QUALITY ASSURANCE PROJECT PLAN

Barkhamsted - New Hartford Landfill Superfund Site Barkhamsted, Connecticut

Barkhamsted Site PRP Group

October 1999

O'BRIEN & GERE
ENGINEERS, INC.

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October 20, 1999

Ms. Carolyn Pina-Springer
Remedial Project Manager
Office of Site Remediation & Restoration
(mail code: HBT)
U.S. Environmental Protection Agency
1 Congress Street, Suite 1100
Boston, MA 02114-2023

Re: Quality Assurance Project Plan
Barkhamsted – New Hartford
Landfill Superfund Site

File: 5268/22708 #2

Dear Ms. Springer:

Please find enclosed two copies of the revised draft Quality Assurance Project Plan for the above-referenced site. In accordance with your request, one copy has been provided to both Mr. Charles Porfert and Ms. Cynthia McLane. We have also provided Mr. Porfert with a copy of the draft Sampling and Analysis Plan.

Please feel free to call Rick Bell at 216-291-7754 or me if you should have any questions.

Very truly yours,

O'BRIEN & GERE ENGINEERS, INC.

Judy A. Shanahan, P.E.
Senior Project Engineer

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Enclosures

cc: S. Gleason – CTDEP
C. McLane – Metcalf & Eddy (w/copy of QAPP)
C. Porfert – USEPA (w/copies of SAP and QAPP)
R. Bell – TRW Inc.
J. Mulhern, Counsel – TRW Inc.
J. Heckathorne, P.E. – O'Brien & Gere
D. Carnevale – O'Brien & Gere

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5268/22708

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Barkhamsted - New Hartford Landfill Superfund Site Barkhamsted, Connecticut

Barkhamsted Site PRP Group

James R. Heckathorne, P.E.
Vice President

October 1999

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Disclaimer

This document is a DRAFT document prepared by the Settling Parties pursuant to a government administrative order which has not received final acceptance from the U.S. Environmental Protection Agency. The opinions, findings, and conclusions expressed are those of the authors and not those of the U.S. Environmental Protection Agency.

1. Project description

1.1. General

This Quality Assurance Project Plan (QAPP) presents specific Quality Assurance/Quality Control (QA/QC) criteria for the additional monitoring to be performed by O'Brien & Gere Engineers Inc. at the Barkhamsted - New Hartford Landfill Superfund Site (Site) in Connecticut. This document supersedes the previous QAPP (1995) which was prepared in accordance with United States Environmental Protection Agency's (EPA's) *Interim Guidelines and Specifications for Preparing Quality Assurance Project Plans, QAMS-005/80, December 29, 1980.* This document has been prepared utilizing the guidance provided in the *EPA Requirements For Quality Assurance Project Plans For Environmental Data Operations, EPA QA/R-5* (USEPA 1994a) and EPA's *Interim Guidelines and Specifications for Preparing Quality Assurance Project Plans* (USEPA 1980).

Samples of ground water, surface water, and seeps will be obtained and analyzed to provide additional data for completion of the risk assessment and to assess the degree to which natural attenuation of contaminants is occurring in ground water. Samples will be analyzed for TCL volatile and semivolatile compounds and TAL metals. In addition, surface water and seep samples will be analyzed for TCL pesticides. Eighteen of the ground water samples will be analyzed for natural attenuation parameters summarized in Section 2.1.3 of the Sampling and Analysis Plan (SAP). Field measurements will be conducted as discussed in the SAP.

The data generated from one round of sampling will be compared with previous data to establish its adequacy for risk assessment, and to determine if one additional round of sampling for constituents of concern is required.

1.2. QAPP objectives

The purpose of this QAPP is to document the objectives, policies, organizations, functional activities, and specific QA/QC activities designed to achieve the data quality objectives (DQOs) of this Site monitoring program such that the data generated will be of a known and acceptable level of precision and accuracy. DQOs are quantitative and qualitative statements that identify the quality of the environmental data required to support the decision-making process. DQOs define the total uncertainty in the data that is acceptable for each specific activity conducted during the Site monitoring program. This uncertainty includes both sampling error and analytical error. Zero uncertainty is the optimum; however, the variables associated with the process (field and laboratory) inherently contribute to the uncertainty of the data. The QAPP's overall objective is to keep the total uncertainty within an acceptable range that will not hinder the intended use of the data. Therefore, requirements are specified in this document for the following data quality parameters: detection and reporting limits, accuracy, precision, sample representativeness, data comparability, and data completeness and usability.

The following Quality Assurance (QA) topics are addressed in this plan:

- project organization and responsibility
- quality assurance objectives
- sampling procedures
- sample custody
- analytical procedures
- calibration procedures, references and frequency
- data reduction and validation
- internal Quality Control (QC) checks and frequency
- performance audits, system audits and frequency
- preventative maintenance procedures and scheduling
- procedures to be used to routinely assess DQOs
- corrective action
- QA reports to management

Analytical requirements equivalent to Level III, as described in the EPA guidance document *Data Quality Objectives for Remedial Response Activities* (EPA 540/G-87/1003) will be achieved for laboratory analyses. This DQO level implies the use of EPA analytical methods, reporting and

deliverable requirements and validation of the data. Field analyses and measurements will adhere to Analytical Levels I and II. Level I implies the use of portable instruments for field screening, while Level II implies the use portable analytical instruments and calibration procedures for in-field measurements. The remainder of this QAPP describes the specific approaches that will be taken to achieve the required DQOs.

2. Project organization and responsibility

2.1. Project organization

While each person involved in the Site monitoring activities and in the generation of data is implicitly a part of the overall project and quality assurance program, certain individuals have specifically designated QA/QC responsibilities. Organizational chart of key individual for this project is presented in Figure 1. Within O'Brien & Gere Engineers, Inc. these are the Project Coordinator, the Project Manager, the Quality Assurance/Data Validator, the Field Operations Manager/Project Hydrogeologist, Site Hydrogeologists and Environmental Technicians. O'Brien & Gere Laboratories, Inc. will provide analytical services for the Site monitoring activities. The contract laboratory's Quality Assurance Program (QAP) is included in Attachment A. Laboratory personnel with QA/QC responsibilities include the Laboratory Project Supervisor, Laboratory Quality Control Officer, and Laboratory Sample Custodian. Organizational chart for the laboratory is included in the Laboratory QAP.

2.2. Project coordinator

Mr. James R. Heckathorne, P.E. will serve as Project Coordinator for this project. As Project Coordinator, he will be responsible for the overall management of the Site monitoring program and for the completion of work specified in the Statement of Work. He will interface between regulatory agency personnel, the client, and O'Brien & Gere management staff. He will also be responsible for budget and administrative oversight.

2.3. Project manager

Ms. Judy Shanahan will act as the Project Manager for this Site monitoring program. As Project Manager, she will monitor the Site monitoring program's progress, regularly review the project schedule, and review work elements prior to submittal. Ms. Shanahan will oversee scheduling and budgeting for field activities and the laboratory subcontract.

2.4. Quality Assurance Officer

Ms. Melissa Listman of O'Brien & Gere Engineers, Inc. will serve as Quality Assurance Officer (QAO) and will be responsible for overall project quality assurance. Ms. Listman will review project plans and revisions to the plans to maintain proper QA throughout the investigation. Ms. Listman will also be responsible for reviewing chemical data and validating laboratory analytical data from the laboratories. In addition, Ms. Listman will be responsible for performance and system audits, data processing activities, data processing quality control, data quality review, corrective actions, and coordinating the QA/QC efforts between O'Brien & Gere Engineers, Inc., and the contract laboratory.

2.5. Field operations manager/project geologist

Mr. David Carnevale, will be assigned the responsibilities of Field Operations Manager/Project Hydrogeologist. The Field Operations Manager/Project Hydrogeologist reports directly to the Project Manager and is immediately responsible for the day-to-day activities of O'Brien & Gere Engineers field personnel. In this capacity, the Field Operations Manager is responsible for verifying that field quality assurance activities are performed in accordance with the QAPP. Further responsibilities include the initialing and accuracy verification of field notebooks, chain-of-custody records, sample labels, and other field-related documentation.

