeat failures
5	SOP Status
	Report the percentage of SOPs that have been revised or reviewed within the last 24 months.
6	Miscellaneous QA and Operational Issues
	Narrative outlining improvements, regulatory compliance issues and general concerns.
Appended	Metrics Spreadsheet
	Summarize metrics in template provided by the Corporate Quality Director

5. *Technical Requirements*

5.1. Personnel

5.1.1. General

The STL-Connecticut management believes that its highly qualified and professional staff is the single most important aspect in assuring the highest level of data quality service in the industry.

STL-Connecticut staff consists of over forty professionals and support personnel that include:

- Laboratory Director
- Senior Management
- Quality Assurance Manager
- Information Systems Analyst
- Analytical Chemists
- Laboratory Technicians
- Sample Custodian
- Health and Safety/Waste Management Coordinators
- Customer Service Staff
- Account Executives

In order to ensure that employees have sufficient education and experience to perform a particular task, job descriptions are defined for each laboratory position. Job descriptions are located on the STL Intranet HR web page.

The personnel who are responsible for operations of sample analyses and data validation are outlined in Section 5 of the Appendix. Section 1 of the appendix presents professional profiles of key personnel within the STL-Connecticut organization. Profiles of additional STL staff members are available for review during a facility visit or are available upon special request.

5.1.2. Training

STL is committed to furthering the professional and technical development of employees at all levels. The QA Manager and the Laboratory Management may periodically review the training needs of the staff and make recommendations for any additional training. Each department within the laboratory is responsible for personnel training. Each training session, whether it be individual or group training must be documented utilizing the forms attached to the SOP for Employee Training. The completed forms must be submitted to the Human Resource department for placement into the employee training files.

Orientation to the laboratory's policies and procedures, in-house method training, and employee attendance at outside training courses and conferences all contribute toward employee proficiency. The QA section, in conjunction with the Human Resources section are responsible for maintaining documentation of these activities.

Project specific training may also take place. Prior to work on a new project, the dissemination of project information and/or project opening meetings may occur to discuss schedules and unique aspects of the project by the Project Manager. Items to be discussed may include the project technical profile, turnaround times, holding times, methods, analyte lists, reporting limits, deliverables, sample hazards, or other special requirements. Group Leader will then hold departmental meeting to discuss upcoming projects. These meetings provide direction to the laboratory staff in order to maximize production and client satisfaction, while maintaining quality.

The following evidence items are maintained in the employees technical training file for each technical employee:

- Initial Demonstration of Capability (IDOC)
- The employee has read and understood the latest version of the laboratory's quality documentation.
- The employee has read and understood the latest, approved version of all test methods and/or SOPs for which the employee is responsible.
- Annual evidence of continued DOC that may include successful analysis of a blind sample on the specific test method; a similar test method; an annual DOC; or four successive and acceptable LCSs.
- An ethic Agreement signed by each staff member (renewed each year)
- A confidentiality agreement signed by each staff member (renewed each year)
- Documentation of external training courses attended
- All training regarding QA policies and procedures

Human Resources maintains documentation and attestation forms on employment status & records; benefit programs; timekeeping/payroll; and employee conduct (e.g., ethics). This information is maintained in the employee's secured personnel file. This includes:

- An Ethics Agreement signed by each staff member (renewed each year).
- A Confidentiality Agreement signed by each staff member (renewed each year).

Minimum training requirements for STL-Connecticut employees are outlined in Table 5.

Table 5 STL Employee Minimum Training Requirements

Required Training	Time Frame [1]	Employee Type
Environmental Health & Safety	Month 1	All
Ethics	Two Weeks	All
Data Integrity	Two Weeks	Technical and PMs
Ethics Refresher	Annually	All
Quality Assurance	Quarter 1	All
Initial Demonstration of Capability (IDOC)	Prior to unsupervised method Performance	Technical

[1] From the date of initial employment unless otherwise indicated.

Technical training is accomplished within each laboratory by management to ensure method comprehension. All new personnel are required to demonstrate competency in performing a particular method by successfully completing an Demonstration of Capability (DoC) before conducting analysis independently on client samples.

DoCs are performed by analysis of four replicate QC check samples. Results of successive LCS analyses can be used to fulfill the DoC requirement. The accuracy and precision, measured as average recovery and standard deviation (using n-1 as the population), of the 4 replicate results are calculated and compared to those in the test method (where available). If the test method does not include accuracy and precision requirements, the results are compared to target criteria set by the laboratory. The laboratory sets the target criteria such that they reflect the data quality objectives of the specific test method or project data quality objectives. An DoC Certification Statement is recorded and maintained in the employee's training or personnel file. Figure 2 shows an example of a DoC Certification Statement.

Continuing DoCs certification is required annually and must be documented in the same manner as the DoC.

Figure 2 Demonstration of Capability Certification Statement

Demonstration of Capability
Certification Statement

Laboratory Name: Date:
Laboratory Address:

Method:_____
Matrix: _____

Analyst Name:

We the undersigned certify that:

1. The analyst identified above, using the cited test method, which is in use at this facility for the analysis of samples under the National Environmental Laboratory Accreditation Program, have met the Initial Demonstration of Capability.
2. The test method was performed by the analyst identified on this certification.
3. Copies of the test method and SOP are available for all personnel on site.
4. The data associated with the DoC are true, complete and representative.
5. All raw data (including a copy of this certification form) necessary to reconstruct and validate these analyses have been retained at the facility, and that the associated information is available for review by authorized inspectors.

Laboratory Manager/Supervisor	Signature	Date
Quality Assurance Manager	Signature	Date

5.1.3. Ethics Policy

Establishing and maintaining a high ethical standard is an important element of a quality system. In order to ensure that all personnel understand the importance the company places on maintaining high ethical standards at all times, STL has established an Ethics Policy P-L-006 and an Ethics Agreement (Figure 4). Each employee shall sign the Ethics Agreement, signifying agreed compliance with its stated purpose.

Violations of this Ethics Policy will not be tolerated. Employees who violate this policy will be subject to disciplinary actions up to and including termination. Criminal violations may also be referred to the Government for prosecution. In addition, such actions could jeopardize the Company's ability to do work on Government contracts, and for that reason, the Company has a Zero Tolerance approach to such violations.

Ethics is also a major component of the STL training program. Each employee must be trained in ethics within three months of hire in a training program that includes an overview of regulatory programs and program goals, a review of the ethics statement, and group discussions about data integrity and data misrepresentation. Employees must be trained as to the legal and environmental repercussions that result from data misrepresentation. A data integrity hotline is maintained by STL and administered by the QA Director. An annual refresher in ethics will be held for each employee.

Figure 3 STL Ethics Agreement

Severn Trent Laboratories, Inc.

I understand that STL is committed to ensuring the highest standard of quality and integrity of the data and services provided to our clients. I have read the Ethics Policy of the Company.

With regard to the duties I perform and the data I report in connection with my employment at the Company, I agree that:

- I will not intentionally report data values that are not the actual values obtained;
- I will not intentionally report the dates, times, sample or QC identifications, or method citations of data analyses that are not the actual dates, times, sample or QC identifications, or method citations;
- I will not intentionally misrepresent another individual's work;
- I will not intentionally misrepresent any data where data does not meet Method or QC requirements. If it is to be reported, I will report it with all appropriate notes and/or qualifiers;
- I agree to inform my Supervisor of any accidental reporting of non-authentic data by me in a timely manner; and I agree to inform my Supervisor of any accidental or intentional reporting of non-authentic data by other employees; and
- If a supervisor or a member of STL management requests me to engage in or perform an activity that I feel is compromising data validity or quality, I will not comply with the request and report this action immediately to a member of senior management, up to and including the President of STL.

As a STL employee, I understand that I have the responsibility to conduct myself with integrity in accordance with the ethical standards described in the Ethics Policy. I will also report any information relating to possible kickbacks or violations of the Procurement Integrity Act, or other questionable conduct in the course of sales or purchasing activities. I will not knowingly participate in any such activity and will report any actual or suspected violation of this policy to management.

The Ethics Policy has been explained to me by my supervisor or at a training session, and I have had the opportunity to ask questions if I did not understand any part of it. I understand that any violation of this policy subjects me to disciplinary action, which can include termination. In addition, I understand that any violation of this policy which relates to work under a government contract or subcontract could also subject me to the potential for prosecution under federal law.

EMPLOYEE SIGNATURE _____ Date _____

Supervisor/Trainer: _____ Date _____

5.2. Facilities

The laboratory is a secured facility with controlled and documented access. Access is controlled by various measures including locked doors (key access), and a staffed reception area. All visitors sign in and are escorted by STL Connecticut personnel while at the facility. The laboratory is locked at all times, unless a receptionist is present to monitor building access (e.g., between the hours of 8:30 a.m. and 5:00 p.m. Monday through Friday).

The laboratory currently maintains a staff of approximately 40 environmental professionals and occupies a facility of approximately 14,000 sq. ft. Separate laboratory areas are dedicated to GC instrumentation, GC/MS instrumentation, extractions for organic parameters, sample preparation for metals analysis, metals analysis and wet chemistries. The floor plan of the analytical laboratory is included in Section 4 of the Appendix.

The volatiles analysis laboratory containing GC/MS instrumentation has a separate air handling system which is maintained at a positive pressure at all times. The organic sample preparation laboratory has a separate HVAC system that creates negative pressure in the area. This design results in a contaminant-free environment for trace-level volatiles analysis.

Critical instrumentation such as GC/MS units, ICP's, AA's, data systems, gas chromatographs and LIMS are tied into an uninterruptible power supply system (UPS) to minimize instrument downtime and damage for short duration power interruptions.

The sample receipt and storage area is under the responsibility of the sample custodian. A locked walk-in refrigeration unit and 10 locked commercial refrigerator units are used to house samples waiting for analysis. Samples for volatile analysis are stored in separate units. Locked laboratory refrigerators, located throughout the laboratory, are used to maintain sample extracts or laboratory reagents. Each laboratory refrigerator is dedicated to sample, sample extract, or reagent storage.

All STL facilities are equipped with structural safety features. Each employee is familiar with the location, use, and capabilities of general and specialized safety features associated with their workplace. STL also provides and requires the use of protective equipment including safety glasses, protective clothing, gloves, respirators, etc.

5.3. Test Methods

5.3.1. Method Selection

Most of the test methods performed at STL-Connecticut originate from test methods published by a regulatory agency such as the US EPA and other state and federal

regulatory agencies. These include, but are not limited to, the following published compendiums of test methods:

Compendium of Methods for the Determination of Toxic Organic Compounds in Ambient Air, US EPA, January, 1996.

Guidelines Establishing Test Procedures for the Analysis of Pollutants Under the Clean Water Act, and Appendix A-C; 40 CFR Part 136, USEPA Office of Water.

Methods for Chemical Analysis of Water and Wastes, EPA 600 (4-79-020), 1983.

Methods for the Determination of Inorganic Substances in Environmental Samples, EPA-600/R-93/100, August 1993.

Methods for the Determination of Metals in Environmental Samples, EPA/600/4-91/010, June 1991.

Methods for the Determination of Organic Compounds in Drinking Water, EPA-600/4-88-039, December 1988, Revised, July 1991, Supplement I, EPA-600-4-90-020, July 1990, Supplement II, EPA-600/R-92-129, August 1992.

Statement of Work for Inorganics Analysis, ILM04.1, USEPA Contract Laboratory Program Multi-media, Multi-concentration.

Statement of Work for Organics Analysis, OLM03.2, USEPA Contract Laboratory Program, Multi-media, Multi-concentration.

Statement of Work for Organic Analysis, Multi-Media, Multi-Concentration, OLM04.2/OLM04.3, USEPA Contract Laboratory Program, September 1998.

Standard Methods for the Examination of Water and Wastewater, $18^{th}/19^{th}$ edition; Eaton, A.D. Clesceri, L.S. Greenberg, A.E. Eds; American Water Works Association, Water Pollution Control Federation, American Public Health Association: Washington, D.C.

Test Methods for Evaluating Solid Waste Physical/Chemical Methods (SW846), Third Edition, September 1986, Final Update I, July 1992, Final Update IIA, August 1993, Final Update II, September 1994; Final Update IIB, January 1995; Final Update III, December 1996.

Annual Book of ASTM Standards, American Society for Testing & Materials (ASTM), Philadelphia, PA.

5.3.2. SOPs

Each STL facility maintains an SOP Index for all standard, non-standard, and laboratory developed methods. SOPs are also maintained for describing processes that are not related to a specific method. Method SOPs are maintained to describe a specific test method. Process SOPs are maintained to describe function and processes not related to a specific test method.

Method SOPs contain the following information:

Title Page with Document Name, Document Number, Revision Number, Effective Date, Page Numbers and Total # of Pages, Authorized Signatures, Dates and Proprietary Information Statement (Figure 4).

1. Identification of Test Method
2. Applicable Matrix
3. Reporting Limit
4. Scope and Application, including test analytes
5. Summary of the Test Method
6. Definitions
7. Interferences
8. Safety
9. Equipment and Supplies
10. Reagents and Standards
11. Sample Collection, Preservation, Shipment and Storage
12. Quality control
13. Calibration and Standardization
14. Procedure
15. Calculations
16. Method Performance
17. Pollution Prevention
18. Data Assessment and Acceptance Criteria for Quality Control Measures
19. Corrective Actions for Out-of-Control Data
20. Contingencies for Handling Out-of-Control or Unacceptable Data
21. Waste Management
22. References
23. Tables, Diagrams, Flowcharts and Validation Data

Process SOPs contain the following information:

Title Page with Document Name, Document Number, Revision Number, Effective Date, Page Numbers and Total # of Pages, Authorized Signatures, Dates and Proprietary Information Statement (Figure 4).

1. Scope
2. Summary
3. Definitions
4. Responsibilities
5. Safety
6. Procedure
7. References
8. Tables, Diagrams, and Flowcharts

Reference the STL-Connecticut SOP on SOPs for the exact format.

The QA Department is responsible for maintenance of SOPs, archival of SOP historical revisions, and maintenance of an SOP index. SOPs, at a minimum, undergo annual review. Where an SOP is based on a published method, the laboratory maintains a copy of the reference method.

Figure 4 Proprietary Information Statement

SOP Appendix
In some cases, a standard laboratory procedure is modified slightly for a specific client or project at the client or regulatory agency's request. In these cases, an Appendix to the SOP may be attached that indicates the modifications to the SOP which are specific to that project. SOP appendices shall not be used to alter test methods required by regulation such that the modifications would results in non-compliances.

5.3.3. Method Validation

Laboratory developed methods are validated and documented according to the procedure described in Section 5.3.5.

5.3.4. Method Verification

Method verification is required when a validated standard test method or a method modification is implemented. The level of activity required for method verification is dependent on the type of method being implemented, or on the level of method modification and its affect on a method's robustness. Method modification often takes advantage of a method's robustness, or the ability to make minor changes in a method without affecting the method's outcome. Method verification commonly will minimally require Determination of Method Sensitivity and Determination of Accuracy and Precision as described in Section 5.3.5. When implementing new, but previously validated methodologies, method verification may require additional activities such as Determination of Range.

5.3.5. Method Validation and Verification Activities

Before analyzing samples by a particular method, method validation and/or method verification must occur. A complete validation of the method is required for laboratory developed methods. While method validation can take various courses, the following activities are generally required as part of method validation. Method validation records are designated QC records and are archived accordingly.

Determination of Method Selectivity
Method selectivity is demonstrated for the analyte(s) in the specific matrix or matrices. In some cases, to achieve the required selectivity for an analyte, a confirmation analysis is required as part of the method.

Determination of Method Sensitivity
Sensitivity can be both estimated and demonstrated. Whether a study is required to estimate sensitivity depends on the level of method development required when applying a particular measurement system to a specific set of samples. Where estimations and/or demonstrations of sensitivity are required by regulation or client agreement, such as the procedure in 40 CFR Part 136 Appendix B, under the Clean Water Act, these shall be followed. The laboratory determines MDLs are described in Section 4.4.3.6 and the corporate procedure S-Q-003.

Relationship of Limit of Detection (LOD) to the Quantitation Limit (QL)
An important characteristic of expression of sensitivity is the difference in the LOD and the QL. The LOD is the minimum level at which the presence of an analyte can be reliably concluded. The QL is the minimum level at which both the presence of an analyte and its concentration can be reliably determined. For most instrumental measurement systems, there is a region where semi-quantitative data is generated around the LOD (both above and below the estimated MDL or LOD) and below the QL. In this region, detection of an analyte may be confirmed but quantification of the analyte is unreliable within the accuracy and precision guidelines of the measurement system. When an analyte is detected below the QL, and the presence of the analyte is confirmed by meeting the qualitative identification criteria for the analyte, the analyte can be reliably reported, but the amount of the analyte can only be estimated. If data is to be reported in this region, it is done so with a qualification that denotes the semi-quantitative nature of the result.

Determination of Interferences
A determination that the method is free from interferences in a blank matrix is performed.

Determination of Range
Where appropriate, a determination of the applicable range of the method is performed. In most cases, range is determined and demonstrated by comparison of the response of an analyte in a curve to established or targeted criteria. The curve is used to establish the range of quantitation and the lower and upper values of the curve represent upper and lower quantitation limits. Curves are not limited to linear relationships.

Demonstration of Capability
DoCs are performed prior to method performance.

Determination of Accuracy and Precision
Accuracy and precision studies may be required as a separate determination from the IDC. Accuracy and precision studies are generally performed using four replicate analyses, with a resulting percent recovery and measure of reproducibility (standard deviation, relative standard deviation) calculated and measured against a set of target criteria.

Documentation of Method
The method is formally documented in an SOP. If the method is a minor modification of a standard laboratory method that is already documented in an SOP, an SOP Appendix describing the specific differences in the new method is acceptable in place of a separate SOP.

Continued Demonstration of Method Performance
Continued demonstration of Method Performance is addressed in the SOP. Continued demonstration of method performance is generally accomplished by batch specific QC samples such as Laboratory Control Samples and Method Blanks.

5.3.6 Data Reduction and Review

Analytical data are entered/downloaded directly into LIMS or recorded on pre-formatted bench sheets that are paginated and bound into laboratory logbooks. These logbooks are issued and controlled by the laboratory's QA Section. A unique document control code is assigned to each book to assure that chronological record keeping is maintained.

Analytical data is referenced to a unique sample identification number for internal tracking and reporting. Both LIMS entries and logbook pages contain the following information, as applicable: analytical method, analyst, date, sequential page number, associated sample numbers, standard concentrations, and raw data. Entries are in chronological order and maintained so as to enable reconstruction of the analytical sequence.

The analyst is responsible for entering / recording all appropriate information, and for signing and dating all logbook entries daily. All entries and logbook pages are reviewed for completeness by a supervisor, peer reviewer. Data review checklists document the analytical review of the LIMS entries, logbook and associated QC indicators. Copies of instrument outputs (chromatograms, mass spectra, etc..) are maintained on file or electronically with the analyst's signature/initials and date.

5.6.3.1 Data review

All data, regardless of regulatory program or level of reporting, are subject to a thorough review process. All levels of the review are documented.

Initial Review

The initial review is often referred to as a "bench-level" review. In most cases, the analyst who generates the data (i.e. logs in, prepares and/or runs the samples) is the initial reviewer. In some cases, an analyst may be reducing data for samples run by an auto-sampler set up by a different analyst. In this case, the identity of both the analyst and the initial reviewer is identified in the raw data.

One of the most important aspects of primary review is to make sure that the test instructions are clear, and that all project specific requirements have been understood and followed. If directions to the analyst are not clear, the analyst must go to the Supervisor, Manager, or PM, who must clarify the instructions.

Once an analysis is complete, the initial reviewer ensures that:

- Sample preparation information is complete, accurate, and documented.
- Calculations have been performed correctly.
- Quantitation has been performed accurately.
- Qualitative identifications are accurate.
- Manual integrations are appropriate.

- Data flags to indicate manual integrations are recorded.
- Manual integrations are authorized by a date and signature or initials of primary analyst.
- Client specific requirements have been followed.
- Method and process SOPs have been followed.
- Method QC criteria have been met.
- QC samples are within established limits.
- Dilution factors are correctly recorded and applied.
- Non-conformances and/or anomalous data have been documented and communicated.
- COC procedures have been followed.
- Initial review is documented by date and initials/signature of primary analyst.

Any anomalous results and/or non-conformances noted during the Initial Review are communicated to the Supervisor and the PM for resolution. Resolution can require sample reanalysis, or it may require that data be reported with a qualification. Non-conformances are documented per Section 4.9.

The laboratory employs a system of QA sign-off sheets called QC Batch Approval Forms and Quality Control Approval Reports (QCAR's), where each analyst must sign off that their respective part of the analysis is complete and meets the QA/QC requirements of the governing SOP. Both the Volatile and semi-volatile computer systems produce batch-specific QC summary reports to check various analytical parameters. Analysis QCAR's are filed with the analysis batches while the final deliverable QCAR's are signed and placed in each job folder along with any Corrective Action Forms (CAF) which details any problems which were encountered in the measurement of samples. Any deviations from SOPs are noted on CAF's and explained in the SDG narrative which is incorporated into the final report. The group leader has final sign-off responsibility on the QCAR and is responsible for assuring the overall quality of the data.

