Final Approved 5/23/01 comment JAF

Supplemental Remedial Investigation Work Plan

93B Maple Avenue Former MGP Site
and Clove and Maple Avenues Former MGP Site
Haverstraw, New York

GEI Consultants, Inc.

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SUBMITTED TO

Orange & Rockland Utilities, Inc.
Monroe, New York

David B. Terry
Project Manager

April 5, 2001
01082-1001

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1. Introduction

On behalf of our client, Orange and Rockland Utilities, Inc. (O&R), GEI Consultants, Inc. (GEI) has prepared this work plan for supplemental remedial investigation (RI) work at the 93B Maple Avenue and the Clove and Maple Avenues former manufactured gas plant (MGP) sites located in Haverstraw, New York. The supplemental RI work described herein was requested by the New York State Department of Environmental Conservation (NYSDEC). The goal of the investigation is to generate sufficient data to complete the RI. The scope of the work is based upon the following:

NYSDEC's January 6, 2000 comment letter on the Draft RI Report for the 93B Maple Avenue former MGP site

- GEI's May 3, 2000 letter responding to NYSDEC's May 3rd letter on the Draft RI Report for the 93B Maple Avenue site.
  NYSDEC's June 9, 2000 letter responding to GEI's May 3rd Response to NYSDEC Comments on the Draft RI Report for the 93B Maple Avenue former MGP Site
  NYSDEC's December 5, 2000 comment letter on the Draft RI Report for the Clove and Maple Avenues former MGP site
- Decisions made during a February 13, 2001 meeting with NYSDEC, O&R, and GEI regarding the Clove and Maple Avenues former MGP site
  GEI's March 15, 2001 letter responding to NYSDEC's December 5th comment letter on the Draft RI Report for the Clove and Maple Avenues former MGP site

Except where specifically noted herein, all methods used during the supplemental RI will be in accordance with the methods presented in GEI's September 1, 1998 work plan, *Remedial Investigation Work Plan, 93B Maple Avenue Former MGP Site, Haverstraw, New York;* GEI's September 8, 1998 work plan, *Remedial Investigation Work Plan, Clove and Maple Avenues Former MGP Site, Haverstraw, New York*; and in the approved addenda to those work plans. Only new or revised field sampling methodologies are discussed in this Supplemental RI Work Plan. The most recent Quality Assurance Project Plan (QAPP) for the laboratory contractor is provided as Appendix A. A newly revised project organization chart is provided as Figure 1.

2. Scope of Work

The scope of work presented in this work plan addresses additional field investigation tasks requested by NYSDEC and includes preparation of a revised RI report for each of the two former MGP sites. The revised RI reports will incorporate the new data findings and will discuss the nature and extent of contamination. Also, as requested by NYSDEC, the reports will: include the findings of a Step II Fish and Wildlife Impact Assessment (FWIA); include a qualitative assessment of potential human health risks; and address whether MGP-related contaminants have impacted the sediments within the embayment to the Hudson River.

The scope of work addressed by this work plan includes the following tasks.

- Preliminary Site Visit
- Soil Borings, Monitoring Well Installations, and Surface-Soil Sampling
- Sediment Characterization and Sampling
- Groundwater Sampling, Storm Sewer Assessment, and Hydraulic Conductivity Testing
- Steps IIA and IIB Fish and Wildlife Impact Analysis
- Qualitative Human Health Risk Assessment
- RI Report Preparation
- Presentation of Findings

Descriptions of each proposed work activity are provided separately below. Figure 2 presents the proposed schedule for the tasks. The proposed schedule is dependent on receipt of NYSDEC approval of this work plan and on the timely acquisition of access agreements to off-site parcels.

2.1 Preliminary Site Visit

Prior to mobilizing to conduct the field program, GEI will conduct a site visit with O&R and NYSDEC to agree upon the actual locations of the planned borings and monitoring wells. We recommend that this site visit be conducted prior to final acceptance of the Work Plan by NYSDEC so that any logistical constraints can be addressed in the final Work Plan.

2.2 Soil Borings, Monitoring Well Installations, Surface Soils

This section of the supplemental RI Work Plan discusses the proposed soil borings, monitoring wells, and surface-soil samples. Table 1 presents the general rationale for each specific boring and well, as discussed and agreed to with NYSDEC and O&R. The locations of proposed borings, wells and surface-soil samples are shown on Figures 3 and 4.

2.2.1 Soil Borings and Monitoring Wells

GEI will mobilize to the site and conduct the soil borings and monitoring well installations listed in Table 1. All drilling work will be conducted by hollow-stem auger drilling methods and split-spoon sampling methods. Drilling and sampling procedures are described in the approved 1998 work plans. GEI has selected Aquifer Drilling & Testing, Inc. (ADT) as the drilling subcontractor. The number and location of the borings and wells are based on the documents listed above and on conversations between GEI, O&R, and NYSDEC. The proposed depth of each boring/well is based on existing hydrogeologic information gathered during the RI work conducted at the two sites.

Two soil samples from each boring will be collected if evidence of potential impacts is observed in the boring (i.e., odors, staining, tar, photoionization detector [PID] readings, etc.). In this instance, the interval indicating the greatest degree of contamination would be sampled to evaluate the magnitude of the observed impacts at each boring. In addition, a sample from beneath the observed impacted intervals would also be analyzed to define the vertical extent of the observed impacts.

If no apparent contamination in a particular boring is observed, then only one soil sample will be collected from the deepest interval (anticipated to be the alluvium/till interface sample).

Each soil sample will be analyzed for volatile organic compounds (VOCs) by New York State Analytical Services Protocols (NYSASP) Method 95-1, semivolatile organic compounds (SVOCs) by NYSASP Method 95-2, total cyanide by Contract Laboratory Protocol (CLP) methods, weak acid dissociable (WAD) cyanide by Standard Methods, Method 4500 CN-I and target analyte list (TAL) metals by Inorganic Laboratory Methods 04.1.

Quality Assurance/Quality Control (QA/QC) samples will include two duplicate samples and two Matrix Spike/Matrix Spike Duplicate (MS/MSD) samples. An equipment rinsate blank will also be collected from a decontaminated split-spoon. Severn Trent

Laboratories (STL) of Shelton, Connecticut will perform the analyses. STL's QAPP is provided as Appendix A.

The construction of each monitoring well will follow the procedures described in the approved 1998 work plans and the approved addenda to the RI work plans.

Drilling and monitoring well installation tasks at the 146 Maple Avenue (Head Start Facility) property will be conducted in the evening hours (anticipated 6 pm to 9 pm) to minimize disturbance to the day care facility.

2.2.2 Fingerprint Analyses

In addition to the above analyses, if impacts are observed in the soil samples collected from the three borings located in the Ferry/Fuel Terminal area, GEI will submit one soil sample to META Environmental, Inc. (META) for fingerprinting analysis to determine if the observed contamination is related to the MGP or other potential sources such as releases from the fuel terminal. If no impacts are observed in this area, then no samples will be submitted for fingerprinting analyses.

The fingerprinting analyses performed by META will include Gas Chromatograph-Flame Ionization Detector (GC-FID) analysis and Gas Chromatograph/Mass Spectrometer (GC/MS) analysis of the sediment, soil, and source material (tar) samples. META will conduct the analyses and will compare the results against a library of over 500 source material chromatograms. The intent of the fingerprinting analysis is to determine whether contaminants detected in sediments or soils away from the two MGP sites is related to the sites, or is the result of other releases such as petroleum fuels or asphalt. META will conduct the analyses in a step-wise fashion, first performing the GC-FID analyses, and then (only if needed) performing the GC/MS analyses to aid in the fingerprinting.

META will prepare a forensics report, which will include a case narrative, a quality control discussion, a sample-by-sample interpretation of the results, a summary of the findings, and all appropriate appendices.

2.2.3 Well Development

Development of the newly installed monitoring wells will be performed by alternately surging and pumping, utilizing either a centrifugal or piston pump, for a maximum of 1 hour or until the turbidity of the development water is less than 50 nephelometric turbidity units (NTUs). A field turbidity meter will be used to monitor NTU levels.

2.2.4 Surface-Soil Sampling

Surface-soil samples will be collected from the three residential parcels surrounding the 93B Maple Avenue site. Two samples will be collected from each residential parcel; typically one sample from the front yard and one sample from the back yard of each property. Sample identifications are 93B-SS-1 through 93B-SS-6 and their locations are shown on Figure 3.

Three surface-soil samples will also be collected from the apartment complex parcel on the eastern side of Maple Avenue, and one surface-soil sample will be collected from the residential parcel to the northwest of the Clove & Maple Avenues site. Note that surface-soil samples have already been collected from the Head Start parcel located southeast of the Clove & Maple site.

Background surface-soil samples will be collected from six locations on publicly accessible parcels outside the potential former MGP operations footprint.

The following surface-soil sampling procedure supercedes the Standard Operating Procedure referenced in the approved 1998 Work Plans. The surface-soil samples will be collected from the 0- to 2-inch depth below any turf or vegetative cover and will be submitted for analysis of benzene, toluene, ethylbenzene, and xylenes (BTEX) by NYSASP Method 95-1, SVOCs by NYSASP Method 95-2, total cyanide by CLP methods, and WAD cyanide by Method 4500 CN-I.

Decontaminated, stainless-steel trowels and bowls will be used to collect each sample from the 1-square-meter area. QA/QC samples will include one duplicate sample and an MS/MSD sample. An equipment rinsate blank will also be collected from the decontaminated equipment. STL will perform the analyses.

2.2.5 Waste Disposal Sampling

One composite soil sample will be collected from the soil cutting drums and analyzed for Toxicity Characteristic Leaching Procedure (TCLP) VOCs, SVOCs, and metals along with reactivity (cyanide, sulfide), ignitability, corrosivity, and paint filter tests. These analyses are intended to characterize the wastes to determine the appropriate disposal options available to O&R.

2.3 Sediment Characterization and Sampling

NYSDEC has requested that sediments in the embayment to the Hudson River be characterized to determine if potential impacts from MGP materials are present. GEI will retain the services of a marine drilling contractor to assist in the collection of sediment samples and in the conduct of a sediment probing study.

We plan a one-day sediment probing study within the embayment and extending out to the mouth of the embayment. The probing study will generally follow a grid pattern starting near the storm water outfall location. The sediments will be probed by a threaded steel rod to depths of up to 10 feet below the sediment surface. The rod and the overlying water column will be inspected for indications of contamination (sheen, stained sediments, odor, etc.). Based upon the findings of the probing study, GEI and the marine drilling contractor will collect Vibracore samples at up to seven locations. Five of these locations will be within the areas potentially impacted by discharges from the former MGP, one will be at an upstream location, and one will be at a downstream location. As NYSDEC has requested, two additional background (upstream) vibracore samples may be collected. These samples will only be collected if the work can be done within the planned one day of vibracore sampling. If the findings of this initial evaluation of sediments indicates the need for an expansion of the sediment characterization scope, an additional work scope can be developed and implemented at a later date. Refer to Figure 4 for proposed Vibracore sampling locations. These locations will be modified based upon the findings of the probing study.

The vibracore samples will be examined and described by the GEI field staff representative. Analytical samples will be collected from each core sample as follows. If the core sample exhibits potential evidence of MGP impacts, then two samples will be submitted for laboratory analysis; the sediment surface sample, and the interval exhibiting the greatest degree of impacts. If the core sample does not exhibit potential MGP impacts, then only the sediment surface interval will be submitted for laboratory analysis. A Standard Operating Procedure (SOP) for sediment sampling using vibracore equipment is provided in Appendix B.

Each sample will be analyzed for VOCs by NYSASP Method 95-1, SVOCs by NYSASP Method 95-2, total cyanide by CLP methods, WAD cyanide by Method 4500 CN-I, Total Organic Carbon (TOC) by the Lloyd Kahn Method, pH by CLP Methods, and hardness by method SM2340.B. One duplicate sample and one MS/MSD sample will be collected as QA/QC samples. An equipment rinsate blank will also be collected.

In addition, if potentially MGP-related impacts are observed within sediments, one sediment sample will be submitted to META for fingerprinting analysis to determine if the observed contamination is related to MGP processes or other contamination sources such as petroleum fuels or asphalt emulsions. To aid in this fingerprinting analysis, GEI will also submit a source area tar sample (collected from well MW-2 at the Clove and Maple site) to META.

2.4 Groundwater Sampling, Storm Sewer Evaluation, Hydraulic Conductivity

2.4.1 Groundwater Sampling

A minimum of two weeks following completion and development of all the planned new monitoring wells, groundwater samples will be collected from each newly installed well and from each existing well at the Clove and Maple Avenues site and the 93B Maple Avenue site. Groundwater samples will be collected from a total of 23 monitoring wells as follows:

Nine newly proposed monitoring wells

- 93B Maple Avenue monitoring wells MW-1, MW-2, and MW-3
- Clove & Maple Avenue monitoring wells MW-1, MW-2, MW-3, MW-4, MW-5, MW-6, MW-7, MW-8, MW-9, MW-10, and MW-11

Dense nonaqueous phase liquid (DNAPL) has previously been present in well MW-2. If a substantial DNAPL accumulation is present in well MW-2 or any other well, then no groundwater sample will be collected for laboratory analysis. If DNAPL is found to accumulate in a well, then the DNAPL will be bailed from the well and the recovery rate of the DNAPL will be assessed.

Groundwater purging and sampling of the 23 monitoring wells will not be conducted according to the procedures in the approved 1998 work plans. Instead, procedures will generally follow the guidelines set forth in *Low Stress (low flow) Purging and Sampling Procedure for the Collection of Ground Water Samples From Monitoring Wells,* published July 30, 1996 by the United States Environmental Protection Agency (EPA) Region I. The wells will be purged and sampled at rates that minimize or eliminate significant drawdown. Dedicated polyethylene tubing will be used at each well. Water quality will be monitored for pH, temperature, specific conductivity, oxidation-reduction potential (Eh), dissolved oxygen, and turbidity. The tubing volume will be calculated and, upon removal of one tubing volume of groundwater, parameters will be recorded at five-minute intervals to determine well stability. Stability is achieved when pH is within

0.1 standard unit, temperature is within 0.5°C, Eh is within 10% and specific conductivity is within 10% for three consecutive readings.

When stability is attained, samples will be collected from the well. Samples for VOC analysis will be collected using a disposable polyethylene bailer. Samples for all other analyses will be collected directly from the tubing. Groundwater samples will be collected directly into pre-cleaned and appropriately preserved sample containers provided by STL.

Each groundwater sample will be analyzed for VOCs by NYSASP Method 95-1, SVOCs by NYSASP Method 95-2, total cyanide by CLP methods, and WAD cyanide by Method 4500 CN-I. On February 27, 2001, Mr. John Helmeset of NYSDEC indicated to GEI that metals analysis is not a required analysis for the groundwater samples that will be collected during the supplemental RI activities.

In addition to the 23 primary samples, the following QA/QC samples will be collected.

- One trip blank sample per day of sampling
- One duplicate sample
- One equipment rinse sample

Each QA/QC sample will be analyzed for VOCs, SVOCs, total cyanide, and WAD cyanide, except the trip blank samples, which will be analyzed only for VOCs.

Groundwater elevations will be measured in all monitoring wells and the water level of the Hudson River at the embayment will be measured at two tidal stages (high and low tides) to determine whether tidal effects influence the groundwater flow directions.

2.4.2 Storm Sewer Assessment and Sampling

NYSDEC has requested that water and sediment samples be collected from every catch basin between the Clove and Maple Avenues site and the outfall located at the embayment of the Hudson River. NYSDEC has also requested that the outfall itself be sampled where it discharges to the river. In addition, NYSDEC has requested that samples of the storm sewer in the alley adjacent to the 93B Maple Avenue site be collected. It is prudent to evaluate the storm sewer system layout and any potential contributors of contaminants and to determine the number and locations of catch basins between the two sites and the outfall location.

At this time, we do not have full knowledge of the storm sewer system, and have not investigated potential contributors to the sewer system. GEI will research the storm sewer layout and potential contributors (specifically of cyanide) to the storm water system. This assessment should include conducting an EPA database search, interviews with Haverstraw officials to determine the storm sewer layout and industrial/commercial dischargers to the system, and evaluation of building records for the current Head Start property (formerly a vitamin plant that potentially used cyanide in its processes) to determine if there are any dry wells or tie-ins to the storm sewer.

To evaluate the quality of storm water and sediments in the catch basins, we propose collecting samples from up to six catch basin locations. Samples will be obtained from one catch basin upstream of any potential input from the MGP sites, from the two catch basins adjoining the Clove and Maple Avenues site, from one accessible point adjoining the 93B Maple Avenue site (or from the nearest downstream accessible point), and from two catch basins downstream of both sites. In addition, a storm water sample will be collected at the outfall location at the embayment of the Hudson River. The location of the storm sewer outfall is shown on Figure 4. The storm sewer water samples will be collected under base flow conditions (no precipitation during the preceding 24-hour period), if possible. If no flow is present in the storm water system, then sampling may have to follow a precipitation event.

Each storm water and storm sewer sediment sample will be analyzed for VOCs by NYSASP Method 95-1, SVOCs by NYSASP Method 95-2, total cyanide by CLP methods, WAD cyanide by Method 4500 CN-I, TOC (by the Lloyd Kahn method), and pH by CLP Methods. The storm water samples will also be analyzed for hardness by method SM2340.B. One duplicate sample and one equipment rinsate blank sample will be collected and analyzed for both the storm water and the storm sewer sediments.

GEI has also learned that an apparently inactive Sanitary Sewer Line follows a path similar to that of the former stream trace beneath the bulk fuel terminal (Rockland Fuel Company) at the Hudson River. The three borings planned for the Fuel Terminal parcel (SB-30, SB-31, and SB-32) will be used to evaluate whether any impacts exist along this former Sanitary Sewer Line and the former stream trace. It is unknown at this time whether the sewer line is still in place or was removed.

Because of the uncertainty relative to the storm sewer layout and potential contributors to the system, this storm sewer evaluation scope is subject to change. Prior to modifying the scope, GEI and O&R will obtain NYSDEC concurrence.

2.4.3 Hydraulic Conductivity Testing

NYSDEC requested that hydraulic conductivity tests be performed at the 93B Maple Avenue site. GEI proposes conducting in-situ hydraulic conductivity tests (slug tests) at wells MW-1 and MW-3 at the 93B site. A Standard Operating Procedure (SOP) for in-situ hydraulic conductivity testing is provided in Appendix B.

Previous sampling of wells MW-1 and MW-3 at the 93B Maple Avenue site indicates that the wells are screened in low conductivity formations. Although recharge to the wells screened within the clay was relatively slow, slug test methods for determining hydraulic conductivity are still valid for low-conductivity formations. An evaluation of the geology surrounding the screened intervals of the on-site wells has revealed that determination of hydraulic conductivity in two wells would be appropriate. Monitoring well MW-1 is screened across alternating layers of clay and gravel, while MW-3 is screened solely within the clay. Performing hydraulic conductivity tests within both of these wells will identify the variability of hydraulic characteristics within the top of the clayey unit. As such, GEI will conduct one rising head slug test (slug-out test) in both monitoring wells MW-1 and MW-3. Because of the slow recharge of the formation, and therefore long test duration, these tests will be performed during other field activities.

2.5 Steps IIA and IIB Fish and Wildlife Impact Analysis

GEI will retain Northern Ecological Associates (NEA) to prepare a Step IIA and IIB FWIA. NEA prepared the Step I FWIA for the Haverstraw sites, is familiar with the ecological setting, and has extensive experience preparing FWIAs in New York State. The analysis will comply with the requirements outlined in NYSDEC's *Fish and Wildlife Impact Analysis for Inactive Hazardous Waste Sites (FWIA)* issued in October 1994. The Step II analysis includes three parts: IIA Pathway Analysis, IIB Criteria-Specific Analysis, and IIC Toxic Effect Analysis. Only Steps IIA and IIB are included as part of the supplemental RI. Step IIC cannot be planned for or conducted at this time because it is not known what complete exposure pathways exist for ecological resources, and there are no analytical data for all media (i.e., sediment, off-site surface soils, subsurface soils, and groundwater) to determine whether concentrations of contaminants are present in specific media that could indicate a potential risk to the ecological receptors. If the Steps IIA and IIB FWIA indicate complete ecological exposure pathways and contaminant concentrations attributable to the former MGP sites, then a Step IIC analysis may be required as an additional scope item of the RI.

The general scope of work to be performed includes the following.

- Conducting a site visit
- Evaluating all previously gathered environmental data for the sites
- Incorporation of the findings from the Step I FWIA
- Preparation of a conceptual site model identifying the completed pathways or potential pathways
- Evaluation of the existing analytical data
- Identification of contaminants of potential ecological concern (COPECs)
- Conducting a criteria-specific analysis, including comparison of the COPECs against published numerical criteria (NY sediment screening criteria, Applicable, Relevant, and Appropriate Requirements [ARARs], etc.)
- Preparation of a Step IIA and IIB FWIA Report for inclusion in the two RI reports

2.6 Qualitative Human Health Risk Assessment

In accordance with direction provided by NYSDEC, a qualitative human health risk assessment will be prepared. This assessment will generally follow the guidelines provided in the November 9, 2000 document, titled *New York State Department of Health Qualitative Human Health Exposure Assessment* provided by NYSDEC. In general, the assessment will identify the exposure setting, identify exposure pathways, and will evaluate the fate and transport of the contaminants. The assessment will include text discussions and graphics depicting the potential exposure pathways. The characterization will include all environmental data gathered pertaining to the investigation of the two sites and adjacent parcels (on site and off site). The qualitative assessment will identify potential risks for specific potential receptors based on complete pathways of exposure to contaminant levels exceeding default "screening criteria," such as the NYSDEC-recommended soil cleanup objectives and drinking water standards. The qualitative risk assessment will not quantitatively evaluate the potential carcinogenic and non-carcinogenic risks to potential receptors. In addition, the qualitative assessment will not evaluate potential alternative risk-based exposure criteria or risk-based cleanup criteria.