2.7. Site hydrogeologists and environmental technicians

Ground water, surface water, and seep sampling tasks required by this monitoring program will be conducted by experienced hydrogeologists and/or environmental technicians. Their responsibilities will include the documentation of the proper sample collection protocols, sample collection, field measurements, equipment decontamination, and chain-of-custody documentation.

2.8. Laboratory project supervisor

Mr. Thomas Alexander will serve as the Laboratory Project Manager. Mr. Alexander will be responsible for analytical performance, including adherence to contract and quality control requirements. He will serve as the primary contact between O'Brien & Gere Engineers, Inc. and the laboratory, and any modifications to the scope of work will be processed by him. He will monitor the progress and timeliness of the work, review work orders, and authorize release of laboratory reports.

2.9. Laboratory quality control officer

Mr. Joseph Houser will serve as the Laboratory Quality Control Officer. Mr. Houser will be responsible for laboratory quality assurance and quality control activities associated with the project. Mr. Houser is also responsible for updating the laboratory's Quality Assurance Program. The specific duties will include verifying that analyses are conducted within the appropriate holding times and that laboratory custody procedures are followed. He will be responsible for monitoring daily precision and accuracy records, maintaining detailed copies of the procedures, rescheduling analyses based upon unacceptable data accuracy or precision, and identifying and implementing corrective actions necessary to maintain quality assurance standards. The laboratory Quality Assurance Program contains more detailed information regarding the quality assurance oversight procedures implemented at the laboratory.

2.10. Laboratory sample custodian

Mr. Mark Jackson will serve as the Laboratory Sample Custodian and will be responsible for sample log-in, secured sample storage, laboratory chain of custody procedures, retaining shipping documents, and verification of chain of custody records and sample integrity in accordance with the standard operating procedure summarized in Section 5.2.

3. Quality assurance objectives

This section discusses the quality assurance parameters: precision, sensitivity, accuracy, representativeness, comparability, and completeness (PSARCC parameters). Provided below are concise definitions of the PSARCC parameters and quantitative requirements for precision, accuracy, completeness, and sensitivity as they pertain to this project for field and laboratory measurements. Further, this section discusses the methods used to evaluate precision, accuracy, completeness, and sensitivity, as well as the procedures used to verify that the required representativeness and comparability goals are achieved.

3.1. Definitions of PARCC parameters

Precision describes the ability to reproduce results. It is defined as the agreement between the numerical values of two or more measurements that have been made in an identical manner. Precision can be expressed in a variety of manners, including the absolute methods of deviation from the mean or median values, standard deviation and variance, or by relative methods, such as relative deviation from the mean or median. Laboratory precision will be evaluated through the analysis of laboratory duplicates or matrix spike duplicate (MSDs). Field duplicate samples will be collected to assess field sampling precision. Field duplicate analyses measure both field and laboratory precision; therefore, the results may contain more variability than laboratory MSDs which measure only laboratory performance.

Accuracy is a measure of closeness of an individual measurement or an average of a number of measurements to the true value, and is expressed in terms of absolute or relative error. Accuracy will be expressed as percent recovery or the percentage of the "known" or "true" value. Accuracy will be evaluated through analysis of surrogate spikes, LCSs, and matrix spike/matrix spike duplicate (MS/MSD) samples. Laboratory and field blanks will also be analyzed to determine if contamination is present. Surrogates are compounds similar in nature to the target analytes

which are spiked into environmental samples, blanks, and quality control samples prior to sample preparation for organic analyses. MS/MSDs samples consist of environmental samples in which a predetermined concentration of a representative mix of the target analytes are added prior to sample preparation. MS/MSD analyses and surrogate recoveries are assessed to provide information on sample preparation and analysis procedure with respect to specific sample matrices. The evaluation of the results of these surrogate spikes is not necessarily straightforward. The sample itself may produce effects due to such factors as interferences and high concentrations of analytes.

LCSs are standard solutions that consist of known concentrations of the target analytes spiked into laboratory distilled water or a clean sand. LCSs are prepared and analyzed following the same procedures employed for environmental sample analysis. LCSs are prepared from reference materials that are either purchased from an external source or prepared independently from the calibration standards. LCS recoveries provide an independent verification on the calibration procedure and are used to evaluate method accuracy independently of sample matrix effects. Section 13 contains the procedures and equations used to measure accuracy.

Representativeness refers to the degree to which a sample taken from a site accurately represents the matrix being sampled. Representativeness will be maximized by the use of EPA procedures for the collection and preservation of samples and by completing sample extraction and analyses within EPA specified holding times. Ground water, surface water, and seep locations were selected based on data obtained from the previous RI/FS. Ground water samples will be collected after three to five well volumes have been purged and water quality parameters will be monitored to verify that the sample collected is representative of the ground water aquifer.

To increase the representativeness of the ground water samples they will be collected using the low flow ground water sampling protocol contained in the SAP.

Comparability refers to the use of consistent procedures, reporting units, quantitation limits, standardized methods of field analysis and standardized data format with document control and data validation. Adherence to standard procedures maximizes the probability that data generated from different laboratories can be validly compared to one another. The

analysis of LCSs provides a verification that the contract laboratory can accurately determine the concentration of a standard which has been verified by an independent manufacturer.

Completeness refers to the process of obtaining required data as outlined in this QAPP. Completeness is calculated by determining the percentage of measurements judged to be usable for qualitative and quantitative purposes. On a nationwide basis, the EPA has found CLP data to be 80-85% complete. Section 13 contains the procedures and equations used to measure completeness.

Sensitivity refers to the measurable concentration of an analyte which can be determined with a designated level of confidence. Sensitivity is established by laboratory method detection limits (MDLs) and practical quantitation limits (PQLs) as described in Section 7. PQLs have been established for this project based on previous RI/FS and quarterly monitoring data. PQLs are summarized in Table 4. It should be noted that these PQLs can only be achieved in an undiluted sample free of matrix interferences. If matrix interferences are encountered or if high concentrations of target compounds are present, established PQLs may not be achievable without impacting the instrument quality. The laboratory may dilute samples which are known to have high levels of target compounds based on the previous monitoring studies conducted.

3.2. PARCC parameter goals

Project wide accuracy and precision will be evaluated based on individual measurements taken during sample analysis. Results for blanks, MS/MSDs, surrogates, and LCSs will be used assess accuracy. Results for MSDs and laboratory duplicates will be used to assess laboratory precision. Laboratory and field blanks will not contain contaminants at concentrations greater than the practical quantitation limits (or five times these limits for common laboratory contaminants). Acceptance limits for MS/MSD and LCS analyses will be based on previously established laboratory control limits for samples of similar matrix. Laboratory control limits are discussed in sections 10 and 13 of this document and are summarized in Table A-1 of the Laboratory Quality Assurance Program (QAP) included as Attachment A.

Field precision will be assessed through the analysis of field duplicate samples. Relative percent differences (RPDs) will be calculated and

evaluated for field duplicate samples. RPD criteria goals of $\leq$50% will be used to evaluate detected results greater than five times the PQL. A control limit of $\pm$ two times the PQL will be used to evaluate detected results less than five times the PQL. Since these criteria are goals, it is understood they may not always be met due to the inhomogeneity of environmental samples. In the event that these goals are not met, the effect of this excursion on data quality will be evaluated in the data validation report.

A goal of 95% completeness has been established for the quarterly sampling program. Laboratory PQLs for this program are described in Section 7 and are summarized in Table 4. Numerical goals cannot be established for representativeness or comparability since these are qualitative concepts.

In the event that these goals are not met, the laboratory will implement corrective action procedures. The Quality Assurance Officer and Project Manager will be notified when these events occur. It is the responsibility of the laboratory to demonstrate that out-of-control events are the result of sample matrix or sample inhomogeneity and not the result of instrument or human error. In some cases, corrective action procedures may involve resampling and reanalysis.

4. Sampling procedures

This section presents an overview of the sampling program that will be performed. Detailed descriptions of sampling procedures are presented in the SAP. Reusable sampling equipment that may directly or indirectly contact samples will be decontaminated as described in the SAP.