Secondary Review

The secondary review is a complete technical review of a data set and is performed by the Group/Section or designee. The secondary review is documented and the secondary reviewer is identified. The following items are reviewed:

- Qualitative Identification
- Quantitative Accuracy
- Calibration
- QC Samples
- Method QC Criteria
- Adherence to method and process SOPs
- Accuracy of Final Client Reporting Forms
- Manual Integrations – 100% as verified by signature of secondary data reviewer
- Completeness
- Special Requirements/Instructions

If problems are found during the secondary review, the reviewer must work with the appropriate personnel to resolve them. If changes are made to the data, such as alternate qualitative identifications, identifications of additional target analytes, re-quantitation, or re-integration, the secondary reviewer must contact the laboratory analyst and/or primary reviewer of the data so that the primary analyst and/or reviewer is aware of the appropriate reporting procedures. It is at this time the case narrative is written for the report.

Completeness Review

The completeness review performed by the Project Manager, the includes the review of a project narrative and/or cover letter which outlines anomalous data and non-compliances using project narrative notes and non-compliance reports generated during the primary and secondary review. The completeness review addresses the following items:

- Is the project report complete with all samples present?
- Does the data meet with the client's expectations?
- If available, were the data quality objectives of the project met?
- Are QC outages and/or non-conformances approved and appropriately explained in the narrative notes?

5.3.6.1 Data Reduction

The complexity of the data reduction depends on the analytical method and the number of discrete operations involved (e.g., extractions, dilutions, instrument readings and concentrations). The analyst calculates the final results from the raw data or uses appropriate computer programs to assist in the calculation of final reportable values.

For manual data entry, e.g., Wet Chemistry, the data is reduced by the analyst and then verified by the section manager or alternate analyst prior to updating the data in LIMS. The spreadsheets, or any other type of applicable documents, are signed by both the analyst and alternate reviewer to confirm the accuracy of the manual entry(s).

Manual integration of peaks will be documented and reviewed and the raw data will be flagged in accordance with the STL Corporate SOP entitled *Acceptable Manual Integration Practices* (S-Q-004).

Copies of all raw data and the calculations used to generate the final results, such as bound logbooks, are retained on file for a minimum of 5 years or as otherwise requested by the client/project.

Calculations and data reduction steps for various methods are summarized in the respective analytical SOPs or program requirements.

The following sections will describe the general procedures which are employed at the STL-Connecticut laboratory. More specific detail can be found in the standard operating procedures.

- Gas Chromatography

Data from the Gas Chromatographs is acquired through interfaces with a computer system utilizing Perkin Elmer Turbo Chrom chromatography software. After acquisition, the data is automatically copied to the Thermo analytical systems Target software package for data processing and quantitation. Data is reviewed at the bench level by the analyst. The data is reviewed for chromatographic scaling and dilutions. Necessary reintegrations and rescalings are done using Target. On column result data is then transferred to the labnet LIMS system. Prep data is manually entered and then linked to the analyses for final result calculation. If the data meets QC requirements, final reports are printed.

- GC/Mass Spectrometry

GC/MS data is acquired utilizing Hewlett Packard Chemstation computer systems with Environquant software. After acquisition, the data is automatically copied to the Thermo analytical systems Target software package for data processing and quantitation. This software allows for the comparison of sample non-target spectrum against reference library spectra. The most recent NIST/EPA mass spectral library supported by the system must be used. On column result data is then transferred to the labnet LIMS system. Prep data is manually enter and then linked to the analyses for final result calculation. Data is reviewed by the analyst. If the data meets QC requirements, final reports are printed.

- Atomic Spectroscopy

ICAP metals are analyzed by a Thermo-Jarrel Ash 61E or 61E Purge. The raw data collected is transferred via a network system to the labnet LIMS system. Mercury data is analyzed on the mercury analyzer and is transferred via a network system to the labnet LIMS system. Prep data is manually entered and then linked to the analysis for finally result calculation.

- Classical Chemistry

Routine wet chemistry analyses have pre-printed logbooks, such as distillation logs and digestion logs. The less frequent analyses are recorded in analysts' notebooks. Raw data is then entered into the LIMS for data calculation. This includes the calibration curve data which may have been previously entered. Semi-automated analyses performed on the Lachat produce results. These results are then electronically transferred to the LIMS system. Any associated prep data is manually entered and then linked to the analysis for final result calculation. Any raw data produced is stored in a central file.

5.3.7 Data Integrity and Security

This section details those procedures that are relevant to computer systems that collect, analyze, and process raw instrumental data, and those that manage and report data. STL Connecticut uses Labnet, STL's propriety LIMS, for Quotes, Project setup, sample login, standard and reagent traceability, data and report generation.

Security and Traceability

Access to computer systems that collect, analyze, and process raw instrumental data, and those that manage and report data is both controlled and recorded. There are various systems at STL to which this applies, which include the Laboratory Information Management System (LIMS), as well as specific systems such as a chromatography data system.

Control of the system is accomplished through limitation of access to the system by users with the education, training and experience to perform the task knowledgeably and accurately. System users are granted privileges that are commensurate with their experience and responsibilities.

Computer access is tracked by using unique login names and passwords for all employees that have access to the computer system. Entries and changes are documented with the identity of the individual making the entry, and the time and date. Where a computer system is processing raw instrumental data, the instrument identification number as described in Section 5.4.1 is recorded. Many of these systems, such as the Target Data System, have the capability of maintaining audit trails to track entries and changes to the data. This function is activated on any computer system that has that capability.

Outputs from all instruments are monitored for readability and consistency. If clarity is less than desired, corrective actions are undertaken to rectify the output based on instrument manufacturers' recommendations.

Verification

All commercially obtained software is verified prior to use and after version upgrade. Verification involves assessing whether the computer system accurately performs its intended function. Verification generally is accomplished by comparing the output of the program with the output of the raw data manually processed, or processed by the software being replaced. The records of the verification are required to contain the following information: software vendor, name of product, version, comparison of program output and manual output, raw data used to verify the program, date, and name of the individual performing the verification. Records of verification are retained as QC records.

Validation

Software validation involves documentation of specifications and coding as well as verification of results. Software validation is performed on all in house programs. Records of verification include original specifications, identity of code, printout of code, software name, software version, name of individual writing the code, comparison of program output with specifications, and verification records as specified above. Records of validation are retained as QC records.

Auditing

The QA Department systems audit includes review of the control, security, and tracking of Information Technology (IT) systems and software.

STLs LIMS System Managers continually review the control, security, and tracking of IT systems and software.

Version Control
The laboratory maintains copies of outdated versions of software and associated manuals for all software in use at the laboratory for a period of 5 years from its retirement date. The associated hardware, required to operate the software, is also retained for the same time period.

5.4. Equipment

5.4.1. Equipment Operation

STL facilities maintain state of the art instrumentation to perform the analyses within the QC specifications of the test methods. Each STL facility maintains an equipment list that includes the following information:

- Identity
- Date Installed
- Manufacturer's Name, Model Number, Serial Number
- Current Location
- Preventative Maintenance Schedule

All equipment is subject to rigorous checks upon its receipt, upgrade, or modification to establish that the equipment meets with the selectivity, accuracy, and precision required by the test method for which it is to be used. All manufacturer's operations and maintenance manuals are kept up to date and accessible for the use of the equipment operator. Documentation of equipment usage is maintained using analytical run and maintenance logbooks. Table 6 lists STL's major equipment.

Table 6 Major Equipment List

Instrument Type	Number
Gas Chromatograph (GC)	6
Gas Chromatograph/Mass Spectrometer (GC/MS)	8
Air Desorber	1
Inductively Coupled Argon Plasma Emission Spectrophotometer (ICP)	2
Mercury Cold Vapor Analyzer	1
Infrared Spectrophotometer (IR)	1
Wet Chemistry Autoanalyzer	2
Ion Chromatograph	1
UV-Visible Spectrophotometer	2
TOC Analyzer	2

5.4.2. Equipment Maintenance

STL employs a system of preventative maintenance in order to ensure system up time, minimize corrective maintenance costs and ensure data validity. All routine maintenance is performed as recommended by the manufacturer and may be performed by an analyst, instrument specialist or outside technician. Maintenance logbooks are kept on all major pieces of equipment in which both routine and non-routine maintenance is recorded. Notation of the date and maintenance activity is recorded each time service procedures are performed. The return to analytical control following instrument repair is documented in the maintenance logbook. Maintenance logbooks are retained as QC records. Section 5 of the Appendix outlines the Preventive Maintenance performed at STL Connecticut.

Where it is desirable, the STL-Connecticut laboratory has service contracts for major instruments. These contracts provide routine preventive maintenance according to the manufacturer's requirements. Additionally the laboratory maintains an inventory of expendable parts and supplies to minimize downtime and to allow laboratory personnel to make minor repairs if necessary.

5.4.3. Equipment Verification and Calibration

All equipment is tested upon receipt to establish its ability to meet the QC guidelines contained in the test method for which the instrumentation is to be used. This testing is documented in instrument run and maintenance logbooks. Once an instrument is placed in routine service, ongoing instrument calibration is demonstrated at the appropriate frequency as defined in the test method. The calibration data, which includes instrument conditions and standard concentrations, is documented in pre-formatted instrument runlogs or within LIMS itself. The preparation of all reference materials used for calibration is documented via LIMS. Refer to Corporate SOP P-T-001, Selection of Calibration Points for Proper handling of Calibration data. Any instrument that is deemed to be malfunctioning is clearly marked and taken out of service. When the instrument is brought back into control, this is documented in the instrument maintenance log.

5.5. Measurement Traceability

5.5.1. General

Traceability of measurements is assured using a system of documentation, calibration, and analysis of reference standards. Laboratory equipment that are peripheral to analysis and whose calibration are not necessarily documented in a test method analysis or by analysis of a reference standard is subject to ongoing certifications of accuracy.

These include procedures for checking specifications ancillary equipment: balances, thermometers, temperature, Deionized (DI) and Reverse Osmosis (RO) water systems, automatic pipettes and other volumetric measuring devices. With the exception of Class A Glassware (including glass microliter syringes that have a certificate of accuracy), quarterly accuracy checks are performed for all mechanical volumetric devices. Eppendorf pipets shall be verified monthly and checked prior to use. Wherever possible, subsidiary or peripheral equipment is

checked against standard equipment or standards that are traceable to national or international standards.

The accuracy of any non standard lab ware, such as plastic digestion cups or sample vials, used to measure initial sample volumes or final sample extract volumes must be verified one per lot. Class A glassware such as flasks, pipets, graduated cylinders and volumetrics shall be verified one per lot prior to being put into service within the lab. Accuracy must be verified to within 3 percent in accordance with ASTM procedures.

An external certified service engineer services laboratory balances on an annual basis. This service is documented on each balance with a signed and dated certification sticker. Balances are calibrated on each day of use. All thermometers are calibrated annually against a traceable reference thermometer. Temperature readings of ovens, refrigerators, and incubators are checked on each day of use.

Laboratory SOPs specify the required level of accuracy in volumetric glassware. In all cases, volumetric glassware meets the requirements specified in the published test method.

5.5.2. Reference Standards

The receipt of all reference standards is documented in labnet. References standards are purchased from commercial vendors and labeled with a unique Standard Identification Number, date received, and the expiration date. The expiration dates for ampulated solutions shall not exceed the manufacturer's expiration date. Expiration dates for laboratory-prepared stock and diluted standards shall be no later than the expiration date of the stock solution or material first. Expiration dates for pure chemicals shall be established by the laboratory and be based on chemical stability, possibility of contamination, and environmental and storage conditions. All documentation received with the reference standard is retained as a QC record and references the Standard Identification Number.

The preparation of all daughter solutions, whether a single or multiple-component stock, intermediate, or working standard solution, is documented in a standard solution preparation logbook, in a designated section of the analytical logbook or in the LIMS systems reagent program. This documentation references the Standard ID of the respective parent solution(s) used in its preparation, providing a solid trail back to the solution or chemical received from the vendor. These records include the standard name, final volume, matrix, final concentration, analyst initials, prep date and expiration date. A daughter solution should not have an expiration date which post-dates any of the parent solutions used in its preparation.

Where possible standards are purchased with an accompanying Certificate of Analysis that documents the standard purity. If a standard cannot be purchased from a vendor that supplies a Certificate of Analysis, the purity of the standard is documented by analysis. The documentation of standard purity is archived, and references the Standard Identification Number.

All efforts are made to purchase standards that are $\geq$ 97.0% purity. If this is not possible, the purity is used in performing standards calculations.

The accuracy of calibration standards is checked by comparison with a standard from a second source. In cases where a second standard manufacturer is not available, a different lot is acceptable for use as a second source. The appropriate QC criteria for specific standards are defined in laboratory SOPs. In most cases, the analysis of an ICV or LCS is used as the second source confirmation.

Storage conditions, such as shelf life, ambient or chilled, controlled or restricted access, wet or desiccated, etc.., are in conformance with the specifications set in the associated method, the program requirements, or the manufacturer's recommendation, as appropriate.

Analytical Calibration Standards

The calibration standards used for instruments and equipment are described in the specific analytical methods, or instrument manufacturers' operational guides. All standard preparations are recorded in a bound "Standards Preparation Log Book" or entered into labnet, with the lot number, method of preparation, date and analyst's initials. The labnet system and or log provides the internal documentation which traces the internal working standards to primary and secondary (purchased) stocks.

Samples shall not be stored in the same areas as the standards.

Records on the traceability of the standards are maintained within each department. These records include sources, dates of receipt, lot numbers (if applicable) and expiration dates (if applicable). All purchased standards shall be traceable to NIST Standards including EPA/A2LA standards.

Table 7 provides an overview of the standard sources, types and preparation by instrument group.

- Metals Calibration Standards

Commercially available at 1000 ppm levels from Inorganic Ventures and prepared from primary standard material traceable to NIST Standards including EPA/A2LA standards. Stock standards solutions are prepared every six months or when needed as multi-element stocks.

- Inorganic Calibration Standards

Calibration standards described in the methodology use ACS Reagent Grade materials. Some reference materials are available from NIST to standardize titrating solutions. Stock solutions are prepared every three months while diluted working standards are prepared daily at the time of analysis

- Organic Calibration Standards

Pure compounds, Calibration mixes and Spike solutions for organic compounds are available through, Protocol, Supelco, Inc., Restek, Inc. and Accustandard, Inc. Volatile organic stocks are

prepared every six months and diluted working standards are prepared weekly. Stock non-volatile solutions can be prepared every six months and diluted working standards are prepared as needed.

- pH Calibration Standards

Calibration materials which are certified by the manufacturer to be standardized against NIST Standards are commercially available and are used by the laboratory. Three standards - 4,7, and 10 are used daily to calibrate the pH meters.

- Weighing Calibration Standards

Analytical balances are certified annually. Calibration is performed on a weekly or daily basis using class "S" weights (0.50, 5.00, and 50g). All Class S weights shall be calibrated within 5 years and traceable to NIST.

- Oven Calibration Standards

Daily calibration by monitoring oven temperature with a thermometer calibrated annually with a NIST Certified Thermometer. Digital thermometers shall be calibrated on a quarterly basis.

- Conductivity Calibration Standard

Conductivity solutions are described in Standard Methods, 18th edition, Section 502.

- Turbidity Standards

Formazin solution prepared from CMS neat standard according to EPA Method 180.1-2. Four standards are used to prepare a calibration curve and are made fresh daily. The stock formazin standard is prepared every three months and kept under refrigeration.

- Photometer Calibration Standard

Spectronic Standards - Catalog #331-31-50 (wavelength calibration).

TABLE 7 .STANDARD SOURCES AND PREPARATION

Inst. Group	Source	Form Received	Storage	Preparation from Source	Laboratory Storage	Preparation Frequency
GC/MS-Volatiles	Restek, Inc. EPA Supelco Accustandard Protocol	Neat Solutions> 1000 ppm	Frozen	Primary stocks are prepared from source stocks	Freezer	Semi-annual
				Intermediate stocks are prepared from primary or source stocks	Refrigerator	Weekly
				Working stocks are prepared from intermediates	N/A	Weekly
GC/MS GC - SV	Restek, Inc. EPA RTP Supelco Accustandard	Neat Solutions >1000 ppm	Frozen	Primary stocks are prepared from source stocks	Freezer	Semi-annual
				Intermediate stocks are prepared from primary or source stocks	Refrigerator	Semi-annually
				Working stocks are prepared from intermediates	Refrigerator Certain Pesticies stored at room temperature	Semi-annually
ICP	Inorganic Ventures	Solutions of 1000ppm	Room temp.	Primary stocks (1 - 10 ppm) are prepared from source	O.15% HNO_3 at room temperature	Annually
				Intermediate stocks (1ppb - 1 ppm)	0.15% HNO_3 at room temperature	Semi-annually or as needed
				Working stocks	0.15% HNO_3 at room temperature	Daily

The accuracy of calibration standards is checked by comparison with a standard from a second source. In cases where a second standard manufacturer is not available, a different lot is acceptable for use as a second source. The appropriate Quality Control (QC) criteria for specific standards are defined in laboratory SOPs. In most cases, the analysis of an Initial Calibration Verification (ICV) or Laboratory Control Sample (LCS) is used as the second source confirmation.

5.5.3. Reagents

Reagents are, in general, required to be analytical reagent grade unless otherwise specific in method SOPs. Reagents must be at a minimum the purity required in the test method.

With the exception of the cycletainers, all solvents are pretested at an alternate STL facility. Documentation of approval is submitted to QA and posted on the STL intranet. All reagents are entered into the labnet lims system for tracking. The date of reagent receipt or preparation, and the date the reagent was opened are documented on the preprinted labnet label.

Cycletainers

STL-CT utilizes cycletainers for the organic Extractions solvents such as Hexane and Methylene Chloride. To access certification of these containers the distributor will fax a certificate of analysis from the manufacturer for the lots to be used to the QA Manager. These are kept on file. Cycletainers that do not come with a Certificate of Analysis must be pre-tested at the lab prior to being put into use. A sample of the solvent shall be concentrated and analyzed by the appropriate method. Solvents are tested and accepted in accordance with STLs Corporate *Testing Solvents and Acids* procedure (S-T-001). Documentation of lot verification must be in the extraction log and data kept on file with QA.

5.6. Sampling

Sample representativeness and integrity are the foundations upon which meaningful analytical results rely. Where documented and approved SAPs and/or LQMPs are in place, they must be made available to the laboratory before sample receipt, and approved by laboratory management before sample receipt.

5.7. Sample Handling, Transport, and Storage

5.7.1. General

Chain of Custody (COC) can be established either when bottles are sent to the field, or at the time of sampling. STL can provide all of the necessary coolers, reagent water, sample containers, preservatives, sample labels, custody seals, COC forms, ice, and packing materials required to properly preserve, pack, and ship samples to the laboratory.

Samples are received at the laboratory by a designated sample custodian and a unique Laboratory Project Identification Number is assigned thru the labnet system. The following information is recorded for each sample shipment: Client/Project Name, Date and Time of Laboratory Receipt, Laboratory Project Number, and Signature or initials of the personnel receiving the cooler and making the entries.

Upon inspection of the cooler and custody seals, the sample custodian opens and inspects the contents of the cooler, and records the cooler temperature. All documents are immediately inspected to assure agreement between the test samples received and the COC.

Any non-conformance, irregularity, or compromised sample receipt as described in Section 4.7.1 is documented on the labnet checklist and brought to the immediate attention of the PM for resolution with the client. The COC, shipping documents, documentation of any non-conformance, irregularity, or compromised sample receipt, record of client contact, and resulting instructions become part of the permanent project record. The sample data is then logged into the LIMS system by the Sample Management department.

Samples that are being tested at another STL facility or by an external subcontractor are repackaged, iced, and sent out under COC.

Following sample labeling as described in Section 5.7.1, the sample is placed in storage. Sample storage is required to be access controlled. All samples are stored according to the requirements outlined in the test method, and in a manner such that they are not subject to cross contamination or contamination from their environment. Unless specified by method or state regulation, a tolerance range of $\pm$ 2°C is used. The walk-in storage unit is monitored daily, all others are monitored each business day.

The National Enforcement Investigations Center (NEIC) of EPA defines custody of evidence in the following ways:

- It is in your actual possession; or
- It is in your view, after being in your physical possession; or
- It was in your possession and then you locked or sealed it up to prevent tampering; or it is in a secure area

At STL-Connecticut, chain of custody begins with shipment of the sample bottles and coolers. STL-Connecticut has a printed external chain-of-custody form that accompanies each sample shipment. An example of this form is found in Section 3 of the appendix.

Upon receipt of the samples in the laboratory the sample custodian and the sample control group are responsible for obtaining all necessary shipping documentation and verification of all data entered into the laboratory sample custody records. The internal laboratory custody form is generated at this point.

All samples and projects entering the laboratory are identified with a job/project number. Individual sample bottles are then identified using the job number and sample counter. The samples are then stored according to the requirements of the analytical protocols (refrigeration) and preservative type.

Preliminary sample receipt notifications are distributed to each department to notify department of sample arrival and facilitate the analysis of parameters with short holding times. Each department has a system of tracking sample analysis throughout their respective departments to ensure protocol holding times are met.

All documentation received with samples is reviewed by the sample custodian at the time of receipt. The project manager then reviews the paperwork and checks off the login review in labnet. If there are any discrepancies noted by the sample custodian, the client is then contacted for resolution.

The specific procedures and requirements for receiving samples are specified in the SOP for sample control - "Sample Processing Methods Performed at Sample Arrival". STL's chain-of-custody record is designed to meet the legal requirements of federal, state and local government agencies and the courts of law. The record covers:

- Labeling of sample bottles, packing the shipping container and transferring the shipping container under seal to the custody of a shipper;
- Outgoing shipping manifests;
- The chain-of-custody form completed by the person(s) breaking the shipping container seal, taking the sample, resealing the shipping container and transferring custody to a shipper;
- Incoming shipping manifests;
- Breaking the shipping container's reseal;
- Storing each labeled sample bottle in a secured area;
- Disposition of each sample to an analyst or technician; and
- The use of the sample in each bottle in a testing procedure appropriate to the intended purpose of the sample.