2.7 Survey and Sample Point Location

Following completion of the planned soil borings, monitoring wells, and collection of the surface-soil samples, each of these points will be surveyed by a New York State Licensed Land Surveyor. The elevation of each new monitoring well will be determined to +/-0.01 foot. In addition, a permanent surveyed benchmark will be established at the Hudson River, by which to measure the river elevation. All locations and elevations will be tied to the existing survey data set.

Sediment core sample locations will be obtained by a Global Positioning System (GPS) provided by the marine drilling contractor. The depth of the water column and sediment core depths will also be determined and the relative core elevations will be established.

2.8 Data Validation, Deliverables, and Usability Reports

Severn Trent Laboratories will provide New York State Category B data deliverables. The data will be validated in accordance with NYSASP protocols. The data validator will prepare a data usability report summarizing the adequacy of the analytical data obtained from the laboratory and discussing any pertinent data excursions or limitations on the use of the data. The data usability report will be used in preparing the revised RI reports for the two sites, and will be submitted as part of the revised RI reports.

3. RI Report Preparation

GEI will revise the existing Draft RI Reports submitted to NYSDEC for the Clove and Maple Avenues site and the 93B Maple Avenue site. The revised reports will incorporate the findings of the supplemental RI activities. The supplemental information will be used to describe the nature and extent, and fate and transport of all contaminants associated with the two former MGP sites. The reports will identify specific contaminant concentrations throughout each media (e.g., soil, groundwater, sediments, etc.), which is necessary to determine whether any media require remediation. The reports will also incorporate the findings of the Step IIA and IIB FWIA and the Qualitative Human Health Risk Assessment.

4. Presentation of Findings

GEI recommends that a meeting be held between GEI, O&R, and NYSDEC following submittal of the Draft RI Reports to NYSDEC. This meeting will allow a face-to-face discussion of the findings and will likely streamline the comment and response-to-comment process. This meeting can also be used as a forum to discuss the potential or likely remedial actions for the sites.

5. Schedule

GEI can begin preparation for field mobilization upon receipt of NYSDEC approval of this supplemental work plan. Mobilization for field activities can be accomplished within five days of receipt of NYSDEC approval. However, the commencement of field activities is contingent upon attaining access agreements to all off-site parcels where field activities will occur.

A preliminary site visit by GEI, O&R, and NYSDEC should be conducted during the week of either April 23, 2001 or April 30, 2001 to finalize the supplemental RI sampling locations.

It is expected that final NYSDEC approval of this supplemental RI work plan will be given by the end of May 2001. Based on this approval date, the soil boring, monitoring well installation, and surface-soil sampling could begin on June 4, 2001 and be completed by June 11, 2001. Sediment sampling could begin on June 18, 2001. Groundwater sampling, storm sewer sampling, and hydraulic conductivity testing could be conducted the week of June 25, 2001. Upon validation and compilation of the supplemental RI laboratory data, the FWIA and qualitative risk assessment can be started the last week of August 2001 and be completed in September 2001. Report preparation activities would continue through September 2001, at which point GEI will submit both Draft RI Reports. Dependent on NYSDEC review and a presentation of findings meeting in October, final submittal of both Draft RI Reports is expected by December 1, 2001. A detailed, chronological schedule of the supplemental RI activities is shown on Figure 2.

6. Project Team

The proposed project team is presented in Figure 1. The GEI staff that will be working on this project are currently involved in O&R's MGP program. GEI's key project members and their roles are summarized below.

- David Terry – Project Manager

Mr. Terry will have ultimate responsibility for successful completion of the work scope, will interface with O&R and NYSDEC, and will be responsible for project quality control.

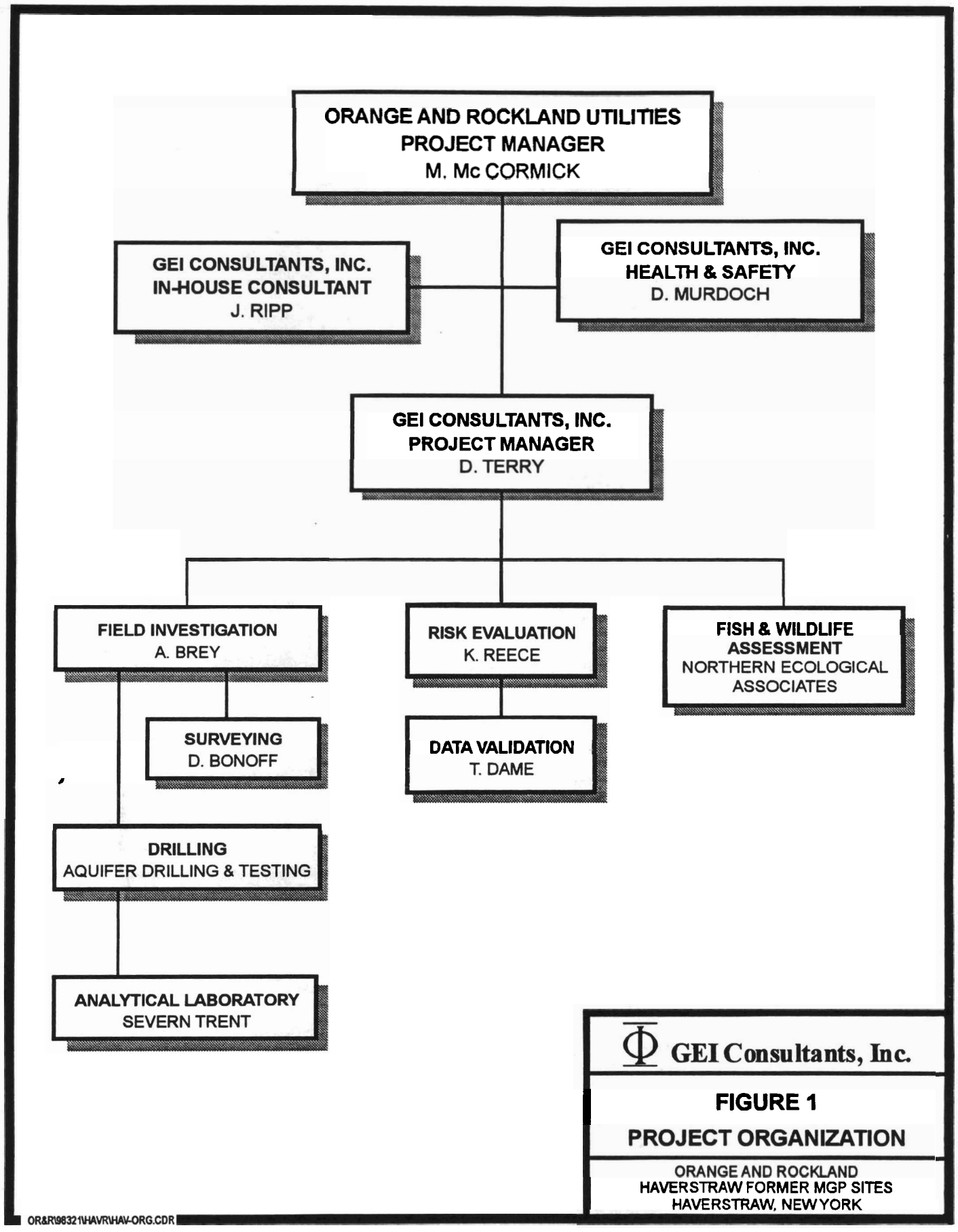
- John Ripp – In-House Consultant

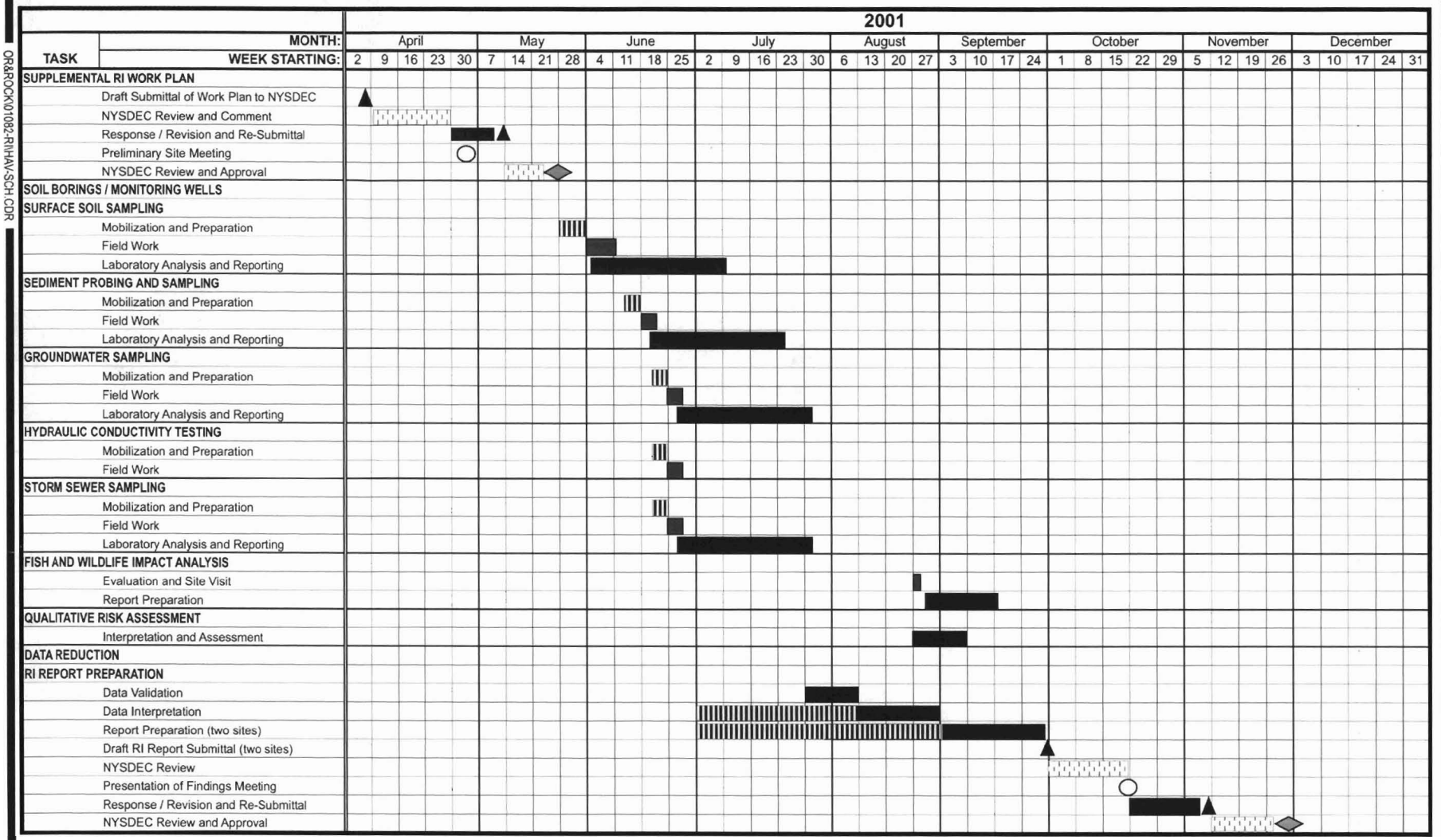
Mr. Ripp will serve as GEI's in-house consultant for the project team and for O&R. Mr. Ripp's extensive MGP experience and understanding of MGP historic operations and the behavior of MGP contaminants in the environment are a valuable asset to the project team.

- Andrew Brey – Lead Geologist

Under the direction of Mr. Terry, Mr. Brey will be primarily responsible for implementation of the field program, managing GEI's subcontractors, interpretation of the investigation findings, and preparation of the revised RI reports.

Figures


ORANGE AND ROCKLAND UTILITIES
PROJECT MANAGER
M. Mc CORMICK
GEI CONSULTANTS, INC.
IN-HOUSE CONSULTANT
J. RIPP
GEI CONSULTANTS, INC.
HEALTH & SAFETY
D. MURDOCH
GEI CONSULTANTS, INC.
PROJECT MANAGER
D. TERRY
FIELD INVESTIGATION
A. BREY
SURVEYING
D. BONOFF
DRILLING
AQUIFER DRILLING & TESTING
ANALYTICAL LABORATORY
SEVERN TRENT
RISK EVALUATION
K. REECE
DATA VALIDATION
T. DAME
FISH & WILDLIFE
ASSESSMENT
NORTHERN ECOLOGICAL
ASSOCIATES
GEI Consultants, Inc.
FIGURE 1
PROJECT ORGANIZATION
ORANGE AND ROCKLAND
HAVERSTRAW FORMER MGP SITES
HAVERSTRAW, NEW YORK
OR&R\98321\HAVR\HAV-ORG.CDR



KEY:

ACTIVITY

FIELD ACTIVITY

INTERMITTENT ACTIVITY

NYSDEC REVIEW

SUBMITTAL TO NYSDEC

PLANNED MEETING

NYSDEC APPROVAL

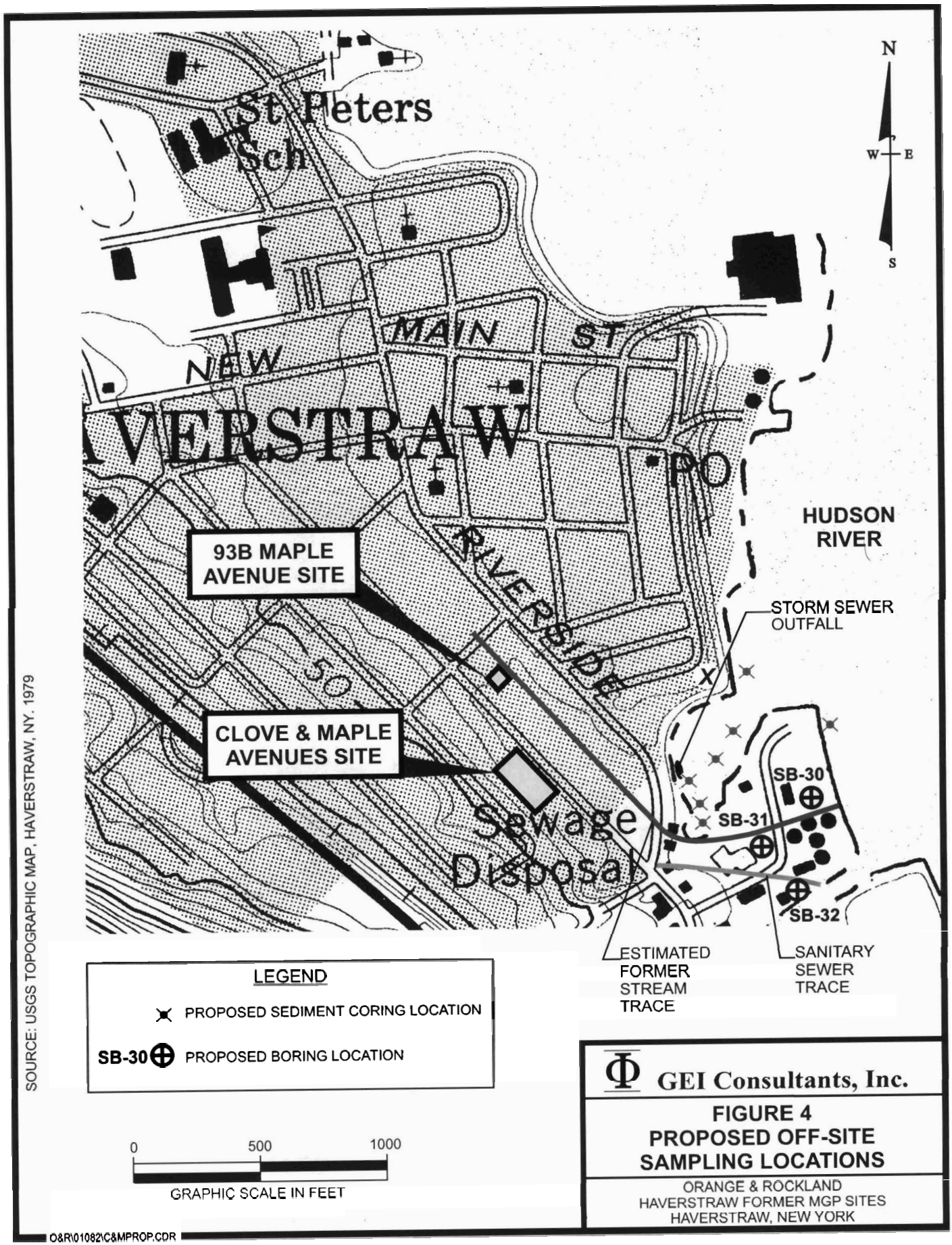
GEI Consultants, Inc.

FIGURE 2

PROJECT SCHEDULE

ORANGE & ROCKLAND
HAVERSTRAW FORMER MGP SITES
HAVERSTRAW, NEW YORK

ORANGE & ROCKLAND/01082-RIHAV-SCH.CDR



GEI Consultants, Inc.

FIGURE 4
PROPOSED OFF-SITE SAMPLING LOCATIONS

ORANGE & ROCKLAND
HAVERSTRAW FORMER MGP SITES
HAVERSTRAW, NEW YORK

Appendix A

Severn Trent Laboratories – Connecticut, Quality Assurance Project Plan

SEVERN TRENT LABORATORIES - CONNECTICUT
QUALITY ASSURANCE PLAN
Revision: 4

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Approved by:

Jeffery C. Curran, Laboratory Director — April 4, 2000 — Date

Michael V. Bonomo, General Manager — 4/4/2000 — Date

Marsha K. Culik, Quality Assurance Manager — April 4, 2000 — Date

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Tables

Figures

1. Introduction, Purpose, and Scope

1.1. STL Overview

Severn Trent Laboratories (STL) is a part of Severn Trent Services Inc. (STS), a major group of US based companies. Both companies are owned by Severn Trent, plc, an international provider of water and wastewater services headquartered in Birmingham, UK.

STL offers a broad range of environmental testing services provided by over one thousand professionals at twenty five locations 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, 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 objectives, 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.

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 Mission Statement

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

1.4. 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 QAP 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 QAP. 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 facility.

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

Air Force Center for Environmental Excellence (AFCEE)
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)
Resource Conservation and Recovery Act (RCRA)

Safe Drinking Water Act (SDWA)

STL also provides services under various state and local municipal guidelines. A current Table of Analytical Services and list of certifications is provided in the appendix of this LQM.

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, August 1994.

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.

Quality Assurance Project Plan, HQ Air Force Center for Environmental Excellence, Version 3.0, March 1998.

National Environmental Laboratory Accreditation Conference, Constitution, Bylaws, and Standards, EPA600/R-98/151, US EPA Office of Research and Development, July 1999.

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

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. 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.

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.

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.

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%, and is the point at which the possibility of detection of false negatives and false positives is equal. 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 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.

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%, and is the point as which the possibly of detection of false negative and false positive is equal. 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, judgement, 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.

Proprietary: belonging to a private person or company.

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.

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).

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.

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).

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.

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 Manager.

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 QMP 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 QMP and is responsible for ensuring that business operations are conducted in accordance with its requirements.

Corporate QA Manager

The Corporate QA Manager is responsible for establishing, implementing and communicating STL's Quality System. The Corporate QA Manager monitors compliance with the Corporate QMP, conducts management system reviews, 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 employee training within STL. The Corporate QA Manager is available to any employee in STL to resolve data quality or ethical issues.

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 and objectives for both the business and the employees, and achieving the financial, business, and quality objectives of the facility. The Laboratory Director ensures timely compliance with audits and corrective actions, and is responsible for maintaining a working environment which encourages open, constructive problem solving and continuous improvement.

QA Manager

The QA Manager is responsible for implementing and communicating the STL Corporate QMP, providing Quality Systems training to all new personnel, maintaining a Laboratory Quality Manual (LQM), and performing systems, data, special, and external audits. The QA Manager oversees the maintenance of QC records, maintains certifications, submits monthly QA Reports, and assists in reviewing new work as needed. The QA Manager has 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 QA Manager is available to any employee at the facility to resolve data quality or ethical issues.

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 STL clients with not only scientifically sound, well documented, and regulatory compliant data, but also to ensure that STL provides the highest quality service available in the industry. A well-structured and well-communicated Quality System is essential in meeting this goal. STL's Quality System is designed to minimize systematic error, encourage constructive, documented problem solving, and provide a framework for continuous improvement within the organization.

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.

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 QA. 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.

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.

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 (QAPPs), 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 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.

4.5. Subcontracting

STL network laboratories occasionally choose to send selected analyses to a subcontract laboratory outside of the STL organization. The most common reason for utilization of a subcontract facility is that the procedure is not routinely performed by an STL network laboratory and the subcontractor has greater experience in day-to-day execution of the method. In such cases, although an STL lab could in all likelihood conduct the analysis, it is more cost effective for both STL and the client to utilize a subcontract lab as necessary. 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, QAPPs, 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 STL'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.

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.

4.7. Service to the Client

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

Client complaints 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.

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, 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 record logs or pre-printed measurement logs. This policy will facilitate the organization and archival of all laboratory data for future reference.

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 logbooks or on pre-printed log sheets 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	QMP	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

*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 QMP 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 years 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 QMP upon facility location change or ownership transfer. Upon STL facility location change, all archives are retained by STL in accordance with the QMP. Upon ownership transfer, record retention requirements are addressed in the ownership transfer agreement and the responsibility for maintaining archives is clearly established.