4.1. Sampling protocols

Ground water, surface water, and seep samples will be collected in accordance with the procedures described in the SAP and the following documents: *EPA Region I Low Flow Standard Operating Procedure (USEPA Region I, August 10, 1994), A Compendium of Field Operations Methods (USEPA 1987b); and Test Methods for Evaluating Solid Waste (SW-846), Update 1 (USEPA July 1992).*

Ground Water - A total of thirty-five monitoring wells and three residential taps served by wells will be sampled. The sampling locations are presented in Section 2.1.1 of the SAP. Water level measurements will be taken and ground water samples will be collected with the low flow sampling protocol as described in Section 2.1.2 of the SAP.

Surface Water - Six surface water samples will be collected from locations specified in Section 2.3.1 of the SAP. The sampling protocol for the surface waters is described in Section 2.3.2 of the SAP.

Seeps - Five seep locations will be sampled as described in Sections 2.2.1 and 2.2.2 of the SAP.

During sample collection activities, preserved samples will be checked with pH paper to verify that preservation requirements summarized in Table 1 are met. Volatile preserved samples will be checked by collecting a test vial and checking the vials pH. If the sample's pH is greater than two, additional HCL will be added to the test vial until the pH is less than two. The amount of HCL added to the test vial will also be added to the sample vials.

Information collected during field sampling will be documented in a bound field notebook. Field notebooks will have pre-numbered pages and entries will be made in indelible ink.

4.2. Sample handling

Table 1 is a summary of sample containers, sample volumes, preservation methods and holding times by analytical method and matrix. The laboratory will provide pre-cleaned sample containers, chain of custody records, custody seals, laboratory analyte free water, trip blanks, and sample coolers. The laboratory will pre-label sample containers with the following information: project name, preservation if applicable, and analyses to be performed. Sample labels will have sufficient space for the sampling team to record the following information: site name, sample identification, date and time of collection, and initials of sampling team. Sample containers for water analyses will be pre-preserved.

Samples will be uniquely identified for each sample location to provide a tracking procedure for retrieval of information for a particular sample. Samples will be numbered in the same manner as established in the previous RI/FS investigation as described in the SAP. A listing of the sample identification numbers will be maintained by the sample team leader.

Samples requiring refrigeration will be transferred to coolers packed with ice and ice packs to maintain the temperature inside the cooler at approximately 4 °C. Samples will then be shipped to the laboratory within twenty-four hours of sample collection and will arrive at the laboratory within forty-eight hours of sample collection. Saturday deliveries will be scheduled with the laboratory in order to complete delivery of samples within forty-eight hours. Sample transportation will comply with U.S. Department of Transportation requirements. Sample preservation and cooler temperatures will be verified by the laboratory upon receipt.

4.3. Field QA/QC samples

Quality control samples, consisting of trip blanks, equipment blanks, field duplicates, MS/MSDs (or MS/Laboratory duplicates for inorganics) will be collected in the same type of sample containers and handled in the same manner as the environmental samples. Table 2 summarizes the number of QA/QC samples that will be collected by analytical method and sample matrix.

- **MS/MSDs or MS/Laboratory Duplicate** - Two additional sample volumes will be collected by the field sampling team from the sample location designated as the MS/MSD for organic analyses and MS/laboratory duplicate for inorganic analyses. These samples will be collected at the frequency of one per matrix type and every twenty samples of similar matrix. Sample volumes will be collected by alternating filling sample containers for each parameter, securing samples for volatile parameters first. MS/MSD samples will be spiked at the laboratory with a subset of target analytes and evaluated to assess method accuracy and precision with respect to sample matrix. MSDs or laboratory duplicate results will be used to evaluate laboratory precision with respect to sample matrix.

- **Field duplicates** - Field duplicate samples will be two samples collected at the same time from the same source, but submitted as separate samples. Field duplicate sample volumes will be collected by alternately filling sample containers for each parameter securing samples for volatile parameters first. These QA/QC samples are collected to measure the precision of field sampling procedures, as well as the laboratory's analytical methods. Duplicate samples will be identified on chain of custody records as such that laboratory personnel cannot distinguish the location from which the duplicate was collected. Field duplicate samples will be collected at a frequency of one per matrix type and every twenty samples of similar matrix.

- **Equipment Blanks** - Equipment blanks will be collected by pouring or pumping laboratory analyte free water through decontaminated sampling equipment used in the collection of aqueous and sediment samples. Equipment blank samples will be collected, handled, and analyzed in the same manner as the environmental samples. Equipment blanks will be used to measure contamination encountered during sampling. One equipment blank will be collected for each piece of sampling equipment used per sampling event at a maximum frequency of five percent.

- **Trip Blanks** - Trip blanks will accompany every cooler of soil and water samples sent to the laboratory for volatile analysis. Trip blanks will be prepared by the laboratory, shipped with the sample containers to the field, handled like a sample, and returned to the laboratory for analysis. Trip blanks will not be opened in the field.

- **Split Samples** - If split samples are required, they will be collected in the same manner as field duplicates.

5. Sample custody

Chain of custody procedures will be instituted and followed throughout the project. These procedures include field custody, laboratory custody, and final evidence file custody. This procedure creates an accurate and legally defensible document that can be used to trace possession of a sample from its collection through extraction and final disposal. Upon completion of analysis, the Quality Assurance Officer or her assignee will begin assimilating the field and laboratory data reports. In this way, the evidence file for the project will be generated. The file will be chronologically arranged for ease of review. When the information has been gathered, the file will be inventoried, numbered, and stored for future reference.

The Chain of Custody Record (Figure 1) will be signed by the handlers of the sample. The Quality Assurance Officer must produce documentation that traces the samples from the field to the laboratory and through the process of extraction and analysis. The National Enforcement Center of EPA has defined custody of evidence as follows:

- in actual physical possession
- in view after being in physical possession
- in a locked laboratory
- in a secure, restricted area

5.1. Field chain of custody procedures

Formal custody procedures will begin in the field. The laboratory will provide sample containers purchased from an EPA-certified manufacturer (I-Chem series 200 or equivalent). The laboratory will provide Chain of Custody Records forms and custody seals with shipment of sampling containers. Sample labels (Figure 2) will be affixed to sampling containers and will be pre-labeled by the laboratory with the following information: project, preservation if applicable, and analyses required. The field sampler is responsible for filling out the remaining information

with respect to sample location, date and time of collection, and initials of sampling personnel.

Chain of Custody Records will be completed in the field during sample collection. In the field notebook, samplers will note meteorological data, equipment employed for sample collection, well evacuation techniques, calculations, and information regarding collection of QA/QC samples. The following physical information will be recorded in the field notebook, on sample labels, and on Chain of Custody Records by the field sampling team:

- project identification
- sampling location
- required analysis
- date and time of sample collection
- type of sample (matrix)
- sampling technique
- preservation used if applicable
- initials of the sampler

The field sampler will sign the Chain of Custody Record when relinquishing custody and include the form in a plastic bag in the sample cooler with the associated samples. Sampling containers will be packed in styrofoam sheets, and put in plastic bags to help prevent breakage and cross-contamination. Samples will be shipped in coolers containing ice and ice packs to maintain inside temperature at approximately 4°C. Sample coolers will then be sealed with a custody seal prior to shipment. The custody seal will be an adhesive-backed tape that easily rips if it is disturbed. Samples are shipped to the laboratory by common over-night carrier or are delivered by O'Brien & Gere Engineers, Inc. If commercial vendors are used, they will be required to document the transfer of the package within their organization.

5.2. Laboratory control of incoming samples

The laboratory will be responsible for proper sample handling, identification, and recording of sample custody from sample receipt to disposal. The Laboratory Sample Custodian is responsible for sample log-

in, storage, and laboratory chain of custody procedures. The Laboratory Sample Custodian will be responsible for retaining shipping documents and verifying data recorded on the Chain of Custody Records.

Upon receipt, the sample custodians will follow the standard operating procedure (SOP) outlined below to verify sample integrity and chain of custody information.

1) The integrity of the sample cooler is checked by verifying that the custody seal is intact.

2) The cooler internal temperature is measured and recorded in the case file under subsection "Comments/Discrepancy" (Figure 5-2 of the QAP included in Attachment A). If the cooler internal temperature is greater than 10°C, the sample custodian will immediately notify the Laboratory Project Supervisor. The Laboratory Project Supervisor and Project Manager will then meet to discuss potential impacts to the samples and identify corrective actions that may be necessary.