For each link in this process the records indicate the following:

- The person with custody; and
- The time and date each person accepted or relinquished custody.

STL has implemented the following standard operating procedures with regard to laboratory chain-of-custody:

- Samples are stored in a secure area;
- Non-employee access to the laboratories are controlled through the use of limited access points at each facility. Outside personnel can access the facility either through the front receptionist or the sample receipt area. Other access doors to the laboratory are maintained in a secure manner at all times;

- All visitors to each facility are required to sign-in at the reception area and must be escorted by an STL representative at all times while in the laboratory;

- The designated sample custodian and authorized personnel control access to the sample storage units; and

- Samples remain in secured sample storage until removed for sample preparation or analysis; and

All samples are stored in either the walk-in refrigerator or in a separate locked refrigerator. Samples must be stored at 4 ± 2° C. All unused portions of samples, including empty sample containers, are returned to the secure sample control area.

5.7.2. Sample Identification and Traceability

Each sample container is assigned a unique Sample Identification Number that is cross-referenced to the client identification number such that traceability of test samples is unambiguous and documented. Each sample container is affixed with a sample identification label. Access to samples is controlled and documented, identifying the identity of the sample handler, and date and time of sample access. All unused portions of th sample are returned to the Sample control area.

5.7.3 Subsampling

Taking a representative sub-sample from a container containing a soil or solid matrix is necessary to ensure that the analytical results are representative of the sample collected in the field. The size of the sample container, the quantity of sample fitted within the container, and the homogeneity of the sample need consideration when sub-sampling for sample preparation.

After thoroughly mixing the sample within the sample container or transfer to a wip bag (or other suitable plastic bag), a sub-sample from various quadrants and depths of the sample are taken to acquire the required sample weight. Any non-homogenous looking material is avoided and noted as such within the sample preparation record.

The procedure used for subsampling with the laboratory is outlined in the SOP for Compositing, Homogenization and splitting Environmental Samples.

5.7.4 Sample Preparation

Sample preparation procedures are documented in the laboratory's analytical SOPs.

5.7.5 Sample Disposal

Samples are retained in the STL-Connecticut storage facilities for 30 days after the project report is sent unless prior arrangements have been made with the client. Samples may be held longer or returned to the client per written request. Unused portions of samples found or suspected to be hazardous according to state or federal guidelines may be returned to the client upon completion of the analytical work. All radioactive or dioxin containing samples will be returned to the client.

The STL-Connecticut laboratory has a designated hazardous waste storage area with bermed floors and separate ventilation. This area and satellite accumulation areas are the direct responsibility of the Hazardous Waste Manager (HWM). The HWM routinely inspections each area to ensure regulatory adherence.

Samples designated for disposal are removed from sample control and brought to the hazardous waste storage area. Samples designated for disposal may be returned to clients for disposal, on a case-by-case basis.

The laboratory sample waste to be disposed of is segregated by waste streams. Waste profiles have been generated for the following streams: acid liquid waste, NaOH liquid waste, vials (GC, GC/MS), waste organic solvent and waste pyridine. Other laboratory waste is disposed of through the established compatible waste streams. If no compatible waste stream is available the waste is sent out via lab pack procedure.

A Hazard Waste Minimization Plan has been prepared for the STL-Connecticut facility and is designed to minimize the volume and toxicity of all waste streams being generated whenever possible. This Hazard Waste Minimization Plan is designed to meet or exceed the requirements set forth in 54 FR 25056, June 12, 1989.

Each process that generates waste will be assessed to determine if there are ways to either reduce the volume or toxicity of waste being generated. It is unlikely that most processes will be changed due to the stringent EPA standard operating procedures which must be followed. Strong emphasis will, however, be placed on efficient use of products used to prevent excessive amounts from becoming waste.

5.8. Assuring the Quality of Test Results

5.8.1. Proficiency Testing

STL analyzes Proficiency Test (PT) samples as required for certification and as outlined in the National Environmental Laboratory Accreditation Conference (NELAC). Each STL facility participates in the PT program semi-annually for each area of testing and matrix (e.g. organics, inorganics, microscopy, radiological, microbiological; aqueous and drinking water) for which it is accredited. In addition to the PT program required for NELAC accreditation, STL participates in a number of additional PT programs, as appropriate for the specific facility, such as the Army Corps of Engineers Laboratory Assessment program.

PT samples are handled and tested in the same manner (procedural, equipment, staff) as environmental samples. PT test sample data is archived using the requirements for project and raw data record retention.

Double Blind Performance Evaluation

STL CT also participates in a double blind performance. An external vendor is contracted by the corporate QA Director to submit double blind samples to the STL facility. Both the level of customer service and the accuracy of the test results are assessed objectively by the external contractor, who provides a detailed report to the QA Director and to each of the STL facilities. This is administered as a double blind program in order to assess all facets of STL operations.

5.8.2. Control Samples

Control samples are analyzed with each batch of samples to monitor laboratory performance in terms of accuracy, precision, sensitivity, selectivity, and interferences. Each regulatory program and each method within those programs specify the control samples that are prepared and/or analyzed with a specific batch. There are also a number of QC sample types that monitor field sampling accuracy, precision, representativeness, interferences, and the effect of the matrix on the method performed Note that frequency and criteria of control samples vary with specific regulatory, methodology and project specific criteria.

5.8.2.1 Method Performance Control Samples: Preparation Batch

Sample preparation or pre-treatment is commonly required before analysis. Typical preparation steps include homogenization, grinding, solvent extraction, sonication, acid digestion, distillation, reflux, evaporation, drying and ashing. During these pre-treatment steps, samples are arranged into discreet manageable groups referred to as preparation (prep) batches. Prep batches provide a means to control variability in sample treatment.

Control samples are added to each prep batch to monitor method performance (Table 8) and are processed through the entire analytical procedure with investigative/field samples.

Table 8. Preparation Batch Control Samples

Control Sample Type	Details	
Method Blank (MB)	Use	Monitors for potential contamination introduced during the sample preparation and analytical processes.
	Typical Frequency [1]	1 per batch of $\leq$ 20 samples per matrix type per sample extraction or preparation method.

Table 8. Preparation Batch Control Samples

Control Sample Type	Details	
	Description	Organics: Laboratory pure water for water samples or a purified solid matrix for soil or solid samples (when available or when requested); solid matrices commonly include sodium sulfate, vendor or agency supplied soil or solid, or purchased sand; these solids may require purification at the laboratory prior to use. Inorganics: Laboratory pure water for both water and soil or sediment samples. ***Volume/weights are selected to approximately equal the typical sample volume/weight used in sample preparation; and final results in a soil/solid batch may be calculated as mg/kg or ug/kg, assuming 100% solids and a weight equivalent to the aliquot used for the corresponding field samples, to facilitate comparison to actual field samples.***
Laboratory Control Sample (LCS)	Use	Measures the accuracy of the method in a blank matrix and assesses method performance independent of potential field sample matrix affects.
	Typical Frequency [1]	1 per batch of $\leq$ 20 samples per matrix type per sample extraction or preparation method. For multi-analyte methods, the LCS may consist of surrogates in the blank matrix, and or a representative selection of target analytes/internal standards.
	Description	Prepared from a reference source of known concentration and processed through the preparation and analysis steps concurrently with the field samples. Aqueous LCS's may be processed for solid matrices unless a solid LCS is requested; final results may be calculated as mg/kg or ug/kg, assuming 100% solids and a weight equivalent to the aliquot used for the corresponding field samples, to facilitate comparison with the actual field samples.
Known QC Sample	Use	Comply with regulatory requirements; check the accuracy of an analytical procedure; troubleshoot method performance problems; verify an analyst in training's ability to accurately perform a method; to verify the return-to-control after method performance problems; and may also be used as an LCS.
	Typical Frequency [1]	As defined by the client or QAPP.
	Description	Obtained from outside suppliers or agencies; generally require preparation from concentrated materials by dilution into a standard matrix; contain known analytes or compounds; acceptance limits are provided by the vendor.

[1] Denotes an STL required frequency.

Field blanks, equipment blank and trip blanks, when received, are analyzed in the same manner as other field samples. However, a field blank should not be selected for matrix QC,

as it does not provide information on the behavior of the target compounds in the field samples. Usually, the client sample ID will provide information to identify the field blanks with labels such as "FB", "EB", or "TB".

5.8.2.2 Method Performance Control Samples: Matrix

Matrix control samples include sample duplicates (MD), sample matrix spikes (MS), and sample surrogate spikes. These control samples help monitor for potential physical and chemical effects which may interfere with the precision and/or accuracy of the selected analytical method. Since interferences can enhance or mask the presence of target analytes, matrix control samples measure the degree of interference and are used to assist in the interpretation of the analytical results. The laboratory avoids performing matrix QC on known field blank samples, such as trip blanks and rinsates, since these samples are not indicative of the sample matrix.

Table 9. Matrix Control Samples

Control Sample Type	Details	
Matrix Duplicate (MD)	Use	Monitors the effect of site matrix on the precision of the method; and of the reproducibility of laboratory preparation and measurement techniques. **Note:** Precision may also be affected by the degree of homogeneity of the sample, particularly in the case of non-aqueous samples or aqueous samples with particulates. Sample homogeneity and matrix effect should be considered when field samples are used to assess reproducibility. **Note:** A field duplicate, when received, measures Representativeness of sampling and the effect of the site matrix upon precision.
	Typical Frequency [1]	1 per 20 samples per matrix or per SAP/QAPP [2].
	Description	***Performed by analyzing two aliquots of the same field sample independently; analyzed for each associated sample matrix (e.g., when requested by the client or the analytical method).***
Matrix Spike (MS)	Use	Measures the effect of site sample matrix on the accuracy of the method.
	Typical Frequency [1]	1 per 20 samples per matrix or per SAP/QAPP.

Table 9. Matrix Control Samples

Control Sample Type	Details	
	Description	Aliquot of a field sample which is spiked with the analytes or compounds of interest; analyzed for each associated sample matrix (when requested by the client or analytical method). The determination of MS percent recovery (% R) requires an analysis of a fortified sample and a non-fortified sample under the same procedural conditions (e.g., sample volumes, dilutions, procedural conditions, etc..). The concentration determined in the non-fortified sample is subtracted from the fortified sample concentration before determining the %R. The degree of homogeneity of the sample, particularly in the case on non-aqueous samples or samples with particulates, may affect the ability to obtain representative recoveries.
Matrix Spike Duplicate (MSD)	Use	Measures effect of site sample matrix on precision of method.
	Typical Frequency [1]	1 per 20 samples per matrix, when requested by the client or the analytical method, or per SAP/QAPP [2].
	Description	Alternative to sample duplicate. Generally, inorganic protocols specify an MD/MS and organic protocols specify an MS/MSD.
Surrogate Spike	Use	Measures method performance to sample matrix (organics only).
	Typical Frequency [1]	Every QC and analytical sample.
	Description	Compounds similar to the target analytes in structure, composition and chromatography, but not typically found in the environment, are added to each QC and analytical sample, prior to preparation (e.g., extraction). If the surrogates in an analytical batch do not all conform to established control limits, the pattern of conformance in investigative and control samples is examined to determine the presence of matrix interference or the need for corrective action.
Internal Standards	Use	Monitor the qualitative aspect of organic and inorganic analytical measurements.
	Typical Frequency [1]	All organic and ICP/MS methods as required by the analytical method.
	Description	Used to correct for matrix effects and to help troubleshoot variability in analytical response and are assessed after data acquisition. Possible sources of poor internal standard response are sample matrix, poor analytical technique or instrument performance.

[1] Denotes an STL required frequency.
[2] Either an MSD or an MD is required per 20 samples per matrix or per SAP/QAPP.

5.8.3 Statistical Control Limits and Charts

Statistical control limits and control charts are used to establish method performance of a given analysis and to monitor trends of QC results graphically over time. Once a data base

of the laboratory results for a method/matrix/QC analyte combination is established, the acceptability of a given analysis of that QC parameter (and of the analytical batch to which it belongs) can be evaluated in light of the laboratory's normal performance. This is intended to help identify problems before they might affect data. Often, patterns of response that are not at all evident in sets of numbers are very distinct when the same values are viewed as a chronological graph.

Establishment of Limits

The purpose of using statistical control limits is to define, for each analyte in a given method/matrix/QC type combination, a range of expected values. This range encompasses the random variation that occurs normally in the laboratory and allows one to evaluate control samples in that context, rather than according to an arbitrary or external set of values. Limits for accuracy and precision are defined below:

Accuracy

As recoveries of a QC analyte in a given matrix are tabulated over time, a mean value for recovery is established, as is the standard deviation (s) of those recoveries. If the analysis is in statistical control (e.g., if the set of QC recoveries over time show random variation about the mean) approximately 99.7% of all recoveries for that QC will fall within three standard deviations (3s) of the mean. Thus, assuming that the mean itself is an acceptable level of recovery, the values corresponding to 3s above and 3s below the mean are defined as the Control Limits. Any single recovery outside these values is assumed to have resulted from some circumstance other than normal variation and shall be investigated.

Roughly 95% of points should fall within 2s of the mean. The values +2s and -2s are the Warning Limits. Any normal result has approximately a 1/20 chance of being between 2s and 3s from the mean, so a result in this region doesn't necessarily warrant corrective action, but attention should be paid to such points.

Precision

Precision is used to indicate matrix variability so that appropriate decisions can be made by the client when repeated analyses vary significantly. The coefficient of variation, expressed as a percentage (e.g., the %RSD) for the data set used to calculate accuracy control limits defines the control limit for precision. Duplicate analyses of the QC samples, such as duplicates or MS/MSD, should have an RPD less than or equal to this established precision control limit to be considered free of matrix interferences.

The laboratory calculates statistical control limits on an annual basis, or more frequently if change have been made to the analytical process which affects the chemistry of the method. Such limits are available on a project or QAPP-specific basis.

In the case where laboratory generated limits do not meet the requirements of a specific project or regulation then the project and regulatory limits shall supersede the laboratory defined limits.

5.8.4 Calibration

Calibration protocols are method specific and defined in STL facility method SOPs.

- Instrument Calibration Procedures

The proper calibration of instrumentation and equipment is a key element in the quality of the analysis done by the laboratory. Each type of instrumentation and each EPA approved method has specific requirements for the calibration procedures, depending on the analytes of interest and the medium of the sample.

Table 10 lists in tabular form the general procedures which are followed by STL Connecticut. The calibration protocols meet or exceed the minimum method criteria requirements. Exact details regarding calibration for each method are outlined in the analytical SOPs. If a method calibration requirement, outlined in a project specific QA Plan, is more stringent than those listed in the Quality Assurance Plan, the more stringent will be followed in each case.

Documentation and records on calibrations are maintained in instrument logs and also with the data sets of the samples which are analyzed and related to them. In addition, laboratory department managers monitor the results of the calibration program to ensure the proper implementation at the analyst level.

TABLE 10 INSTRUMENT CALIBRATION SUMMARY

Analysis	Cal. Type	# Standards	Type of curve	Acceptance/rejection criteria	Frequency
GC Pesticides Herbicides OP pesticides GRO/DRO	Initial Continuing	5 concentration levels 1 standard (mid)	Linear	$\leq$ 20% RSD $r^2 \leq 0.99$ +/- 15% Difference	continuing calibration fails every 12 hrs or 20 samples
GC/MS quadrupole	Initial Continuing	5 concentration levels; tuning with BFB/DFTPP 1 standard; tuning with BFB/DFTPP	Linear; tuned to manufacturer's specifications	$\leq$ 30% RSD $r^2 \leq 0.99$ +/- 20% Diff	continuing calibration failure Every 12 hours
ICP	Initially Daily Continuing	5 concentration levels 2 levels 1 standard	Linear	According to instrument manufacture's instructions	Quarterly Every 10 samples
Lachat Analysis	Initially, Daily Continuing	5 concentration levels 1 standard	Linear	<.995 coefficient of variation $r^2 \leq 0.99$	continuing calibration failure Every 10 samples
pH Meters	Initially and daily Continuing	3 standards 1 standard	Linear	+/- 95% of value $r^2 \leq 0.99$	Daily Every 10 samples
Spectrophoto-meter	Initially and daily Continuing	5 concentration levels plus set %T with no cuvette in holder 1 standard	Linear	<.995 coefficient of variation $r^2 \leq 0.99$ +/- 95% of value	Daily Every 10 samples
Infrared Spectrophoto-meter	Initially and monthly Continuing	5 concentration levels 1 level	Linear	<.995 coefficient of variation $r^2 \leq 0.99$ +/- 95% of value	Daily Every 10 samples
Conductivity meter	Daily Continuing	3 concentration levels 3 concentration levels	Linear	<.995 coefficient of variation $r^2 \leq 0.99$ +/- 95% of value	Daily Every 10 samples

TABLE 10 INSTRUMENT CALIBRATION SUMMARY

Turbidimeter	Daily Continuing	3 concentration levels 3 concentration levels	Linear	<.995 coefficient of variation $r^2 \leq 0.99$ +/- 95% of value	Daily Every 10 samples
Balance	Daily	3 levels Class "S" weights	Point		Check single weight upon use

5.8.5 Glassware cleaning

STL Connecticut employs rigorous cleaning procedures for all glassware used within the laboratory. Glassware washing procedures are to be posted at all relevant stations. Detailed procedures are outlined in SOP for Glassware Washing.

5.8.6 Procedure for Permitting Departures from Documented Procedure

Where a departure from a documented SOP, test method, or policy is determined to be or perceived to be necessary, or is unavoidable, the departure is documented on a non-conformance summary or in a format specifically designed for that purpose. The departure from procedure must be authorized by the QA Manager, the Laboratory Director or the department Manager. Where a departure affects a specific client project, the PM must be informed of the deviation. In some instances, it is appropriate to inform the client before permitting a departure. Any such occurrence is documented in the cover letter and/or project narrative.

5.8.7 Development of QC Criteria, Non-Specified in Method/Regulation

Where a method or regulation does not specify acceptance and/or rejection criteria, the laboratory must examine the data user's needs and the demonstrated sensitivity, accuracy and precision of the available test methods in determining appropriate QC criteria.

Data users often need the laboratory's best possible sensitivity, accuracy, and precision using a routinely offered test method, or are unsure of their objectives for the data. For routine test methods that are offered as part of STL's standard services, the laboratory bases the QC criteria on statistical information such as determination of sensitivity, historical accuracy and precision data, and method verification data. The method SOP includes QC criteria for ongoing demonstration that the established criteria are met (e.g., acceptable LCS accuracy ranges, precision requirements, method blank requirements, initial and continuing calibration criteria, etc..).

In some cases, a routine test method may be far more stringent than a specific data user's needs for a project. The laboratory may either use the routinely offered test method, or may opt to develop an alternate test method based on the data user's objectives for sensitivity, accuracy, and precision. In this case, it can be appropriate to base the QC criteria on the data user's objectives, and demonstrate through method verification and ongoing QC samples that these objectives are met.

For example, a client may require that the laboratory to test for a single analyte with specific DQOs for sensitivity, accuracy, and precision as follows: Reporting Limit of 10 ppm, Accuracy ±25%, and RSD of <30%. The laboratory may opt to develop a method that meets these criteria and document through the Method Blank results, MDL study, and LCS results that the method satisfies those objectives. In this case, both the method and the embedded QC criteria have been based on the client's DQOs.

In some cases, the data user needs more stringent sensitivity, accuracy, and/or precision than the laboratory can provide using a routine test method. In this case, it is appropriate that the laboratory provide documentation of the sensitivity, accuracy, and precision obtainable to the data user and let the data user determine whether to use the best available method offered by the laboratory, or determine whether method development or further research is required.

5.9. Project Reports

5.9.1. General

Laboratory customers have a wide variety of analytical needs. In order to meet these varied requirements, the laboratory offer several levels of data reporting options ranging from very simple format to an extreme level of documentation. Table 11 presents the contents of various levels of reports offered by the laboratory. Custom reporting beyond those listed is usually available but may require additional cost. The information provided in Table 11 is a summary only. In some cases, individual methods may not include the indicated items. For example, in metals graphite furnace analysis an ICP interference check would not be included since it is inappropriate for that method.

The criteria described in Section 5.9.2 apply to all Project Reports that are generated under NELAC requirements. The criteria described in Section 5.9.3 and 5.9.4 apply to all Project Reports.

5.9.2. Project Report Content

- Title
- Laboratory name, address, telephone number, contact person
- Unique Laboratory Project Number
- Total Number of Pages (report must be paginated)

- Name and address of Client
- Client Project Name (if applicable)
- Laboratory Sample Identification
- Client Sample Identification
- Matrix and/or Description of Sample
- Dates: Sample Receipt, Collection, Preparation and/or Analysis Date
- Definition of Data Qualifiers
- Reporting Units
- Test Method

The following are required where applicable to the specific test method or matrix:

- Solid Samples: Indicate Dry or Wet Weight
- Whole Effluent Toxicity: Statistical package used
- If holding time $\leq$ 48 hours, Sample Collection, Preparation and/or Analysis Time
- Indication by flagging where results are reported below the quantitation limit.