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	Annual
Data	QA Department	5% of all projects
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 QA Manager of the facility within 21 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 Department Supervisor and/or Manager, and copied to the General Manager and Laboratory Director.

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

4.13.3. Data Audits

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

A data auditing frequency target of 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 permanent corrective action.

Where specific clients and regulatory programs require more frequent data auditing, the individual facility meets the data auditing frequency for that program.

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 focussed 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 management systems review of the facility is performed at least annually by the QA Manager 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.

Figure 1 Monthly QA Report Format

1.	Audits Internal systems audits performed, significant and/or repeat deficiencies noted. External systems audits performed.

Data audits (in percent).

2. Revised Reports/Client Complaints
   Revised reports in percent.
   Total number of client complaints, reason, and resolution.

3. Certifications/parameters changes.

4. Proficiency Testing
   Score for each PT as a percent.
   Note repeat failures and/or significant problems.

5. Miscellaneous QA and Operational Issues
   Narrative outlining improvements, regulatory compliance issues, general concerns, and assistance required from Corporate QA. Include corrective actions and/or audit follow through that are beyond completion date.

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 fifty professionals and support personnel that include:

- Senior Management
- Quality Assurance Manager
- Information Systems Analysts
- Analytical Chemists
- Laboratory Technicians
- Sample Custodian
- 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.

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. Training sessions are scheduled on a monthly basis. 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.

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

Table 5 STL Employee Minimum Training Requirements

Required Training	Time Frame*	Employee Type
Environmental Health & Safety	Month 1	All
Basic Analytical Skills	Month 1	Technical
Quality System	Quarter 1	
Waste Handling	6 months	Technical
Demonstration of Capability (DoC)	Prior to unsupervised method performance	Technical

* From date of employment

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 an DoC Certification Statement.

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 Agreement (Figure 3). Each employee signs the Ethics Agreement, signifying agreed compliance with its stated purpose. A data integrity Hot Line is maintained by STL and administered by the Corporate QA manager.

5.2. Facilities

The laboratory currently maintains a staff of approximately 50 environmental professionals and occupies a facility of approximately 18,000 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 uninterruptable power supply system (UPS) to minimize instrument downtime and damage for short duration power interruptions.

The laboratory is secured by a key access system. Only authorized STL-Connecticut personnel have access to the facility. All visitors must sign in with the receptionist and must be accompanied by an STL-Connecticut employee.

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.

Figure 3 STL Ethics Agreement

It is the policy of STL to incorporate the highest standard of quality with all analytical programs by adhering to the following practices:

STL will only offer environmental analyses for which it can consistently demonstrate compliance with high quality, traceable and legally defensible performance standards.
All STL staff is committed to the practice of complete honesty in the production and reporting of data.
Staff who are aware of misrepresentation of facts or data manipulation to bypass established QA/QC requirements, are required to immediately inform their supervisor or any member of the upper management.

All employees are asked to sign a copy of the statement below upon their first day of employment.

I, _____(print name) understand that high standards of integrity are required of me with regard to the duties I perform and the data I report in connection with my employment at the Company. I agree that in the performance of my duties at the Company:
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; 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 the upper management, up to and including the president of Severn Trent Laboratories Inc.
I will not intentionally report data values that do not meet established quality control criteria as set forth in the Method and/or Standard Operation Procedures, or as defined by Company Policy.

I agree to inform my Supervisor of any accidental reporting of non-authentic data by me in a timely manner. I agree to inform my Supervisor of any accidental or intentional reporting of non-authentic data by other employees. I have read this Ethics Agreement and understand that failure to comply with the conditions stated above will result in disciplinary action, up to and including termination from the Company.

Compliance with this policy of business ethics and conduct is the responsibility of every STL employee. Disregard or failing to comply with this standard of business ethics and conduct could lead to disciplinary action, up to and including possible termination of employment.

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, OLMO4.2, USEPA Contract Laboratory Program, September 1998.

Standard Methods for the Examination of Water and Wastewater, 18th/19th 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.

A listing of the analytical capablities for the STL-Connecticut laboratory is presented in the Appendix.

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. Method Detection 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.

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
Method sensitivity is determined using detection limit studies. Method detection limit studies are performed using the criteria in 40 CFR Part 136 Appendix B. Instrument detection limits are performed where required by specific data quality objectives or regulation.

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 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.

Primary Review

The primary 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 primary 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 primary 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 primary 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 properly documented and appropriately communicated.
- COC procedures have been followed.
- Primary review is documented by date and initials/signature of primary analyst.

Any anomalous results and/or non-conformances noted during the Primary 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 filled 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. 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.

Completeness Review

The completeness review includes the generation 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?
- Does the data meet with the client's expectations?
- Were the data quality objectives of the project met?
- Are QC outages and/or non-conformances approved and appropriately explained in the narrative notes?

5.3.7. 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.

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 Chem Station 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.

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 collected through interfaces and processed by a computer system with Perkin Elmer Turbo Chrom chromatography software. Data is reviewed at the bench level by the analyst. If all required QC is met then the data is reviewed for chromatographic scaling and dilutions. If necessary reintegrations and rescalings are done using the PE system software. The binary result files are then converted to ASCII report files for transfer to the LIMS system for data report forms generation.

- GC/Mass Spectrometry

  GC/MS data is collected utilizing Hewlett Packard Chemstation computer systems with Environquant software. 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. Data is reviewed by the analyst. If the data meets QC requirements, then binary data files are then converted to ASCII report files for transfer to the LIMS computer system via the network for data report forms generation.

- Atomic Spectroscopy

  ICAP metals are analyzed by a Thermo-Jarrel Ash 61E or 61E Purge. The data collected is transfered via a network system to the LIMS system. Furnace data from the Varian is collected on PC and also transferred to the network to the LIMS system for forms generation. Mercury data is analyzed on the mercury analyzer and entered into LIMS.

- 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 calculated final results. These results are then entered into LIMS. Any raw data produced is stored in a central file. Quality control data is manually calculated. Results data is reported off LIMS in the required format.

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.

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 five years from its retirement date.

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
Atomic Absorption Spectrophotometer (AA)	1
Inductively Coupled Argon Plasma Emission Spectrophotometer (ICP)	2
Cold Vapor Atomic Absorption Spectrophotometer (CVAA)	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.

Each analytical measurement SOP lists the preventive maintenance schedule for each instrument which is to be followed by in-house and extramural repair contractors. In addition, each measurement group must maintain a log of all in-house and ex-tramural preventive maintenance activities.

Where it is economically feasible, 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. 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 is not necessarily documented in a test method analysis or by analysis of a reference standard is subject to ongoing certifications of accuracy.

At a minimum, these include procedures for checking specifications for balances, thermometers, temperature, De-ionized (DI) water systems, automatic pipettes and other volumetric measuring devices. Wherever possible, subsidiary or peripheral equipment is checked against standard equipment or standards that are traceable to national or international standards.

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 mercury 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. References standards are labeled with a unique Standard Identification Number, date received, and the expiration date. All

documentation received with the reference standard is retained as a QC record and references the Standard Identification Number.

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 weight of the standard is corrected for the purity when performing calculations.

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" with the lot number, method of preparation, date and analyst's initials. This log provides the internal documentation which traces the internal working standards to primary and secondary (purchased) stocks.

Stock calibration standards are coded in the "Prep Log" mentioned above with the analyte, concentration, date prepared, initials, and referenced to the book and page where a description of the preparation can be found and traced. No samples are maintained in the same areas as the standards.

Records on the traceability of the standards are maintained in the office of the Quality Assurance Manager. These records include sources, dates of receipt, lot numbers (if Applicable) and expiration dates (if applicable).

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 EPA A2LA standards. Stock standards solutions are prepared every six months or when needed as multi-element stocks.

- Inorganic Calibration Standards

Most calibration standards described in the methodology used 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. Spike solution preparation is also documented in the solution/standard log book.

- 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).

- Oven Calibration Standards

Daily calibration by monitoring oven temperature with a thermometer calibrated annually with a NIST Certified Thermometer.

- 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 Stock Storage	Preparation Frequency
GC/MS	Restek, Inc. EPA Supelco Accustandard Protocol	Neat Solutions> 1000 ppm	Frozen Frozen	Primary stocks are prepared from source stocks Intermediate stocks are prepared from primary or source stocks Working stocks are prepared from intermediates	Freezer Refrigerator N/A	Semi-annual Weekly Weekly
GC	Restek, Inc. EPA RTP Supelco Accustandard	Neat Solutions >1000 ppm	Frozen Frozen	Primary stocks are prepared from source stocks Intermediate stocks are prepared from primary or source stocks Working stocks are prepared from intermediates	Freezer Refrigerator N/A	Semi-annual Semi-annually Semi-annually
GFAA; ICP	Inorganic Ventures	Solutions of 1000ppm	Room temp.	Primary stocks (1 - 10 ppm) are prepared from source Intermediate stocks (1ppb - 1 ppm) Working stocks	O.15% HNO_3 at room temperature 0.15% HNO_3 at room temperature 0.15% HNO_3 at room temperature	Annually Semi-annually or as needed 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. The date of reagent receipt and the date the reagent was opened are documented.

5.6. Sampling

Sample representativeness and integrity are the foundations upon which meaningful analytical results rely. Where documented and approved SAPs and/or QAPPs 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. 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 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.

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 5.8.2, 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. Sample storage temperatures are monitored daily.

Samples are physical evidence and are handled at STL according to certain procedural safeguards. For the purposes of legal proceedings, a demonstration to the court that the laboratory is a secure area may be all that is required for the analyzed evidence to be admitted. However, in some cases, the court may require a presentation of the hand-to-hand custody of the samples while they were at the laboratory. In the event that a client requires such a comprehensive chain-of-custody demonstration, upon special request, STL is capable of producing documentation that traces the in-house custody of the samples from the time of receipt to completion of analysis.

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 2 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 again at the time of log-in to the computer system. If there are any discrepancies noted by the sample custodian, a corrective action report is filled out and submitted to the project manager. 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;
- Sample storage units are kept locked.
- 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

  Upon request, all transfers of samples into and out of storage are documented through a sample request form and documented on an internal chain-of-custody.

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 samples, including empty sample containers, are returned to the secure sample control area.

5.7.3. Sample Preparation

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

5.7.4 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 bearmed 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

Each STL facility also participates in a double blind performance. An external vendor is contracted 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 Corporate QA Manager 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. Control Sample types and typical frequency of their application are outlined in Table 9. Note that frequency of control samples vary with specific regulatory, methodology and project specific criteria.

5.8.3. 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.

Tables 8 list in tabular form the procedures which are followed by STL Connecticut The calibration protocols meet or exceed the minimum method criteria requirements 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 8 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	≤ 20% RSD +/- 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	≤ 30% RSD +/- 20% Diff	continuing calibration failure Every 12 hours
AAS Graphite	Initially Continuing	5 concentration levels 1 standard	Linear	>.995 coefficient of variation +/- 95% of value	continuing cal. failure Every 10 samples
ICP	Initially Daily Continuing	5 concentration levels 2 levels 1 standard	Linear	According to instrument manufactures's instructions	Quarterly Every 10 samples
Lachat Analysis	Initially,Daily Continuing	5 concentration levels 1 standard	Linear	<.995 coefficient of variation	continuing calibration failure Every 10 samples
pH Meters	Initially and daily Continuing	3 standards 1 standard	Linear	+/- 95% of value	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 +/- 95% of value	Daily Every 10 samples
Infrared Spectrophoto-meter	Initially and monthly Continuing	5 concentration levels 1 level	Linear	<.995 coefficient of variation +/- 95% of value	Daily Every 10 samples

TABLE 8 INSTRUMENT CALIBRATION SUMMARY					
Conductivity meter	Daily	3 concentration levels	Linear	<.995 coefficient of variation	Daily
	Continuing	3 concentration levels		+/- 95% of value	Every 10 samples
Turbidimeter	Daily	3 concentration levels	Linear	<.995 coefficient of variation	Daily
	Continuing	3 concentration levels		+/- 95% of value	Every 10 samples
Balance	Daily	3 levels Class "S" weights	Point		Check single weight upon use

5.8.4. 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.

Table 9 Control Samples

Laboratory QC Sample Type	Use	Typical Frequency
Laboratory Control Sample (Laboratory Fortified Blank)	Measures accuracy of method in blank matrix	1 per batch of 20 or less samples per matrix type per sample extraction or preparation method(1)
Method Blank	Measures method contribution to any source of contamination	1 per batch of 20 or less samples per matrix type per sample extraction or preparation method(1)
Instrument Blank	Measures instrumental contribution to any source of contamination	As specified in test method
Cleanup Blank	Measures clean up step contribution to any source of contamination	As specified in test method
Storage Blank	Measures storage contribution to any source of contamination (Volatiles only)	As specified in test method or SOP
Field QC Sample Type	**Use**	**Typical Frequency**
Matrix Duplicate	Measures effect of site matrix on precision of method	Per 20 samples per matrix or per SAP/QAPP (1,2)
Matrix Spike	Measures effect of site matrix on accuracy of method	Per 20 samples per matrix or per SAP/QAPP (1)
Matrix Spike Duplicate	Measures effect of site matrix on precision of method	Per 20 samples per matrix or per SAP/QAPP (1,2)
Equipment Blank (Equipment Rinsate)	Measures field equipment contribution to any source of contamination	Per SAP/QAPP
Trip Blank	Measures shipping contribution to any source of contamination (Volatiles)	Per Cooler
Field Blank	Measures field environment contribution to any source of contamination	Per SAP/QAPP
Field Duplicate	Measures representativeness of sampling and effect of site matrix on precision	Per SAP/QAPP

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 10 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 10 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 Laboratory Director or his/her designee authorizes the release of the project report with a signature.

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

Subcontracted data is clearly identified as such, and the name, address, and telephone number for the laboratory performing the test is included in the project report. Subcontracted results from laboratories external to STL are not reported on STL report forms or STL letterhead. Test results from more than one STL facility are clearly identified with the name of the STL facility that performed the testing, address, and telephone number for that facility.

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 secondary review to ensure their accuracy and completeness.

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 10 Report Content Options

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

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.

Committed To *Your* Success

PROFESSIONAL PROFILE
Jeffrey C. Curran

TITLE: **Laboratory Director**

ACADEMIC ACCOMPLISHMENTS:

Southern Connecticut State University - New Haven, Connecticut
B.A. Chemistry, 1975
M.S. Chemistry, 1978

MAJOR AREA OF EXPERTISE:

Quality Control/Quality Assurance
Hazardous Waste Analyses
Classical and Wet Chemistry Analyses
PCB Analysis
Capillary GC/MS Analysis
Industrial Hygiene

Certified Laboratory Director for the States of Connecticut, New York, New Jersey and Massachusetts.

SUMMARY OF EXPERIENCE:

Mr. Curran is responsible for the overall direction of the laboratory and has extensive experience in analytical chemistry specializing in environmental analysis. He has worked in all areas of the laboratory and has hands-on expertise in general wet chemistry techniques, atomic spectroscopy, gas chromatography, infrared spectroscopy and gas chromatography/mass spectrometry.

PROFESSIONAL EXPERIENCE:

Present

Severn Trent Laboratories (IEA, Inc. - CT)

Position Laboratory Director

Responsibilities

For the past 18 years Mr. Curran has directed and participated in a variety of projects. Some highlights are listed below:

Hazardous Waste Site, East Windsor, CT

At a major Connecticut Hazardous Waste site Mr. Curran participated in the sampling analysis of buried drums of hazardous waste during a state-supervised cleanup project.

Ethylene Oxide Emissions Testing, Sherburn, New York

At a major E+O user in Upstate New York, Mr. Curran directed an on-site testing program for measuring E+tO emissions using gas chromatography. Mr. Curran also worked on a testing program in conjunction with the NYSDEC for testing pollutant control equipment for EtO sterilizers.

Canadian Tariff Board Hearings

Mr. Curran provided expert witness testimony at a Canadian Tariff Board Hearing concerning chemical composition of foam packaging material.

Worker Exposure Study, Lynchburg, Virginia

Mr. Curran directed an on-site industrial hygiene study to monitor employee exposure to various solvents and chemicals. Mr. Curran was also part of the team which analyzed the various samples collected using gas chromatography, atomic spectroscopy, and UV-VIS spectroscopy in accordance with NIOSH protocols.

Food Processing Plant, Rochester, New York

Mr. Curran conducted an investigation to determine the cause of stainless steel tubing failures for a national food process company. The results of this study were used in determining alternatives to the current materials used in the process.

Hazardous Breakdown Product Study

Mr. Curran designed a system to identify and measure potentially hazardous breakdown products resulting from the pyrolysis of plastic materials for an international aircraft manufacturer. Results of this study were used to identify what materials were responsible for and how to alleviate the problem.

PROFESSIONAL AFFILIATIONS:

Member of the American Chemical Society

Committed To *Your* Success

PROFESSIONAL PROFILE
Marsha Culik

TITLE: QA Manager

ACADEMIC ACCOMPLISHMENTS:

S.U.N.Y. at Alfred - Alfred, New York
A.A.S. Medical, 1976
Laboratory Technology

MAJOR AREA OF EXPERTISE:

Extensive development and "hands on" experience with Gas Chromatography, Atomic Absorption Spectrophotometry, Auto Analyzer, and some computer data stations.

SUMMARY OF EXPERIENCE:

Ms. Culik has over 12 years experience in the environmental laboratory field. Experience ranges from analysis of drinking water with a Grade 3 Water Treatment Plant Operator to gas chromatography chemist with environmental samples. Ms. Culik has experience as supervisor of the Gas Chromatography department.

PROFESSIONAL EXPERIENCE:

1/91 to Present

Severn Trent Laboratories (IEA, Inc. - CT)

Position QA Manager

Responsibilities

Quality Assurance Manager, responsible for monitoring the continuing compliance with the Corporate QA Program and to be a liaison between Corporate QA and laboratory staff.

Additional responsibilities include maintaining certification programs, coordination of external and internal audits, coordinate all inquiries relative to quality issues and follow-up on corrective actions as necessary, maintain files of all QA related documentation include review and approval of all SOP's.

1986 to 1991

Position GC Group Leader

Responsibilities

Supervisor of GC Group, responsible for analysis of environmental samples for pesticides/PCB's according to EPA/NYSDEC CLP Protocols, SW846 Methods and EPA "600" Series Methods. Additional responsibilities include analysis of samples via purge & trap/GC according to various protocols.

Other duties include analysis of air samples, charcoal absorbent tubes and other miscellaneous samples for any parameters requiring gas chromatography analysis. She is also responsible for supervision of the group including sample tracking, data review, etc.

1984 to 1986

Position Chemist

Responsibilities

Experience in sample prep and GC analyses of Pesticides/PCB's in water, oil and soil samples.

1981 to 1984

Position Laboratory Analyst - American Waterworks Service Company

Responsibilities

Experience performing complete laboratory analysis or raw, potable, and waste water including all miscellaneous include Volatile Organics, Trihalomethanes and Aromatics using Purge and Trap techniques; Pesticides and Herbicides by GLC; Transition and Heavy Metals by Flame and Graphite Furnace Atomic Absorption; and Nutrients by Automated and other various wet chemistry procedures. Assisted Lab Director in the development of many methods used in these analyses. Responsible for collection and interpretation of all quality control data.

1978 to 1981

Position Lab Technician - Suffolk County Water Authority

Responsibilities

Laboratory experience in the analysis of potable water for a large water utility. Cooperative studies done in conjunction with state and local health agencies concerning water and wastewater quality. Also monitoring the chemical quality of water and seawater programs for the U.S.G.S. Primary responsibilities were for the analysis of Halogenated and Aromatic organic compounds by Purge and Trap Gas Chromatography. Other areas of experience include the analyses of nutrients by Technicon Auto Analyzer, metals by Flame and Graphite Furnace Atomic Absorption, and microbiological testing using Millipore System.

Marsha Culik

1976-1978

Position Lab Technician - Hooker Chemicals & Plastics

Responsibilities

Responsible for the analysis of vinyl chloride monomer in PVC Compounds, Resins and Food Packageability studies utilizing Gas Chromatography. Responsible for monitoring the air quality of the plant environment.

SPECIALIZED TRAINING:

1984 Certified Grade 3 Water Treatment Plant Operator

1977 ASCP Registered MLT

Environmental Laboratory Management
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

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PROFESSIONAL PROFILE
Lawrence H. Decker

TITLE: **GC/MS Manager**

ACADEMIC ACCOMPLISHMENTS:

Franklin Pierce College - Rindge, New Hampshire
B.A. Biology 1982

MAJOR AREA OF EXPERTISE:

Final Data Review
Coordination of sample analysis for the GC/MS group
Organics analysis by GC/MS

SUMMARY OF EXPERIENCE:

Lawrence Decker has 12 years of GC/MS experience. He has been responsible for operations of the GC/MS group for five years. Presently functioning as the GC/MS Manager, and Volatiles Group Leader.

PROFESSIONAL EXPERIENCE:

5/92 to Present

Severn Trent Laboratories (IEA, Inc. - CT)

Position GC/MS Manager

Responsibilities

Responsible for the volatile group operations. Duties include: Scheduling workforce, ordering supplies, final data package review, employee reviews, overseeing sample analysis and sample prioritizing, adhering to forecasted budget, dealing with client requests, training employees, updating sample/job status with client service and laboratory directors. Tracking workflow through group. Assisting Laboratory Director with assigned tasks.

10/91 to 5/92

Position GC/MS Section Leader

Responsibilities

Responsibilities included: Sample analysis for both semi-volatile and volatile samples, tracking and scheduling samples, troubleshooting instrumentation, final data package preparation and review. Unknown compound determination (TIC's). Assisting with selected tasks.