3) The Chain of Custody Record (Figure 1) is signed and dated to verify time of sample receipt.

4) Sample containers are checked for breakage, leakage, or damage.

5) Sample containers are verified against chain of custody records.

6) The pH of preserved samples (except for volatile organics) is measured, if applicable, and recorded on the laboratory sample log-in form to verify that preservation was performed in accordance with EPA method requirements. The pH of volatile samples are verified during analysis.

7) Each sample is assigned and tagged with a unique, sequential laboratory identification number.

8) Samples are placed in a secured walk-in cooler maintained at 4°C $\pm$ 2°. Refrigerator temperatures are monitored and recorded daily by the sample control personnel.

9) Sample control records are initiated.

10) Samples are logged into the Laboratory Information Management System (LIMS) and the analyses are scheduled.

Documentation of cooler integrity, temperature, preservation, and any problems with sample receipt are recorded in the case file and the Quality Assurance Coordinator is contacted immediately.

The Chain of Custody Record, case file form, sample control record, and original laboratory report form are maintained by the laboratory and copies of these forms will be included in the laboratory report.

The laboratory minimizes phthalate contamination of samples by strictly adhering to glassware cleaning procedures and minimizes contact with plastics in the laboratory. Glassware cleaning procedures are described in Section 6.3 of the Laboratory QAP included as Attachment A.

Methylene chloride contamination is minimized by having volatile organic samples analyzed in a dedicated laboratory with positive air flow. Methylene chloride is only used in the extraction laboratory which is under negative pressure.

5.3. Sample tracking

Laboratory sample numbers and client ID numbers will be recorded on raw data and preparation logs. Samples are primarily tracked using the laboratory sample identification numbers. Analysts will be responsible for recording pertinent information regarding sample preparation and analyses in bound laboratory notebooks and on appropriate tracking forms. It is the responsibility of the Laboratory Sample Custodian and Quality Assurance Officer to verify that proper chain of custody and sample tracking procedures have been maintained. Copies of the following items will be stored:

- Documentation of the preparation and analysis of samples, including copies of the analyst's notebooks.
- Bench sheets, graphs, computer printouts, chromatograms, and mass spectra.

- Copies of QA/QC data.
- Instrument logs showing the date, time, and identity of the analyst.
- Analytical tracking forms that record the date, time, and the identity of the analyst for each step of the sample preparation, extraction, and analysis.

5.4. Location and disposal

Samples are stored in a secured walk-in cooler. The analysts will date and sign sample control forms when samples are removed and returned to secured storage. Sample extracts or digestates are stored in refrigerators in the appropriate laboratory section. Standards are stored in separate refrigerators in the appropriate laboratory section.

The method of sample disposal depends on the analytical data. The results are compared to RCRA criteria and a decision is made in connection with the hazardous waste officer to the means of disposal. If the sample is classified as hazardous, it is placed in the appropriate drum in the hazardous waste room. Upon filling the drum, the hazardous waste officer manifests the drum, arranges for disposal and files the disposal logs.

5.6. Special training requirements

Field investigation personnel must comply with the training requirements for hazardous waste operations, codified in 29 CFR 1910.120(e). Each individual must have successfully completed a 40-hour (or 24-hour) course appropriate to the level of work which they perform. In addition, each individual must have completed an 8-hour refresher course within the last 12 months if the initial training was more than 12 months ago. Field investigation personnel must have documentation (copies of certificates, or I.D. cards) available on site as proof of compliance with these training requirements.

6. Calibration and frequency

6.1. Laboratory equipment calibration

Calibration of laboratory analytical instrumentation is essential for the generation of reliable data which meets project data quality objectives. The calibration procedures to be followed are specified, in detail, in the analytical methods and laboratory SOPs. These procedures specify the type of calibration, calibration material to be used, calibration standard concentration, and frequency of calibration. The laboratory will be responsible for the proper calibration and maintenance of laboratory analytical equipment. Documentation of initial and continuing calibration checks will be kept on file and be submitted as part of the laboratory report. Tables 5A, 5B, 5C, 5D, and 5E provide a summary of calibration requirements and corrective action procedures.

GC/MS calibration

Before the GC/MS is calibrated, it is first auto-tuned and then tuned with PFTBA. Then the mass calibration and resolutions of the instruments are verified by either a 50 ng injection of BFB (4-bromofluorobenzene) for volatile organics or a 50 ng injection of DFTPP (decafluorotriphenylphosphine) for semivolatile organics. The tune must meet the ion abundance criteria specified in the analytical method. The system must be re-tuned every 12 hours of analysis and when the instrument performance check solution fails to meet criteria. After re-tuning, the performance check solution is reanalyzed. Samples will not analyzed until tuning criteria are met.

An initial five-point calibration is performed for the target compounds prior to start-up and whenever system specifications change or if the continuing calibration acceptance criteria have not been met. One of the calibration standards must be at or below the PQL. If the percent relative standard deviation (%RSD) is less than fifteen percent, the average relative response factor (RRF) may be used for quantitation. If RSD is greater than fifteen percent, calibration curves must be generated and used

for quantitation. In addition, the RRFs and %RSD of specific compounds must meet established criteria as specified in the method. If these parameters fail to meet criteria, corrective actions must be implemented and the initial calibration must be repeated.

A continuing calibration standard containing the target compounds is analyzed at the beginning of every 12-hour period following GC/MS tune. This standard must meet specific QC limits listed in the method to verify that the initial five-point calibration is still valid. The concentration of the continuing calibration is 250 ng for volatiles and 50 ng for semivolatiles.

GC calibration for pesticides

Two columns will be used to analyzed pesticides. Calibration requirements must be met for both columns if pesticides are detected in the samples. If pesticides are not detected calibration requirements must be met for one of the two columns. An initial five-point calibration is performed for the target compounds prior to start-up and whenever system specifications change or if the continuing calibration acceptance criteria have not been met. One of the calibration standards must be at or below the PQL. If the percent relative standard deviation (%RSD) is less than twenty percent, the average relative response factor (RRF) may be used for quantitation. If RSD is greater than fifteen percent, calibration curves must be generated and used for quantitation.

A continuing calibration standard containing the target compounds is analyzed at the beginning and end of every analysis sequence and at frequency of ten percent. Percent differences (%D) must be less than fifteen percent.

Retention time windows are established and are up-dated with the first continuing calibration standard. Degradation check standards are analyzed prior to sample analysis and every 12 hours. Pesticide degradation for endrin and 4,4'-DDT must be less than twenty percent (total degradation must be less than thirty percent).

Metals calibration

Instrument calibration for metal analyses will be performed daily. A two point calibration for ICP analysis, and sixpoint calibration curve for mercury cold vapor analysis are performed. Calibration curves must have correlation coefficients greater than or equal to 0.995 or corrective actions must be implemented and the initial calibration repeated. Calibration

verification is monitored by analyzing a calibration verification standard and a calibration blank following calibration, every ten samples, and at the end of the analytical sequence. The calibration verification standard recovery must be within 90% to 110% for all metals, except mercury which must be within 80% to 120%, or the instrument must be resloped and, if necessary, recalibrated. The calibration blank must not contain target compounds at concentrations greater than the PQL or corrective actions are implemented. To verify interelement and background corrective factors for ICP analysis, interference check samples (ICSA and ICSAB) must be analyzed at the beginning and end of the analysis sequence or a minimum of twice per eight hours. The percent recoveries for ICS solutions must be within 80% to 120% or corrective actions must be implemented. In addition, for ICP analyses, a serial dilution analysis must be performed per sample matrix. If the analyte concentration is greater than fifty times the MDL in the original sample, a serial dilution (five fold dilution) must agree within ten percent of the original determination. Detection limits, interelement corrective factors, and linear ranges must be established at the frequency specified in the method.