5.9.3. Project Narrative

A Project Narrative and/or Cover Letter is included with each project report and at a minimum includes an explanation of any and all of the following occurrences:

- Non-conformances
- "Compromised" sample receipt (see Section 4.7.1)
- Method Deviations
- QC criteria failures

Project Release

The Project Manager or his/her designee authorizes the release of the project report with a signature. The Laboratory Director or his/her designee authorizes the release of the project report narrative with a signature as required by the data reporting deliverables.

Where amendments to project reports are required after issue, these shall be in the form of a separate document and/or electronic data deliverable. The revised report is clearly identified as revised with the date of revision and the initials of the person making the revision. Specific pages of a project report may be revised using the above procedure with an accompanying cover letter indicating the page numbers of the project revised. The original version of the project report must be kept intact and the revisions and cover letter included in the project files.

5.9.4. Subcontractor Test Results

Project reports from external subcontract shall not be altered, and shall be included in original form in the final project report provided by STL. Data from subcontractors' reports may be added to an STL electronic deliverable.

Subcontracted data shall be clearly identified as such, and the name, address, and telephone number for the laboratory performing the test is included in the project report. If the report is being generated under NELAC requirements, all information outlined in Section 5.9.2 are required for both the originating laboratory and the subcontracting laboratory.

Data subcontracted within STL may be reported on the originating laboratory's report forms provided the following mandatory requirements are met:

- The name, address, and telephone number of the facility are provided.
- Analytical results produced by the STL intra-company subcontractor are clearly identified as being produced by the subcontractor facility.
- The intra-company subcontractor's original report, including the chain of custody is retained by the originating laboratory.
- Proof of certification is retained by the originating laboratory.
- All information as outlined in Section 5.9.2 is included in the final report where the report is required to be compliant with NELAC, for both the originating and subcontracting laboratory.

5.9.5. Electronic Data Deliverables

Electronic Data Deliverables (EDD) are routinely offered as part of STL's services. STL offers a variety of EDD formats including Environmental Restoration Information Management System (ERPIMS), New Agency Standard (NAS), Format A, Excel, Dbase, GISKEY, and Text Files.

EDD specifications are submitted to the IT department by the PM for review and undergo the contract review process in Section 4.4.1. Once the facility has committed to providing diskettes in a specific format, the coding of the format is performed. This coding is documented and validated. The validation of the code is retained as a QC record.

EDDs are subject to a review to ensure their accuracy and completeness. If EDD generation is automated, review may be reduced to periodic screening if the laboratory demonstrates that it can routinely generate that EDD without errors. Any revisions to the EDD format are reviewed until it is demonstrated that it can routinely be generated without errors.

5.9.6. Project Report Format

STL offers a wide range of project reporting formats, including EDDs, short report formats, and complete data deliverable packages modeled on the Contract Laboratory Protocol (CLP) guidelines. Regardless of the level of reporting, all projects undergo the same levels of review as described in Section 5.3.6.

Table 11 Report Content Options

	Data reporting Options			
Wet Chemistry	Level 1	Level 2	Level 3 *	Level 4 (CLP)
Case narrative	Yes	Yes	Yes	Yes
Sample Results	Result forms	Result forms	Result forms	Result forms
Method Blank	Yes	Yes	Yes	Yes
External Chain of Custody	Yes	Yes	Yes	Yes
Internal Chain of Custody	Yes	Yes	Yes	Yes
Duplicate	-	Yes	Yes	Yes
Matrix Spike	-	Yes	Yes	Yes
Initial Calibration Verification (ICV)	-	-	Yes	Yes
Continuing Calibration Verification (CCV)	-	-	Yes	Yes
Laboratory Control Sample (LCS)	-	-	Yes	Yes
EPA Forms 1-14	-	-	Yes	Yes
Metals	Level 1	Level 2	Level 3 *	Level 4 (CLP)
Case Narrative	Yes	Yes	Yes	Yes
Sample Results	Result forms	Result forms	Result forms	Result forms
Method Blank	Yes	Yes	Yes	Yes
External Chain of Custody	Yes	Yes	Yes	Yes
Internal Chain of Custody	Yes	Yes	Yes	Yes
Duplicate	-	Yes	Yes	Yes
Matrix Spike	-	Yes	Yes	Yes
Initial Calibration Verification (ICV)	-	-	Yes	Yes
Continuing Calibration Verification (CCV)	-	-	Yes	Yes
Laboratory Control Sample (LCS)	-	-	Yes	Yes
ICP Interference Check	-	-	Yes	Yes
ICP Linear Range	-	-	Yes	Yes
ICP Post Spike	-	-	Yes	Yes
EPA Forms 1-14	-	-	Yes	Yes
Organics	Level 1	Level 2	Level 3*	Level 4 (CLP)
Case Narrative	Yes	Yes	Yes	Yes
Sample Results	Result forms	Result forms	Result forms	Result forms
Method Blank	Yes	Yes	Yes	Yes
External Chain of Custody	Yes	Yes	Yes	Yes
Internal Chain of Custody	Yes	Yes	Yes	Yes
Matrix Spike	-	Yes	Yes	Yes
Matrix Spike Duplicate	-	Yes	Yes	Yes
Laboratory Control Sample (LCS)	-	-	Yes	Yes
Surrogate Recovery Information	-	Yes	Yes	Yes
Tuning Data (GC/MS only)	-	-	Yes	Yes
Initial Calibration Information	-	-	Yes	Yes
Continuing Calibration Information	-	-	Yes	Yes
Run Sequence Logs	-	-	Client Specific	Client Specific
Sample Preparation Logs	-	-	Yes	Yes
Chromatograms and Mass Spectra	-	-	-	Yes
EPA Forms 1-8	-	-	Yes	Yes

* Raw backup data not provided

Table 12 Correlation of QMP Sections with NELAC Quality Manual Requirements

NELAC Chapter 5.5.2 Quality Manual	Quality Management Plan Section
a. Quality policy statement, including objectives and commitments	1.2 Quality Assurance Policy 4.2.1 Objectives of the Quality System
b. Organization and management structure	4.1 Organization and Management
c. Relationship between management, technical operations, support services and the quality systems	4.1.2 Roles and Responsibilities 4.2 Quality System
d. Records retention procedures; document control procedures	4.3 Document Control 4.12.2 Record Retention
e. Job descriptions of key staff and references to job descriptions of other staff	4.1.2 Roles and Responsibilities
f. Identification of laboratory approved signatories	4.1 Organization and Management
g. Procedures for achieving traceability of measurements	5.5 Measurement Traceability
h. List of all test methods under which the laboratory performs its accredited testing	5.3.1 Method Selection
i. Mechanisms for assuring the laboratory reviews all new work to ensure that it has the appropriate facilities and resources before commencing such work	4.4.2 Project-Specific Quality Planning
j. Reference to the calibration and/or verification test procedures used	5.4.3 Equipment Verification and Calibration
k. Procedures for handling submitted samples	4.7.1 Sample Acceptance Policy 5.7 Sample Handling, Transport and Storage
l. Reference to the major equipment and reference measurement standards used as well as the facilities and services used in conducting tests	5.2 Laboratory Facilities 5.4.2 Equipment Maintenance 5.4.3 Equipment Verification and Calibration
m. Reference to procedures for calibration, verification and maintenance of equipment	5.4.2 Equipment Maintenance 5.4.3 Equipment Verification and Calibration
n. Reference to verification practices including interlaboratory comparisons, proficiency testing programs, use of reference materials and internal QC schemes	5.8.1 Proficiency Testing 5.8.2 Control Samples
o. Procedures for feedback and corrective action whenever testing discrepancies are detected, or departures from documented procedures occur	4.9 Control of Non-Conformances 4.10 Corrective Action 4.11 Preventive Action 5.8.6 Permitting Departures from Documented Procedures

Table 12 Correlation of QMP Sections with NELAC Quality Manual Requirements

NELAC Chapter 5.5.2 Quality Manual	Quality Management Plan Section
p. Laboratory management arrangements for exceptionally permitting departures from documented policies and procedures	4.4.2 Project-Specific Quality Planning 5.8.6 Permitting Departures from Documented Procedures
q. Procedures for dealing with complaints	4.8 Complaints
r. Procedures for protecting confidentiality and proprietary rights	4.7.2 Client Confidentiality and Proprietary Rights
s. Procedures for audits and data review	4.13 Internal Audits 5.3.6 Data Reduction and Review
t. Process/procedures for establishing that personnel are adequately experienced in duties they are expected to carry out and are receiving any needed training	5.1.2 Training
u. Ethics policy statement developed by the laboratory and training personnel in their ethical & legal responsibilities	5.1.3 Ethics Policy
v. Reference to procedures for reporting analytical results	5.3.6 Data Reduction & Review 5.9 Project Reports
w. Table of contents, listing reference, glossaries and appendices	TOC Table of Contents Appendix I: List of Cited SOPs and Misc. Laboratory Information

APPENDIX, Section 1

PROFESSIONAL PROFILES OF KEY PERSONNEL

The following professional profiles are presented alphabetically and represent the key quality assurance and laboratory management personnel for the network organization. Additional professional profiles are available for review during a site visit to any of our laboratory facilities.

Qualifications Summary

Mr. Frick has 20 years of experience in environmental and analytical chemistry that includes broad management and leadership experience. He is responsible for the overall direction of the laboratory and has extensive knowledge in environmental analytical chemistry and business management.

Professional Experience

Laboratory Director – 2004 to present

STL Connecticut—Shelton, CT
Mr. Frick directs the growth and development of the laboratory, including strategic plan development and implementation. He is responsible for all phases of operation within the Shelton, Connecticut facility, including; the technical and administrative management of the laboratory. The functional groups of the facility include Sample Control, Sample Preparation, Organic Chemistry, Metals, Wet Chemistry, Project Management, QA/QC and Information Technology, Report Generation, Data Management, and Human Resources. His other responsibilities include adherence to budget, staff development and control, quality assurance and quality control, scheduling, client support/liaison, as well as profit and loss responsibility for the facility. In addition, he is responsible for oversight of the Environmental Health and Safety Program, and was instrumental in the set up of the mixed waste license for the Connecticut laboratory.

Chromatography Product Manager
Supelco Incorporated—Bellefonte, PA—1998 to 2004

Laboratory Director
American Environmental Network—Schaumburg, IL—1996 to 1998

Laboratory Manager
Industrial Environmental Analysts—Schaumburg, IL—1995 to 1996

Group Leader
Industrial Environmental Analysts—Monroe, CT—1988 to 1995

Chemist
Environmental Analysis Corporation—Norwalk, CT—1984 to 1988

Education

- BS in Chemistry – University of Connecticut—Storrs, CT—1984
- MBA in Finance – University of Bridgeport—Bridgeport, CT—1993

Professional Training

- Environmental Laboratory Management —John H. Taylor, ACS Course
- Performance Management Workshop—Cynthia. Barnet, HR Consultant
- Interview Skills Workshop—Cynthia. Barnet, HR Consultant
- Frontline Leadership Development —William Frackler, Ingoldsby, Inc.
- 40 Hour OSHA Training —Lynn Sherman, YWC Midwest
- Radiation Safety Program Training —Radiation Safety Associates, Inc.
- Theory of Constraint Training—Sigma-Aldrich, Inc.
- Strategic Sales Management —Sigma-Aldrich, Inc.
- Corporate Finance Workshops—Sigma-Aldrich, Inc.

Professional Affiliations

- American Chemical Society

Qualifications Summary

Mr. Hobart has 14 years of experience in the environmental laboratory industry that includes management of the client services and sample control departments, project management responsibilities, and experience performing analyses. He possesses excellent presentation skills, communication skills, and writing proficiency. Paul is adept at motivating his team to achieve goals and objectives.

Professional Experience

Client Services Manager – 1999 to present

STL Connecticut -- Shelton, CT
Mr. Hobart's responsibilities include the administrative management of the project management, sample control and courier staff of the facility. He coordinates the project management staff with laboratory operations to ensure that projects are executed properly and effectively. He is responsible for generating and tracking price quotations, and for providing detailed forecasting and project schedules to the laboratory director. Additionally, Paul is responsible for the management of key client accounts.

Project Manager – 1996 - 1999
STL Connecticut – Whippany NJ and Shelton, CT

Project Manager – 1993 -1996
Quanterra, Inc. – Edison, NJ and Pittsburgh, PA

Analyst/Project Manager – 1990 - 1993
Analytica, Inc. – Golden, CO

Analyst – 1980 - 1990
Ledoux & Co. – Teaneck, NJ

Education

- BA in Literature – Ramapo College of NJ--Mahwah, NJ--1986

Professional Training

- Seminar- Conference on Customer Service, 2000
- Principles of Mass Spectrometry , 1991

Qualifications Summary

Ms. Culik has over 22 years experience in the environmental laboratory field. Experience includes analysis of drinking water utilizing a variety of organic and inorganic methods and Gas chromatography chemist on environmental samples. Experience also includes supervisor of the Gas Chromatography department responsible for analysis of environmental samples for pesticides/PCB's according to EPA/NYSDEC CLP Protocols, SW846 Methods and EPA "600" Series Methods.

Professional Experience

Quality Assurance Manager – 1991 to present

STL Connecticut (formerly IEA Incorporated)--Shelton, CT--1991 to Present

Ms Culik is responsible for developing and implementing the laboratory's quality system and laboratory quality manual to ensure compliance with STL policies for quality assurance and control (QA/QC). She administrates the laboratory certification and accreditation programs and responds to external audits. She is responsible for the assessment of operations through internal audits, management review and proficiency testing and for the oversight of preventative and corrective actions. Additional responsibilities include document control and archival of laboratory records. In addition, she prepares and submits monthly reports to corporate management, assists in reviewing project QA plans and serves as a laboratory/client support liaison.

Ms. Culik's responsibilities also include maintaining the laboratory's LIMS reporting system.

Gas Chromatography Group Leader

IEA Incorporated –Monroe, CT – 1986 to 1991

Chemist

York Laboratories – Monroe, CT – 1984 to 1986

Laboratory Analyst

American Waterworks Service Company – 1981 to 1984

Lab Technician

Suffolk County Water Authority 1978 to 1981

Lab Technician

Hooker Chemicals & Plastics – 1976 to 1978

Education

- AAS – Medical Technology, S.U.N.Y. at Alfred - Alfred, New York, 1976

Professional Training

- Two day seminar on Environmental Laboratory Management
  John H. Taylor, Analytical Technology.

- Performance Management Workshop
  One day seminar
  Cynthia Barnet, Human Resources Consultant

- Interview Skills Workshop
  One day seminar
  Cynthia Barnet, Human Resources Consultant

- Leadership Development Workshop
  Four day workshop
  William Frackler, Ingoldsby, Inc.

- Mass Spectral Data Interpretation
  One day seminar
  Dr. Frank Rutecek, Cornell University

- Introduction to Analytical Separations
  Four day seminar
  Dr. Dhea Habboush, Sacred Heart University

- ASQC Course
  Auditing of Quality Systems

- ASQC Course
  Introduction to SPC

- Six Sigma Green belt training

Professional Affiliations

Qualifications Summary

Mr. Helfrich has 15 years of experience in the environmental laboratory industry that includes extensive management/leadership experience with full profit and loss responsibility. He has functioned in numerous analytical roles including: Sample prep, furnace analysis, ICP analysis and hazardous waste coordinator. Experienced in data review, and familiar with EPA and NYSDEC protocols. He possesses excellent communication skills. Mr. Helfrich has an exceptional ability to effectively handle multiple projects and tasks. He is action-oriented, with a can-do attitude, a fast learner who has the capacity to adapt quickly to new situations.

Professional Experience

Inorganic Manager – 1998 to present

STL Connecticut - 1998 to Present
Mr. Helfrichs' responsibilities include the technical management of the inorganic analytical laboratory including approximately 10 chemists. The functional groups of the facility include Sample Preparation, Metals, General Inorganic Chemistry, and Report Generation. His other responsibilities include staff development and control, quality assurance and quality control of the inorganic departments, scheduling, as well as profit and loss responsibility for the Inorganic department. In addition, he is responsible for oversight of Waste Management and is part of the Environmental Health and Safety Program team.

Metals Manager
IEA INC – Monroe CT, 1992 to 1998

Metals Chemist
IEA INC – Monroe CT, 1989-1992

Education

- BS in Biology - St. Anselm College, Manchester NH, 1982
- MS in Chemistry - Quinnipiac College, Hamden CT, 1986
- MBA in Finance – Sacred Heart University, Fairfield CT, 1990

Qualifications Summary

Mrs. Maturo has over 19 years of experience in the environmental laboratory industry that includes extensive management/leadership experience.

She started in the Organic Extractions department as a lab technician and worked her way up to supervisor. From there, she transferred to the Gas Chromatography Department in order to expand her knowledge by learning more about the analysis of environmental samples. She is now Group Leader of the GC Department and is experienced in Pesticide and PCB residue analysis as well as a variety of other GC parameters.

Professional Experience

Gas Chromatography Group Leader-1991 to present

STL Connecticut (formery IEA, Inc.)-1991 to present
Mrs. Maturo is Supervisor of the Gas Chromatography Department. She is responsible for the analysis of environmental samples for Organochlorine and Organophosphorous pesticides, PCB's, Diesel Range Organics, and CT. Extractable Petroleum Hydrocarbons according to EPA/NYSDEC CLP Protocols, SW846 Methods and EPA "600" Series Methods.

Other duties include hiring personnel, ordering supplies, tracking samples thru the department, updating SOP's and final data package review.

GC- Senior Lab Technician

STL Connecticut (formerly IEA, formerly AEN)-1988 to 1991
Ms. Maturo's primary duties were the operation of gas chromatographs for a variety of analyses. She has experience in pesticide/PCB determinations as well as other miscellaneous analytes.

Other duties included sample tracking, data entry, report generation, and preparation of standards used for instrument calibration.

Extractions Technician/Extractions Group Leader

STL Connecticut (formerly YWC)-1988 to 1991
Over this time period Ms. Maturo was a member of the extractions group and supervised the operations and staff for the last year. Her duties were primarily extraction of environmental samples for semi-volatile organics, pesticides/PCB's and herbicides.
Other duties included preparation of standard reagents used in the extraction procedures, writing SOP's, and screening of sample extracts by gas chromatography.

Education

- BS in Biology – Southern Connecticut State University—New Haven, CT--1985

Professional Training

- Six Sigma Yellow Belt Management Training, 2003
- HAZWOPER Refresher-Field Safety Corp., 2000
- Perkin Elmer TurboChrom C/S Fundamentals Training Course, 1999
- Gas Chromatography Open Forum-Hewlett Packard, 1999
- "Dealing with Unacceptable Employee Behavior"- SkillPath Seminar, 1999
- Frontline Leadership-Zenger Miller, date Unknown
- 24 Hour Technician Course for Hazardous Waste Operations and Emergency Response-Field Safety Corp., 1999
- RCRA Compliant Hazardous Waste Handler Program-Field Safety Corp., 1999
- "Coaching and Teambuilding Skills for Managers and Supevisors"-SkillPath Seminar, date unknown
- Gas Chromatography Workshop-Env. Research Institute, UCONN., 1995
- "Basic Supervision"-SkillPath Seminar, 1988

Professional Affiliations

Qualifications Summary

Mr. Decker has 18 years of experience in the environmental laboratory industry that includes supervisory and leadership experience. He possesses extensive knowledge in volatile organic analyses and is a resource to the laboratory, project management and customers. He is an action-oriented manager with a can-do attitude; who has the capacity to adapt quickly to new situations.

Professional Experience

GC/MS Manager – 1992 to present

Mr. Decker's responsibilities include the management and overall production of the volatile organics laboratory including 3 employees and 7 analytical systems. Methodologies include SW-846, CLP, EPA 500 and 600 series methods. Other responsibilities include work scheduling, data review, method development and compliance and employee training. He is also proficient in the maintenance and troubleshooting of all analytical systems in his laboratory. In addition, he ensures conformance to STL Environmental Health and Safety and manages costs and expenditures incurred by his laboratory.

GC/MS Section Leader
Industrial Environmental Analysts—Monroe, CT—1991 to 1992

GC/MS Analyst
Industrial Environmental Analysts—Monroe, CT—1986 to 1991

Education

- BA in Biology – Franklin Pierce College—Rindge, NH --1982

Professional Training

- Mass Spectroscopy Data Interpretation – Dr. Frank Turecek
- GC/MS Software Training – Mark Hartwick
- HP User I Course – Hewlett-Packard
-

Professional Affiliations

American Chemical Society

Qualifications Summary

Mrs. May has 14 years of experience in the environmental laboratory industry that includes extensive experience in all phases of laboratory operations in the organic departments. She began as an analyst for GC volatile organics and quickly became responsible for the analysis of GC/MS volatiles, GC Pesticide/PCB and Herbicides, as well as GC/MS semi-volatiles. She also learned the extractions of all these analyses. She then changed companies to work in GC Pesticide/PCB/Herbicide/DRO analysis and reporting for SW-846 and CLP protocols. She became the Senior analyst in the department and was responsible for any troubleshooting issues with the instruments as well as system manager for the acquisition/analysis software system. She was then promoted to GC/MS Semivolatile Group leader and is now responsible for the day to day operation of the GC/MS Semi-Volatiles group.

Professional Experience

GC/MS Semi-volatile Group Leader – June 1, 2004 to present

STL Connecticut--Shelton, CT—June 1, 2004 to Present
Mrs. May's responsibilities include the supervision of 2 analyst's, sample tracking through the department, the analysis of semi-volatile extracts, target and non-target compound identification, instrument troubleshooting and maintenance, the reporting of data, and the final review of data packages. She provides guidance to staff to ensure that project specific data quality objectives are met. She ensures that the SOP's are updated and that the department is meeting protocol requirements.