Lawrence H. Decker

4/86 to 9/90

Position GC/MS Operator

Responsibilities

Running samples, calibrating instruments, tracking samples, screening, total solids standard preparation, paperwork. Familiarity with EPA/NYSDEC CLP, SW846 and EPA "6--" Series VOA and BNA methods and routine analysis of aqueous and soil samples for VOA and BOA target and non-target (TIC) compounds. Experience in the data review process which involves monitoring surrogate recoveries, internal standard areas, target compounds concentration ranges and matrix spike/matrix spike duplicate performance parameters.

SPECIALIZED TRAINING:

Mass Spectroscopy Data Interpretation
One day Seminar
Dr. Frank Turecek (Cornell University)

Course description included close examination of mass spectra pertaining to identification of molecular ion, stability structure relationship, characteristic ion group effects, fragmentation and identifiable isotope clusters. Further concepts discussed include the nitrogen rule, the picket fence (alkane) series, and common fragment ions.

RTE-VI Procedures File Workshop
Four day seminar
GC/MS HP Aquarius Software Training
Mark Harwick (HP Instructor)

Course description included detailed examination of GC/MS Hardware, theory and function of mass spectroscopy, data acquisition and interpretation. Course emphasized software manipulation to enhance the overall quality and quantity of accurate and legible data.

Hewlett-Packard User I Course
Five day seminar
Hewlett-Packard, Paramus, New Jersey

Course description included a general overview of the HP computer system, mass spectrometer theory, instrument tuning and utility programs.

Introduction to Analytical Separations

Introduction to Chemical Analysis

Terms associated with chemical analysis; a review of the important considerations in analytical chemistry; sensitivity and detection limit; evaluation of results.

Analytical Separation

Solvent extraction; emulsions, completeness of extraction; extraction of organic compounds; pH effect; extraction with metal chelator.

Chromatography (General Principles)

Chromatographic behavior of solutes; column efficiency and resolution.

Gas Chromatography

Gas chromatograph; gas chromatographic columns; liquid phases and column selection; detectors for gas chromatography; optimization of experimental conditions; interfacing gas chromatography with mass spectrometry.

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PROFESSIONAL PROFILE
John Bennett, Jr.

TITLE: **Semi-Volatile Organics Group Leader**

ACADEMIC ACCOMPLISHMENTS:

Southern Connecticut State University - New Haven, CT
B.S. Biology 1978 (Chemistry Minor)

MAJOR AREA OF EXPERTISE:

Classical Chemistry
Atomic Spectroscopy
Organic Extractions
Gas Chromatography
Microbiology

SUMMARY OF EXPERIENCE:

An extensive background in all phases of laboratory operations. Was responsible for designing, specifying, and hiring staff for a state of the art environmental laboratory. Had day to day responsibility for all phases of operation of the lab. Responsible for writing and conducting performance reviews for staff. Implemented stringent QA/QC program in the lab following USEPA CLP protocols. Had direct responsibility for inorganics section of the laboratory. Functioned as a resource person and problem solver for staff.

Wide ranging experience in the analysis of environmental and hazardous waste samples using EPA, APHA, and ASTM methodologies. Experienced in the analysis of contaminants from stationary sources. Has performed industrial hygiene surveys fore a variety of contaminants, and is familiar with the NIOSH procedures for their analysis. Instrumental expertise is in GC/MS, as well as other detectors. Also familiar with ICP spectroscopy, as well as flame and furnace atomic absorption spectroscopy. In addition, has extensive experience with all basic laboratory apparatus.

A broad background in microbiology including the identification and enumeration of microorganisms from a wide variety of sources. Familiar with USP and APHA procedures of analysis. Performed studies on the effects of point source contamination of water supplies and has performed characterization of problem microorganisms in sewage treatment plants. Developed a novel procedure for determining the microbial kill effectiveness of ethylene oxide sterilization cycles.

PROFESSIONAL EXPERIENCE:

1994 to Present

Severn Trent Laboratories (IEA, Inc. - CT)

Position **Semi-Volatile Organics Group Leader**

Responsibilities

Responsible for the day to day operation of the GC/MS Semi-Volatiles group. Performed instrumental analysis of semi-volatile extracts, target and non-target compound identification, instrument troubleshooting and maintenance, as well as final review of data. Provide guidance to staff to ensure that project specific data quality objectives are met. Wrote SOP's to ensure that laboratory operations met protocol requirements.

1988 to 1994

IEA, Inc. - Connecticut

Position Sample Preparation Laboratory Supervisor

Responsibilities

Responsible for daily operations of organics extractions group. Interacted with other departments in the laboratory concerning the status of client samples. Responsible for the supervision of six staff members. Responsible for the quality of work produced by group as well as meeting turnaround goals.

1987 to 1989

Position Laboratory Director - Chemrox, Inc.

Responsibilities

State of Connecticut Certified Laboratory Director for Chemrox Laboratory Services. Had overall responsibility for the operation of the laboratory, as well as the development of the business. Supervised 10 staff members. Interacted with other departments in the company, as well as outside clients on technical aspects of laboratory analyses. Participated in seminars to educate various groups about environmental issues.

1985 to 1987

Position Senior Chemist

Responsibilities

Responsible for ethylene oxide associated analyses. Performed pilot scale testing on a variety of medical devices to determine optimal de-gassing conditions. Aided in the design and construction of a pilot ethylene oxide. Was a member of the AAMI committee that developed reference test methods for ethylene oxide residues in medical services.

John Bennett, Jr.

1980 to 1985

Position Senior Microbiologist/Associate Chemist - YWC, Inc.

Responsibilities

Responsible for performing non-routine microbiological analyses as well as providing technical guidance to technicians performing routine work. Instituted strict quality control procedures on all reagents, media and organisms. Was responsible for routine and non-routine chemical analyses on environmental samples. Was heavily involved in atomic spectroscopy analysis. Also performed evaluations on consumer products ranging from air cleaners to home water purification units.

1978 to 1980

Position Senior Chemist - Nutmeg Chemical Company

Responsibilities

Promoted to Assistant Director of Laboratory. Supervised staff in absence of Director. Served as liaison between director and staff. Performed non-routine water and oil analysis, quality control companies products as well as routine water, oil and deposit analysis. Also performed microbiological analysis of water samples.

1978 to 1979

Position Laboratory Technician

Responsibilities

Responsibilities included routine water and oil analyses and quality control of products.

SPECIALIZED TRAINING:

Basic Atomic Spectroscopy
Perkin Elmer
Norwalk, Connecticut 1979

ICP Spectroscopy
Spectra Inc.
Pompton Lakes, New Jersey 1988

Graphite Furnace Atomic Absorption Spectroscopy
Spectra Inc.
Pompton Lanes, New Jersey 1988

Interpretation of Low Resolution Mass Spectra
YWC
Whippany, New Jersey 1989

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PROFESSIONAL PROFILE
Kimberly A. Maturo

TITLE: **Gas Chromatography Group Leader**

ACADEMIC ACCOMPLISHMENTS:

Southern Connecticut State University - New Haven, Connecticut
B.S. Biology, 1985

SUMMARY OF EXPERIENCE:

Ms. Maturo has over 13 years experience in the environmental field. 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.

PROFESSIONAL EXPERIENCE:

3/91 to Present

Severn Trent Laboratories (IEA, Inc. - CT)

Position GC Group Leader

Responsibilities

Supervisor of GC Group, responsible for extraction and analysis of environmental samples for pesticides/PCB's according to EPA/NYSDEC CLP Protocols, SW846 Methods and EPA "600" Series Methods. Additional responsibilities include analysis of samples via purge & trap/GC according to various protocols.

Other duties include analysis of air samples, charcoal absorbent tubes and other miscellaneous samples for any parameters requiring gas chromatography analysis. She is also responsible for supervision of the group including sample tracking, data review, etc.

10/88 to 3/91

Position GC- Senior Lab Technician

Responsibilities

Ms. Maturo's primary duties are the operation of the gas chromatographs for a variety of analyses. She has experience in pesticide/PCB determinations as well as other miscellaneous analytes such as alcohols, herbicides and solvents in general.

Ms. Maturo's other duties include computer data entry, sample tracking and monitoring QC samples for the group.

10/85 to 10/87

Position Extractions Group

Responsibilities

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. She also was responsible for screening of organic extracts via gas chromatography.

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PROFESSIONAL PROFILE
Daniel W. Helfrich

TITLE: **Inorganics Manager**

ACADEMIC ACCOMPLISHMENTS:

Quinnipiac College
Sacred Heart University
M.S. Chemistry
M.B.A.
B.A. Biology
B.S. Biology, 1985

MAJOR AREA OF EXPERTISE

Four years running ICP on environmental samples.
Two years running Furnace analysis.
Four years sample prep in enviornmental area.
Three years CLP Data Review.
OSHA trained and certified.
Familiar with EPA and NYSDEC protocols and SW846 Methods relating to inorganic metals anaylsis.

SUMMARY OF EXPERIENCE:

Mr. Helfrich has over 13 years experience in environmental analysis. 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. OSHA trained and experienced.

PROFESSIONAL EXPERIENCE:

1992 to Present

IEA, Inc. - Connecticut

Position Group Leader

Responsibilities

Manage daily flow of work, set priorities.
Monitor productivity of group.
CLP data review ensuring QA/QC protocols are followed.
Manage the collection and removal of all hazardous waste generated by IEA-CT.

1989 to 1992

Position Senior Chemist - IEA

Responsibilities

ICP & Furnace Operator, manage flow or work, CLP dat review ensuring QA/QC protocols are followed.

1987 to 1989

Position Lab Manager - PGP Industries

Responsibilities

ICP Operator and Health & Safety Manager

1984 to 1987

Position Senior Chemist - Handy Harmon

Responsibilities

ICP Operator

SPECIALIZED TRAINING:

OSHA Seminar - 40 Hour Training + 28 Hours Update
Clean Harbours - Hazardous Waste Seminar

APPENDIX, Section 2

ETHICS POLICY and QUALITY STATEMENT

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SEVERN TRENT LABORATORIES INC. ETHICS AGREEMENT

INTRODUCTION

STL is committed and dedicated to providing only the highest quality analytical data possible to its clients. This means that the data produced, managed and reported by STL must meet the requirements of its clients and comply with both the letter and spirit of the various municipal, state and federal regulations and guidelines.

POLICY

It is the policy of STL to incorporate the highest standard of quality with all analytical programs by adhering to the following practices:

- STL will only offer environmental analyses for which it can consistently demonstrate compliance with high quality, traceable and legally defensible performance standards.
- All STL staff are committed to the practice of complete honesty in the production and reporting of data.
- Staff who are aware of misrepresentation of facts or data manipulation to bypass established QA/QC requirements, are required to immediately inform their supervisor or any member of the upper management.

PERSONAL PLEDGE

I, _____ (print name) understand that high standards of integrity are required of me with regard to the duties I perform and the data I report in connection with my employment at the Company.

I agree that in the performance of my duties at the Company :

- **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 citation;**
- **I will not intentionally misrepresent another individual's work; and**
- **If a supervisor or other member of the 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 the upper management, up to and including the president of Severn Trent Laboratories Inc.**
- **I will not intentionally report data values that do not meet established quality control criteria as set forth in the Method and/or Standard Operation Procedures, or as defined by Company Policy.**

I agree to inform my Supervisor of any accidental reporting of non-authentic data by me in a timely manner.
I agree to inform my Supervisor of any accidental or intentional reporting of non-authentic data by other employees.
I have read this Ethics Agreement and understand that failure to comply with the conditions stated above will result in disciplinary action, up to and including termination from the Company.

_____ (Signature)

_____ (Location)

_____ (Printed Name)

_____ (Witness)

_____ (Date)

APPENDIX, Section 3

SLT CHAIN-OF-CUSTODY FORM

Severn Trent Laboratories
200 Monroe Turnpike
Monroe CT 06468
Tel: (203) 261-4458
Fax: (203) 268-5346

STL
mmitted To *Your* Success

CHAIN O. USTODY RECORD

PAGE OF | NO.

STL JOB #:

CLIENT:

PROJECT ID:

STL PROJECT MGR:

RUSH ☐ YES ☐ NO | DUE DATE

TESTS								GENERAL REMARKS
BOTTLE TYPE AND PRESERVATION								

OTTLE SET #	CLIENT SAMPLE ID	DATE / TIME SAMPLED	MATRIX	LAB ID	QC Y / N	FIELD FILTERED - CIRCLE Y or N								SAMPLE REMARKS
						Y / N	Y / N	Y / N	Y / N	Y / N	Y / N	Y / N	Y / N	

MATRIX CODES

- - AIR
- Q - AQUEOUS
- - COMPLEX
- - DRUM WASTE
- I - OIL
- S - SOIL
- SL - SLUDGE
- W - WIPE
- O - OTHER
- FB - FIELD BLANK
- TB - TRIP BLANK

BOTTLES PREPARED BY	DATE / TIME	BOTTLES REC'D BY	DATE / TIME
SIGNATURE		SIGNATURE	
SAMPLES COLLECTED BY	DATE / TIME	RECEIVED IN LAB BY	DATE / TIME
		SIGNATURE	

REMARKS ON SAMPLE RECEIPT

☐ BOTTLES INTACT ☐ CUSTODY SEALS

☐ PRESERVED ☐ SEALS INTACT

☐ CHILLED ☐ SEE REMARKS

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.

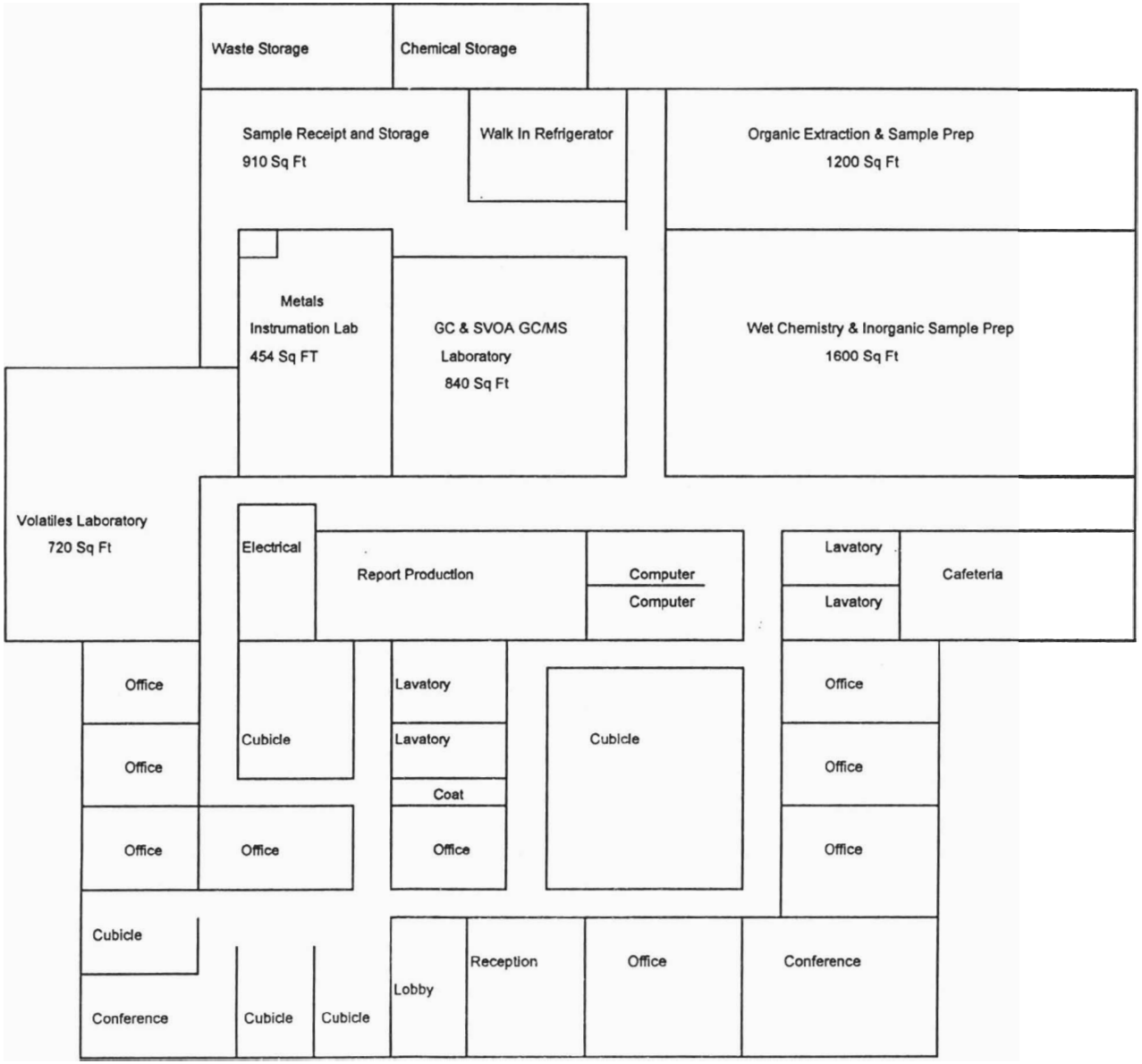
APPENDIX, Section 5

LABORATORY FLOOR PLAN

EQUIPMENT LIST

PREVENTIVE MAINTENANCE

Severn Trent Laboratories
Shelton, CT



Severn Trent Laboratories - CT Equipment List

April 3, 2000

WET CHEMISTRY

Equipment Name	Manufacturer	Model Number	Serial Number
Centirfuge	DYNAC	0101	16846
Spectrophotometer, UV-VIS	Perkin-Elmer	35	34630
Turbidimeter	Orbeco/Hellige	965-10	2780
TOC Analyzer	Xertex-Dohrmann	DC-80	9107404
TOC Analyzer	Xertex-Dohrmann	DC-190	96026010
Fluorometer	Sequoia-Turner Corp.	112-003	D 01491
pH/ISE Meter	Orion	SA 720	SR45A
pH/ISE Meter	Beckman	12	0232578
Conductivity Meter	Cole-Parmer Instrument	1484-20	1421
Flash Point Apparatus	Precision Scientific	Pensky-Martin	10 Au-12
Oven	Fisher Scientific	55G	291
Oven	VWR	1320	0701090
Incubator	Blue M Electric	100 A	IN1-1362
Bio Refrigerator	Frost Queen	R20/L	00029
BOD Incubator (2)	Precision Scientific	FU199JRW2/FU178RRW2	FLC02662
Midi Distillation Setup (2)	Andrews Glass Co.	110-10-R	A4W0309/0209
D.O. Meter	YSI	51A	0241
COD Reactor	HACH	45600	920300006892
Muffle Furnace	Thermolyne		
TKN block digestor	Scientific Instruments	AD-4020	8915049
Digital Hot Plate/Stirrer (2)	PMC	730	0298E
TCLP Spinners- 34 positions (4)	Dayton	3M137B/5K939B	
Semiautomated Analyzer	LACHAT	Quikchem AE	2000-0033
Semiautomated Analyzer	LACHAT	Quikchem AE	2000-0069

METALS

Equipment Name	Manufacturer	Model Number	Serial Number
Mercury Analyzer	Spectro-Products	HG4	4708
Mercury Analyzer	Leeman		HG 4019
Autoclave	Market Forge	STM-E	034200
ICP-Trace	Jarell-Ash	JA61T	349490
ICP-Purge	Jarrell-Ash	JA61E	67782
Furnace AA	Varian	0091066	AA4002

ORGANIC EXTRACTIONS

Equipment Name	Manufacturer	Model Number	Serial Number
Chiller	VWR		2081-230
Gel Permeation Chromatograph	ABC	1002B	
Gel Permeation Chromatograph	ABC	AP1000	9309-2I
Refrigerator	WW	4EF	F3978U
Oven	ASP	D 1142	144011
Oven	ASP	D 1162	145010
Sonicator	Sonics & Materials	SM500	6892
Sonicator	Sonics & Materials	VCX-400	20030C
Rotary Evaporator	BUCH I	R-114	
Seporatory Funnal Shaker	Glas-Col	Series 100	263595
Muffle Furnace	Wilt	M001210	91661

GC/MS VOLATILES

Equipment Name	Manufacturer	Model Number	Serial Number
Purge & Trap	Tekmar	LSC 2000	88326004
Purge & Trap	Tekmar	ALS 2016	89055011
Purge & Trap	Tekmar	LSC 2000	91254010
Purge & Trap	Tekmar	ALS 2016	90157035
Purge & Trap	Tekmar	LSC 2000	91267021
Purge & Trap	Tekmar	ALS 2016	89242002
Purge & Trap	Tekmar	LSC 3000	952000014
Purge & Trap	Tekmar	ALS 2016	94189009
Purge & Trap	Tekmar	LSC 2000	91049003
GC/MS	Hewlett Packard	5890 Series II/5970 MSD	3029A30026
GC/MS	Hewlett Packard	5890 Series II/5971A MSD	3240A18492
GC/MS	Hewlett Packard	5890 Series II/5970 MSD	3033A33746
GC/MS	Hewlett-Packard	5890 Series II/5971A MSD	3133A37851
GC/MS	Hewlett-Packard	5890 Series II/5971A MSD	3203A41807
Tube Desorber	Envirochem	810TD	268153
Computer/Data System	Hewlett Packard	ChemStation - EnviroQuant	
PCs – 5	Dell		
Printers	Hewlett Packard	Laserjet IV	
Archon 51	Varian	51	12744
Archon 4552	O/I Analytical	4552	11840-1295A

GC/MS SEMI-VOLATILE

Equipment Name	Manufacturer	Model Number	Serial Number
GC/MS/MSD	Hewlett-Packard	5890 SeriesII/5971MSD	3033A38086
GC/MS/MSD	Hewlett-Packard	5890 SeriesII/5971AMSD	3121A35549
GC/MS/MSD	Hewlett-Packard	5890 SeriesII/5971MSD	3033A32891
Data System -Enviroquant	Hewlett-Packard	2 -Vectra XM2 PCs	
Data System -Enviroquant	Hewlett-Packard	1 - Dell PC	