Wet chemistry calibration

For colorimetric and total organic carbon analyses, a standard curve consisting of five to seven points are used to calibrate the instruments. One of the calibration standards is at the PQL. Correlation coefficient for a first or second order curve must be ≥ 0.997. A LCS and a method blank are analyzed daily prior to sample analysis. LCS recovery must be within laboratory established control limits and method blank must not contain target analytes above the PQL. Continuing calibration standards at midpoint concentration are run at a frequency of ten percent throughout the analytical sequence. Percent recoveries must be within 90% to 110% or the instrument must be recalibrated.

Titrating solutions are standardized when prepared and rechecked monthly. A LCS and a method blank are analyzed prior to sample analysis. LCS recovery must be within laboratory established control limits and method blank must not contain target analytes above the PQL.

6.2. Field equipment calibration

Field equipment will be calibrated, operated, and maintained in accordance with the SAP. Instrument calibration will be documented in the field logbook. Specific monitoring devices and their expected accuracy and precision are presented on Table 6.

6.3. Standards

Standards may be generally grouped into two classifications: primary and secondary. Primary standards include United States Pharmacopoeia (USP) drugs, National Institute of Science and Technology (NIST) and ASTM materials, and certain designated EPA reference materials. Other standards are considered secondary. Testing of primary standards is not necessary. Primary standards will not be used if there is any physical indication of contamination or decomposition (i.e. partially discolored, etc.) or if the manufacturers expiration data has passed. Secondary standards should be examined when first received, either by comparison to an existing primary standard or by comparing known physical properties to literature values. The less stable standards will be rechecked at appropriate intervals, usually six months to one year. Laboratory analytical methods will be calibrated with certified standards. These standards are considered primary. Secondary standards will be used for other QC samples.

6.4. Records

Documentation of standard receipt and preparation will be maintained in a bound standards log. Standards log entries will also be stored on a database and will include the following:

- manufacturer name and lot numbers
- purity and concentration of standard solution

- initials of preparer
- method of preparation, including special storage requirements
- date received and/or prepared
- expiration date

Standard solutions are validated prior to use. Validation procedures range from a check for chromatographic purity to verification of the concentration of the standard using a standard prepared at a different time or obtained from a different source. Reagents and solvents are examined for purity by subjecting an aliquot or sub-sample to the analytical method in which it will be used: for example, lots of methylene chloride used in organic extractions are analyzed for undesirable contaminants prior to laboratory.

7. Analytical procedures

7.1. Analytical methods

Ground water, surface water, and seep samples will be analyzed for TCL volatile and semivolatile organics, and TAL total metals. Surface water and seep samples will also be analyzed for TCL pesticides. Selected ground water samples also will be analyzed for natural attenuation parameters presented in Section 2.1.3 of the SAP. Field measurements will be taken in accordance with the SAP. Table 3 is a summary of the analytical methods that will be employed. The laboratory maintains detailed SOPs for analytical procedures.

7.2. Method detection limits and practical quantitation limits

The MDL is the minimum concentration of an analyte that can be measured and reported with 99% confidence that the analyte is greater than zero. The MDL is empirically derived value from replicate analyses of clean matrix (organic-free water or sand) spiked with known concentrations of analytes in accordance with the procedures specified in the analytical methods and from *40 CFR 136 Appendix B* (Federal Register 10/26/84). The MDL is used to estimate the lowest concentration a method can detect. MDLs are updated periodically. The PQL is an established value where the precision and accuracy are assumed to be defined and it must be greater than or equal to the empirically derived MDL. Laboratory PQLs are reporting limits. Laboratory PQLs in Table 4. PQLs are verified through the analysis of calibration standards prepared at concentrations at or below the PQL. For volatile and semivolatile analyses, when a target analyte is detected above the MDL, but below the PQL, the laboratory will quantitate the concentration if GC/MS criteria are met for organic analyses. This value will be

flagged a "J" qualifier to indicate that the concentration is estimated since the precision and accuracy of the method at this level are not defined.

PQLs can only be achieved in an undiluted sample free of matrix interferences. If matrix interferences are encountered or if high concentrations of target compounds are present, established PQLs may not be achievable without impacting the instrument quality. The laboratory may dilute samples which are known to have high levels of target compounds based on previous monitoring studies conducted.

8. Laboratory data reduction, review, and reporting

8.1. Data reduction

Data reduction consists of manual and computer data reduction procedures and calculations. Computer data reduction procedures and calculations will be checked manually by the laboratory to verify compound identification and quantitation adhere to method requirements. The laboratory will be responsible for maintaining a listing of computer-based data reduction programs and SOPs for data reduction. Sample preparation or extraction logs will be used to document sample preparation information (for example, preparation weights, volumes, reagents). Instrument injection logs or bench sheets will also be maintained for each instrument.

Qualitative identification and quantitation of organic analytes will be performed by experienced analysts in accordance with analytical method requirements.

8.2. Laboratory data review

Analytical results will be entered into the LIMS by the analyst, independently reviewed by another analyst or supervisor experienced in the method, and approved by the Laboratory Manager. The following requirements will be examined as part of this review:

- Initial calibration criteria were met. Standards in the calibration curve covered the expected concentration ranges of the samples including the practical quantitation limit.

- Initial and continuing calibration verification checks met the acceptance criteria defined in the method standard procedure.
- Sample results fell within the range of the standard curve.
- For GC/MS methods requiring internal standards, retention times and area responses were evaluated against limits established by the daily calibration.
- Method blanks were processed with each analytical batch and no detectable levels of contamination were identified.
- MS/MSDs were performed at the required frequency and recoveries were within acceptable control limits.
- Duplicate analyses were performed at the required frequency and results were within the control limits.
- LCS analyses were performed with each analytical batch and the results obtained were within control limits.
- For organic compound analyses, surrogate spike recoveries was within control limits.
- Compounds identified by GC/MS have been manually rechecked by comparison with the data system library for both target compounds and tentatively identified compounds. Retention times and ratios of fragmentation were verified.
- Compounds identified by GC have been confirmed by secondary column. Retention time requirements are met for both columns.
- Calculations have been accurately performed.
- Data for the analysis provide a complete audit trail.

The analyst's supervisor will check a minimum of 10% of the data back to raw data in the secondary review. This review is evidenced by a supervisor's signature on the data page. A tabulation of results will be submitted to the supervisor during the data review. When required analyses on the samples in a project are complete, entered, and reviewed,

a report will be generated. The report will be forwarded to the assigned Laboratory Project Supervisor for review. The Laboratory Project Supervisor's review will cover the following points:

- QC data will be reviewed to identify whether or not internal specification and contract requirements have been met.
- Non-conformance reports, if any, were reviewed for completion of corrective action and impact upon results. Noncompliance and corrective action procedures are documented as case narrative in the final report.

The report requires the signature of the Laboratory Project Supervisor and the laboratory manager. Electronic data are copied onto computer tape, inventoried, and stored off-site in a secure facility, or within locked cabinets on site. This data archive system is maintained minimally for ten years.

Following final review, two copies of the report will be shipped to O'Brien & Gere Engineers, Inc.

8.3. Laboratory reports

Laboratory reports will adhere to SW-846 requirements. The data report forms will be securely bound and all pages will be sequentially numbered. Reports will include the following information:

- Case narrative report containing a summary of the samples collected, problems with sample receipt, methods employed, QA/QC excursions, corrective action procedures.
- Cross reference table of client sample identifications, laboratory sample identifications, date of sample collection, and date of sample receipt.
- Case file containing documentation of cooler temperature and preservation checks performed.
- Copies of completed chain-of-custody records.

- Internal laboratory chain of custody records.
- Analytical results of environmental samples, field duplicates, equipment blanks, and trip blanks with appropriate PQLs.
- Surrogate recovery results.
- Batch specific QA/QC results for laboratory method blanks, MS/MSDs, and LCSs.
- Summary tables of control limits used to assess surrogates, MS/MSDs, and LCSs.
- GC/MS tuning and calibration data summarized.
- GC calibration and retention time window data summarized.
- Internal standard summary forms.
- Summary table of MDLs and PQLs.
- Extraction bench sheets, digestion logs, injection logs.
- Appropriate raw instrument outputs for samples, blanks, QA/QC samples, and calibration standards.