GC Analyst II to IV/Reporting
STL Connecticut--Shelton, CT—April 1996 to June 2004

Responsiblities included data reporting as well as analysis of Pesticides, PCB's, Herbicides, CTETPH, DRO's, and Fingerprint Analysis. Responsible for troubleshooting and maintenance of all instrumentation as well as method development. She was the system manager for the Perkin Elmer Turbochrom software system. She perfomed data review of data packages.

GC/MS Semivolatile and Volatile analyst
Averill Environmental Laboratory—Plainville, CT--1993 to 1996

Responsible for the analysis and reporting of volatile and semi-volatile samples using SW-846 and drinking water methodologies. Responsible for the extraction of pesticides, PCB's, semi-volatile and TPH extracts.

GC Analyst
Averill Environmental Laboratory—Plainville, CT--1990 to 1996

Responsible for the analysis and reporting of Volatile, Pesticide, PCB, and Herbicide samples using SW-846 and drinking water methodologies.

Education

- BS in Renewable Natural Resources-Cum laude – University of Connecticut—Storrs, CT--1990

Professional Training

- Capillary Chromatography Training - 1996
- Turbochrom Client/Server System Manager – 2001
- Comprehensive Environmental GC Training - 2001
- RCRA Compliant Hazardous Waste Handler Program – 1999

Qualifications Summary

Ms. Haas has 7 years of experience in the environmental laboratory industry that includes management/leadership experience. Ms. Haas is responsible for the overall operations of the classical chemistry department. These responsibilities include but are not limited to meeting client satisfaction goals, managing the human resources within the department, and ensuring health and safety and quality assurance plan compliance. Ms. Haas serves as a technical resource to department employees, as well as project managers, sales personnel, and clients. She makes recommendations to laboratory management in regard to process improvements.

Professional Experience

Department Manager – Classical Chemistry – 2001 to present

STL Connecticut, Shelton, CT--2001 to Present
Ms. Haas' responsibilities include:

- Coordinating work projects with project managers to appropriately schedule laboratory workload to meet client requirements.
- Prioritizing samples for analysis to ensure that OTD and TAT requirements are met.
- Determining client-specific requirements and testing methodology; communicating requirements to analysts.
- Scheduling employees in regard to workload and backlog to improve efficiency.
- Supervising supervisors to maximize productivity and ensure appropriate testing procedures are used n compliance with QA and SOP requirements.
- Preparing and analyzing samples for analysis based on method requirements.
- Uploading data files to reporting system.
- Reviewing data produced in assigned department and authorizes its release.
- Communicating department issues and providing status reports to Laboratory Director and Projects Managers.
- Recommending process improvements to improve efficiency.
- Partnering with laboratory management to evaluate new work opportunities and plan implementation.

Classical Chemistry Laboratory Analyst/Data Manager

STL Connecticut, Shelton, CT--1997 to 2001

- Analyzed water and soil matrices using Standard Operation Procedures specific to the classical chemistry department.
- Performed tests such as total suspended and dissolved solids, pH, alkalinity, oil and grease, and hexavalent chromium using colorimetric, gravimetric, instrumental, and titrametric methods.
- Oversaw quality control of department.
- Prepared and reviewed client reports using raw data.
- Supervised data management staff.

Veterinary Technician
Mobile Veterinary Clinic, Trumbull, CT--1994-1997

- Performed diagnostic tests and procedures, such as radiographs and blood collection.
- Administered medical treatments.
- Provided surgical assistance and nursing care.
- Supervised kennel workers.
- Educated clients.

Campus Organizer
NJ Public Interest Research Group (NJPIRG), New Brunswick, NJ--1990-1993

- Organized student activities in NJPIRG chapter at Rutgers University.
- Created and implemented environmental programs, such as educating grade-school children about recycling.
- Lobbied for environmental legislation.
- Managed 100 student interns and volunteers.
- Developed relations with administration and faculty.

Education

- BS in Biology – Rutgers University—New Brunswick, NJ --1990

Qualifications Summary

Ms. Dubauskas has 24 years of experience in the environmental industry that includes extensive knowledge of laboratory, hazardous waste treatment and project management skills. She possesses excellent organizational and communication ability. Her enthusiasm for the highest achievable level of quality and customer service is apparent. Johanna has an exceptional capability to effectively handle multiple projects and tasks.

Professional Experience

Senior Project Manager – 1991 to present

STL Connecticut – Shelton, CT
Ms. Dubauskas' responsibilities include assisting clients in solving problems, answering client inquiries, discussing technical issues and managing clients through sampling programs with guidance on proper protocols. She is also responsible for scheduling sample pickups, coordinating incoming work within the laboratory, preparing written price quotations and invoicing. In addition, she assists Account Executives on sales calls and in project kick-off meetings.

Client Service Representative – 1987 to 1991
York Labs – Monroe, CT

Inside Sales Representative – 1986 to 1987
The Rockbestos Company – New Haven, CT

Chemical Buyer – 1985 to 1986
Pfaltz & Bauer – Waterbury, CT

Lab Technician – 1984 to 1985
Cecos Treatment Corporation – Bristol, CT

Research and Development Chemist –1983 to 1985
American Chemical and Refining, Inc. – Waterbury, CT

Chemist – 1980 to 1983
Environmental Waste Removal, Inc. – Waterbury, CT

Education

- BA in Biology – Western Connecticut State University – Danbury, CT - 1979

Professional Training

- Certificate Program of Environmental Science – 1985
- Customer Service Seminar - 2000

Qualifications Summary

Mrs. Duhancik has 6 years of experience in the environmental laboratory industry that includes project management and volatile organic compound GC/MS analysis experience. She possesses excellent communication and organizational skills. Jill has a passion for the highest achievable level of quality and customer service. She has an exceptional ability to effectively handle multiple projects and tasks. She is an action-oriented individual with a can-do attitude; a fast learner who has the capacity to adapt quickly to new situations. Jill is also adept at motivating a team to achieve goals and objectives.

Professional Experience

Project Manager – 2002 to present

STL Connecticut -Shelton, CT
Mrs. Duhancik's responsibilities include the coordination and management of customer's projects through all phases of laboratory operations, ensuring fulfillment of Severn Trent Laboratories commitments to client requirements, error-free work, and on-time delivery. She maintains communications with clients and Account Executives and serves as a liaison between clients and laboratory operations to meet client's needs. Mrs. Duhancik works closely with business unit personnel to manage quotations and change orders for existing scopes of work. She monitors compliance with industry regulations, contractual agreements, program management processes, and program specifications. She works towards achieving goals for revenue, profit, and KRI's through the effective utilization of laboratory capacity and definition of customer requirements.

VOA Analyst – 1998-2002
STL Connecticut – Shelton, CT

Waitress – 1996-1998
Olive Garden – Orange, CT

Education

- BS in Environmental Science – Saint Joseph College – West Hartford, CT -1998
- BS in Biology - Saint Joseph College – West Hartford, CT -1998

Qualifications Summary

Mr. Goodman has 3 years of experience in the environmental laboratory industry that includes Semivolatiles extractions and GC/MS analysis and management positions. He possesses excellent communication and writing skills. He has a passion for the highest achievable level of quality and customer service and the ability to effectively handle multiple projects and tasks. He is an action-oriented member of STL-CT with a can-do attitude; a fast learner who has the capacity to adapt quickly to new situations. He is also adept at motivating a team to achieve goals and objectives.

Professional Experience

Project Manager – 2004 to present

STL Connecticut – Shelton, CT--2004 to Present
Mr. Goodman's responsibilities include coordination and management of customers' projects through all phases of laboratory operations, ensuring fulfillment of Severn Trent Laboratories' commitments to client requirements, error-free work, and on-time delivery. Maintains communications with clients and Account Executives and serves as a liaison between clients and laboratory operations to meet client needs. Works closely with business unit personnel to manage quotations and change orders for existing scopes of work. Monitors compliance with industry regulations, contractual agreements, program management processes, and program specifications. Works toward achieving goals for revenue, profit, and customer service through the effective utilization of laboratory capacity and definition of customer requirements.

Extractions Manager
STL-Connecticut—Shelton, CT—02/2004 to 05/2004

Semivolatiles Analyst
STL-Connecticut—Shelton, CT—01/2002 to 02/2004

Extractions Analyst
STL-Connecticut—Shelton, CT—09/2001 to 02/2002

Education

- B.S. Environmental Science, St. Michael's College, Winooski Park, Colchester, VT May 2001.

APPENDIX, Section 2

ETHICS POLICY and QUALITY STATEMENT

SEVERN TRENT STL

Severn Trent Laboratories, Inc.
EMPLOYEE ETHICS STATEMENT

I understand that STL is committed to ensuring the highest standard of quality and integrity of the data and services provided to our clients. I have read the Ethics Policy of the Company.

With regard to the duties I perform and the data I report in connection with my employment at the Company, I agree that:

- I will not intentionally report data values that are not the actual values obtained;
- I will not intentionally report the dates, times, sample or QC identifications, or method citations of data analyses that are not the actual dates, times, sample or QC identifications, or method citations;
- I will not intentionally misrepresent another individual's work;
- I will not intentionally misrepresent any data where data does not meet Method or QC requirements. If it is to be reported, I will report it with all appropriate notes and/or qualifiers;
- I agree to inform my Supervisor of any accidental reporting of non-authentic data by me in a timely manner; and I agree to inform my Supervisor of any accidental or intentional reporting of non-authentic data by other employees;
- If a supervisor or a member of STL management requests me to engage in or perform an activity that I feel is compromising data validity or quality, I will not comply with the request and will report this action immediately to a member of senior management, up to and including the President of STL; and
- I will not share the pricing or cost data of Vendors or Suppliers with anyone outside of the Severn Trent family of companies.

As a STL employee, I understand that I have the responsibility to conduct myself with integrity in accordance with the ethical standards described in the Ethics Policy. I will also report any information relating to possible kickbacks or violations of the Procurement Integrity Act, or other questionable conduct in the course of sales or purchasing activities. I will not knowingly participate in any such activity and will report any actual or suspected violation of this policy to management.

The Ethics Policy has been explained to me by my supervisor or at a training session, and I have had the opportunity to ask questions if I did not understand any part of it. I understand that any violation of this policy subjects me to disciplinary action, which can include termination. In addition, I understand that any violation of this policy which relates to work under a government contract or subcontract could also subject me to the potential for prosecution under federal law.

EMPLOYEE SIGNATURE _____ Date _____

Supervisor/Trainer: _____ Date _____

Reference: STL Ethics Policy, P-L-006, Rev. 5.

SEVERN TRENT STL

Severn Trent Laboratories, Inc.

CONFIDENTIALITY AND PROPRIETARY INFORMATION AGREEMENT

Severn Trent Laboratories, Inc. and its predecessors, in their businesses, have developed and use commercially valuable technical and non-technical information and to guard the legitimate interests of STL and its clients, it is necessary to protect certain information as confidential and proprietary.

I, _____ , understand and acknowledge that during the term of my employment by STL, I will be privy to and entrusted with certain confidential information and trade secrets of STL and its clients.

Confidential information and trade secrets include, but are not limited to: customer and client lists; price lists; marketing and sales strategies and procedures; operational and equipment techniques; business plans and systems; quality control procedures and systems; special projects and technological research, including projects, research and reports for any government entity or client; client's plans and processes; client's manner of operation; the trade secrets of clients; client's data; vendor or supplier pricing; and any other records, data, files, drawings, inventions, discoveries, applications, or processes which are not in the public domain.

I agree as follows:

1. I will not in any way, during the term of my employment, or at any time thereafter, except as authorized in writing by the Legal Department of STL or the client where client data is involved, disclose to others, use for my own benefit, remove from STL's premises, copy or make notes of any confidential information and/or trade secrets of STL or its clients, excepting only that information which may be public knowledge. Technical and business information of any previous employer or other third party which I may disclose to STL shall be limited to that which was acquired legitimately and disclosed to me without restriction as to secrecy.

2. I agree that all inventions (whether or not patentable) conceived or made by me during the period of my employment by STL shall belong to STL, provided such inventions grow out of my work for STL and are related to the business of STL. I agree to disclose and assign such inventions to STL. In California, this provision shall not apply to any invention which qualifies fully under Section 2870 of the California Labor Code.

3. On termination of my employment from STL, I will deliver to STL all documents, records, notes, data, memoranda, files, manuals, equipment and things of any nature which relate in any way to confidential information and/or trade secrets of STL or its clients and which are in my possession or under my control.

4. I acknowledge that if I were to breach any provision of this Confidentiality Agreement, money damages will be inadequate, and I hereby agree that STL shall be entitled, where appropriate, to specific performance and/or injunctive relief (i.e. to require me to comply with this Agreement). I further acknowledge that the willingness of STL to hire me or to continue my employment constitutes full and adequate consideration for the agreements, and obligations to which I have agreed as set forth in this document.

I have executed this Agreement, intending to be legally bound.

_____	_____	_____
Printed Name	*Signature*	*Date*

Reference: STL Ethics Policy, P-L-006, Rev. 5.

APPENDIX, Section 3

CHAIN-OF-CUSTODY FORM

Chain of Custody Record

STL Connecticut
128 Long Hill Cross Road
Shelton, CT 06484
Tel: 203-929-8140

SEVERN TRENT **STL**

Severn Trent Laboratories, Inc.

STL-4124 (0901)

Client	Project Manager	Date	Chain of Custody Number 00019
Address	Telephone Number (Area Code)/Fax Number	Lab Number	Page _____ of _____
City / State / Zip Code	Site Contact	Lab Contact	Analysis (Attach list if more space is needed)
Project Name and Location (State)	Carrier/Waybill Number		Special Instructions/ Conditions of Receipt
Contract/Purchase Order/Quote No.	Matrix	Containers & Preservatives	

Sample I.D. No. and Description (Containers for each sample may be combined on one line)	Date	Time	Matrix: Air	Aqueous	Sed.	Soil		Containers & Preservatives: Unpres.	H2SO4	HNO3	HCl	NaOH	ZnAc/ NaOH		Analysis	Special Instructions/ Conditions of Receipt

Possible Hazard Identification

☐ Non-Hazard ☐ Flammable ☐ Skin Irritant ☐ Poison B ☐ Unknown

Sample Disposal

☐ Return To Client ☐ Disposal By Lab ☐ Archive For _____ Months

(A fee may be assessed if samples are retained longer than 1 month)

Turn Around Time Required

☐ 24 Hours ☐ 48 Hours ☐ 7 Days ☐ 14 Days ☐ 21 Days ☐ Other_____

QC Requirements (Specify)

1. Relinquished By	Date	Time	1. Received By	Date	Time
2. Relinquished By	Date	Time	2. Received By	Date	Time
3. Relinquished By	Date	Time	3. Received By	Date	Time

Comments

DISTRIBUTION: WHITE - Returned to Client with Report; CANARY - Stays with the Sample; PINK - Field Copy

APPENDIX, Section 4

STL SAMPLE PRESERVATION AND HOLDING TIME REQUIREMENTS

Parameter[1]	Methods	Matrix	Holding Time*	Container	Preservation
Inorganics-Metals					
Metals, excluding Hg	200 Series 7000 Series 6010	Water	6 months	500 ml P,G	HNO3 to PH <2
Mercury	200 Series 7000 Series	Water	28 Days	500 ml P,G	HNO3 to PH <2
Metals, excluding Hg	200 Series 7000 Series 6010	Soil	6 months	100 g P,G	Cool 4°C
Mercury	200 Series 7000 Series	Soil	28 Days	100 g P,G	Cool 4°C
Inorganics-Wet Chemistries					
Acidity	EPA 600	Water	14 Days	100 ml P,G	Cool 4°C
Alkalinity	EPA 600	Water	14 Days	100 ml P,G	Cool 4°C
BOD	EPA 600	Water	48 Hours	1000 ml P,G	Cool 4°C
Bromide	EPA 600	Water	28 Days	50 ml P,G	None Req.
COD	EPA 600	Water	28 Days	50 ml P,G	Cool 4°C, H2SO4 to pH <2
Chloride	EPA 600	Water	28 Days	50 ml P,G	None Req.
Chromium, CR+6	EPA 600	Water	24 Hours	50 ml P,G	Cool 4°C
Cyanide	EPA 600	Water	14 Days[2]	500 ml P,G	Cool 4°C, NaOH to pH > 12 Ascorbic Acid[3]
Fluoride	EPA 600	Water	28 Days	500 ml P,G	None Req.
Hardness	EPA 600	Water	6 Months	100 ml P,G	HNO3 to pH <2
MBAS	EPA 600	Water	48 Hours	500 ml P,G	Cool 4°C
Nitrogen-Ammonia	EPA 600	Water	28 Days	500 ml P,G	Cool 4°C, H2SO4 to pH <2
Nitrogen-TKN	EPA 600	Water	28 Days	500 ml P,G	Cool 4°C, H2SO4 to pH <2
Nitrate	EPA 600	Water	48 Hours	100 ml P,G	Cool 4°C
Nitrate-Nitrite	EPA 600	Water	28 Days	100 ml P,G	Cool 4°C, H2SO4 to pH <2

Parameter	Methods	Matrix	Holding Time*	Container	Preservation
Inorganics-Wet Chemistries-cont.					
Oil and Grease	EPA 600	Water	28 Days	1000 ml P,G	Cool 4°C, HCL or H2SO4 to pH <2
Petroleum Hydrocarbons	EPA 600-418.1	Water	28 Days	1000 ml P,G	Cool 4°C, HCL to pH <2
pH	EPA 600	Water	Immed.	50 ml P,G	NA
Phenols	EPA 600	Water	28 Days	500 ml P,G	Cool 4°C, H2SO4 to pH<2
Phosphorus, Ortho	EPA 600	Water	48 Hours	50 ml P,G	Filter Immed., Cool 4°C
Phosphorus,Total	EPA 600	Water	28 Days	50 ml P,G	Cool 4°C, H2SO4 to pH <2
Residue, TDS	EPA 600	Water	7 Days	100 ml P,G	Cool 4°C
Residue, TSS	EPA 600	Water	7 Days	250 ml P,G	Cool 4°C
Residue, TS	EPA 600	Water	7 Days	250 ml P,G	Cool 4°C
Residue, Volatile	EPA 600	Water	7 Days	250 ml P,G	Cool 4°C
Residue, Settleable	EPA 600	Water	48 Hours	250 ml P,G	Cool 4°C
Specific Conductance	EPA 600	Water	28 Days	100 ml P,G	Cool 4°C
Sulfate	EPA 600	Water	28 Days	250 ml P,G	Cool 4°C
Sulfide	EPA 600	Water	7 days	500 ml P,G	Cool 4°C, ZnAc/NaOH to pH >9
TOC	EPA 600	Water	28 Days	50 ml P,G	Cool 4°C, HCL or H2SO4 to pH <2
TOX	EPA 600	Water	28 Days	40 ml G	Cool 4°C, H2SO4 to pH <2, Sodium Sulfite
Turbidity	EPA 600	Water	48 Hours	100 ml P,G	Cool 4°C
Cyanide	SW846	Soil	14 Days	100 g G	Cool 4°C
Sulfide	SW846	Soil	7 Days	100 g G	Cool 4°C

Parameter	Methods	Matrix	Holding Time*	Container	Preservation
Organics-Parameters by Gas Chromatography					
Volatiles; Halogenated	600 series SW846	Water	7/14 Days[5]	3 x 40 ml vial	Cool 4°C, Thiosulfate[4]
Volatiles; Aromatics	600 series SW846	Water	7/14 Days[5]	3 x 40 ml vial	Cool 4°C, HCL to pH <2 Thiosulfate[4]
Volatiles; Non-Halogenated	SW846 - 8015	Water	7/14 Days[5]	3 x 40 ml vial	Cool 4°C, Thiosulfate[4]
Semi-volatiles	600 series SW846	Water	ext.- 7 Days anal.-40 Days	1L, amber G	Cool 4°C, Thiosulfate[4]
Organochlorine Pesticides/PCBs	600 series SW846	Water	ext.- 7 Days anal.-40 Days	1L, amber G	Cool 4°C, Thiosulfate[4]
Organophosphorus Pesticides	600 series SW846	Water	ext.- 7 Days anal.-40 Days	1L, amber G	Cool 4°C, Thiosulfate[4]
Herbicides	SW846	Water	ext.- 7 Days anal.-40 Days	1L, amber G	Cool 4°C, Thiosulfate[4]
Volatiles; Halogenated	SW846	Soil	14 Days	50 g, G	Cool 4°C
Volatiles; Aromatics	SW846	Soil	14 Days	50 g, G	Cool 4°C
Volatiles; Non-Halogenated	SW846 - 8015	Soil	14 Days	50 g, G	Cool 4°C
Semi-volatiles	SW846	Soil	ext.- 14 Days anal.-40 Days	100 g, G	Cool 4°C
Organochlorine Pesticides/PCBs	SW846	Soil	ext.- 14 Days anal.-40 Days	100 g, G	Cool 4°C
Organophosphorus Pesticides	SW846	Soil	ext.- 14 Days anal.-40 Days	100 g, G	Cool 4°C
Herbicides	SW846	Soil	ext.- 14 Days anal.-40 Days	100 g, G	Cool 4°C

Parameter	Methods	Matrix	Holding Time*	Container	Preservation
Organics-GC/MS Parameters					
Volatiles; Halogenated	600 series SW846	Water	7/14 Days[5]	3 x 40 ml vial	Cool 4°C, Thiosulfate[4]
Volatiles; Aromatics	600 series SW846	Water	7/14 Days[5]	3 x 40 ml vial	Cool 4°C, HCL to pH <2 Thiosulfate[4]
Volatiles; Halogenated	500 series	Water	7/14 Days[5]	3 x 40 ml vial	Cool 4°C, HCL to pH <2 Thiosulfate[4]
Volatiles; Aromatics	500 series	Water	7/14 Days[5]	3 x 40 ml vial	Cool 4°C, HCL to pH <2 Thiosulfate[4]
Semi-volatiles	600 series SW846	Water	ext.- 7 Days anal.-40 Days	1L, amber G	Cool 4°C, Thiosulfate[4]
Volatiles; Halogenated	SW846	Soil	14 Days	50 g, G	Cool 4°C
Volatiles; Aromatics	SW846	Soil	14 Days	50 g, G	Cool 4°C
Semi-volatiles	SW846	Soil	ext.- 14 Days anal.-40 Days	100 g, G	Cool 4°C

* From Collection

1. The following information is based upon WPA requirements outlines in Part 136, title 40 of the Code of Federal Regulations. Various state agencies have differing requirements for both holding times and preservation from those listed above. In such cases, the local requirements supersede the EPA information.