Printers	Hewlett Packard	Laserjet IV	

GAS CHROMATOGRAPHY

Equipment Name	Manufacturer	Model Number	Serial Number
GC -Dual ECD w/ Autosampler	Hewlett-Packard	5890 Series II	3033A33529
GC -Dual ECD w/ Autosampler	Hewlett-Packard	5890 Series II	2750A14991
GC -Dual ECD w/ Autosampler	Hewlett-Packard	5890 Series II Plus	3336A55482
GC -Dual ECD w/ Autosampler	Hewlett-Packard	5890 Series II	3140A3A129
GC- NPD/FID w/Autosampler	Hewlett-Packard	5890 Series II	3033A32099
GC- Dual FID w/Autosampler	Hewlett-Packard	5890 Series II	3033A32563
Integrators - 4	Hewlett-Packard	3396A	
Data System - LAS	Hewlett-Packard	HP1000A	3020A05230
Terminals (4)	Hewlett-Packard	2397A	---
Printers (3)	Hewlett-Packard	Laserjets: 1-III, 1-IV, 1-V	---
Tape Drive	Hewlett Packard	9144	2724E13732
Data System-Enviroquant	Hewlett-Packard	Vectra XM2	

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	Inspect syringe	Daily

Autosampler		
	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	
Graphite Furnace	Clean contact rings, furnace housing and quartz windows	Daily
	Inspect, clean or replace graphite tubes	As needed
	Replenish matrix modifiers	Daily
	Check lamp alignments and energies	Daily
	Clean mirrors for the optical sensors	Weekly
	Clean windows on furnace housing	Weekly

	Inspect contact rings for excessive wear	Monthly
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

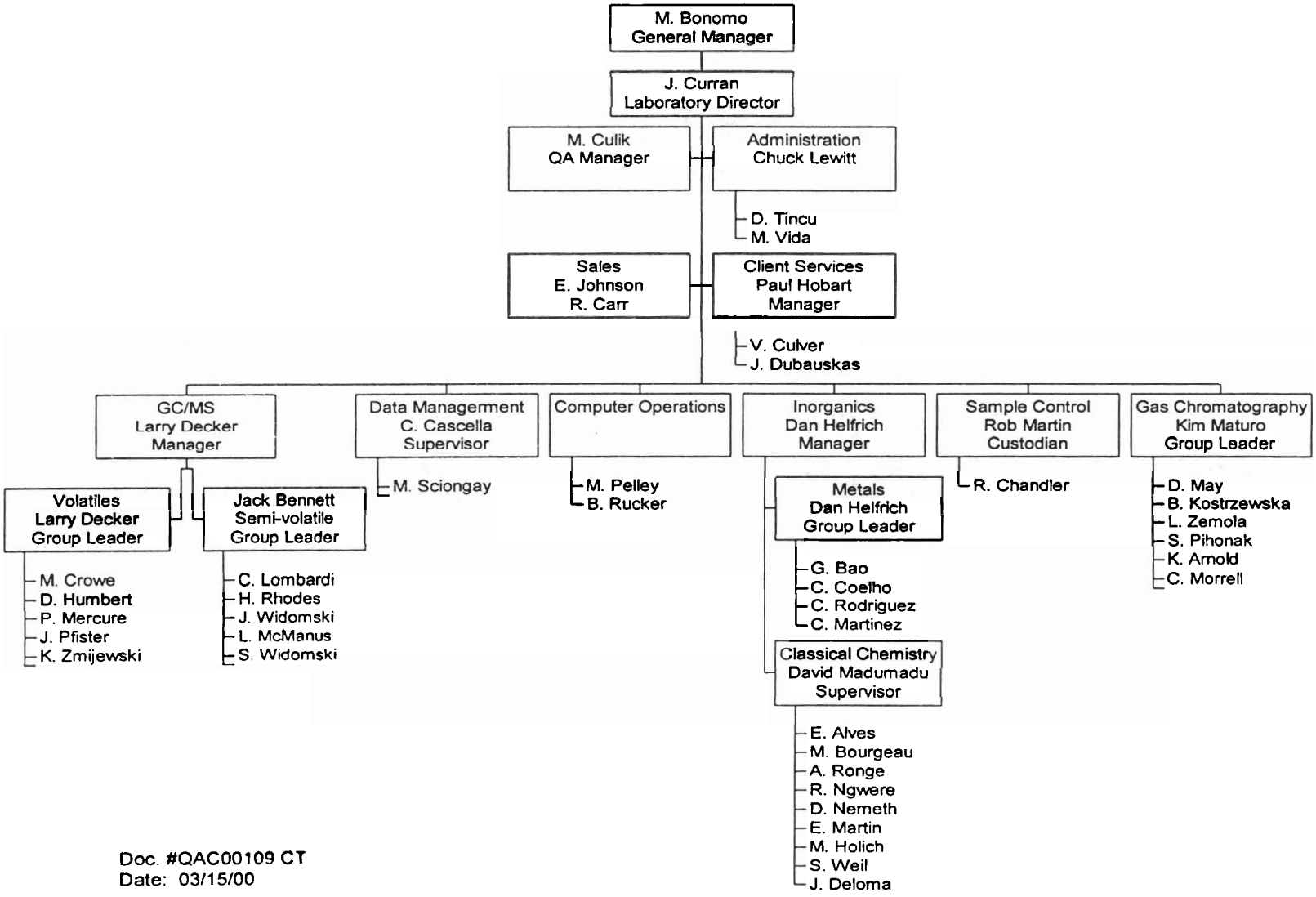
APPENDIX, Section 6

ORGANIZATIONAL CHART

APPENDIX, Section 6

ORGANIZATIONAL CHART

STL - Connecticut Organizational Chart



Doc. #QAC00109 CT
Date: 03/15/00

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

__Gas Chromatography __ Mass Spectrometry __ Report Generation

__Client Service __ Sample Preparation __Systems __ 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 use only)

Corrective Action Approved: _____

Date Finalized: _____

STL Doc.# QAF00202CT

APPENDIX, Section 8

LISTING OF LABORATORY

STANDARD OPERATING PROCEDURES (SOPs)

SAMPLE CONTROL

Standard Operating Procedure	Code	Date Generated	Date last Revised
SOP for Bottle Order Preparation	SMS00103.CT	02/15/95	10/27/99
SOP for Sample Processing and Sample Arrival	SMS00405.CT	05/15/92	10/27/99
SOP for Log-in of CLP Samples	SMS00505.CT	05/15/92	10/29/99
SOP for Storing Water and Soil Samples	SMS00606.CT	05/12/92	10/27/99
SOP for Generating Labels/Labeling Containers	SMS00703.CT	05/15/92	10/26/99
SOP for Documenting Sample Removal from Laboratory	SMS00805.CT	05/15/92	10/26/99
SOP for Securing the Laboratory and Samples	SMS00906.CT	05/15/92	10/26/99
SOP for Temperature Control Requirements	SMS01003.CT	05/15/92	11/01/99
SOP for Compositing Samples	SMS01103.CT	06/16/94	10/27/99
SOP for Sample Receipt (NJDEPE)	SMS01201.CT	01/24/95	Archived 11/05/99
SOP for Log-in CLP (OLM04.2) Samples	SMS01300.CT	01/26/00	
SOP for Sample Disposal	SMS01400.CT	03/20/00	
SOP for Operating and Maintaining Fume Hoods	SFS00202.CT	05/15/92	03/21/95
SOP for Hazardous Waste Disposal	SFS00100.CT	05/06/92	05/06/93
SOP for Emergency Procedures	SFS00300.CT	06/21/94	
SOP for Hazardous Waste Minimization Plan	SFS00500.CT	07/25/94	
SOP for Tracking and Collection of Mixed Waste	RAS00101.CT	02/06/94	02/22/99
SOP for Radioactivity Swpie Tests	RAS00201.CT	08/17/94	02/22/99
SOP for Radiation Screening	RAS00301.CT	08/15/94	02/22/99
SOP for Management/Disposal of Mixed Waste	RAS00400.CT	08/24/94	

DATA MANAGEMENT/HANDLING

Standard Operating Procedure	Code	Date Generated	Date last Revised
SOP for Preparation/ Review of Laboratory Reports	RPS00304.CT	02/16/94	02/24/00
SOP for Documentation Policy/Procedures	DM:090191:2	09/01/91	
SOP for Data Reduction, Mgt, and Handling - CLP	RPS00200.CT	05/05/92	
SOP for Sample Tracking	QAS00201.CT	01/13/92	09/16/93
SOP for Data validation/Self Inspection - CLP	QAS00100.CT	05/06/92	
SOP for Data Validation/Self Inspection - OLM02.1	QAS00600.CT	01/17/94	Archived
SOP for Data Validation	QAS00700.CT	dft	

EXTRACTIONS

Standard Operating Procedure	Code	Date Generated	Date last Revised
SOP for CLP Aqueous BNA Preparation	SPS00303.CT	08/20/91	Archived
SOP for CLP Aqueous Pesticide/PCB Preparation	SPS00403.CT	08/19/91	Archived
SOP for CLP Soil BNA Preparation	SPS00102.CT	08/23/91	Archived
SOP for CLP Soil Pesticide/PCB Preparation	SPS00202.CT	08/26/91	Archived
SOP for CLP Extractions Standard Prep	SPS00702.CT	05/07/92	Archived
SOP for CLP BNA extract Screening	SPS00803.CT	05/12/92	Archived
SOP for CLP GPC BNA Extracts	SPS00502.CT	08/29/91	Archived
SOP for CLP GPC Pesticide/PCB Extracts	SPS00602.CT	04/02/92	04/22/93
SOP for Cleaning Glassware	SPS00901.CT	05/13/92	
SOP for Hydrocarbon Sample Prep	SPS01000.CT	dft	
SOP for Preparation of Chlorinated Herbicides (W) – 8151A	SPS02803.CT	10/07/98	10/14/99
SOP for Aqueous BNA Methods 3510/3520	SPS01304.CT	09/10/93	03/12/99
SOP for Aqueous Pest/PCB Methods 3510C/3520C	SPS01204.CT	09/15/93	02/15/00
SOP for Soil BNA Method 3550	SPS01403.CT	12/10/93	03/12/99
SOP for Soil Pest/PCB Method 3550	SPS01604.CT	01/21/94	02/15/00
SOP for Aqueous OP Pesticides Methods 3510/3520	SPS01702.CT	06/15/94	03/01/99
SOP for SW846 GPC of BNA extracts	SPS01801.CT	12/17/94	07/03/96
SOP for GPC of Pesticide/PCB extracts method 3640	SPS01900.CT	03/04/94	
SOP for Soil OP Pesticides Method 3550	SPS02702.CT	03/07/94	03/01/00
SOP for Waste dilution - BNA	SPS03003.CT	03/08/94	03/12/99
SOP for Waste dilution - Pesticides/PCB (3580)	SPS03102.CT	03/04/94	02/16/00
SOP for Pesticide/PCB extraction method 608	SPS03204.CT	08/24/94	02/14/00
SOPs for extractions CLP OLM02.1	SPS02000.CT-SPS02600.CT	dft	Archived
SOP for Extraction Standard Prep	SPS01500.CT	dft	

EXTRACTIONS - cont.

Standard Operating Procedure	Code	Date Generated	Date last Revised
SOP for Prep Soil/Sediment samples for CLP P/P OLM03.1	SPS03300.CT	11/11/94	
SOP for GPC of Pesticide extracts OLM03.1	SPS03400.CT	11/11/94	
SOP for Prep Soil/Sed samples for CLP BNA's OLM03.1	SPS03500.CT	11/11/94	
SOP for GPC of Semivolatile extracts OLM03.1	SPS03600.CT	11/11/94	
SOP for Prep of Aqueous samples for CLP BNA's OLM03.1	SPS03700.CT	11/11/94	
SOP for Prep of Aqueous samples for CLP P/P OLM03.1	SPS03800.CT	11/11/94	
SOP for CLP Extraction Standard Prep	SPS03901.CT	11/29/94	06/18/97
SOP for Alumina Column C/U Method 3611A	SPS02901.CT	03/23/95	07/26/96
SOP for Prep Aqueous SV OLC10/92	SPS04000.CT	Dft	
SOP for Prep of Semivolatiles in Tissue samples	SPS04200.CT	10/21/95	
SOP for Prep of Pesticides/PCBs in Tissue samples	SPS04304.CT	10/21/95	03/13/00
SOP for Prep of Chlorinated Herbicides -Method 8151 (S)	SPS04403.CT	10/07/98	02/16/00
SOP for Prep of PUF Samples for Pesticides/PCB T04	SPS04501.CT	07/15/96	03/10/00
SOP for Prep of PUF Samples for Semi-volatiles T013	SPS04600.CT	07/15/96	
Sop for Prep of SV Method 625 (Water)	SPS04700.CT	4/23/96	
SOP for Prep of Wipe Samples Pesticides/PCBs	SPS04800.CT	03/09/00	
SOP for Florisil Cartridge clean-up P/P extracts	SPS04902.CT	11/8/96	03/10/00
SOP for Prep of Low Level PCBs - Method 608	SPS05001.CT	03/19/97	03/13/00
SOP for Prep of Low level PCBs - 3510A	SPS05100.CT	11/29/97	7/?/97
SOP for Prep of Aqueous samples for DRO analysis - 8015B	SPS05303.CT	06/02/98	03/09/00
SOP for Prep of Solid samples for DRO analysis - 8015B	SPS05202.CT	03/16/98	03/09/00
SOP for Solid samples for GC parameters - Soxhlet Method 3540C	SPS05502.CT	9/08/98	10/14/99
SOP for Solid samples for BNAs-Soxhlet Method 3540C	SPS05400.CT	DFT	
SOP for Prep of Aqueous samples for CLP P/P OLM04.2	SPS05600.CT	01/18/00	
SOP for Prep of Soil/Sediment samples for CLP P/P OLM04.2	SPS05700.CT	01/17/00	
SOP for GPC CLP P/P Extracts OLM04.2	SPS05800.CT	01/17/00	

EXTRACTIONS - cont.

Standard Operating Procedure	Code	Date Generated	Date last Revised
SOP for Standards Prep for CLP P/P OLM04.2	SPS05900.CT	01/19/00	
SOP for Prep of Aqueous samples for CLP BNA's OLM04.2	SPS06000.CT	01/19/00	
SOP for Prep of Solid samples for CLP BNA's OLM04.2	SPS06100.CT	01/13/00	
SOP for GPC of Semivolatile extracts OLM04.2	SPS06200.CT	01/14/00	
SOP for Standards Prep for CLP BNA OLM04.2	SPS06300.CT	01/18/00	
SOP for Standards Prep for CLP Pest/PCB OLM03.2	SPS06400.CT		

GC/MS

Standard Operating Procedures	Code	Date Generated	Date last Revised
SOP for CLP Volatiles (GC/MS)	MSS00601.CT	09/04/91	Archived
SOP for Semi-volatile CLP OLM01.8	MSS01001.CT	09/10/91	Archived
SOP for Volatile Std Prep CLP	MSS00100.CT	05/05/92	04/30/93
SOP for Semi-volatile Std Prep CLP	MSS00200.CT	05/05/92	04/30/93
SOP for Cleaning AS vials	MSS01200.CT	02/15/93	
SOP for Analysis of BNA Method 8270A	MSS00700.CT	05/23/94	Archived
SOP for Analysis of Volatiles Method 8240A	MSS00400.CT	04/30/93	Archived
SOP for Volatile Standard Prep	MSV:120588:1	12/05/88	Archived
SOP for BNA standard Prep	MSSV:112686:2	11/26/86	
SOP for GC/MS Semi-volatiles CLP OLM02.1	MSS00800.CT	01/14/94	Archived
SOP for GC/MS Volatiles CLP OLM02.1	MSS00900.CT	01/14/94	Archived
SOP for Volatile Std Prep CLP OLM02.1	MSS01300.CT	01/14/94	Archived
SOP for Semi-volatile Std Prep CLP OLM02.1	MSS01400.CT	01/14/94	Archived
SOP for GC/MS Volatiles in Air	MSS00300.CT	dft	
SOP for GC/MS Volatile in Air - Summa Canister	MSS01100.CT	dft	Archived
SOP for GC/MS Volatile 524.2 Rev. 3	MSS01500.CT	dft	
SOP for GC/MS Semivolatiles OLM03.2	MSS01601.CT	11/12/94	06/27/97
SOP for GC/MS Semivolatile Standard Prep OLM03.1	MSS01700.CT	11/12/94	
SOP for GC/MS Volatiles OLM03.2	MSS01801.CT	11/12/94	06/27/97
SOP for GC/MS Volatile Standard Prep OLM03.1	MSS01900.CT	11/12/94	
SOP for GC/MS Analysis Method 625	MSS02002.CT	07/13/94	09/04/96
SOP for GC/MS Analysis Method 624	MSS02102.CT	02/27/95	02/15/00
SOP for GC/MS Semivolatile OLC10/92	MSS02200.CT	Dft	
SOP for GC/MS Semivolatile Method T013	MSS02300.CT	09/27/96	
SOP for GC/MS Volatiles Method 8260A	MSS02500.CT	DFT	Archived
SOP for GC/MS Semivolatiles Method 8270B	MSS02401.CT	10/2/96	09/08/97
SOP for GC/MS SemiVolatiles - M&E Region I DAS	MSS02600.CT	01/14/98	

GC/MS (cont.)

Standard Operating Procedure	Code	Date Generated	Date last Revised
SOP for GC/MS Semivolatile analysis - Method 8270C	MSS02703.CT	01/06/98	10/10/99
SOP for GC/MS Volatile analysis - Method 8260B	MSS02803.CT	01/21/98	10/27/99
SOP for GC/MS Volatiles – OLC02.1	MSS02900.CT	DFT	
SOP for GC/MS VOA OLM04.2	MSS0300.CT	10/01/99	
SOP for GC/MS Semi-volatiles OLM04.2	MSS03100.CT	01/13/00	
SOP for GC/MS Semi-volatile screening OLM04.2	MSS03200.CT	01/18/00	
SOP for GC/MS Volatile Standards Prep OLM04.2	MSS03300.CT	01/27/00	

GAS CHROMATOGRAPHY

Standard Operating Procedures	Code	Date Generated	Date last Revised
SOP for GC CLP OLM01.8	GCS00201.CT	09/11/91	Archive
SOP for Standard Prep CLP- Pesticides	GCS00101.CT	05/05/92	04/30/93
SOP for Sulfur Removal	GCS00300.CT	04/30/93	
SOP for Pest/PCB Method 8080A	GCS00601.CT	02/15/94	09/04/96
SOP for Analysis of OP Pesticides Method 8141A	GCS00502.CT	02/28/94	03/01/00
SOP for HP3350A LAS System	GCS00400.CT	06/08/93	Archive
SOP for Misc. Volatiles Method 8015 (DAI)	GCS00701.CT	02/14/94	03/01/00
SOP for Herbicide analysis Method 8150	GCS00800.CT	02/14/94	
SOP for Analysis of Hydrocarbon Fingerprinting	GCS01300.CT	08/02/94	
SOP for GC/ECD Pesticides/PCB CLP OLM02.1	GCS00900.CT	01/14/94	Archived
SOP for Pesticide/PCB Standard Prep OLM02.1	GCS01000.CT	01/14/94	Archived
SOP for Pesticides/PCB Method 608	GCS01102.CT	02/15/94	02/14/00
SOP for Sulfur Removal - CLP OLM01.8	GCS01200.CT	06/10/94	Archived
SOP for GC/ECD Pesticides/PCB analysis OLM03.2	GCS01501.CT	11/11/94	06/25/97
SOP for Pesticide/PCB Standard Prep OLM03.1	GCS01600.CT	11/11/94	
SOP for Low Level Pesticide/PCB analysis - 8080	GCS01400.CT	11/29/94	Archived
SOP for Pesticide/PCB analysis - Method 8081	GCS01700.CT	12/28/95	
SOP for Diesil Range Organics - Method 8015B	GCS01802.CT	02/07/96	03/10/00
SOP for Gasoline Range Organics - Method 8015B	GCS01900.CT	02/07/96	
SOP for Pesticide/PCB analysis - Method T04	GCS02001.CT	07/15/97	03/09/00
SOP for Water soluble Organics - DAI/NPD	GCS02101.CT	08/14/97	09/04/98
SOP for Analysis of Pesticides - Method 8081A	GCS02203.CT	01/26/98	02/15/00
SOP for Analysis of PCBs - Method 8082	GCS02303.CT	01/26/98	02/15/00
SOP for Analysis of Herbicides - Method 8151A	GCS02400.CT	07/02/98	
SOP for GC/ECD Pesticides/PCB CLP OLM04.2	GCS02500.CT	01/18/00	
SOP for Pesticide/PCB Standard Prep OLM04.2	GCS02600.CT	01/19/00	
SOP for CT ETPH - DRO	GCS02700.CT	DFT	

METALS

Standard Operating Procedures	Code	Date Generated	Date last Revised
SOP for SW846 Method 3005A	MES00801.CT	04/21/93	02/01/99
SOP for SW846 Method 3010A	MES00901.CT	04/21/93	02/01/99
SOP for SW846 Method 3020A	MES00701.CT	04/21/93	10/30/95
SOP for SW846 Method 3050B	MES01002.CT	04/21/93	02/01/99
SOP for CLP SOW Digestion (S)	MES01100.CT	04/21/93	Archived
SOP for CLP SOW Digestion (W)	MES01200.CT	04/21/93	Archived
SOP for Method 200.7 with TJA 61 Operation	MES00600.CT	04/16/93	
SOP for GFAAS 200 series methods	MES00501.CT	04/16/93	09/13/94
SOP for Tracking Metals and Cyanide Samples	IN:050189:1	05/01/89	
SOP for Standards Preparations	AS:092988:1	09/29/88	
SOP for Determination of Mercury in Water ILM03.0	MES01300.CT	06/10/94	Archived
SOP for Determination of Mercury in Soils ILM03.0	MES01400.CT	06/10/94	Archived
SOP for Determination of Mercury in Water - 7470A	MES01501.CT	09/12/94	04/09/96
SOP for Determination of Mercury in Soils - 7471A	MES01602.CT	09/12/94	05/14/99
SOP for Method 6010A with TJA 61	MES00400.CT	09/12/94	
SOP for GFAAS SW846 series methods	MES00300.CT	09/12/94	
SOP for Microwave Digestion Method 3015 (W)	MES01700.CT	04/20/95	Archived
SOP for Microwave Digestion Method 3051 (S)	MES01800.CT	04/20/95	Archived
SOP for Digestion of AS/SE (GFAA)	MES01901.CT	10/02/95	02/05/99
SOP for Method 6010A - TJA61 Trace ICP	MES02000.CT	01/25/95	
SOP for Microwave Digestion ILM03.0	MES02100.CT	04/20/95	Archived

METALS (cont.)