8.4. Date acquisition requirements

Analytical data generated for this sampling round will be used in conjunction with historical data obtained during previous monitoring events. Previous data has been validated and used to formulate decisions at the Site, and therefore, can be used within the limits defined by the previous validation reports. The analytical data for this sampling round will be used to assess the degree to which natural attenuation of contaminants is occuring in ground water and to update the risk assessment that was performed for this Site.

9. Data validation and reconciliation with user requirements.

The analytical data will be validated by O'Brien & Gere Engineers, Inc. personnel experienced and familiar with the interpretation of analytical data and EPA Region I validation guidelines. A Tier II data validation will be performed in accordance with QA/QC criteria established in the analytical method, in this QAPP, and USEPA's Region I- *New England Data Validation Functional Guidelines for Evaluating Environmental Analyses, July 1996,* or the most recent up-date.

Data validators will be responsible for reviewing the laboratory reports with respect to Chain of Custody Records, sample tracking records, holding times, calibration, blank analyses, detection limits, laboratory QC analyses and control limits, corrective actions, compound identification and quantitation, instrument performance, and data package completeness. Data validators will review field records. Data validators will recalculate a minimum of 10% of laboratory sample calculations using raw data when verifying sample results. In addition, data validators will review raw data at a frequency of ten percent to verify that compound identification was performed correctly and transcription errors are not present. Complete data packages will be maintained on file and made available to EPA upon request.

Data quality will be evaluated using laboratory control limits. When possible, laboratory control limits will be evaluated against control limits established in the analytical methods. When method control limits are not available, professional judgement will be used by the data validators to verify that laboratory control limits will produce data of high quality. Any control limits outside of the acceptable range specified in the method shall be identified. Sample data will be qualified based on excursions from laboratory control limits. Data not within control limits require corrective action by the laboratory. Data validators will check corrective action reports and results of reanalysis if available. Corrective actions implemented by the laboratory will be referenced in the data validation report.

Minor deficiencies in the data generation process noted in the data validation will result in approximation of sample data. Approximation of

a data point indicates uncertainty in the reported concentration of the chemical but not its assigned identity. Major deficiencies noted in the data validation will result in the rejection of sample results. Rejected data would be considered unusable for quantitative or qualitative purposes. Data qualifiers may include the following:

U Indicates that the compound was analyzed for, but was not detected. The sample quantitation limit is presented and adjusted for dilution and percent moisture. This qualifier is also used to signify that the detection limit of an analyte was raised as a result of analytes detected in laboratory and/or field blank samples.

J Indicates that the detected sample result should be considered approximate. This qualifier is used when the data validation process identifies a deficiency in the data generation process. Additionally, for organic analyses this qualifier is used either when estimating a concentration for tentatively identified compounds or when the mass spectra data indicate the presence of a compound that meets identification criteria but, the sample result is less than the compound quantitation limit.

UJ Indicates that the detection limit for the analyte in this sample should be considered approximate. This qualifier is used when the data validation process identifies a deficiency in the data generation process.

R Indicates that the previously reported detection limit or sample result has been rejected due to a major deficiency in the data generation procedure. The data should not be used for qualitative or quantitative purposes.

If compounds are detected in blanks at concentrations greater than PQL, data will be qualified based on blank action level calculated at five times (ten times for common laboratory contaminants) the highest concentration detected in the associated blanks. Samples collected, prepared, or analyzed in conjunction with contaminated blanks, which contain analytes less than calculated action levels will be qualified as blank contaminants and flagged with the "U" qualifier. Qualification of sample results will be based on date of analysis for calibration blanks, date of sample preparation for method blanks, and date of sample collection for trip and equipment blank samples.

The following method specific QA/QC parameters will be evaluated during the data validation.

Volatile and Semivolatile Organic Analyses

- Holding Times and Sample Preservation
- GC/MS Tuning Criteria
- Initial and Continuing Calibration
- Blank Analysis
- Surrogate Recovery
- MS/MSD Analysis
- Field Duplicate Analysis
- LCS Analysis
- Internal Standards Performance
- Compound Identification and Quantitation
- System Performance
- Documentation Completeness
- Overall Assessment

Pesticide Analyses

- Holding Times and Sample Preservation
- Initial and Continuing Calibration
- Retention Time Window
- Degradation
- Blank Analysis
- Surrogate Recovery
- MS/MSD Analysis
- Field Duplicate Analysis
- LCS Analysis
- Compound Identification and Quantitation
- System Performance
- Documentation Completeness
- Overall Assessment

Metals and Wet Chemistry Analyses

- Holding Times and Sample Preservation
- Initial and Continuing Calibration
- Blank Analysis
- MS/MSD Analysis
- Field Duplicate Analysis
- LCS Analysis
- ICP Interference Check Sample and Serial Dilution Analysis (metals)
- Analyte Quantitation

- Instrument Performance
- Documentation Completeness
- Overall Assessment

Validated sample results from the Site will be reviewed by the Project Manager. Data usability with respect to the data quality objectives and data uses will be compared to the project requirements. The parameters that will be used to assess the precision, accuracy, representativeness, comparability, and completeness, are presented in Sections 3 and 10 of this QAPP. In the event that the completeness objective of 90% is not achieved due to major quality control deviations in the sample analysis process, samples will be recollected at the discretion of the Project Manager.

10. Internal quality control checks

10.1. Laboratory quality control checks

Tables 5A (volatiles and semivolatiles), 5B (metals), 5C (pesticides), 5D (wet chemistry), and 5E (nonhalogenated volatiles and dissolved hydrogen) are summaries of laboratory quality control checks, frequency of analysis, control limits, and corrective actions to be implemented if excursions are observed. A brief description of laboratory QA/QC analyses are in the following subsections.

GC/MS Tuning - Tuning and performance criteria are established to verify that mass resolution, identification, and to some degree, instrument sensitivity. These criteria are not sample specific; conformance is determined using standard materials. Therefore, these criteria should be met in all circumstances.

Calibration - Compliance requirements for satisfactory instrument calibration are established to verify that the instrument is capable of producing acceptable quantitative data. Initial calibration demonstrates that the instrument is capable of acceptable performance at the beginning of analysis, and continuing calibration checks document satisfactory maintenance and adjustment of the instrument on a day-to-day basis.

Interference check samples (ICSs) will be analyzed in accordance with method protocols. Potential interferences from calcium, magnesium, aluminum, and iron will be evaluated for arsenic, lead, selenium, and thallium analysis results. The ICSs will be analyzed and include reporting of As, Pb, Se and Tl in the presence of Ca, Mg, and Al at 500 mg/l and Fe at 200 mg/L.

Laboratory Blanks - Several types of blanks will be analyzed by the laboratory. Corrective action procedures will be implemented for blank analyses if target compounds are detected at concentrations greater than the PQL (or five times the PQL for acetone, 2-butanone, methylene

chloride, toluene, and phthalate compounds). The criteria for evaluation of blanks apply to any blank associated with a group of samples. If problems with a blank exist, data associated with the project must be carefully evaluated to determine whether or not there is a inherent variability in the data for the project, or if the problem is a isolated occurrence not affecting other data.

A reagent blank consists of laboratory distilled water and any reagents added to a sample during analysis only, or straight solvent. This type of sample is analyzed to evaluate whether contamination is occurring during the analysis of the sample. A reagent blank is usually analyzed following highly contaminated samples to assess the potential for cross-contamination during analysis.

A method blank is a water blank which undergoes the preparation procedures applied to a sample (i.e., extraction, digestion, clean-up). These samples are analyzed to examine whether sample preparation, clean-up, and analysis techniques result in sample contamination. The laboratory will prepare and analyze a method blank with each group of twenty samples of similar matrix that are extracted, digested, or analyzed at the same time (within same 12 hour period for volatile analysis).

Equipment and trip blanks will also be collected and submitted for laboratory analysis. Equipment and trip blanks will be handled in the same manner as environmental samples. Equipment and trip blanks are analyzed to assess contamination introduced during field sampling procedures and sample shipment, respectively.

Internal Standards Performance - Internal standards which are compounds not found in environmental samples will be spiked into blanks, samples, MS/MSDs, and LCSs at the time of analysis for volatiles and semivolatiles. Internal standards are used to quantitate results and correct for injection variability. Internal standards must meet retention time and performance criteria specified in the analytical method or the sample will be reanalyzed.