2. Maximum holding time is 24 hours when sulfide is present. Sample must be tested with lead acetate paper be fore pH adjustment in order to determine is sulfide is present.

3. If residual chlorine is present in the sample 0.6 g of ascorbic acid is utilized.

4. If samples contain residual chlorine sodium thiosulfate must be added at the time of sampling.

5. If samples do not received pH adjustment, the holding time is 7 days.

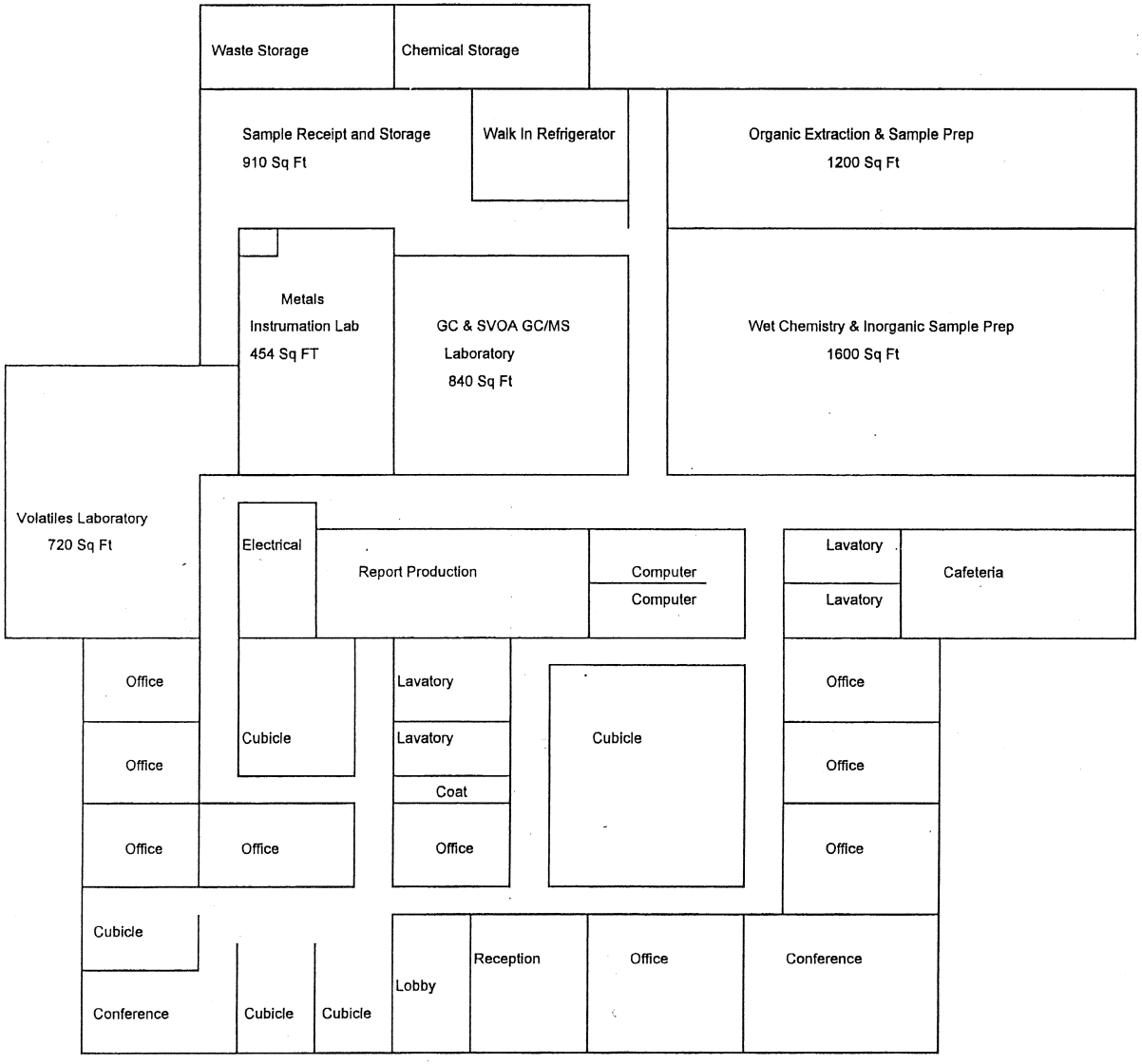
APPENDIX, Section 5

LABORATORY FLOOR PLAN

EQUIPMENT LIST

PREVENTIVE MAINTENANCE

Severn Trent Laboratories
Shelton, CT



STL CONNECTICUT LABORATORY
Instrument List

Instrument Type	Manufacturer	Model	Purchase Date	Autosampler	Method Performed
ICP	Thermo Jarrell Ash (61E) S/N 349490	61E ICAP	1994	Yes	6010B, 200.7
	Thermo Jarrell Ash (61P) S/N 464790	61E Trace	1997	Yes	6010B, 200.7
Mercury Analyzer	Perkin Elmer S/N 1398	FIMS	1999	Yes	7471A, 7470, 245.1
GC/MS Semivolatiles	Hewlett-Packard (U) S/N US33210086	5973/6890	2004	Yes	8270C, 625, SIM
	Hewlett-Packard (Q) S/N US00007319	5890/5971	1992	Yes	8270C, 625, SIM
	Hewlett-Packard (R) S/N US00036181	5890/5971	1992	Yes	8270C, 625, SIM
	Hewlett-Packard (P) S/N US00007291	5890/5971	1992	Yes	8270C, 625, SIM
GC/MS Volatiles	Hewlett-Packard (L) S/N 3240A18492	5890/5971	1992	Yes	8260B, 624
	Hewlett-Packard (K) S/N 3029A30026	5890/5970	1990	Yes	8260B, 624 – waters
	Hewlett-Packard (O) S/N 3203A41807	5890/5971	1991	Yes	8260B, 624 – waters
	Hewlett-Packard (N) S/N 3133A37851	5890/5971	1991	Yes	8260B, 624
	Hewlett-Packard (M) S/N 33033A33746	5890/5970	1991	Yes	8260B, 624 – soils
	Hewlett-Packard (T) S/N 3336A51317	5890/5972	1996	Yes	T0 17 – air
	Hewlett-Packard (v) S/N	6890/5973	2004	Yes	8260B, 624
GC Semivolatiles	Hewlett-Packard (GC1C/D) S/N	5890II - Dual ECD	1994	Yes	8081, 8082, 608
	Hewlett-Packard (GC4C/D) S/N 3033A33529	5890II - Dual ECD	1992	Yes	8082
	Hewlett-Packard (GC5C/D) S/N	5890II - Dual ECD	1989	Yes	8081, 8082, 608
	Hewlett-Packard (GC7C/D) S/N	5890II - Dual ECD	2004	Yes	8081, 8082, 608
	Hewlett-Packard (GC2C/D) S/N 3033A32099	5890II – FID/NPD	1991	Yes	WSO, 8141
	Hewlett-Packard (GC3) S/N 3033A32563	5890 - FID	1991	Yes	8015B (DRO), ETPH
Ion Chromatograph	Lachat S/N A83000-1476	Quickchem 8000	1999	Yes	300.0, 9056 350.1, 351.2 9012, 335.4, 353.2, 420.2
TOC	Dohrmann	Phoenix 8000	2004	No	415.2, 9060

STL CONNECTICUT LABORATORY
Instrument List

Instrument Type	Manufacturer	Model	Purchase Date	Autosampler	Method Performed
	Dohrmann	DC-190	1998	Yes	415.2, 9060
TKN Digestion System	Scientific Instruments	AD-4020	1994	No	351.2, 351.3
UV/VIS	Barnstead Turner	SP 830	2003	No	7196A, 376.2
UV/VIS	Buck Scientific	HC 404	2000	No	418.1
PH Meter	Orion Research	SA 720	1998	No	9040B, 9045C, 150.1
PH Meter	Beckman	12	1995	No	9040B, 9045C, 150.1
Autotitrator (pH, Alkalinity, Conductance)	Man-Tech (ATZ)	PC 1300	2003	Yes	9040B, 9045C, 150.1, 2320B, 310.1, 310.2, 2510B, 9050A, 120.1
Dissolved Oxygen Meter	YSI	51A	1994	No	405.1
Turbidimeter	HACH	2100 N	1990	No	180.1
Conductivity	Cole-Parmer	1484-20	1996	No	120.1
Automated Distillation Apparatus	Westco S/N 1028	1075 Easy Dist	2003	No	350.1, 420.2, 9066
COD	HACH	45600	1991	No	410.4
Flash Point Apparatus	Precision Scientific	Pensky-Martin	1990	No	1020
Midi Distillation Setups	Andrews Galss	110-10-R	1995	No	9012A, 335.1, 335.3
TCLP Spinners	Dayton	3M137B/5K939B	1990	No	1311, 1312
GPC	ABC	Autoprep 1000	1999	Yes	8270, 8081, 8082

STL- Connecticut LABORATORY PREVENTIVE MAINTENANCE

GC/MS SYSTEMS		
EQUIPMENT	ACTION PERFORMED	FREQUENCY
Hewlett-Packard 5970 MSD / 5971 MSD/5972 MSD	Check oil level in mechanical pumps	Weekly
	Change the oil in the mechanical pumps	Every 6 months
	Inspect the pump hoses and replace if required	Every 6 months
	Change oil in the turbo pump	Every 6 months
	Change exhaust trap absorbent	Every 6 months
	Inspect and refill the calibration sample vial with PFTBA	Every 6 months
	Vacuum fan grills and filters	Every 6 months
	Ion source cleaning and filament replacement	As needed
	Manual tuning	As needed
	Replace electron multiplier	As needed
	Clean out transfer line to GC	After every column removal
Hewlett-Packard 5890 GC	Check helium gas supply	Daily
	Change split vent trap	Every 3 months
	Column replacement and conditioning	As needed
	Column cutting and reinstallation	Daily or as needed
	Change helium gas cylinder	As needed
	Change liner and septum	Daily or as needed
	Clean injection port	As needed
EQUIPMENT	ACTION PERFORMED	FREQUENCY
Hewlett-Packard 7672A Autosampler	Inspect and correct injector alignment	After reseating
	Inspect syringe	Daily
	Check compressed air gas supply	Daily
	Inspect and adjust tension on sample tray	Daily
	Change rinse vials	Daily
	Change waste vials	Weekly
	Replace syringe	As needed
	Sand injector post	As needed
	Realign autosampler on brackets	As needed

	Change compressed air cylinder	As needed
Hewlett-Packard 7673A Autosampler	Inspect syringe	Daily
	Inspect seating of injector	Daily
	Change rinse vials	Daily
	Change waste vials	Weekly
	Replace syringe	As needed
	Reset control box	As needed
Tekmar Purge and Trap Sample Concentrators and Autosamplers	Inspect spargers and fittings	Daily
	Check purge flow	Daily
	Inspect line and valve temperatures	Daily
	Change and condition trap	As needed
	Adjust purge flow	As needed
	Rinse or clean sparging vessels	As needed
	Rinse sample lines	As needed
	Bake out trap	After each analysis, extend as needed
	Replace lines and fittings	As needed
	Adjust line and valve temperatures	As needed
EQUIPMENT	ACTION PERFORMED	FREQUENCY
Envirochem Air Sample Concentrator and AS	Inspect fittings	Daily
	Check flows	Daily
	Inspect line and valve temperatures	Daily
	Change and condition internal traps	As needed
	Adjust flow	As needed
	Bake out trap	After each analysis, extend as needed
	Replace lines and fittings	As needed
	Adjust line and valve temperatures	As needed
Archon	Check Syringe	Daily
	Check reagent water and waste bottles	Daily
	Autocalibrate robotic arm	As needed
	Replace inline filter	As needed

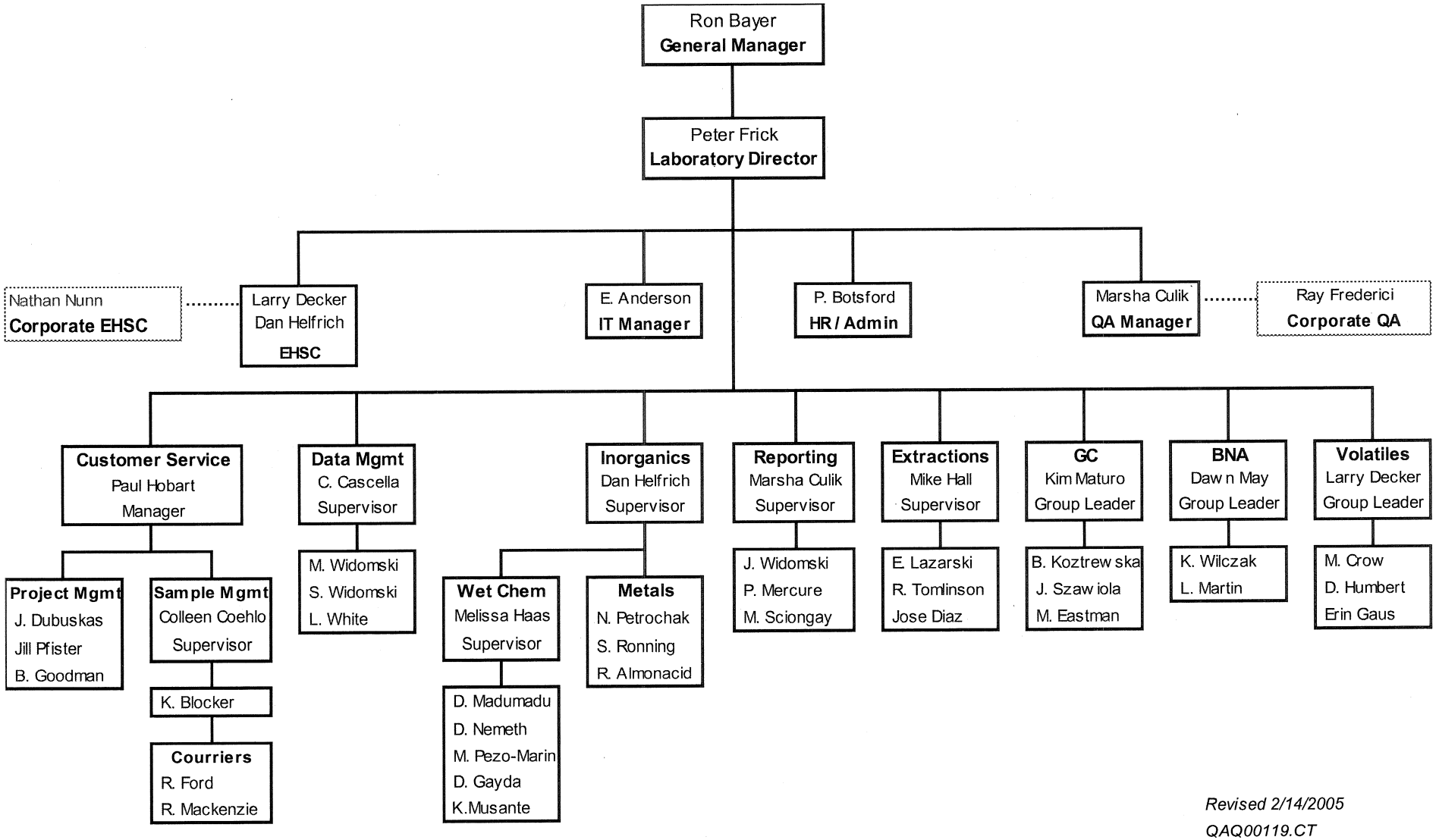
GC SYSTEMS		
EQUIPMENT	ACTION PERFORMED	FREQUENCY
Hewlett-Packard 5890A GC (GC-1,4,5 Dual ECD)	Check gas supply	Daily
	Check breakdown criteria	As required by run sequence
	Vacuum filters and grills	Quarterly
	Column replacement and conditioning	As needed
	Column cutting and reinstallation	As needed
	Change gas cylinders	As needed
	Change liner and septum	As needed
	Replace guard column	As needed
	Clean injection port	As needed
	Recondition ECD	As needed
	Change ECD vent absorbent traps	Quarterly
EQUIPMENT	ACTION PERFORMED	FREQUENCY
Hewlett-Packard 5890A GC (GC-3 FID/NPD)	Check gas supply	Daily
	Vacuum filters and grills	Quarterly
	Column replacement and conditioning	As needed
	Column cutting and reinstallation	As needed
	Change gas cylinders	As needed
	Change liner and septum	As needed
	Clean injection port	As needed
	Replace or reactivate the NPD collector	As needed
Hewlett-Packard 7673A Autosampler	Inspect syringe	Daily
	Inspect seating of injector	Daily
	Inspect rinse and waste vials	Daily
	Vacuum filters and grills	Quarterly
	Replace syringe	As needed
	Change rinse and waste vials	As needed

EQUIPMENT	ACTION PERFORMED	FREQUENCY
METALS SYSTEMS		
Inductively Coupled Plasma	Change capillary and pump tubing	Twice weekly
	Replace liquid argon tank	As required
	Reprofile via slit micrometer	Per manual
	Replace and realign plasma torch	As needed
	Clean nebulizer and spray chamber	As needed
	Check primary imaging mirror	Weekly
Mercury Analyzer	Clean sample cell and tubing	Monthly
	Check sparger condition	Daily
	Check level of mercury scrubber solution	Daily
	Replace lamps	As required
WET CHEMISTRY SYSTEMS		
EQUIPMENT	ACTION PERFORMED	FREQUENCY
pH Meters	Clean electrode if calibration has deteriorated	As needed
	Store pH electrodes in pH 7.0 buffer	Daily
	Check ISE electrodes and meter	Per manual
Analytical Balances	Surfaces cleaned and covered	Daily
	Calibrated and cleaned by manufacturer	Semi-annually
	Accuracy checked by class "S" weights	Prior to use
Conductivity Meters	Instrument surfaces inspected and cleaned	Daily
	Calibrated using 0.01M potassium chloride	Daily
	Spare cells on inventory	As needed
Spectrophotometers	Instrument cleaned	Daily use
Autoanalyzer Systems	Clean all components and flush system	Daily use
	Inspect all pump tubes and sample lines	Daily use
	Inspect line coils, heating baths and filters	Weekly
	Inspect all colorimeter filters	Weekly
	Inspect and clean chemical manifolds	Monthly

APPENDIX, Section 6

ORGANIZATIONAL CHART

STL Connecticut Organization



Revised 2/14/2005
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Leaders in Environmental Testing

APPENDIX, Section 7

CORRECTIVE ACTION FORM

STL

CORRECTIVE ACTION FORM

A. Originator Information **Client Inquiry**

Client:_____ Job/Case:_____

Date/time:_____ Sample Number(s):_____

Client/Lab Contact: _____ Date/Time Response Due:_____

Detailed Description of Potential Problem:

_____

_____

_____

_____

_____

_____

_____

B. Quality Assurance Information **Corrective Action ID#** _____

Recommended Corrective Action:

_____

_____

_____

_____

Groups Involved:

__Sample Control __ Wet Chemistry __ Metals __Organic Extraction

__Gas Chromatography __ MS- VOA __ Report Generation __Lab Director

__Client Service __ MS -SV __EDD __ Subcontractor

C. Final Resolution

Describe What Happened and Corrective Action Taken:

_____

_____

_____

_____

Supervisor Signature: _____ Date_____ Date/Time Client Notified:_____

D. Quality Assurance Final Approval (QA Manager or designee use only)

Corrective Action Approved:_____

APPENDIX, Section 8

LISTING OF LABORATORY

STANDARD OPERATING PROCEDURES (SOPs)