Standard Operating Procedure	Code	Date Generated	Date last Revised
SOP for Metals Digestion ILM04.1 (Water)	MES02201.CT	07/31/96	02/12/00
SOP for Metals Digestion ILM04.1 (Soil)	MES02301.CT	07/31/96	02/12/00
SOP for Determination of Mercury in Water ILM04.1	MES02401.CT	07/31/96	02/12/00
SOP for Determination of Mercury in Soil ILM04.1	MES02501.CT	07/31/96	02/12/00
SOP for Determination of Metals - ILM04.1 TJA-61E Trace	MES02601.CT	08/1/96	03/22/00
SOP for Determination of Metals - 200.7 TJA 61E Trace	MES02700.CT	08/1/96	
SOP for Determination of Mercury in Water Method 245.1	MES02800.CT	08/1/96	
SOP for Metals Digestion of Wipe Samples	MES02900.CT	Dft	
SOP for Water prep for GFAA	MES03000.CT	DFT	
SOP for Mercury 7470A (Hot Block)	MES03100.CT	09/30/99	
SOP for Mercury 7471A (Hot Block)	MES03200.CT	09/30/99	

COMPUTER SYSTEMS

Standard Operating Procedures	Code	Date Generated	Date last Revised
SOP for PCB EPA CLP Forms and Disk File	SYS00100.CT	05/25/89	Archived
SOP for LIMS Data Entry	SYS00201.CT	02/23/89	
SOP for LIMS Data Entry Errors	SYS00301.CT	05/12/92	
SOP for LIMS Data Base Security and Backup	SYS00400.CT	08/24/91	
SOP for Testing, Modifying and Implementing Changes to Existing Computer Systems	SYS00502.CT	08/25/91	
SOP for System Maintenance Operations and Response Time	SYS00600.CT	08/26/91	
SOP for Lotus Diskette Deliverable	SYS00700.CT	02/25/92	Archived
SOP for Volatile Data Filter Program	SSY00800.CT	03/25/92	Archived
SOP for Metals Data Filter Program	SYS00900.CT	03/26/92	Archived
SOP for Classical Chemistry Results Program	SYS01000.CT	03/24/92	
SOP for LIMS to PC File Transfer	SYS01100.CT	03/27/92	
SOP for Classical Chemistry Completion Date Entry Program	SYS01200.CT	03/31/92	Archived
SOP for Hamilton Standard Diskette Deliverable	SYS01300.CT	04/01/92	Archived
SOP for Envision Software - Organic Deliverables	SYS01400.CT	03/27/92	Archived
SOP for Acres Diskette Deliverable	SYS01501.CT	12/01/92	Archived
SOP for Control Charts	SYS01600.CT	dft	Archived
SOP for CH2MHILL Diskette Deliverable	SYS01701.CT	02/23/93	Archived
SOP for AAS File Filter Program	SYS01800.CT	dft	Archived
SOP for GC/MS Chemserver Archive	SYS01900.CT	04/23/97	
SOP for Generating Standard E-mail Result Files	SYS02000.CT	01/20/98	
SOP for GC Seedpak 1 Tracking	SYS02100.CT	Dft	
SOP for GC Seedpak 2 Deliverables	SYS02200.CT	10/01/98	03/22/99

QUALITY ASSURANCE

Standard Operating Procedures	Code	Date Generated	Date last Revised
SOP for Document Control	QAS00302.CT	05/08/92	07/28/97
SOP for Corrective Action Reports	QAS00503.CT	07/08/91	09/10/98
SOP for Internal Quality Assurance	QAS00400.CT	07/18/92	05/03/93
SOP for Generating SOPs	QAS00802.CT	07/21/97	09/15/99
SOP for Balance Calibraton	QAS00900.CT	07/28/97	
SOP for Document coding, Approval and Revisions	QAS01001.CT	07/28/97	02/23/99
SOP for Thermometer Calibration	QAS01101.CT	07/29/97	02/23/99
SOP for Corrections to Lab Documents	QAS01300.CT	07/28/97	
SOP for Temperature Monitoring of Lab Equipment	QAS01200.CT	07/29/97	
SOP for Solvent Assays	QAS01400.CT	09/18/98	
SOP for Glassware Cleaning	QAS01500.CT	07/11/94	02/04/99
SOP for Employee Training	QAS01600.CT	01/25/99	
SOP for Conducting MDL Studies	QAS01700.CT	02/22/99	
SOP for Reagent Control and Coding	QAS01800.CT	03/01/99	
SOP for Terms and Definitions	QAS01900.CT	09/01/99	
SOP for PT Testing	QAS02000.CT	09/22/99	
SOP for Solvent Approval	QAS02100.CT		

SALES/MARKETING

Standard Operating Procedures	Code	Date Generated	Date last Revised
SOP for Taking Client Orders	MKS00101.CT	02/21/94	03/06/99
SOP for LIMS Log-in	MKS00201.CT	02/21/94	03/06/99
SOP for Preparation for Price Quotations	MKS00300.CT	02/14/94	Archived
SOP for Telephone Logs	MKS00400.CT	06/22/94	

CLASSICAL CHEMISTRY

Standard Operating Procedures	Code	Date Generated	Date last Revised
Analysis of Tannins and Ligins in Environmental Samples	WC:042091:0	04/20/91	
Analysis of Acidity (Method 305.1)	CVS00800.CT	03/24/94	
Bromide (Method 405)	WC040791:0	04/07/91	
Analysis of Hydrocarbons (418.1)	WC:041891:0	04/18/91	Archived
Analysis of Oil & Grease (Gravimetric)- 413.1	CVS01001.CT	03/29/94	09/03/96
Analysis of Salinity in Water	WC:070891:0	07/08/91	
Analysis of Temperature in Water	WC:070591:0	07/05/91	
Analysis of Grain Size	WC:071591:0	07/15/91	
Measurement of Conductivity	CVS04301.CT	08/21/90	02/26/99
Analysis of Dissolved Oxygen in Water	WC:071691:0	07/16/91	
Analysis of Phosphorus in Water	WC:053191:0	05/31/91	Archived 06/25/99
Analysis of Alkalinity in Water - 310.1	CVS00703.CT	02/22/94	10/08/99
Analysis of Ammonia (method 350.2) in Water	CVS02600.CT	07/07/92	10/08/99
Analysis of MBAS in Water	CVS00600.CT	03/31/94	
Measurement of pH	CVS00900.CT	03/31/94	
Analysis of Sulfide	CVS01701.CT	01/08/97	02/04/99
Analysis of Biochemical Oxygen Demand	CVS00503.CT	02/22/94	10/08/99
Analysis of COD (Method 410.4)	CVS01203.CT	08/17/94	10/08/99
Analysis of Hexavalent Chromium in cromite ore samples	WC:911205:0	12/05/91	
Analysis of Samples for Total Cyanide CLP Protocol	CVS01101.CT	07/01/87	02/04/00
Analysis of Flouride in Water (Method 340.2)	CVS04402.CT	05/15/90	10/16/99
Total Organic Halides Analysis in Water Samples	CVS03801.CT	05/14/90	Archived
Analysis of Total Organic Carbon in Water (DC 80)	CVS02200.CT	01/08/97	Archived

CLASSICAL CHEMISTRY (cont.)

Standard Operating Procedures	Code	Date Generated	Date last Revised
Analysis of Hexavalent Chromium Colorimetric	WC:090192:0	09/01/92	Archived
Analysis of Hexavalent Chromium Alkaline digestion of Soil Samples	WC:083192:0	08/31/92	
Analysis of TOC Soil Samples	CVS03400.CT	07/15/96	
Analysis of Hardness in Water	CVS03100.CT	Dft	
Analysis of Chloride (325.2) in Water	CVS03902.CT	08/11/90	10/08/99
Standard Operating Procedure for Reactivity	CVS01901.CT	09/29/94	10/09/99
Standard Operating Procedure for Corrosivity	CVS04601.CT	03/17/97	10/02/99
Standard Operating Procedure for Ignitability (1030)	CVS02301.CT	08/01/96	06/16/99
Manual Spectrophotometric Method for Hexavalent Chromium	WC:110889:4	11/08/89	
Analysis of Total Suspended Solids in Water	CVS00203.CT	08/21/93	10/16/99
Analysis of Sulfate in Water (Method 375.3)	CVS01300.CT	03/04/89	08/30/94
EPTOX Leachate Procedure in Environmental Samples	WC:081090:0	08/10/90	
Analysis of Total Dissolved Solids in Water	CVS00103.CT	08/16/93	10/26/99
Analysis of Nitrate and Nitrite for Water Samples (Method 353.2)	CVS02502.CT	05/03/90	10/08/99
Gravimetric Determination of Lube Oils in Solids	WC:062889:0	06/28/89	
SOP for the Analysis of Total Recoverable Phenols	CVS03600.CT	10/09/96	
Analysis of Environmental Samples for Formaldehyde	WC:072489:0	07/24/89	
SOP for Total Cyanide - Method 335.4	CVS02000.CT	10/04/94	
SOP for Amenable Cyanide - Method 335.1	CVS02100.CT	10/04/94	
SOP for Toxicity Characteristic Leaching Procedure - 1311	CVS01502.CT	09/28/94	10/08/99

CLASSICAL CHEMISTRY (cont.)

Standard Operating Procedures	Code	Date Generated	Date last Revised
Measurement of Turbidity in Water Samples	CVS04002.CT	08/21/90	03/02/99
Shake Extraction of Solids for Wet Chemistry Analysis	WC:041391:0	04/13/91	
SOP for WC Data Reporting/Validation	CVS00400.CT	08/29/93	
SOP for Total Solids	CVS00300.CT	08/21/93	
SOP for Flashpoint - Method 1010	CVS01600.CT	09/28/94	
SOP for Waste Extraction Test (WET) Procedure	CVS01800.CT	09/28/94	
SOP for Cation/Anion Balance	CVS02800.CT	3/20/95	
SOP for CEC Method 9081	CVS02900.CT	3/20/95	
SOP for Soil Homogenization	CVS03000.CT	3/20/95	
SOP for AVS/SEM	CVS03500.CT	07/09/96	
SOP for Oxidation -Reduction Potential	CVS03301.CT	04/29/96	10/15/96
SOP for The Determination of Hydrazine	CVS03200.CT	04/26/96	
SOP for The Determination of Ferrous Iron	CVS03700.CT	10/10/96	
SOP for Phenols Distillation	CVS02400.CT	09/27/96	
SOP for Determination of Percent Solids	CVS04100.CT	01/06/97	
SOP for TOC (W) DC190	CVS04202.CT	01/07/97	10/26/99
SOP for Oil and Grease - Method 1664	CVS04500.CT	01/15/97	
SOP for Total Petroleum Hydrocarbons - Method 418.1	CVS04701.CT	01/21/97	02/04/99
SOP for Analysis of Total Phosphorus	CVS04802.CT		10/26/99
SOP for Sample Screening for Chorine Residual	CVS04901.CT	01/12/98	02/18/99
SOP for Chlorine Residual	CVS05200.CT	02/17/99	
SOP for Reagent Water Monitoring	CVS05100.CT	02/22/99	
SOP for Ferrous Iron (SM4500)	CVS05300.CT	03/17/99	
SOP for Hexavalent Chromium – 7196A	CVS05002.CT		02/25/99
SOP for Total Cyanide – 9012A	CVS05400.CT	10/01/99	
SOP for CC Labeling /Coding of Standards	CVS05500.CT	09/10/99	

CLASSICAL CHEMISTRY (cont.)

Standard Operating Procedures	Code	Date Generated	Date last Revised
SOP for Total Sulfide (W/S) 9030B	CVS5600.CT	10/01/99	
SOP for Paint Filter	CVS5700.CT	10/04/99	
SOP for pH of Soil	CVS5800.CT	10/01/99	
SOP for Sulfate (375.2)	CVS5900.CT	10/26/99	
SOP for TKN	CVS6000.CT	DFT	
SOPfor Ion Chromatography –9065/300	CVS06100.CT	DFT	

APPENDIX, Section 9

LISTING OF ANALYTICAL CAPABLITIES
&
GENERAL QC REQUIREMENTS

STL-Connecticut ANALYTICAL CAPABILITIES

I. ORGANICS-GC/MS

Volatile Organics-524.2
Volatile Organics-CLP
Volatile Organics-624
Volatile Organics-8260
Volatile Organics-T01/T02
Volatile Organics-Appendix IX
Acid & Base/Neutrals-8270
Acid & Base/Neutrals-CLP
Acid & Base/Neutrals-Appendix IX
Acid & Base/Neutrals-625

II. ORGANICS-GC

Misc. DAI - 8015
Organohalide Pesticides & PCBs-608
Organohalide Pesticides & PCBs-8081/8082
Organohalide Pesticides & PCBs-CLP
Organophosphate Pesticides-8141
Organohalide Pesticides & PCBs-ApIX
Chlorinated Herbicides-8151
Chlorinated Herbicides-Appendix IX
Petroleum Hydrocarbons - GRO/DRO

III. INORGANIC METALS

ICP Metals
Furnace Metals
Drinking Water Metals

Appendix IX Metals
TCLP Metals CLP Metals

V. INORGANIC WET CHEMISTRY*

Acidity
Alkalinity
Ammonia
Bicarbonate
Biochemical Oxygen Demand (BOD)
Bromide
Chloride
Chlorine Demand
Chlorine Residual
Chemical Oxygen Demand
Color
Conductivity
Chromium (VI)
Cyanide - Amenable
Cyanide - Total
Cyanide (CLP)
Dissolved Oxygen
Flashpoint
Fluoride

Hydrocarbon analysis
MBAS
Nitrate
Nitrite
Odor
Oil and Grease
Paint Filter Test
pH
Phenols

Phosphate
Phosphorus
Settleable Solids
Silica
Specific Gravity
Sulfate
Sulfide
Sulfite
Sludge Volume Index
Tannins and Lignins
Total Dissolved Solids
Total Kjeldahl Nitrogen
Total Organic Carbon
Total Solids
Total Suspended Solids
Turbidity
Volatile Solids
EPTOX
Corrosivity Characteristics
Ignitability Characteristics
SPLP
TCLP

Date: 04/03/00

Metals

COMPONENT	SAMPLE MATRIX	ANALYTICAL METHOD	PRECISION %RSD	ACCURACY % RECOVERY	UNITS	PQL
Aluminum	Water	200.7	0-20	90-110	ug/l	200
	Water	6010	0-20	90-110	ug/L	200
	Soil	6010	0-20	90-110	mg/Kg	40
Antimony	Water	200.7	0-20	90-110	ug/L	60
	Water	6010	0-20	90-110	ug/L	60
	Soil	6010	0-20	90-110	mg/Kg	12
	Water	204.2	0-20	80-120	ug/L	1.0
	Soil	7412	0-20	80-120	mg/Kg	1.0
Arsenic	Water	200.7	0-20	90-110	ug/L	10
	Water	6010	0-20	90-110	ug/L	10
	Water	206.2	0-20	80-120	ug/L	10
	Water	7060	0-20	80-120	ug/L	10
	Soil	7060	0-20	80-120	mg/Kg	2.0
	Soil	6010	0-20	90-110	mg/Kg	2.0
Barium	Water	200.7	0-20	90-110	ug/l	200
	Water	6010	0-20	90-110	ug/L	200
	Soil	6010	0-20	90-110	mg/Kg	40
Beryllium	Water	200.7	0-20	90-110	ug/l	5.0
	Water	6010	0-20	90-110	ug/L	5.0
	Soil	6010	0-20	90-110	mg/Kg	1.0
Cadmium	Water	200.7	0-20	90-110	ug/l	5.0
	Water	6010	0-20	90-110	ug/L	5.0
	Soil	6010	0-20	90-110	mg/Kg	1.0
Calcium	Water	200.7	0-20	90-110	ug/l	5000
	Water	6010	0-20	90-110	ug/L	5000
	Soil	6010	0-20	90-110	mg/Kg	1000
Cobalt	Water	200.7	0-20	90-110	ug/l	50
	Water	6010	0-20	90-110	ug/L	50
	Soil	6010	0-20	90-110	mg/Kg	10
Chromium	Water	200.7	0-20	90-110	ug/l	10
	Water	6010	0-20	90-110	ug/L	10
	Soil	6010	0-20	90-110	mg/Kg	2.0
Copper	Water	200.7	0-20	90-110	ug/l	25
	Water	6010	0-20	90-110	ug/L	25

Date: 04/03/00

Metals

COMPONENT	SAMPLE MATRIX	ANALYTICAL METHOD	PRECISION %RSD	ACCURACY % RECOVERY	UNITS	PQL
	Soil	6010	0-20	90-110	mg/Kg	5.0
Iron	Water	200.7	0-20	90-110	ug/l	100
	Water	6010	0-20	90-110	ug/L	100
	Soil	6010	0-20	90-110	mg/Kg	20
Lead	Water	200.7	0-20	90-110	ug/L	3.0
	Water	239.2	0-20	80-120	ug/L	3.0
	Water	7421	0-20	80-120	ug/l	3.0
	Water	6010	0-20	90-110	ug/L	3.0
	Soil	6010	0-20	90-110	mg/Kg	0.6
	Soil	7421	0-20	90-110	mg/Kg	0.6
Magnesium	Water	200.7	0-20	90-110	ug/l	5000
	Water	6010	0-20	90-110	ug/L	5000
	Soil	6010	0-20	90-110	mg/Kg	1000
Manganese	Water	200.7	0-20	90-110	ug/L	15
	Water	6010	0-20	90-110	ug/L	15
	Soil	6010	0-20	90-110	mg/Kg	3.0
Molybdenum	Water	200.7	0-20	90-110	ug/l	20
	Water	6010	0-20	90-110	ug/L	20
	Soil	6010	0-20	90-110	mg/Kg	4.0
Mercury	Water	245.1	0-20	80-120	ug/L	0.2
	Water	7470	0-20	80-120	ug/L	0.2
	Soil	7471	0-20	80-102	mg/Kg	0.1
Nickel	Water	200.7	0-20	90-110	ug/L	40
	Water	6010	0-20	90-110	ug/L	40
	Soil	6010	0-20	90-110	mg/Kg	8.0
Potassium	Water	200.7	0-20	90-110	ug/L	5000
	Water	6010	0-20	90-110	ug/L	5000
	Soil	6010	0-20	90-110	mg/Kg	1000
Selenium	Water	200.7	0-20	90-110	ug/L	5.0
	Water	270.2	0-20	80-120	ug/L	5.0
	Water	6010	0-20	90-110	ug/L	5.0
	Water	7740	0-20	80-120	ug/L	5.0
	Soil	7740	0-20	80-120	mg/Kg	1.0

Date: 04/03/00

Metals

COMPONENT	SAMPLE MATRIX	ANALYTICAL METHOD	PRECISION %RSD	ACCURACY % RECOVERY	UNITS	PQL
	Soil	6010	0-20	90-110	mg/Kg	1.0
Silver	Water	200.7	0-20	90-110	ug/L	10
	Water	6010	0-20	90-110	ug/L	10
	Soil	6010	0-20	90-110	mg/Kg	2.0
Sodium	Water	200.7	0-20	90-110	ug/L	5000
	Water	6010	0-20	90-110	ug/L	5000
	Soil	6010	0-20	90-110	mg/Kg	1000
Thallium	Water	200.7	0-20	90-110	ug/L	10
	Water	6010	0-20	90-110	ug/L	10
	Water	279.2	0-20	80-120	ug/L	10
	Water	7841	0-20	80-120	ug/L	10
	Soil	7841	0-20	80-120	mg/Kg	2.0
	Soil	6010	0-20	90-110	mg/Kg	2.0
Tin	Water	200.7	0-20	90-110	ug/L	50
	Water	6010	0-20	90-110	ug/L	50
	Soil	6010	0-20	90-110	mg/Kg	10
Titanium	Water	200.7	0-20	90-110	ug/L	20
	Water	6010	0-20	90-110	ug/L	20
	Soil	6010	0-20	90-110	mg/Kg	4.0
Zinc	Water	200.7	0-20	90-110	ug/L	20
	Water	6010	0-20	90-110	ug/L	20
	Soil	6010	0-20	90-110	mg/Kg	4.0
Vanadium	Water	200.7	0-20	90-110	ug/L	50
	Water	6010	0-20	90-110	ug/L	50
	Soil	6010	0-20	90-110	mg/Kg	10

(1) Acceptance limits are those indicated in the published method data.