Surrogate Recovery - Accuracy and matrix biases for individual samples are monitored for organic analyses using surrogate additions. Environmental samples, blanks, and laboratory QC samples are spiked with surrogate compounds prior to sample preparation. The evaluation of the results of these surrogate spikes is not necessarily straightforward.

The sample itself may produce effects due to such factors as interferences and high concentrations of analytes. Since the effects of the sample matrix are frequently outside the control of the laboratory and may present relatively unique problems, the review and validation of data based on specific sample results is frequently subjective.

LCS Analyses - LCSs will be prepared or purchased from a certified manufacturer from a source independent form calibration standards. LCSs will be prepared and analyzed in the same manner as environmental samples. The laboratory will prepare and analyze a LCS with each group of twenty samples of similar matrix that are extracted, digested, or analyzed at the same time (within same 12 hour period for volatile analysis. Percent recoveries will be evaluated to assess the efficiency of preparation and analysis method independent of environmental sample matrix effects.

MS/MSD or MS/Laboratory Duplicate Samples - MS/MSD (volatile and semivolatile) or MS/laboratory duplicate (metals) analyses will be performed on environmental samples at a frequency of one per sample matrix and every twenty samples of similar matrix. Whenever possible MS/MSD/laboratory duplicate samples will be prepared and analyzed within the same batch as the environmental samples. MS/MSD and MS/ laboratory duplicate samples will be spiked at the laboratory with a subset of target analytes. MS/MSD/laboratory duplicate data are generated to determine long-term precision and accuracy of the analytical method with respect to sample matrices. Generally, these data alone are not used to evaluate the precision and accuracy for individual samples since data may reflect specific matrix effects only present within one sample.

TCL Compound Identification and Quantitation - The objective of the criteria for qualitative analysis is to minimize the number of erroneous identifications of compounds. An erroneous identification can either be a false positive (reporting a compound present when it is not) or a false negative (not reporting a compound that is present). The identification criteria can be applied much more easily in detecting false positive than false negatives. Negatives, or non-detected compounds, on the other hand represent an absence of data and are, therefore, much more difficult to assess.

The objective for quantitative requirements is to maximize the accuracy of data and sensitivity of the instrument. If possible, samples should be analyzed undiluted to maximize sensitivity. Samples must be reanalyzed

at the appropriate dilution when concentrations exceed the linear calibration range to maximize accuracy.

10.2. Control limits

Laboratory control limits are established separately for matrix type, for surrogate, LCS, MS/MSD, and MS/laboratory duplicate analyses. Laboratory control limits can be considered action limits. These limits are defined as ±three standard deviations of the mean and correspond to 99.7% confidence limits of a normal distribution curve. The laboratory will establish control limits for each analyte of concern using a minimum of twenty data points. Laboratory control limits are summarized in Table A-1 of the Laboratory QAP included as Attachment A.

Laboratory control limits presented in the Laboratory QAP are subject to change since limits are continually updated with the addition of new data points. During the validation, laboratory control limits will be reviewed against EPA method limits, where applicable, to verify that laboratory control limits used will produce data that meets data quality objectives.

The laboratory control limits used to assess data for this program will be summarized by the laboratory in the analytical report.

11. Performance and system audits

A performance audit is a review of the laboratory's operation or field sampling operations to verify that the necessary facilities, equipment, staff, and procedures are in place to generate acceptable data. O'Brien & Gere Engineers, Inc. routinely performs laboratory performance audits prior to initiation of work with the specified laboratory. Routine laboratory and field performance will be monitored through the analysis of equipment, trip, and laboratory blanks, spiked samples, laboratory control samples, and field duplicates. The results of these analyses will be documented in the data validation report along with any corrective actions that were required when QC limits specified in this document were exceeded.

At the discretion of the Project Manager, field and laboratory performance audits consisting of on-site performance evaluations will be performed once during the field program and during the laboratory analysis program. The audits will be performed by O'Brien & Gere's Quality Assurance Officer or designee. These audits will evaluate the adherence of the field and laboratory programs to the QA program outlined in the SAP and this QAPP. The protocols used to conduct the audits may be found in the following sections. Acceptance criteria used in determining the need for corrective action will be those criteria defined in this QAPP. Where acceptance criteria are not defined for laboratory procedures and analytical methods, the laboratory's standard operating procedure and QA Manual will be consulted. The results of the field and laboratory audits will be documented and submitted to the Project Manager. These reports and any corrective actions which were implemented as a result of the audits will be included in the project report.

The Quality Assurance Officer, in conjunction with the Laboratory Quality Control Officer, the analyst, analyst's supervisor, and Project Manager will formulate recommendations to correct any deficiencies in the analytical protocol or data observed during the validation process. These corrective measures will be in accord with the laboratory's Quality Assurance Program and this QAPP.

A system audit verifies the ability of the laboratory to correctly identify and quantitate compounds in blind check samples submitted by a regulatory agency. O'Brien & Gere Laboratories, Inc. participates in the following performance evaluation sample programs:

- EPA semiannual drinking water performance check samples (WS series)
- EPA semiannual wastewater performance check samples (WP series)

In addition, the laboratory participates in the following regulatory audit programs:

- New York State Department of Health for air emissions, potable water, wastewater, and hazardous waste.
- New York State Department of Environmental Conservation State Superfund.
- US EPA water pollution and water supply studies for Pennsylvania, New Jersey, Massachusetts, Connecticut, Rhode Island, and North Carolina
- US Air Force Center for Environmental Excellence
- US Army Corps of Engineers

The laboratory has successfully completed EPA's water supply series for 1998. The laboratory Quality Assurance Program included as Attachment A was developed in accordance with the requirements presented in "Interim Guidelines and Specifications for Preparing Quality Assurance Project Plans", EPA 1983 and ANSI/ASQC E-4 and draft NELAC standards.

12. Preventive maintenance

Preventive maintenance procedures will be carried out on field equipment by O'Brien & Gere Engineers, Inc., personnel in accordance with the procedures outlined by the manufacturer's equipment manuals. Maintenance activities involving field equipment will be recorded in the field notebook.

A preventive maintenance schedule is followed per manufacturers' requirements specified in service contracts, and a maintenance log is kept for each instrument. Instrument downtime will be kept to a minimum by keeping service contracts on essential instrumentation, establishing routine maintenance procedures and schedules, and maintaining an adequate inventory of critical spare parts and equipment. Routine maintenance is performed to keep laboratory instruments running under optimum conditions and to reduce instrument malfunction. Specific preventive maintenance programs outlining required maintenance procedures and their application frequencies are incorporated in laboratory SOPs for each methodology.

Minimally, field and laboratory instruments will undergo maintenance on an annual basis and when calibration, blank, or QC analyses indicate that maintenance is necessary to correct or improve system performance. Maintenance, whether performed by laboratory personnel or manufacturer, is documented as an entry in the appropriate log. Log entries include the reason for maintenance, maintenance performed, date, and initials of person in charge during maintenance.

The operating temperatures for refrigerators, coolers, ovens, water baths will be monitored by the laboratory daily. The analyst will record the following information in a bound log book: equipment ID, temperature reading, data and time of reading, and analysts initials.

13. Field and laboratory procedures used to assess data precision, accuracy, and completeness

13.1. Formulas

Accuracy- MS and reference standard analyses will be used to assess accuracy in terms of percent recovery.

%Recovery for MS analysis will be calculated as follows:

$$\% \text{ Recovery} = \frac{(\text{MS result} - \text{Sample Result})}{\text{Spiked Added}} \times 100$$

Recovery for reference standard analysis will be calculated as follows:

$$\% \text{ Recovery} = (\text{Actual Result})/(\text{True Value}) \times 100$$

Precision- Laboratory, MSD and field duplicate analyses will be used to assess precision in terms of percent relative difference (RPD). RPD for duplicate analyses will be calculated as follows:

$$\text{RPD} = \frac{\text{absolute value of (Original Sample Result - Duplicate Sample Result)}}{(\text{Original Sample Result} + \text{Duplicate Sample Result})/2} \times 100$$

Completeness- Data completeness will be calculated as follows for each individual method:

$$\%\text{Completeness} = \frac{\text{Number of Useable Data Points}}{\text{Total Number of Data Points}}$$

13.2. Control limits

Accuracy and precision data will be evaluated using laboratory control limits through the analysis of MS, MSD, and/or LCSs. Laboratory established control limits are summarized in Table A-1 of the Laboratory QAP included as Attachment A.. Control limits for field quality control sample analysis are summarized in Tables 5A through 5E.