Standard Operating Procedures Listing

Dept	Document Number	Revison	Active Date	SOP Title	Document Type
Sample Receipt	**SMS00106.CT**	6	09/05/04	Bottle Order Preparation	SOP
Sample Receipt	**SMS00408.CT**	8	09/06/04	Sample Processing and Sample Arrival	SOP
Sample Receipt	**SMS00609.CT**	9	09/06/04	Storing Water and Soil Samples	SOP
Sample Receipt	**SMS00808.CT**	8	09/06/04	Documenting Sample and Removal from the Laboratory	SOP
Sample Receipt	**SMS00908.CT**	8	09/06/04	Securing the Laboraotory and Samples	SOP
Sample Receipt	**SMS01006.CT**	6	09/06/04	Temperature Control Requirements	SOP
Sample Receipt	**SMS01106.CT**	6	09/06/04	Compositing, Homogenization and Splitting Environmental Samples	SOP
Sample Receipt	**SMS01304.CT**	4	09/06/04	Log-in for CLP (OLM04.2) Samples	SOP
Sample Receipt	**SMS01402.CT**	2	09/06/04	Sample Disposal	SOP
Sample Receipt	**SMS01500.CT**	0	09/04/04	Handling Samples under a Foreign Soil Permit	SOP
Organic Prep	**SPS02804.CT**	2	03/06/03	Preparation of Chlorinated Herbicides (W) - 8151A	SOP
Organic Prep	**SPS01306.CT**	6	05/15/02	Aqueous BNA Methods 3510/3520	SOP
Organic Prep	**SPS01205.CT**	5	04/25/02	Aqueous Pest/PCB Methods 3510C/3520C	SOP
Organic Prep	**SPS01405.CT**	5	09/01/02	Soil BNA Method 3550	SOP
Organic Prep	**SPS01605.CT**	5	06/20/02	Soil Pest/PCB Method 3550	SOP
Organic Prep	**SPS01703.CT**	3	05/15/02	Aqueous OP Pesticides Methods 3510/3520	SOP
Organic Prep	**SPS01805.CT**	5	04/03/02	SW846 GPC of BNA extracts	SOP
Organic Prep	**SPS01902.CT**	2	04/03/02	GPC of Pesticide/PCB extracts method 3640	SOP
Organic Prep	**SPS02703.CT**	3	09/05/02	Soil OP Pesticides Method 3550	SOP
Organic Prep	**SPS03005.CT**	5	04/02/02	Waste dilution - BNA	SOP
Organic Prep	**SPS03103.CT**	3	09/13/02	Waste dilution - Pesticides/PCB (3580)	SOP
Organic Prep	**SPS03205.CT**	5	05/15/02	Pesticide/PCB extraction method 608	SOP
Organic Prep	**SPS03302.CT**	2	09/05/02	Prep Soil/Sediment samples for CLP P/P OLM03.2	SOP
Organic Prep	**SPS03401.CT**	1	04/03/02	GPC of Pesticide extracts OLM03.2	SOP
Organic Prep	**SPS03503.CT**	3	02/21/03	Prep Soil/Sed samples for CLP BNA's OLM03.2	SOP
Organic Prep	**SPS03601.CT**	1	04/03/02	GPC of Semivolatile extracts OLM03.2	SOP
Organic Prep	**SPS03701.CT**	1	02/20/03	Prep of Aqueous samples for CLP BNA's OLM03.2	SOP
Organic Prep	**SPS03802.CT**	2	05/22/02	Prep of Aqueous samples for CLP P/P OLM03.2	SOP
Organic Prep	**SPS03901.CT**	1	06/18/97	CLP Extraction Standard Prep	SOP
Organic Prep	**SPS02901.CT**	1	07/26/96	Alumina Column C/U Method 3611A	SOP
Organic Prep	**SPS04001.CT**	1	06/05/02	Prep of Aqueous SV OLC10/92	SOP
Organic Prep	**SPS04201.CT**	1	09/18/02	Prep of Semivolatiles in Tissue samples	SOP
Organic Prep	**SPS04305.CT**	5	06/20/02	Prep of Pesticides/PCBs in Tissue samples	SOP
Organic Prep	**SPS04403.CT**	3	02/16/00	Prep of Chlorinated Herbicides -Method 8151 (S)	SOP

Standard Operating Procedures Listing

Dept	Document Number	Revison	Active Date	SOP Title	Document Type
Organic Prep	SPS04502.CT	2	09/18/02	Prep of PUF Samples for Pesticides/PCB T04	SOP
Organic Prep	SPS04602.CT	2	09/09/02	Prep of PUF Samples for Semi-volatiles T013	SOP
Organic Prep	SPS04703.CT	3	05/22/02	Prep of SV Method 625 (Water)	SOP
Organic Prep	SPS04801.CT	1	09/18/02	Prep of Wipe Samples Pesticides/PCBs	SOP
Organic Prep	SPS04903.CT	3	09/18/02	Florisil Cartridge clean-up P/P extracts	SOP
Organic Prep	SPS05002.CT	2	06/05/02	Prep of Low Level PCBs - Method 608	SOP
Organic Prep	SPS05101.CT	1	03/06/03	Prep of Low level PCBs - 3510C	SOP
Organic Prep	SPS05304.CT	4	06/05/02	Prep of Aqueous samples for DRO analysis - 8015B	SOP
Organic Prep	SPS05203.CT	3	06/20/02	Prep of Solid samples for DRO analysis - 8015B	SOP
Organic Prep	SPS05602.CT	2	02/13/03	Prep of Aqueous samples for CLP P/P OLM04.3	SOP
Organic Prep	SPS05702.CT	2	02/20/03	Prep of Soil/Sediment samples for CLP P/P OLM04.3	SOP
Organic Prep	SPS05802.CT	2	02/20/03	GPC CLP P/P Extracts OLM04.3	SOP
Organic Prep	SPS05902.CT	2	02/13/03	Standards Prep for CLP P/P OLM04.3	SOP
Organic Prep	SPS06002.CT	2	02/13/03	Prep of Aqueous samples for CLP BNA's OLM04.3	SOP
Organic Prep	SPS06102.CT	2	02/20/03	Prep of Solid samples for CLP BNA's OLM04.3	SOP
Organic Prep	SPS06202.CT	2	02/20/03	GPC of Semivolatile extracts OLM04.3	SOP
Organic Prep	SPS06301.CT	1	02/20/03	Standards Prep for CLP BNA OLM04.3	SOP
Organic Prep	SPS06400.CT	0	03/17/00	Standards Prep for CLP Pest/PCB OLM03.2	SOP
Organic Prep	SPS06500.CT	0	04/02/02	Prep of BNA Soils - Method 3541	SOP
Organic Prep	SPS06600.CT	0	09/10/02	Prep of Soil Samples for GC Method 3541	SOP
GCMS Semi VOA	MSS01604.CT	4	10/04/04	GC/MS Semivolatiles OLM03.2	SOP
GCMS Semi VOA	MSS02009.CT	9	10/10/04	GC/MS Analysis Method 625	SOP
GCMS Semi VOA	MSS02200.CT	0	10/05/04	GC/MS Semivolatile OLC2.1	SOP
GCMS Semi VOA	MSS02706.CT	6	08/19/04	GC/MS Semivolatile analysis - Method 8270C	SOP
GCMS Semi VOA	MSS03501.CT	1	09/14/04	GC/MS Semi-volatiles OLM04.3	SOP
GCMS Semi VOA	MSS03601.CT	1	10/08/04	GC/MS Semi-volatile screening OLM04.3	SOP
GCMS Semi VOA	MSS03701.CT	1	10/07/04	Semi-volatile Std Prep	SOP
GCMS Semi VOA	MSS03400.CT	0	01/21/03	Semi-volatile by Method T0 13A	SOP
GCMS VOA	MSS00100.CT	0	04/30/93	Volatile Std Prep CLP	SOP
GCMS VOA	MSS01500.CT	0	dft	GC/MS Volatile 524.2 Rev. 3	SOP
GCMS VOA	MSS01801.CT	1	06/27/97	GC/MS Volatiles OLM03.2	SOP
GCMS VOA	MSS02102.CT	2	02/15/00	GC/MS Analysis Method 624	SOP
GCMS VOA	MSS02803.CT	3	09/23/03	GC/MS Volatile analysis - Method 8260B	SOP
GCMS VOA	MSS02900.CT	0	dft	GC/MS Volatiles - OLC02.1	SOP
GCMS VOA	MSS03001.CT	1	03/27/03	GC/MS VOA OLM04.3	SOP

Standard Operating Procedures Listing

Dept	Document Number	Revison	Active Date	SOP Title	Document Type
GCMS VOA	MSS03300.CT	0	01/27/00	GC/MS Volatile Standards Prep OLM04.2	SOP
GCMS VOA	MSS03802.CT	2	01/24/05	Volatile by Method T0 17	SOP
GC Semivoa	GCS00302.CT	2	01/13/04	Sulfur Removal	SOP
GC Semivoa	GCS00504.CT	4	01/13/04	Analysis of OP Pesticides Method 8141A	SOP
GC Semivoa	GCS00703.CT	3	02/18/04	Misc. Volatiles Method 8015 (DAI)	SOP
GC Semivoa	GCS01302.CT	2	01/13/04	Analysis of Hydrocarbon Fingerprinting	SOP
GC Semivoa	GCS01104.CT	4	01/20/04	Pesticides/PCB Method 608	SOP
GC Semivoa	GCS01503.CT	3	01/13/04	GC/ECD Pesticides/PCB analysis OLM03.2	SOP
GC Semivoa	GCS01804.CT	4	01/13/04	Diesel Range Organics - Method 8015B	SOP
GC Semivoa	GCS02003.CT	3	01/19/04	Pesticide/PCB analysis - Method T04	SOP
GC Semivoa	GCS02104.CT	4	01/13/04	Water soluble Organics - DAI/NPD	SOP
GC Semivoa	GCS02205.CT	5	01/14/04	Analysis of Pesticides - Method 8081A	SOP
GC Semivoa	GCS02306.CT	6	01/14/04	Analysis of PCBs - Method 8082	SOP
GC Semivoa	GCS02403.CT	3	01/20/04	Analysis of Herbicides - Method 8151A	SOP
GC Semivoa	GCS02503.CT	3	01/20/04	GC/ECD Pesticides/PCB CLP OLM04.3	SOP
GC Semivoa	GCS02603.CT	3	01/20/04	Pesticide/PCB Standard Prep OLM04.3	SOP
GC Semivoa	GCS02702.CT	2	01/13/04	CT ETPH - DRO	SOP
Metals	MES00906.CT	6	04/01/04	SW846 Method 3010A	SOP
Metals	MES01006.CT	6	04/01/04	SW846 Method 3050B	SOP
Metals	MES02001.CT	1	01/20/03	Method 6010B - TJA61 Trace ICP	SOP
Metals	MES02201.CT	1	02/12/00	Metals Digestion ILM04.1 (Water)	SOP
Metals	MES02301.CT	1	02/12/00	Metals Digestion ILM04.1 (Soil)	SOP
Metals	MES02401.CT	1	02/12/00	Determination of Mercury in Water ILM04.1	SOP
Metals	MES02501.CT	1	02/12/00	Determination of Mercury in Soil ILM04.1	SOP
Metals	MES02601.CT	1	03/22/00	Determination of Metals - ILM04.1 TJA-61E Trace	SOP
Metals	MES02700.CT	0	08/01/96	Determination of Metals - 200.7 TJA 61E Trace	SOP
Metals	MES02800.CT	0	08/01/96	Determination of Mercury in Water Method 245.1	SOP
Metals	MES02900.CT	0	dft	Metals Digestion of Wipe Samples	SOP
Metals	MES03103.CT	3	03/27/03	Mercury 7470A (Hot Block)	SOP
Metals	MES03202.CT	2	01/20/03	Mercury 7471A (Hot Block)	SOP
Metals	MES03301.CT	1	07/12/02	Metals Digestion 200.7 (Water)	SOP
Wet Chemistry	CVS01004.CT	4	01/28/04	Analysis of Oil & Grease (Gravimetric)- 413.1	SOP
Wet Chemistry	WC:070891:0	0	07/08/91	Analysis of Salinity in Water	SOP
Wet Chemistry	CVS04301.CT	1	02/26/99	Measurement of Conductivity	SOP
Wet Chemistry	WC:071691:0	0	07/16/91	Analysis of Dissolved Oxygen in Water	SOP

Standard Operating Procedures Listing

Dept	Document Number	Revison	Active Date	SOP Title	Document Type
Wet Chemistry	CVS00706.CT	6	10/14/04	Analysis of Alkalinity in Water - 310.1	SOP
Wet Chemistry	CVS02603.CT	3	10/14/04	Analysis of Ammonia (method 350.2) in Water	SOP
Wet Chemistry	CVS00900.CT	0	03/31/94	Measurement of pH	SOP
Wet Chemistry	CVS01705.CT	5	10/14/04	Analysis of Sulfide	SOP
Wet Chemistry	CVS00506.CT	6	01/23/04	Analysis of Biochemical Oxygen Demand	SOP
Wet Chemistry	CVS01205.CT	5	02/17/04	Analysis of COD (Method 410.4)	SOP
Wet Chemistry	CVS01101.CT	1	02/04/00	Analysis of Samples for Total Cyanide CLP Protocol	SOP
Wet Chemistry	CVS01502.CT	2	10/8/1999	SOP for Toxicity Characteristic Leaching Procedure - 1311	SOP
Wet Chemistry	CVS04003.CT	3	4/10/2000	Measurement of Turbidity in Water Samples	SOP
Wet Chemistry	CVS00103.CT	3	10/26/1999	Analysis of Total Dissolved Solids in Water	SOP
Wet Chemistry	CVS03403.CT	3	10/19/2004	Analysis of TOC Soil Samples	SOP
Wet Chemistry	CVS03902.CT	2	10/8/1999	Analysis of Chloride (325.2) in Water	SOP
Wet Chemistry	CVS01901.CT	1	10/9/1999	Standard Operating Procedure for Reactivity	SOP
Wet Chemistry	CVS04603.CT	3	6/8/2004	Standard Operating Procedure for Corrosivity	SOP
Wet Chemistry	CVS02303.CT	3	10/19/2004	Standard Operating Procedure for Ignitability (1030)	SOP
Wet Chemistry	CVS00204.CT	4	1/21/2004	Analysis of Total Suspended Solids in Water	SOP
Wet Chemistry	CVS02502.CT	2	10/8/1999	Analysis of Nitrate and Nitrite for Water Samples (Method 353.2)	SOP
Wet Chemistry	CVS02002.CT	2	10/20/2004	SOP for Total Cyanide - Method 335.4	SOP
Wet Chemistry	CVS02102.CT	2	10/4/2004	SOP for Amenable Cyanide - Method 335.1	SOP
Wet Chemistry	CVS00300.CT	0	08/21/93	SOP for Total Solids	SOP
Wet Chemistry	CVS02900.CT	0	3/20/1995	SOP for CEC Method 9081	SOP
Wet Chemistry	CVS03000.CT	0	3/20/1995	SOP for Soil Homogenization	SOP
Wet Chemistry	CVS03303.CT	3	10/19/2004	SOP for Oxidation -Reduction Potential	SOP
Wet Chemistry	CVS03700.CT	0	10/10/1996	SOP for The Determination of Ferrous Iron	SOP
Wet Chemistry	CVS02403.CT	3	10/20/2004	SOP for Phenols method 420.1/420.2	SOP
Wet Chemistry	CVS04100.CT	0	1/6/1997	SOP for Determination of Percent Solids	SOP
Wet Chemistry	CVS04504.CT	4	6/8/2004	SOP for Oil and Grease - Method 1664A	SOP
Wet Chemistry	CVS04703.CT	3	10/20/2004	SOP for Total Petroleum Hydrocarbons - Method 418.1	SOP
Wet Chemistry	CVS04804.CT	4	10/27/2004	SOP for Analysis of Total Phosphorus	SOP
Wet Chemistry	CVS04902.CT	2	11/1/1999	SOP for Sample Screening for Chorine Residual	SOP
Wet Chemistry	CVS05203.CT	3	10/28/2004	SOP for Chlorine Residual	SOP
Wet Chemistry	CVS05102.CT	2	10/28/2004	SOP for Reagent Water Monitoring	SOP
Wet Chemistry	CVS05303.CT	3	11/2/2004	SOP for Ferrous Iron (SM4500)	SOP

Standard Operating Procedures Listing

Dept	Document Number	Revison	Active Date	SOP Title	Document Type
Wet Chemistry	**CVS05005.CT**	5	11/2/2004	SOP for Hexavalent Chromium – 7196A	SOP
Wet Chemistry	**CVS05401.CT**	1	5/16/2002	SOP for Total Cyanide – 9012A	SOP
Wet Chemistry	**CVS05500.CT**	0	9/10/1999	SOP for CC Labeling /Coding of Standards	SOP
Wet Chemistry	**CVS05601.CT**	1	05/16/02	Total Sulfide (W/S) 9030B	SOP
Wet Chemistry	**CVS05701.CT**	1	10/07/02	Paint Filter	SOP
Wet Chemistry	**CVS05802.CT**	2	01/29/04	SOP for pH of Soil	SOP
Wet Chemistry	**CVS06000.CT**	0	04/25/00	SOP for TKN (351.2)	SOP
Wet Chemistry	**CVS06100.CT**	0	04/25/00	SOP for Ion Chromatography –9065/300	SOP
Wet Chemistry	**CVS06200.CT**	0	05/21/01	SOP for SPLP Preparation (SW846 1312)	SOP
Wet Chemistry	**CVS06400.CT**	0	03/12/03	SOP for Flashpoint 1020	SOP
Wet Chemistry	**CVS06301.CT**	1	02/12/03	SOP for Cyanide – ILM05.2	SOP
Wet Chemistry	**CVS06500.CT**	0	05/23/03	SOP for Color	SOP
Wet Chemistry	**CVS06600.CT**	0	08/20/03	SOP for Hardness	SOP
Wet Chemistry	**CVS06700.CT**	0	02/12/04	SOP for TPH-IR Soils – Soxtherm	SOP
Wet Chemistry	**CVS07000.CT**	0	01/26/04	SOP for Autotitrator	SOP
Wet Chemistry	**CVS07100.CT**	0	11/02/04	SOP for TOC -water Phoenix 8000	SOP
Information Systems	**SYS01900.CT**	0	04/23/97	SOP for GC/MS Chemserver Archive	SOP
Information Systems	**SYS02000.CT**	0	01/20/98	SOP for Generating Standard E-mail Result Files	SOP
Information Systems	**SYS02300.CT**	0	04/08/02	SOP for GC Target Deliverables	SOP
Information Systems	**SYS02400.CT**	0	07/22/02	SOP for GC Labnet Deliverables	SOP
Information Systems	**SYS02500.CT**	0	DFT	SOP for GC/MS VOA Target Deliverables	SOP
Information Systems	**SYS02600.CT**	0	DFT	SOP for GC/MS VOA Labnet Deliverables	SOP
Project Management	**MKS00101.CT**	1	03/06/99	SOP for Taking Client Orders	SOP
Project Management	**MKS00201.CT**	1	03/06/99	SOP for LIMS Log-in	SOP
Project Management	**MKS00400.CT**	0	06/22/94	SOP for Telephone Logs	SOP
Quality Assurance	**QAS00305.CT**	5	02/12/03	SOP for Document Control	SOP
Quality Assurance	**QAS00504.CT**	4	02/10/03	SOP for Corrective Action Reports	SOP
Quality Assurance	**QAS00803CT**	3	2/10/2003	SOP for Generating SOPs	SOP
Quality Assurance	**QAS00901.CT**	1	1/27/2001	SOP for Balance Calibraton	SOP
Quality Assurance	**QAS01003.CT**	1	10/1/2004	SOP for Document coding, Approval and Revisions	SOP
Quality Assurance	**QAS01101.CT**	1	2/23/1999	SOP for Thermometer Calibration	SOP
Quality Assurance	**QAS01301CT**	1	1/10/2003	SOP for Corrections to Lab Documents	SOP
Quality Assurance	**QAS01201.CT**	1	4/10/2000	SOP for Temperature Monitoring of Lab Equipment	SOP
Quality Assurance	**QAS01501.CT**	1	3/15/2001	SOP for Glassware Cleaning	SOP
Quality Assurance	**QAS01601.CT**	1	6/1/2003	SOP for Employee Training	SOP

Standard Operating Procedures Listing

Dept	Document Number	Revison	Active Date	SOP Title	Document Type
Quality Assurance	**QAS01700.CT**	0	02/22/99	SOP for Conducting MDL Studies	SOP
Quality Assurance	**QAS01800.CT**	0	03/01/99	SOP for Reagent Control and Coding	SOP
Quality Assurance	**QAS01900.CT**	0	09/01/99	SOP for Terms and Definitions	SOP
Quality Assurance	**QAS02001.CT**	1	02/12/03	SOP for PT Testing	SOP
Quality Assurance	**QAS02102.CT**	2	02/24/03	SOP for Maintenance logs	SOP
Quality Assurance	**QAS02200.CT**	0	04/10/00	SOP for Sample Prep for MEOH preserved Volatiles	SOP
Quality Assurance	**QAS02400.CT**	0	05/01/04	SOP for Independent QA Review	SOP
Report Preparation	**RPS00304.CT**	4	04/25/00	Preparation and Review of Laboratory Reports	SOP
Report Preparation	**RPS00400.CT**	0	03/21/95	Report Retrieval	SOP
Report Preparation	**RPS00600.CT**	0	10/07/04	EDD Generation	SOP
Health and Safety	**SFS00202.CT**	2	06/03/02	Operating and Maintaining Fume Hoods	SOP
Health and Safety	**SFS00101.CT**	1	01/14/05	Tracking and Collection of Hazardous Waste	SOP
Radiological	**RAS00102.CT**	2	06/03/02	Tracking and Collection of Mixed Waste	SOP
Radiological	**RAS00202.CT**	2	06/03/02	Radioactivity Swipe Tests	SOP
Radiological	**RAS00302.CT**	2	06/03/02	Radiation Screening	SOP
Radiological	**RAS00400.CT**	0	08/24/94	Management/Disposal of Mixed Waste	SOP