Date: 04/03/00

Wet Chemistry

COMPONENT	SAMPLE MATRIX	ANALYTICAL METHOD	PRECISION %RSD	ACCURACY % RECOVERY	UNITS	PQL
Acidity	Water	305.1	0-20	NA	mg/L	1.0
Alkalinity	Water	310.1	0-20	NA	mg/L	2.0
Ammonia-N	Water	350.1	0-20	75-125	mg/L	0.04
Bicarbonate	Water	310.1	0-20	NA	mg/L	2.0
Biochemical Oxygen Demand (BOD)	Water	405.1	0-20	75-125	mg/L	2.0
Bromide	Water	320.1	0-20	75-125	mg/L	2.0
Bromide	Water	9056/300	0-20	75-125	mg/L	0.10
Chloride	Water	325.2	0-20	75-125	mg/L	3.0
Chloride	Water	9056/300	0-20	NA	mg/L	0.5
Chlorine Residual	Water	330.5	0-20	NA	mg/L	0.05
Chemical Oxygen Demand (COD)	Water	410.4	0-20	75-125		10.0
Color	Water	110.2	0-20	NA	Pt-Co	5.0
Conducitivity	Water	120.1	0-20	NA	umho/cm	NA
Chromium (VI)	Water	7196	0-20	75-125	mg/L	0.01
Cyanide-Total	Water	335.4	0-20	75-125	ug/L	10.0
Cyanide-Total	Water	9012	0-20	75-125	ug/L	10.0
Cyanide-Amenable	Water	335.1	0-20	75-125	ug/L	10.0
Cyanide-CLP	Water	ILM04	0-20	75-125	ug/L	10.0
Dissolved Oxygen	Water	4500	0-20	NA	mg/L	1.0
Flashpoint	Water	1010	0-20	75-125		
Fluoride	Water	340.2	0-20	75-125	mg/L	0.10
Fluoride	Water	9056	0-20	75-125	Mg/L	0.05
Hardness	Water	SM2340B	0-20	75-125	mg/L	1.0
Hrdrocarbons (IR)	Water	418.1	0-20	75-125	mg/L	1.0
MBAS	Water	425.1	0-20	75-125	mg/L	0.04
Nitrate-Nitrite-N	Water	353.2	0-20	75-125	mg/L	0.10
Nitrate-N	Water	353.2	0-20	75-125	mg/L	0.10
Odor	Water	140.1	0-20	NA	NA	
Oil & Grease (Grav.)	Water	1664	0-20	80-120	mg/L	5.0
Paint Filter Test	Water	9095	0-20	75-125	NA	
pH	Water	150.1	0-20	NA	NA	

Date: 04/03/00

Wet Chemistry

COMPONENT	SAMPLE MATRIX	ANALYTICAL METHOD	PRECISION %RSD	ACCURACY % RECOVERY	UNITS	PQL
pH	Water	9040	0-20	NA	NA	
Phenols	Water	420.2	0-20	75-125	mg/L	0.01
Phenols	Water	9066	0-20	75-125	mg/L	0.01
Phosphorus	Water	365.2	0-20	75-125	mg/L	0.10
Phosphate (Ortho)	Water	365.2	0-20	75-125	mg/L	0.10
Settable solids	Water	160.5	0-20	NA	mL/L	1.0
Silica	Water	370.1	0-20	75-125	mg/L	1.0
Specific Gravity	Water	3-61	0-20	75-125	NA	
Sulfate	Water	375.3	0-20	75-125	mg/L	10.0
Sulfate	Water	375.2	0-20	75-125	mg/L	10.0
Sulfate	Water	9056/300	0-20	75-125	Mg/L	1.0
Sulfide	Water	376.1	0-20	75-125	mg/L	1.0
Sludge Volume Index	Water	213C	0-20		ml/mg	1.0
Total Kjeldahl Nirogen	Water	351.2	0-20	75-125	mg/L	0.1
Total Soilds	Water	160.3	0-20	N/A	mg/L	1.0
Total Dissolved Solids	Water	160.1	0-20	N/A	mg/L	10.0
Total Suspended Solids	Water	160.2	0-20	N/A	mg/L	10.0
Total Volatile Solids	Water	160.4	0-20	N/A	mg/L	10.0
Total Organic Carbon	Water	415.2	0-20	75-125	mg/L	1.0
Turbidity	Water	180.1	0-20		NTU	1.0
Cyanide	Soil	ILM04	0-20	75-125	mg/Kg	0.5
Total Organic Carbon	Soil	9060	0-20	75-125	mg/Kg	100
Corrosivity Char.	Soil	9045				
Ignitability Char.	Soil	BRT				
TCLP	W/S	1311				
SPLP	W/S	1312				

* Acceptance limits are those indicated in the published method data.

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COMPONENT	ACCURACY % RECOVERY	MATRIX SPIKE % RECOVERY	PQL* Ug/L
Method 608 Organochlorine Pesticides in Water			
alpha-BHC	37-134	26-126	.001
beta-BHC	17-147	54-140	.001
delta-BHC	19-140	3-113	.001
gamma-BHC (Lindane)	32-127	47-123	.001
Heptachlor	34-111	26-119	.001
Aldrin	42-122	53-104	.001
Heptachlor epoxide	37-142	59-125	.001
Endosulfan I	45-153	69-138	.002
Dieldrin	36-146	50-136	.002
4,4'-DDE	30-145	73-104	.002
Endrin	30-147	52-154	.002
Endosulfan II	D-202	18-124	.015
4,4' DDD	31-141	10-163	.006
Endosulfan sulfate	26-144	59-152	.006
4,4'-DDT	25-160	51-140	.005
Methoxychlor	62-181	62-181	.006
Toxaphene	41-126		2 1
Aroclor 1016	50-114		1 ⁵9
Aroclor 1221	15-178		1 76
Aroclor 1232	10-215		418
Aroclor 1242	39-150		40⁷
Aroclor 1248	38-158		118
Aroclor 1254	29-131		282
Aroclor 1260	8-127		144
Chlordane (technical)	45-119		0.076
Endrin aldehyde	30-164	30-164	.008
Endrin ketone	30-150	30-150	.006

* subject to change when MDLs are updated

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COMPONENT	LCS/QC CHECK % RECOVERY	MATRIX SPIKE % RECOVERY LIMIT	RELATIVE % DIFFERENCE (RPD)	PQL ug/L
Method 8081/8082 Organochlorine Pesticides/PCBs in Water				
alpha-BHC	70-124			0.05
beta-BHC	59-163			0.05
delta-BHC	27-109			0.05
gamma-BHC (Lindane)	73-138	56-123	20	0.05
Heptachlor	67-117	40-131	20	0.05
Aldrin	58-114	40-120	20	0.05
Heptachlor epoxide	76-138			0.05
Endosulfan I	72-142			0.05
Dieldrin	75-141	52-126	20	0.1
4,4'-DDE	59-134			0.1
Endrin	86-137	56-121	20	0.1
Endosulfan II	72-187			0.1
4,4' DDD	45-137			0.1
Endosulfan sulfate	59-137			0.1
4,4'-DDT	58-137	38-127	20	0.1
Methoxychlor	80-178			0.5
Toxaphene				0.5
Aroclor 1016				1.0
Aroclor 1221				2.0
Aroclor 1232				1.0
Aroclor 1242	21-121			1.0
Aroclor 1248				1.0
Aroclor 1254				1.0
Aroclor 1260	32-119	15-175	20	1.0
Chlordane (technical)				0.2
Alpha-chlordane				0.05
Gamma-chlordane				0.05
Endrin aldehyde	61-160			0.1
Endrin ketone				0.1
Method 8151Chlorinated Herbicides in Water				
2,4-D	50-176	10-200	20	0.50
Silvex (2,4,5-TP)	10-134	10-197	20	0.50
2,4,5-T	10-146			0.50

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COMPONENT	LCS/QC CHECK % RECOVERY	MATRIX SPIKE % RECOVERY LIMIT	RELATIVE % DIFFERENCE (RPD)	PQL ug/L
Method 8141A Organophosphorus Pesticides				
2-Picoline	14-87	14-87	15	2.0
O,O,O - Triethylphosphorthioate	39-156	39-156	15	0.8
Thionazin	37-176	37-176	15	0.8
Phorate	43-157	43-157	15	0.8
Sulfotepp	45-159	45-159	15	0.8
Disulfoton	41-159	41-159	15	0.8
Dimethoate	45-158	45-158	15	0.8
Parathion	33-177	33-177	15	0.8
Famphur	32-178	32-178	15	0.8

COMPONENT	LCS/QC CHECK % RECOVERY	MATRIX SPIKE % RECOVERY LIMIT	RELATIVE % DIFFERENCE (RPD)	PQL ug/L
Method 8015B Diesel Range Organics				
#2 Fuel Oil	29 - 146%	60 - 130%	20%	500

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COMPONENT	LCS/QC CHECK % RECOVERY	MATRIX SPIKE % RECOVERY LIMIT	RELATIVE % DIFFERENCE (RPD)	PQL ug/Kg
Method 8081/8082 Organochlorine Pesticides/PCBs in Soil				
alpha-BHC	68-139			1.7
beta-BHC	85-150			1.7
delta-BHC	35-107			1.7
gamma-BHC (Lindane)	77-142	46-127	20	1.7
Heptachlor	68-157	35-130	20	1.7
Aldrin	76-137	40-120	20	1.7
Heptachlor epoxide	81-143			1.7
Endosulfan I	81-152			1.7
Dieldrin	82-152	31-134	20	3.3
4,4'-DDE	67-143			3.3
Endrin	91-155	42-139	20	3.3
Endosulfan II	87-183			3.3
4,4' DDD	40-152			3.3
Endosulfan sulfate	72-151			3.3
4,4'-DDT	73-143	23-134	20	3.3
Methoxychlor	19-271			17
Toxaphene				17
Aroclor 1016				33
Aroclor 1221				67
Aroclor 1232				33
Aroclor 1242	36-134			33
Aroclor 1248				33
Aroclor 1254				33
Aroclor 1260	56-121	36-151	20	33
Chlordane (technical)				6.7
Alpha-chlordane				1.7
Gamma-chlordane				1.7
Endrin aldehyde	55-171			3.3
Endrin ketone				3.3
Method 8151Chlorinated Herbicides in Soil				
2,4-D	50-176	10-200	20	20
Silvex (2,4,5-TP)	10-134	10-197	20	20
2,4,5-T	10-146			5.0

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COMPONENT	LCS/QC CHECK % RECOVERY	MATRIX SPIKE % RECOVERY LIMIT	RELATIVE % DIFFERENCE (RPD)	PQL ug/Kg
Method 8141A Organophosphorus Pesticides				
2-Picoline	60 - 140	60 - 140	15	67
O,O,O - Triethylphosphorthioate	60 – 140	60 – 140	15	30
Thionazin	60 – 140	60 – 140	15	30
Phorate	60 - 140	60 - 140	15	30
Sulfotepp	60 - 140	60 - 140	15	30
Disulfoton	60 – 140	60 – 140	15	30
Dimethoate	60 – 140	60 – 140	15	30
Methylparathion	60 - 140	60 - 140	15	30
Parathion	60 – 140	60 – 140	15	30
Famphur	60 – 140	60 – 140	15	30

COMPONENT	LCS/QC CHECK % RECOVERY	MATRIX SPIKE % RECOVERY LIMIT	RELATIVE % DIFFERENCE (RPD)	PQL ug/Kg
Method 8015B Diesel Range Organics				
#2 Fuel Oil	30 – 162%	60 - 130%	20%	17,000

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GC/MS Volatile Organics

	LFB % RECOVERY LIMIT	LAB MATRIX SPIKE % RECOVERY LIMIT	RELATIVE % DIFFERENCE (RPD) LIMIT	PQL (ug/l)
Method 524.2 Low Level Purgeables in Water				
Benzene	80-120	80-120	13	1.0
Bromobenzene	80-120	80-120	13	1.0
Bromochloromethane	80-120	80-120	13	1.0
Bromodichloromethane	80-120	80-120	13	1.0
Bromoform	80-120	80-120	13	1.0
Bromomethane	80-120	80-120	13	1.0
n-Butylbenzene	80-120	80-120	13	1.0
sec-Butylbenzene	80-120	80-120	13	1.0
tert-Butylbenzene	80-120	80-120	13	1.0
Carbon tetrachloride	80-120	80-120	13	1.0
Chlorobenzene	80-120	80-120	13	1.0
Chloroethane	80-120	80-120	13	1.0
Chloroform	80-120	80-120	13	1.0
Chloromethane	80-120	80-120	13	1.0
2-Chlorotoluene	80-120	80-120	13	1.0
4-Chlorotoluene	80-120	80-120	13	1.0
Dibromochloromethane	80-120	80-120	13	1.0
1,2-Dibromo-3-chloropropane	80-120	80-120	13	1.0
1,2-Dibromoethane	80-120	80-120	13	1.0
Dibromomethane	80-120	80-120	13	1.0
1,2-Dichlorobenzene	80-120	80-120	13	1.0
1,3-Dichlorobenzene	80-120	80-120	13	1.0
1,4-Dichlorobenzene	80-120	80-120	13	1.0
Dichlorodifluoromethane	80-120	80-120	13	1.0
1,1-Dichloroethane	80-120	80-120	13	1.0
1,2-Dichloroethane	80-120	80-120	13	1.0
1,1-Dichloroethene	80-120	80-120	13	1.0
cis-1,2-Dichloroethene	80-120	80-120	13	1.0
trans-1,2-Dichloroethene	80-120	80-120	13	1.0
1,2-Dichloropropane	80-120	80-120	13	1.0
1,3-Dichloropropane	80-120	80-120	13	1.0

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GC/MS Volatile Organics

	LFB % RECOVERY LIMIT	LAB MATRIX SPIKE % RECOVERY LIMIT	RELATIVE % DIFFERENCE (RPD) LIMIT	PQL (ug/l)
2,2-Dichloropropane	80-120	80-120	13	1.0
1,1-Dichloropropene	80-120	80-120	13	1.0
Ethylbenzene	80-120	80-120	13	1.0
Hexachlorobutadiene	80-120	80-120	13	1.0
Isopropylbenzene	80-120	80-120	13	1.0
p-Isopropyltoluene	80-120	80-120	13	1.0
Methylene chloride	80-120	80-120	13	1.0
Naphthalene	80-120	80-120	13	1.0
n-Propylbenzene	80-120	80-120	13	1.0
Styrene	80-120	80-120	13	1.0
1,1,1,2-Tetrachloroethane	80-120	80-120	13	1.0
1,1,2,2-Tetrachloroethane	80-120	80-120	13	1.0
Tetrachloroethene	80-120	80-120	13	1.0
Toluene	80-120	80-120	13	1.0
1,2,3-Trichlorobenzene	80-120	80-120	13	1.0
1,2,4-Trichlorobenzene	80-120	80-120	13	1.0
1,1,1-Trichloroethane	80-120	80-120	13	1.0
1,1,2-Trichloroethane	80-120	80-120	13	1.0
Trichloroethene	80-120	80-120	13	1.0
Trichlorofluoromethane	80-120	80-120	13	1.0
1,2,3-Trichloropropane	80-120	80-120	13	1.0
1,2,4-Trimethylbenzene	80-120	80-120	13	1.0
1,3,5-Trimethylbenzene	80-120	80-120	13	1.0
Vinyl chloride	80-120	80-120	13	1.0
o-Xylene	80-120	80-120	13	1.0
m/p-xylene	80-120	80-120	13	1.0

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GC/MS Volatile Organics

	QC CHECK/LCS % RECOVERY LIMIT	MATRIX SPIKE % RECOVERY LIMIT	PQL* (ug/l)
Method 624 Purgeables in Water			
Benzene	37-151	37-151	0.52
Bromodichloromethane	35-155	35-155	0.47
Bromoform	45-169	45-169	0.81
Bromomethane	d-242	d-242	1.6
Carbon tetrachloride	70-140	70-140	0.66
Chlorobenzene	37-160	37-160	0.41
Chloroethane	14-230	14-230	2.09
2-Chloroethylvinyl ether	D-305	D-305	1.23
Chloroform	51-138	51-138	0.53
Chloromethane	D-273	D-273	1.0
Dibromochloromethane	53-149	53-149	0.69
1,2-Dichlorobenzene	18-190	18-190	0.65
1,3-Dichlorobenzene	59-156	59-156	0.37
1,4-Dichlorobenzene	18-190	18-190	0.43
1,1-Dichloroethane	59-155	59-155	0.82
1,2-Dichloroethane	49-155	49-155	0.41
1,1-Dichloroethene	D-234	D-234	0.82
1,2-Dichloroethene (total)	54-156	54-156	1.0
1,2-Dichloropropane	D-210	D-210	0.52
cis-1,3-Dichloropropene	D-227	D-227	0.54
trans-1,3-Dichloropropene	17-183	17-183	0.53
Ethylbenzene	37-162	37-162	0.54
Methylene chloride	D-221	D-221	1.14
1,1,2,2-Tetrachloroethane	46-157	46-157	1.11
Tetrachloroethene	64-148	64-148	0.48
Toluene	47-150	47-150	0.51
1,1,1-Trichloroethane	52-162	52-162	0.39
1,1,2-Trichloroethane	52-150	52-150	0.81

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GC/MS Volatile Organics			
	QC CHECK/LCS % RECOVERY LIMIT	MATRIX SPIKE % RECOVERY LIMIT	PQL* (ug/l)
Trichloroethene	71-157	71-157	0.27
Trichlorofluoromethane	17-181	17-181	0.72
Vinyl Chloride	D-251	D-251	1.07

* subject to change when MDLs are updated

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GC/MS Volatile Organics

	QC CHECK/LCS % RECOVERY LIMIT	MATRIX SPIKE % RECOVERY LIMIT	RELATIVE % DIFFERENCE (RPD) LIMIT	PQL (ug/l)
Method 8260BPurgeables in Water				
Acetone	0-262			10
Benzene	73-124	76-127	11	5
Bromodichloromethane	71-129			5
Bromoform	53-133			5
Bromomethane	30-135			10
2-Butanone	21-215			10
Carbon disulfide	30-148			5
Carbon tetrachloride	53-132			5
Chlorobenzene	83-121	75-130	13	5
Dibromochloromethane	59-136			5
Chloroethane	28-174			10
2-Chloroethylvinyl ether	Ns			10
Chloroform	73-129			5
Chloromethane	22-140			10
1,1-Dichloroethane	73-130	61-145	14	5
1,2-Dichloroethane	68-133			5
1,1-Dichloroethene	63-134			5
1,2-Dichloroethene (total)	73-127			5
1,2-Dichloropropane	74-137			5
cis-1,3-Dichloropropene	73-119			5
trans-1,3-Dichloropropene	71-117			5
Ethylbenzene	86-121			5
2-Hexanone	17-202			10
Methylene chloride	58-141			5
4-Methyl-2-pentanone	42-163			10
Styrene	77-126			5
1,1,2,2-Tetrachloroethane	64-147			5
Tetrachloroethene	68-124			5
Toluene	72-123	76-125	13	5
1,1,1-Trichloroethane	68-134			5
1,1,2-Trichloroethane	75-131			5

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GC/MS Volatile Organics

	QC CHECK/LCS % RECOVERY LIMIT	MATRIX SPIKE % RECOVERY LIMIT	RELATIVE % DIFFERENCE (RPD) LIMIT	PQL (ug/l)
Trichloroethene	66-121	71-120	14	5
Vinyl acetate	30-148			10
Vinyl chloride	30-148			10
Xylenes (total)	82-122			5

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GC/MS Volatile Organics

	QC CHECK/LCS % RECOVERY LIMIT	MATRIX SPIKE % RECOVERY LIMIT	RELATIVE % DIFFERENCE (RPD) LIMIT	PQL (ug/Kg)
Method 8260B Purgeables in Soil				
Acetone	0-398			10
Benzene	83-130	66-142	21	5
Bromodichloromethane	59-130			5
Bromoform	36-144			5
Bromomethane	34-190			10
2-Butanone	0-393			10
Carbon disulfide	55-133			5
Carbon tetrachloride	34-137			5
Chlorobenzene	82-126	60-133	21	5
Dibromochloromethane	57-129			5
Chloroethane	49-222			10
Chloroform	65-126			5
Chloromethane	32-191			10
1,1-Dichloroethane	79-152	59-172	22	5
1,2-Dichloroethane	50-118			5
1,1-Dichloroethene	83—134			5
1,2-Dichloroethene (total)	82-128			5
1,2-Dichloropropane	84-161	-	-	5
cis-1,3-Dichloropropene	72-116	-	-	5
trans-1,3-Dichloropropene	59-117	-	-	5
Ethylbenzene	79-105	-	-	5
2-Hexanone	83-256	-	-	10
Methylene chloride	64-158			5
4-Methyl-2-pentanone	39-214			10
Styrene	81-121			5
1,1,2,2-Tetrachloroethane	58-167			5
Tetrachloroethene	41-143			5
Toluene	77-126	50-139	21	5
1,1,1-Trichloroethane	44-139			5
1,1,2-Trichloroethane	72-136			5
Trichloroethene	72-129	62-137	24	5

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GC/MS Volatile Organics				
	QC CHECK/LCS % RECOVERY LIMIT	MATRIX SPIKE % RECOVERY LIMIT	RELATIVE % DIFFERENCE (RPD) LIMIT	PQL (ug/Kg)
Vinyl acetate	0-163			10
Vinyl chloride	23-192			10
Xylenes (total)	81-126			5