APPENDIX, Section 9

LISTING OF ANALYTICAL CAPABLITIES

STL Analytical Capabilities List

STL Connecticut

Program	Technique	Analyte Group	Method ▲	Source	Description
Solid & Hazardous Waste	Waste Characterization	Waste Characterization	1020A	SW-846	Flashpoint (Setaflash)
Solid & Hazardous Waste	Waste Characterization	Waste Characterization	1030	SW-846	Ignitability of Solids
Solid & Hazardous Waste	Waste Characterization	Waste Characterization	1030	SW-846	Flashpoint of Solids
Non-potable Water	Colorimetric	General Chemistry	110.2	EPA	Color
Non-potable Water	Electrometric	General Chemistry	120.1	EPA	Conductance, Specific
Solid & Hazardous Waste	TCLP	Leach	1311	SW-846	Toxicity Characteristic Leachate Procedure
Solid & Hazardous Waste	SPLP	Leach	1312	SW-846	Synthetic Precipitate Leachate Procedure
Non-potable Water	General Chemistry	General Chemistry	140.1	EPA	Odor
Drinking Water	Electrometric	General Chemistry	150.1	EPA	pH
Non-potable Water	Electrometric	General Chemistry	150.1	EPA	pH
Non-potable Water	Gravimetric	Residue Testing, solids	160.1	EPA	Solids, Total Dissolved
Non-potable Water	Gravimetric	Residue Testing, solids	160.2	EPA	Solids, Total Suspended
Non-potable Water	Gravimetric	Residue Testing, solids	160.3	EPA	Solids, Total
Non-potable Water	Gravimetric	Residue Testing, solids	160.3	EPA	Moisture, Percent (%)
Non-potable Water	Gravimetric	Residue Testing, solids	160.4	EPA	Solids, Total Volatile
Non-potable Water	Gravimetric	Residue Testing, solids	160.4	EPA	Solids, Volatile Suspended
Non-potable Water	Gravimetric	General Chemistry	160.5	EPA	Solids, Settleable
Non-potable Water	Gravimetric	Residue Testing, solids	160.5	EPA	Solids, Settleable
Non-potable Water	Gravimetric	Hydrocarbons	1664A	EPA	Oil & Grease
Non-potable Water	Turbidimetric	General Chemistry	180.1	EPA	Turbidity
Drinking Water	Turbidimetric	General Chemistry	180.1	EPA	Turbidity
Drinking Water	ICP	Metals	200.7	EPA	ICP Metals
Non-potable Water	ICP	Metals	200.7	EPA	ICP Metals
Non-potable Water	Calculation	General Chemistry	200.7	EPA	Hardness (calculation from ICP results)
CLP	ICP	Metals	200.7 CLP-M	CLP ILM04.0	ICP Metals
Non-potable Water	General Chemistry	General Chemistry	2120B	SM	Color
Drinking Water	General Chemistry	General Chemistry	2120B	SM	Color
Non-potable Water	Turbidimetric	General Chemistry	2130 B	SM	Turbidity

Drinking Water	Turbidimetric	General Chemistry	2130 B	SM	Turbidity
Non-potable Water	Titrimetric	General Chemistry	2320 B	SM	Alkalinity, Hydroxide
Non-potable Water	Titrimetric	General Chemistry	2320 B	SM	Alkalinity, Bicarbonate
Non-potable Water	Titrimetric	General Chemistry	2320 B	SM	Alkalinity, Total
Non-potable Water	Titrimetric	General Chemistry	2320 B	SM	Alkalinity, Carbonate
Drinking Water	Titrimetric	General Chemistry	2320B	SM	Alkalinity, Bicarbonate
Drinking Water	Titrimetric	General Chemistry	2320B	SM	Alkalinity, Total
Drinking Water	Titrimetric	General Chemistry	2320B	SM	Alkalinity, Carbonate
Non-potable Water	Calculation	General Chemistry	2340B	SM	Hardness
Drinking Water	Calculation	General Chemistry	2340B	SM	Hardness (by calculation)
Non-potable Water	CVAA	Metals	245.1	EPA	Mercury-Hg (cold vapor)
Drinking Water	CVAA	Metals	245.1	EPA	Mercury-Hg (cold vapor)
CLP	CVAA	Metals	245.1 CLP-M	CLP ILM04.0	Mercury-Hg (water by manual cold vapor)
CLP	CVAA	Metals	245.5 CLP-M	CLP ILM04.0	Mercury-Hg (soil by manual cold vapor)
Drinking Water	Electrometric	General Chemistry	2510B	SM	Conductance, Specific
Non-potable Water	Electrometric	General Chemistry	2510B	SM	Conductance, Specific
Non-potable Water	Gravimetric	General Chemistry	2520B	SM	Salinity
Non-potable Water	Gravimetric	Residue Testing, Solids	2540 B	SM	Solids, Total
Drinking Water	Gravimetric	Residue Testing, Solids	2540 C	SM	Solids, Total Dissolved
Non-potable Water	Gravimetric	Residue Testing, Solids	2540 C	SM	Solids, Total Dissolved
Non-potable Water	Gravimetric	Residue Testing, Solids	2540 D	SM	Solids, Total Suspended
Non-potable Water	General Chemistry	General Chemistry	2710D	SM	Sludge Volume Index
Non-potable Water	Ion Chromatography	Anions	300	EPA	Phosphate (Ortho)
Non-potable Water	Ion Chromatography	Anions	300	EPA	Sulfate, as SO4
Non-potable Water	Ion Chromatography	Anions	300	EPA	Nitrite-Nitrogen
Non-potable Water	Ion Chromatography	Anions	300	EPA	Nitrate-Nitrogen
Non-potable Water	Ion Chromatography	Anions	300	EPA	Anions, by IC (Br, PO4, SO4, NO3, NO2,Cl, F)
Non-potable Water	Ion Chromatography	Anions	300	EPA	Fluoride
Non-potable Water	Ion Chromatography	Anions	300	EPA	Nitrate/Nitrite
Non-potable Water	Ion Chromatography	Anions	300	EPA	Chloride
Non-potable Water	Ion Chromatography	Anions	300	EPA	Bromide
Drinking Water	Ion Chromatography	Anions	300.0	EPA	Phosphate (Ortho)
Drinking Water	Ion Chromatography	Anions	300.0	EPA	Anions, by IC (Br, PO4, SO4, NO3, NO2,Cl, F)
Drinking Water	Ion Chromatography	Anions	300.0	EPA	Nitrite-Nitrogen
Drinking Water	Ion Chromatography	Anions	300.0	EPA	Nitrate/Nitrite
Drinking Water	Ion Chromatography	Anions	300.0	EPA	Fl Fluoride (IC)

Drinking Water	Ion Chromatography	Anions	300.0	EPA	Sulfate, as SO4
Drinking Water	Ion Chromatography	Anions	300.0	EPA	Nitrate-Nitrogen
Drinking Water	Ion Chromatography	Anions	300.0	EPA	Chloride
Solid & Hazardous Waste	Digestion	Metals	3010A	SW-846	Acid Digest of Aqueous Samples for Total Metals FLAA& ICP
Solid & Hazardous Waste	Digestion	Metals	3050B	SW-846	Acid Digest of Sediments, Sludges & Soils
Non-potable Water	Titrimetric	General Chemistry	310.1	EPA	Alkalinity, Bicarbonate
Non-potable Water	Titrimetric	General Chemistry	310.1	EPA	Alkalinity, Hydroxide
Drinking Water	Titrimetric	General Chemistry	310.1	EPA	Alkalinity, Carbonate
Drinking Water	Titrimetric	General Chemistry	310.1	EPA	Alkalinity, Hydroxide
Non-potable Water	Titrimetric	General Chemistry	310.1	EPA	Alkalinity, Total
Drinking Water	Titrimetric	General Chemistry	310.1	EPA	Alkalinity, Total
Non-potable Water	Titrimetric	General Chemistry	310.1	EPA	Alkalinity, Carbonate
Drinking Water	Titrimetric	General Chemistry	310.1	EPA	Alkalinity, Bicarbonate
Non-potable Water		Hydrocarbons	310.13	NY	Petroleum Hydrocarbons (TPHC)
Drinking Water	Spectrophotometric	General Chemistry	330.5	EPA	Chlorine Residual
Non-potable Water	Spectrophotometric	General Chemistry	330.5	EPA	Chlorine Residual, DPD
Non-potable Water	Spectrophotometric	Cyanides	335.1	EPA	Cyanide, Amenable to Chlorination
CLP	Spectrophotometric	Cyanides	335.2 CLP-M	CLP ILM04.0	Cyanide, Total
Drinking Water	Spectrophotometric	Cyanides	335.4	EPA	Cyanide, Total
Non-potable Water	Spectrophotometric	Cyanides	335.4	EPA	Cyanide, Total (Semi-automated)
Drinking Water	Colorimetric	Nitrogen Series	350.1	EPA	Ammonia, Nitrogen (w. distillation)
Non-potable Water	Spectrophotometric	Nitrogen Series	350.1	EPA	Ammonia, Nitrogen (w. distillation)
Non-potable Water	Spectrophotometric	Nitrogen Series	350.1	EPA	Ammonia, Nitrogen (Automated phenate)
Non-potable Water	Spectrophotometric	Nitrogen Series	350.1	EPA	Nitrogen, Total Organic (TON), automated phenate
Drinking Water	Colorimetric	Nitrogen Series	350.1	EPA	Ammonia, Nitrogen (Automated phenate)
Non-potable Water	Spectrophotometric	Nitrogen Series	350.2	EPA	Ammonia, Nitrogen (w. distillation)
Non-potable Water	Spectrophotometric	General Chemistry	3500-CR D	SM	Chromium (Hexavalent)
Non-potable Water	Spectrophotometric	Metals	3500-FE D	SM	Ferrous Iron
Non-potable Water	Spectrophotometric	Nitrogen Series	351.2	EPA	Nitrogen, Total Kjeldahl (TKN)
Non-potable Water	Spectrophotometric	Nitrogen Series	351.2	EPA	Nitrogen, Total Organic (TON), automated
Non-potable Water	General Chemistry	Nitrogen series	351.2-350.1	EPA	Organic Nitrogen (calculation)
Solid & Hazardous Waste	Extraction	Organics	3510C	SW-846	Separatory Funnel Liquid-Liquid
Solid & Hazardous Waste	Extraction	Organics	3520C	SW-846	Continuous Liquid-Liquid
Non-potable Water	Spectrophotometric	Nitrogen Series	353.2	EPA	Nitrate/Nitrite, Automated Cd Reduction

Non-potable Water	Spectrophotometric	Nitrogen Series	353.2	EPA	Nitrite-Nitrogen, Automated Cd Reduction
Non-potable Water	Spectrophotometric	Nutrients	353.2	EPA	Nitrate-Nitrogen, Automated Cd Reduction
Drinking Water	Spectrophotometric	Nutrients	353.2	EPA	Nitrate-Nitrogen
Drinking Water	Spectrophotometric	Nitrogen Series	353.2	EPA	Nitrite-Nitrogen
Drinking Water	Spectrophotometric	Nitrogen Series	353.2	EPA	Nitrate/Nitrite
Non-potable Water	Spectrophotometric	Nitrogen Series	354.1	EPA	Nitrite-Nitrogen
Solid & Hazardous Waste	Extraction	Organics	3541	SW-846	Soxhlet (Automated)
Solid & Hazardous Waste	Extraction	Organics	3550B	SW-846	Ultrasonic Extraction
Solid & Hazardous Waste	Extraction	Organics	3580A	SW-846	Waste Dilution
Non-potable Water	Potentiometric	General Chemistry	360.1	EPA	Oxygen, Dissolved
Solid & Hazardous Waste	Clean-Up	Organics	3610B	SW-846	Alumina Cleanup
Solid & Hazardous Waste	Clean-Up	Organics	3620B	SW-846	Florisil Cleanup
Solid & Hazardous Waste	Clean-Up	Organics	3640A	SW-846	Gel-Permeation Cleanup
Non-potable Water	Spectrophotometric	Nutrients	365.2	EPA	Phosphate (Ortho)
Non-potable Water	Spectrophotometric	Nutrients	365.2	EPA	Phosphorus (Total), Persulfate digestion
Solid & Hazardous Waste	Clean-Up	Organics	3660B	SW-846	Sulfur Cleanup
Solid & Hazardous Waste	Clean-Up	Organics	3665A	SW-846	Sulfuric Acid/Permanganate Cleanup
Non-potable Water	Titrimetric	Sulfide Species	376.1	EPA	Sulfide, as S
Non-potable Water	Potentiometric	Demand Series	405.1	EPA	BOD5
Non-potable Water	Spectrophotometric	Demand Series	410.4	EPA	COD, Automated
Non-potable Water	Gravimetric	Hydrocarbons	413.1	EPA	Oil & Grease
Non-potable Water	Infrared Spectrophotometric	Carbon	415.1	EPA	Total Organic Carbon (TOC)
Non-potable Water	Infrared Spectrophotometric	Carbon	415.1	EPA	Dissolved Organic Carbon
Non-potable Water	Gravimetric	Hydrocarbons	418.1	EPA	Petroleum Hydrocarbons-IR (TPHC)
Non-potable Water	Spectrophotometric	Phenols	420.2	EPA	Phenols, Total (Automated)
Drinking Water	General Chemistry	General Chemistry	4500-Cl D, E, F, G, I	SM	Chlorine, Total
Drinking Water	General Chemistry	General Chemistry	4500-Cl G	SM	Chlorine Residual
Non-potable Water	General Chemistry	General Chemistry	4500-Cl G	SM	Chlorine Residual
Drinking Water	Spectrophotometric	Cyanides	4500-CN C E	SM	Cyanide, Total
Drinking Water	Colorimetric	General Chemistry	4500-CN E	SM	Cyanide, Total
Non-potable	Spectrophotometric	Cyanides	4500-CN G	SM	Cyanide, Amenable to Chlorination

Water					
Drinking Water	Spectrophotometric	Cyanides	4500-CN G	SM	Cyanide, Amenable to Chlorination
Non-potable Water	Spectrophotometric	Cyanides	4500-CN I	SM	Cyanide, Weak & Dissociable
Non-potable Water	Spectrophotometric	Cyanides	4500-CN I	SM	Cyanide, Free (Weak Acid Dissociable)
Non-potable Water	Electrometric	General Chemistry	4500-H+B	SM	pH
Drinking Water	Electrometric	General Chemistry	4500-H+B	SM	pH
Non-potable Water	Potentiometric	General Chemistry	4500-O G	SM	Oxygen, Dissolved
Solid & Hazardous Waste	Purge and Trap	Volatile Organics	5030B	SW-846	Purge and Trap for Aqueous Samples
Solid & Hazardous Waste	Purge and Trap	Volatile Organics	5035	SW-846	Closed System Purge and Trap for Soils and Waste
Drinking Water	GC/MS	Volatile Organics	524.2	EPA	Volatiles, Drinking Water
Drinking Water	GC/MS	Volatile Organics	524.2	EPA	Tentatively Identified Compounds (TICs)
Solid & Hazardous Waste	ICP	Metals	6010B	SW-846	Metals
Non-potable Water	GC/ECD	Pesticides	608	EPA	Organochlorine Pesticides
Non-potable Water	GC/ECD	Pesticides	608.1	EPA	Organochlorine Pesticides
Non-potable Water	GC/ECD	Pesticides	614	EPA	OP Pesticides
Non-potable Water	GC/MS	Volatile Organics	624	EPA	Volatiles
Non-potable Water	GC/MS	Semivolatile Organics	625	EPA	Polynuclear Aromatic Hydrocarbons (PAHs)
Non-potable Water	GC/MS	Semivolatile Organics	625	EPA	Semivolatiles
Solid & Hazardous Waste	Colorimetric	Metals	7196A	SW-846	Chromium (Hexavalent)
Solid & Hazardous Waste	CVAA	Metals	7470A	SW-846	Mercury in Liquid Waste
Solid & Hazardous Waste	CVAA	Metals	7471A	SW-846	Mercury in Solid or Semisolid Waste
Solid & Hazardous Waste	GC/FID	Hydrocarbons	8015B	SW-846	Diesel Range Organics
Solid & Hazardous Waste	GC/FID Direct Aqueous Injection	Volatile Organics	8015B	SW-846	VOC-DAI-Direct Aqueous Injection
Solid & Hazardous Waste	GC/ECD	Pesticides	8081A	SW-846	Organochlorine Pesticides
Solid & Hazardous Waste	GC/ECD	PCBs	8082	SW-846	PCBs
Solid & Hazardous Waste	GC/NPD	Pesticides	8141A	SW-846	Organophosphorous Pesticides
Solid & Hazardous Waste	GC/MS	Volatile Organics	8260B	SW-846	Volatile Organic Compounds
Solid & Hazardous	GC/MS	Semivolatile Organics	8270C	SW-846	PAHs GC/MS Scan Low Level

Waste					
Solid & Hazardous Waste	GC/MS	Semivolatile Organics	8270C	SW-846	Semivolatiles
Solid & Hazardous Waste	GC/MS	Semivolatile Organics	8270C SIM	SW-846	PAHs GC/MS SIM Low Level
Solid & Hazardous Waste	Spectrophotometric	Cyanides	9012A	SW-846	Cyanide, Amenable to Chlorination
Solid & Hazardous Waste	Spectrophotometric	Cyanides	9012A	SW-846	Cyanide, Total
Solid & Hazardous Waste	Titrimetric	Sulfide Species	9034	SW-846	Sulfide, Acid Insoluble
Solid & Hazardous Waste	Electrometric	General Chemistry	9040B	SW-846	Corrosivity, as pH
Solid & Hazardous Waste	Electrometric	General Chemistry	9045C	SW-846	pH, Solid & Waste
Solid & Hazardous Waste	Ion Chromatography	Nutrients	9056	SW-846	Nitrate-Nitrogen
Solid & Hazardous Waste	Ion Chromatography	Anions	9056	SW-846	Nitrite-Nitrogen
Solid & Hazardous Waste	Ion Chromatography	Anions	9056	SW-846	Chloride
Solid & Hazardous Waste	Ion Chromatography	Anions	9056	SW-846	Phosphate [Ortho]
Solid & Hazardous Waste	Ion Chromatography	Nutrients	9056	SW-846	Nitrate/Nitrite
Solid & Hazardous Waste	Ion Chromatography	Anions	9056	SW-846	Bromide
Solid & Hazardous Waste	Ion Chromatography	Anions	9056	SW-846	Fl Fluoride (IC)
Solid & Hazardous Waste	Ion Chromatography	Anions	9056	SW-846	Anions
Solid & Hazardous Waste	Ion Chromatography	Anions	9056	SW-846	Sulfate, as SO4
Solid & Hazardous Waste	Infrared Spectrophotometric	Carbon	9060	SW-846	Total Organic Carbon (TOC)
Solid & Hazardous Waste	Colorimetric	Phenols	9066	SW-846	Phenols, Total
Solid & Hazardous Waste	General Chemistry	Physical Properties	9095A	SW-846	Paint Filter Test
Solid & Hazardous Waste	Waste Characterization	Waste Characterization	Chapter 7, Ignitability	SW-846	Ignitability
CLP	Digestion	Metals	CLP Metals Digestion	ILM04.0	CLP Metals Digestion
Other	General Chemistry	Leach	D-3987	ASTM	ASTM Leaching Procedure
Non-potable Water	Titrimetric	Carbon	Lloyd Kahn	Region II	Total Organic Carbon (TOC)

Clean Air	GC/MS	Semivolatile Organics	Mod TO-13A	EPA	Polynuclear Aromatic Hydrocarbons (PAHs)
CLP	GC/ECD	Pesticides/PCBs	Pesticides / Aroclors	CLP OLM03.2	Organochlorine Pesticides / PCBs
CLP	GC/ECD	Pesticides/PCBs	Pesticides / Aroclors	CLP OLM04.1	Organochlorine Pesticides / PCBs
CLP	GC/ECD	Pesticides/PCBs	Pesticides / Aroclors	CLP OLM04.2	Organochlorine Pesticides / PCBs
CLP	GC/MS	Semivolatile Organics	Semivolatile Organics	CLP OLC02.1	Semivolatiles, Low Level
CLP	GC/MS	Semivolatile Organics	Semivolatile Organics	CLP OLM04.1	Semivolatiles
CLP	GC/MS	Semivolatile Organics	Semivolatile Organics	CLP OLM04.2	Semivolatiles
CLP	GC/MS	Semivolatile Organics	Semivolatile Organics	CLP OLM03.2	Semivolatiles
Solid & Hazardous Waste	Waste Characterization	Waste Characterization	SW846,Chapter7	SW-846	Sulfide (Reactive)
Solid & Hazardous Waste	Waste Characterization	Waste Characterization	SW846,Chapter7	SW-846	Cyanide (Reactive)
Clean Air	GC/MS	Semivolatile Organics	TO-13	EPA	Polyaromatic Hydrocarbons by GC/MS
Clean Air	GC/ECD	Pesticides	TO-4	EPA	Pesticide by GC
Non-potable Water	Calculation	General Chemistry	Total Cr - Cr+6	SM	Chromium, Trivalent by Difference
CLP	GC/MS	Volatile Organics	Volatile Organics	CLP OLM03.2	Volatiles
CLP	GC/MS	Volatile Organics	Volatile Organics	CLP OLM04.1	Volatiles
CLP	GC/MS	Volatile Organics	Volatile Organics	CLP OLM04.2	Volatiles
CLP	GC/MS	Volatile Organics	Volatile Organics	CLP OLC02.1	Volatiles, Low Level

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