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GC/MS Volatile Organics

	QC CHECK/LCS % RECOVERY LIMIT	MATRIX SPIKE % RECOVERY LIMIT	RELATIVE % DIFFERENCE (RPD) LIMIT	MDL (ug/l)	PQL (ug/l)
Method 8260B Low Level Purgeables in Water					
Benzene	80-120	80-120	13		1
Bromodichloromethane	80-120	80-120	13		1
Bromoform	80-120	80-120	13		1
Bromomethane	80-120	80-120	13		2
Carbon tetrachloride	80-120	80-120	13		1
Chlorobenzene	80-120	80-120	13		1
Chloroethane	80-120	80-120	13		2
2-Chloroethylvinyl ether	80-120	80-120	13		1
Chloroform	80-120	80-120	13		1
Chloromethane	80-120	80-120	13		2
Dibromochloromethane	80-120	80-120	13		1
1,2-Dichlorobenzene	80-120	80-120	13		1
1,3-Dichlorobenzene	80-120	80-120	13		1
1,4-Dichlorobenzene	80-120	80-120	13		1
1,1-Dichloroethane	80-120	80-120	13		1
1,2-Dichloroethane	80-120	80-120	13		1
1,1-Dichloroethene	80-120	80-120	13		1
1,2-Dichloroethene (total)	36-60	80-120	13		1
1,2-Dichloropropane	80-120	80-120	13		1
cis-1,3-Dichloropropene	80-120	80-120	13		0.5
trans-1,3-Dichloropropene	80-120	80-120	13		0.5
Ethylbenzene	80-120	80-120	13		1
Methylene chloride	80-120	80-120	13		1
1,1,2,2-Tetrachloroethane	80-120	80-120	13		1
Tetrachloroethene	80-120	80-120	13		1
Toluene	80-120	80-120	13		1
1,1,1-Trichloroethane	80-120	80-120	13		1
1,1,2-Trichloroethane	80-120	80-120	13		1

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GC/MS Volatile Organics

	QC CHECK/LCS % RECOVERY LIMIT	MATRIX SPIKE % RECOVERY LIMIT	RELATIVE % DIFFERENCE (RPD) LIMIT	MDL (ug/l)	PQL (ug/l)
Trichloroethene	80-120	80-120	13		1
Trichlorofluoromethane	80-120	80-120	13		1
Vinyl Chloride	80-120	80-120	13		2
Acetone	180-300	80-120	13		20
2-Butanone	180-300	80-120	13		20
n-Butylbenzene	80-120	80-120	13		1
s-Butylbenzene	80-120	80-120	13		1
t-Butylbenzene	80-120	80-120	13		1
Carbon Disulfide	80-120	80-120	13		1
2-Chlorotoluene	80-120	80-120	13		1
4-Chlorotoluene	80-120	80-120	13		1
1,2-Dibromoethane	80-120	80-120	13		1
2-Hexanone	36-60	80-120	13		10
Hexachlorobutadiene	80-120	80-120	13		0.6
Isopropylbenzene	80-120	80-120	13		1
p-Isopropyltoluene	80-120	80-120	13		1
Vinyl Acetate	80-120	80-120	13		1
4-Methyl-2-Pentanone	36-60	80-120	13		1(
MTBE	80-120	80-120	13		1
Naphthalene	80-120	80-120	13		1
n-Propylbenzene	80-120	80-120	13		1
Styrene	80-120	80-120	13		1
1,1,1,2-Tetrachloroethane	80-120	80-120	13		1
1,2,3-Trichlorobenzene	80-120	80-120	13		1
1,2,4-Trichlorobenzene	80-120	80-120	13		1
1,2,4-Trimethylbenzene	80-120	80-120	13		1
1,3,5-Trimethylbenzene	80-120	80-120	13		1
Vinyl Acetate	36-60	80-120	13		10
Total Xylenes	80-120	80-120	13		1

Date: 04/03/00

GC/MS Extractable Organics

	QC CHECK/LCS % RECOVERY LIMIT	MATRIX SPIKE % RECOVERY LIMIT	PQL (ug/l)
Method 625 Extractables in Water			
Acenaphthene	47-145	47-123	0.6
Acenaphthylene	33-145	33-145	0.4
Anthracene	27-133	27-133	0.5
Benzidine			80
Benzo(a)anthracene	33-143	33-143	1.2
Benzo(a)pyrene	17-163	17-163	0.9
Benzo(b)fluoranthene	24-159	24-159	0.7
Benzo(g,h,i)perylene	D-219	D-219	0.6
Benzo(k)fluoranthene	11-162	11-162	1.2
bis(2-Chloroethoxy)methane	33-184	33-184	0.7
bis(2-Chloroethyl)ether	12-158	12-158	0.6
bis(2-Chloroisopropyl)ether	36-166	36-166	0.5
bis(2-Ethylhexyl)phthalate	8-158	8-158	1.8
4-Bromophenyl phenyl ether	53-127	53-127	0.5
Benzyl butyl phthalate	D-152	D-152	1.4
2-Chloronaphthalene	60-118	60-118	0.8
4-Chlorophenyl phenyl ether	25-158	25-158	0.6
Chrysene	17-168	17-168	1.1
Dibenzo(a,h)anthracene	D-227	D-227	0.6
1,2-Dichlorobenzene	32-129	32-129	0.7
1,3-Dichlorobenzene	D-172	D-172	0.6
1,4-Dichlorobenzene	20-124	20-124	0.6
3,3'-Dichlorobenzidine	D-262	D-262	1.0
Diethyl phthalate	D-114	D-114	0.6
Dimethyl phthalate	D-112	D-112	0.5
Di-n-butylphthalate	1-118	1-118	1.1
2,4-Dinitrotoluene	39-139	39-139	0.6
2,6-Dinitrotoluene	50-138	50-138	0.5
Di-n-octylphthalate	4-146	4-146	0.7
Fluoranthene	26-137	26-137	0.7
Fluorene	59-121	59-121	0.6

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GC/MS Extractable Organics

	QC CHECK/LCS % RECOVERY LIMIT	MATRIX SPIKE % RECOVERY LIMIT	PQL (ug/l)
Hexachlorobenzene	D-152	D-152	0.5
Hexachlorobutadiene	24-116	24-116	0.6
Hexachlorocyclopentadiene	D-59	D-59	1.0
Hexachloroethane	40-113	40-113	0.5
Indeno(1,2,3-cd)pyrene	D-171	D-171	0.6
Isophorone	21-196	21-196	0.6
Naphthalene	21-133	21-133	0.6
Nitrobenzene	35-180	35-180	0.6
N- Nitrosodimethylamine			0.4
1,2 diphenylhydrazine			0.6
N-Nitroso-di-n-propylamine	D-230	D-230	0.6
N-Nitrosodiphenylamine	D-114	D-114	1.4
Phenanthrene	54-120	54-120	0.5
Pyrene	52-113	52-113	1.4
1,2,4-Trichlorobenzene	44-142	44-142	0.5
4-Chloro-3-methylphenol	22-147	22-147	0.6
2-Chlorophenol	23-134	23-134	0.5
2,4-Dichlorophenol	39-135	39-135	0.6
2,4-Dimethylphenol	32-119	32-119	0.5
2,4-Dinitrophenol	D-191	D-191	1.7
2-Methyl-4,6-dinitrophenol	D-181	D-181	0.6
2-Nitrophenol	29-182	29-182	0.5
4-Nitrophenol	D-132	D-132	0.3
Pentachlorophenol	14-176	14-176	0.8
Phenol	5-112	5-112	0.3
2,4,6-Trichlorophenol	37-144	37-144	0.6

* subject to change when MDLs are updated

Date: 04/03/00

GC/MS Extractable Organics

	QC CHECK/LCS % RECOVERY LIMIT	MATRIX SPIKE % RECOVERY LIMIT	RELATIVE % DIFFERENCE (RPD) LIMIT	PQL (ug/l)
Method 8270C Extractables in Water				
Acenaphthene	56-144	46-118	31	10
Acenaphthylene	52-132			10
Anthracene	66-138			10
Benzoic acid	0-25			50
Benzo(a)anthracene	62-151			10
Benzo(b)fluoranthene	42-172			10
Benzo(k)fluoranthene	55-150			10
Benzo(g,h,i)perylene	56-166			10
Benzo(a)pyrene	68-147			10
Benzyl alcohol	39-117			10
bis(2-Chloroethoxy)methane	53-142			10
bis(2-Chloroethyl)ether	49-133			10
bis(2-Chloroisopropyl)ether	54-130			10
bis(2-Ethylhexyl)phthalate	63-148			10
4-Bromophenyl phenyl ether	57-150			10
Benzyl butyl phthalate	64-158			10
Carbazole	33-228			10
4-Chloroaniline	48-150			10
2-Chloronaphthalene	52-163			10
4-Chloro-3-methylphenol	63-119	23-97	42	10
2-Chlorophenol	60-112	27-123	40	10
4-Chlorophenyl phenyl ether	55-112			10
Chrysene	72-141			10
Dibenzo(a,h)anthracene	25-159			10
Dibenzofuran	57-136			10
Di-n-butylphthalate	65-146			10
1,3-Dichlorobenzene	18-143			10
1,4-Dichlorobenzene	21-138	36-97	28	10
1,2-Dichlorobenzene	21-143			10
3,3'-Dichlorobenzidine	69-159			10
2,4-Dichlorophenol	66-122			10
Diethyl phthalate	62-132			10
2,4-Dimethylphenol	62-121			10

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GC/MS Extractable Organics

	QC CHECK/LCS % RECOVERY LIMIT	MATRIX SPIKE % RECOVERY LIMIT	RELATIVE % DIFFERENCE (RPD) LIMIT	PQL (ug/l)
Dimethyl phthalate	64-137			10
4,6-Dinitro-2-methylphenol	77-164			25
2,4-Dinitrophenol	70-139			25
2,4-Dinitrotoluene	57-131	24-96	38	10
2,6-Dinitrotoluene	60-142			10?
Di-n-octylphthalate	65-154			10
Fluoranthene	63-145			10
Fluorene	59-131			10
Hexachlorobenzene	53-153			10
Hexachlorobutadiene	5-169			10
Hexachlorocyclopentadiene	1-139			10
Hexachloroethane	8-144			10
Indeno(1,2,3-cd)pyrene	52-157			10
Isophorone	52-140			10
2-Methylnaphthalene	37-137			10
2-Methylphenol (o-cresol)	49-91			10
4-Methylphenol (p-cresol)	48-95			10
Naphthalene	43-144			10
2-Nitroaniline	60-139			25
3-Nitroaniline	65-162			25
4-Nitroaniline	67-155			20
Nitrobenzene	46-141			10
2-Nitrophenol	69-123			10
4-Nitrophenol	21-65	10-80	50	25
N-Nitroso-di-n-propylamine	46-129	41-116	38	10
N-Nitrosodiphenylamine	67-149			10
Pentachlorophenol	63-125	9-103	50	25
Phenanthrene	83-124			10
Phenol	24-57	12-110	42	10
Pyrene	66-152	26-127	31	10
1,2,4-Trichlorobenzene	30-142	39-98	28	10
2,4,5-Trichlorophenol	71-124			25
2,4,6-Trichlorophenol	70-121	-	-	25

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GC/MS Extractable Organics				
	QC CHECK/LCS % RECOVERY LIMIT	MATRIX SPIKE % RECOVERY LIMIT	RELATIVE % DIFFERENCE (RPD) LIMIT	PQL (ug/Kg)
Method 8270C Extractables in Soil				
Acenaphthene	63-131	31-137	19	330
Acenaphthylene	57-127			330
Anthracene	67-134			330
Benzoic acid	0-88			1600
Benzo(a)anthracene	58-148			330
Benzo(b)fluoranthene	37-191			330
Benzo(k)fluoranthene	53-130			330
Benzo(g,h,i)perylene	39-173			330
Benzo(a)pyrene	60-148			330
Benzyl alcohol	58-137			330
bis(2-Chloroethoxy)methane	64-123			330
bis(2-Chloroethyl)ether	60-119			330
bis(2-Chloroisopropyl)ether	64-120			330
bis(2-Ethylhexyl)phthalate	60-146			330
4-Bromophenyl phenyl ether	63-139			330
Benzyl butyl phthalate	65-149			330
Carbazole				330
4-Chloroaniline	0-139			330
2-Chloronaphthalene	70-138			330
4-Chloro-3-methylphenol	62-136	26-103	33	330
2-Chlorophenol	58-139	25-102	50	330
4-Chlorophenyl phenyl ether	58-133			330
Chrysene	60-151			330
Dibenzo(a,h)anthracene	30-154			330
Dibenzofuran	58-131			330
Di-n-butylphthalate	70-139			330
1,3-Dichlorobenzene	55-113			330
1,4-Dichlorobenzene	54-114	28-104	27	330
1,2-Dichlorobenzene	59-116			330
3,3'-Dichlorobenzidine	23-124			660
2,4-Dichlorophenol	67-129			330
Diethyl phthalate	56-142			330
2,4-Dimethylphenol	57-130			330

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GC/MS Extractable Organics

	QC CHECK/LCS % RECOVERY LIMIT	MATRIX SPIKE % RECOVERY LIMIT	RELATIVE % DIFFERENCE (RPD) LIMIT	PQL (ug/Kg)
Dimethyl phthalate	62-139			330
4,6-Dinitro-2-methylphenol	49-186			1600
2,4-Dinitrophenol	8-220			1600
2,4-Dinitrotoluene	46-146	28-89	47	330
2,6-Dinitrotoluene	58-146			330
Di-n-octylphthalate	66-154			330
Fluoranthene	63-145			330
Fluorene	56-133			330
Hexachlorobenzene	63-134			330
Hexachlorobutadiene	54-124			330
Hexachlorocyclopentadiene	20-114			330
Hexachloroethane	54-108			330
Indeno(1,2,3-cd)pyrene	44-160			330
Isophorone	63-123			330
2-Methylnaphthalene	56-120			330
2-Methylphenol (o-cresol)	50-126			330
4-Methylphenol (p-cresol)	51-147			330
Naphthalene	63-124			330
2-Nitroaniline	59-140			1600
3-Nitroaniline	24-172			1600
4-Nitroaniline	35-174			1600
Nitrobenzene	62-119			330
2-Nitrophenol	64-119			330
4-Nitrophenol	37-164	10-80	50	1600
N-Nitroso-di-n-propylamine	61-121	41-126	38	330
N-Nitrosodiphenylamine	69-142			330
Pentachlorophenol	68-124	17-109	47	1600
Phenanthrene	64-140			330
Phenol	48-146	26-90	35	330
Pyrene	55-146	35-142	36	330
1,2,4-Trichlorobenzene	59-115	38-107	23	330
2,4,5-Trichlorophenol	52-119			1600
2,4,6-Trichlorophenol	64-129			330

Appendix B

Standard Operating Procedure for Rising Head Slug Tests

Standard Operating Procedure for Sediment Sampling Using Vibracore Equipment

STANDARD OPERATING PROCEDURE FOR RISING HEAD SLUG TESTS

1. INTRODUCTION

Rising and falling head slug tests can be performed on selected monitoring wells to evaluate the hydraulic conductivity of the aquifer. In general, the approximate horizontal hydraulic conductivity of a given aquifer zone may be determined by adding or removing a known volume (slug) to or from the well, and observing and recording the subsequent rate of water level fall or rise within the well. The resulting data can be used to determine the hydraulic conductivity of the aquifer test zone via a number of analytical solution methods.

Both types of variable-head slug tests, the falling head test (slug injection) and rising head test (slug withdrawal), can be conducted. The falling head test is typically not applicable to "water table" wells (i.e., where the static water table is below the top of the screen), since the escape of water from the well to the unsaturated well pack after adding the slug to the well leads to an overestimation of the hydraulic conductivity (Bouwer, 1989). Therefore, only rising head tests should be conducted at "water table" wells. This procedure describes the methods to be employed when conducting a rising head test.

The testing apparatus and measurement techniques for the rising head test are described below.

A slug bar of known volume will be used to alter the water levels in the wells.

Due to the relatively rapid recovery of water levels in permeable soils subsequent to the insertion or removal of the slug bar, a computerized pressure transducer that is capable of recording pressure changes (which represent water levels) over small time increments will be used. This will allow for frequent and accurate measurements during the critical early part of the test. Further, the pressure transducer is capable of taking measurements on a logarithmic scale, which is amenable to post-test data processing.

2. PROCEDURE

Rising head tests are conducted as follows.

- The static water level (i.e., depth to water) in the well to be tested will be measured and recorded using an electronic water level indicator. All measurements taken during the test will be recorded in the field log book.
- The pressure transducer will be installed in the well a minimum of 5 feet below the deepest point of insertion of the slug bar. Where the well is not deep enough to allow this, the transducer will be installed as far below the deepest point of insertion of the slug bar as possible. The transducer will be allowed to thermally equilibrate for 15 to 30 minutes (to allow instrumentation wiring to expand/ contract) before measurements are taken.

- The slug bar will be fully submerged into the water column of the well.
- The water level in the well will be allowed to return to static condition after both the slug and transducer have been inserted. The transducer will be calibrated to read 100.00 feet at static conditions.
- When the water level in the well has returned to static condition, the transducer will be started using logarithmically-spaced data recording intervals, and the slug bar will be rapidly removed from the water column and well.
- The transducer will continue to record water levels until the water level has recovered to within 15 percent of the original static water level relative to the initial test displacement (85 percent recovery), or until an elapsed time of one hour.
- Data stored in the transducer will be transferred to and stored on a portable computer for analysis.

The Hvorslev (1951) or Bouwer and Rice (1989) methods of slug test analysis will be used to analyze the test data and, as appropriate, to estimate hydraulic conductivities. The data will be presented graphically, and the results and pertinent variables used as part of the analytical solutions will be summarized on the test results.

3. REFERENCES

Hvorslev, M.J., "Time Lag and Soil Permeability In Ground-water Observations," *U.S. Army Corps of Engrs. Waterways Experiment Station Bulletin No. 36,* 1951.

Bouwer, H., "The Bouwer and Rice Slug Test – An Update," *Ground Water,* vol. 27(3) 304, 1989.

STANDARD OPERATING PROCEDURE FOR SEDIMENT SAMPLING USING VIBRACORE EQUIPMENT

1. INTRODUCTION

Sediment samples can be collected via a number of different methods. The chosen method is dependent upon the nature of the sediments and to what depth the sediments are to be sampled. Fine-grained sediments, such as sands, silts and clays can be collected using Vibracore (VC) equipment for depths of up to 10 feet below the top of sediments. The VC equipment utilizes an air powered piston vibrator to drive the core pipe into the unconsolidated sediments. A disposable lexan liner is placed within the core pipe to collect each sample. A new liner is inserted in the core pipe for each sample. There are a cutting edge and a retainer at the bottom of the core pipe to hold the sample in the barrel.

2. PROCEDURES

VC sampling is conducted as follows.

- Sample from downstream to upstream locations so that disturbed sediment will not affect subsequent sampling locations.
- If sediment samples are being collected for laboratory analysis, the sampling equipment (i.e., cutting shoe, retainer, and sampling barrel) shall be decontaminated prior to the collection of samples at each location. Decontamination shall be conducted according to procedures that are outlined in any work plan(s) associated with the site.
- The drilling contractor shall measure the depth of the water column (depth to top of sediments). The drilling contractor shall also record the latitude, longitude and elevation of the sample location by means of the Global Positioning System (GPS). This information will be recorded by the GEI field representative along with a written description of the location (including sketch if appropriate). If GPS is not available, sampling locations will be marked with a labeled stake, buoy, flagging, or other device. When marking locations in navigable waterways, the appropriate regulatory agencies will be informed and proper precautions will be taken to prevent any navigational hazards before, during, and after sampling.
- Prior to coring at each sampling location, the VC watercraft shall be moored in a multi-point fashion.
- The VC drilling contractor will collect sediment samples using 3-inch diameter steel pipe in lengths of 5-feet or 10-feet. A 2-5/16-inch outer diameter (1/16-inch thick) lexan liner is placed into the core barrel. The apparatus is vibrated into the sediments, where penetration rates will vary depending on the sediment type. When the projected/specified depth is reached, the core will be retrieved. If sufficient room on the VC watercraft is available, the GEI field representative will log the core and collect analytical samples from the core onboard. Otherwise, core samples shall be delivered to the field representative at a shore side landing area as soon as practical after acquisition.

- The GEI field representative will identify and record the recovery and the type of sediment in terms of the major and minor constituents (i.e., sand, gravel, silt, and clay) and choose the proper group name and Unified Soil Classification Symbol. Soil samples shall be described according to the American Society for Testing and Materials (ASTM) Standard Practice for Description and Identification of Soils (Visual-Manual Procedure) D2488-90. Estimates of the percentage of each constituent will be recorded and listed in order of predominance.
- The sample structure shall be recorded (i.e., laminated, stratified, homogenous). Note attributes such as cementation, color and mineralogy (if it can be determined).
- Screening for Volatile Organic Compounds (VOCs) will be conducted on sediments throughout the core. A photoionization detector will be used for this process. Only relatively undisturbed portions of the core will be screened. The results of the screening will be recorded.
- The presence of iron-staining or other staining, presence of organic matter, shells, debris or detritus will be recorded. Any odors (i.e., tar-like vs. gasoline-like vs. fuel oil-like, etc.) will be recorded. Any visual impacts will be recorded (i.e., sheens vs. DNAPL vs. staining vs. oil blebs).
- Analytical samples will be selected based on any criteria stipulated in the associated site-specific work plan. Analytical samples shall be collected with stainless steel spatulas (or similar) that have been decontaminated according to procedures that are outlined in any work plan(s) associated with the site. The samples shall be contained in laboratory provided jars or glassware and kept cool. The sample identification, date, time and associated details will be recorded. Pertinent information regarding the samples will be recorded on a chain-of-custody form.

3. REFERENCES

Annual Book of ASTM Standards (1993), Section 4, v. 4.08 Soil and Rock; Building Stones; Geosynthetics, D2488-90, Standard Practice for Description and Indentification of Soils (Visual-Manual Procedure), American Society for Testing and Materials (ASTM).