13.3. Documentation

Laboratory QC data will be recorded in notebooks and printouts in the same format used for sample data. The analyst will be responsible to verify QC information against control limits. When an analysis of a QC sample (blank, spike, duplicate, LCS) is not within control limits, the analyst will immediately notify the laboratory supervisor and/or QA manager. The appropriate corrective action will then be implemented.

14. Corrective action

14.1. Response

Laboratory Corrective Actions

Laboratory corrective action procedures will be implemented based on unacceptable audit results or upon detection of "out of control" QC data. Corrective action procedures are generally handled by the analyst who routinely reviews the preparation or extraction procedure for errors, checks the instrument calibration, and quality control analyses. If the problem persists or if previously reported data are affected by a situation which require correction or in extreme cases resampling and reanalysis, or if the corrective action impacts a project budget or schedule, the action is referred to the Laboratory Project Supervisor. The Laboratory Project Supervisor will immediately notify O'Brien & Gere Engineers' Quality Assurance Officer of the discrepancies and QA/QC corrective actions necessary.

Samples associated with out-of-control data will be identified in the data validation report. An assessment of the data useability will be addressed by the laboratory and the data validator with reference to the corrective actions taken. The laboratory will make every effort to establish when QC failure resulted from matrix effects.

Field Corrective Actions

Field corrective actions will be implemented as required to meet the guidelines set forth in the SAP. Field equipment will be maintained and calibrated in accordance with manufacturer's requirements. If field equipment malfunctions, sample collection will cease until the equipment is repaired or replaced. Laboratory pre-preserved containers are shipped to the Site and are checked prior to initiation of field activities to verify that the correct type and number of containers are present to complete the sampling program. In addition, extra sampling containers will be ordered from the laboratory to minimize downtime due to accidental breakage during sample collection. Samples are to be shipped on ice with

appropriate sample labels, Chain of Custody Records and custody seals within twenty-four hours of collection. Sample shipments must arrive at the laboratory within forty-eight hours of collection. Sample cooler temperature and sample preservation will be checked by the laboratory upon receipt. If sample shipment, preservation, cooler temperatures, sample labels, custody seals, or Chain of Custody Records requirements are not met, the Project Manager will be notified and the affected samples will be recollected.

14.2. Re-establishment of control

When corrective action procedures are required, additional performance audits will be scheduled to verify the effectiveness of the corrective action. The Quality Assurance Officer, Laboratory Supervisor and/or the Quality Control Officer will continue to monitor activities relating to field and laboratory corrective action procedures to verify that the field and analytical systems are operating "in control". Laboratory monitoring may involve additional analyses of QC samples, analyst training or supervision, or the up-dating of control charts. Field monitoring may involve additional collection of field blanks or duplicates, and field training or supervision.

14.3. Documentation

Laboratory Corrective Actions
Laboratory corrective action procedures will be documented to include the following information:

- date of implementation
- cause of "out of control" event
- method of correction
- analyst responsible for implementation of corrective action

- QC data associated with re-establishment of control
- date of re-establishment of control
- samples requiring reanalyses due to "out of control" event.

Field Corrective Actions
Field corrective action procedures will be documented in the field notebook and will include the following information:

- date of implementation
- cause of "out of control" event
- method of correction
- field personnel responsible for implementation of corrective action
- samples requiring resampling.

Corrective action procedures, resulting from laboratory or field performance or system audits, will be summarized as part of the Laboratory Quality Control Summary.

15. Quality assurance reports to management

The deliverables associated with the tasks identified will contain separate QA sections in which data quality information collected during the task is summarized. Those reports will be the responsibility of the Project Manager and will include the Quality Assurance Officer data validation report which details the accuracy, precision, and completeness of the data and the results of the performance and system audits, and any corrective action taken during the project.

Table 1. *Sample container, preservation and holding time requirements.*

Analysis	Sample containers	Preservation	Holding times
TCL Volatiles	3-40ml glass vials with teflon backed silicon septum caps.	Cool to 4 °C pH <2 with HCL	Analyze within 14 days of collection.
TCL Semivolatile	2-one liter amber glass bottles with teflon lined caps.	Cool to 4 °C	Extract within 7 days of collection. Analyzed extracts within 40 days of extraction.
TCL Pesticides	2-one liter amber glass bottles with teflon lined caps.	Cool to 4 °C	Extract within 7 days of collection. Analyzed extracts within 40 days of extraction.
Nonhalogenated VOCs (ethylene, ethane, methane)	60ml serum bottle with 20-mm gray butyl rubber, teflon-faced septum and 20-mm aluminum crimp seal.	Cool to 4 °C Add several drops of 1:1 H_2SO_4	Analyze within 14 days of collection.
Metals	1-one liter plastic bottle.	Cool to 4 °C pH <2 with HNO_3	Analyze within 180 days of collection (except mercury). Analyze mercury within 28 days of collection.
Chloride	1-500 ml polyethylene bottle	Cool to 4 °C	Analyze within 28 days of collection.
Nitrite			Analyze within 48 hours of collection.
Sulfate			Analyze within 28 days of collection.
Alkalinity	1-250 ml glass bottle with no headspace	Cool to 4 °C	Analyze within 14 days of collection.
Sulfide	1-250 ml polyethylene or glass bottle	Cool to 4 °C 1ml zinc acetate and NaoH pH>9	Analyze within 7 days of collection.
Hydrogen	Refer to Appendix D of the Sampling Plan.	None	Analyze within 14 days of collection.
Nitrate	1-250ml polyethylene or glass bottle	Cool to 4 °C pH <2 with H_2S0_4	Analyze within 28 days of collection.
Dissolved Total Organic Carbon	1-250ml polyethylene or glass bottle	Cool to 4 °C pH <2 with H_2S0_4	Analyze within 28 days of collection.

Table 1. *Sample container, preservation and holding time requirements.*

Analysis	Sample containers	Preservation	Holding times
Field Tests(pH, temperature, dissolved oxygen, turbidity, iron (II)	Flow-through cells approximately 1000 ml	Not applicable	Analyze immediately.

Table 2. *Approximate number of field QA/QC samples.*

Parameter	Number of samples	Trip blanks[2]	Equipment blanks[3]	Field duplicates[4]	MSs[5]	MSDs or duplicates[6]	Total analyses
Ground Water							
Field tests [(1)]	38	NA	NA	NA	NA	NA	50
TCL Volatiles	38	5	2	2	2	2	51
TCL Semivolatiles	38	NA	2	2	2	2	46
TAL Metals	38	NA	2	2	2	2	54
Wet chemistry [(7)]	18	NA	1	1	1	1	22
Nonhalogenated Volatiles	18	NA	2	2	NA	NA	22
Hydrogen	18	NA	NA	NA	NA	NA	18
Natural Attenuation Field Parameters [(8)]	18	NA	1	1	1	1	22
Surface Water							
Field tests [(1)]	6	NA	NA	NA	NA	NA	6
TCL Volatiles	6	1	1	1	1	1	11
TCL Semivolatiles	6	NA	1	1	1	1	10
TCL Pesticides	6	NA	1	1	1	1	10
TAL Metals	6	NA	1	1	1	1	10
Seep Sample Collection							
Field tests [(1)]	5	NA	NA	NA	NA	NA	5
TCL Volatiles	5	1	1	1	1	1	10
TCL Semivolatiles	5	NA	1	1	1	1	9
TCL Pesticides	5	NA	1	1	1	1	9
TAL Metals	5	NA	1	1	1	1	9

Table 2. *Approximate number of field QA/QC samples.*

Parameter	Number of samples	Trip blanks[2]	Equipment blanks[3]	Field duplicates[4]	MSs[5]	MSDs or duplicates[6]	Total analyses

Notes:
[1] Field measurements will be taken for pH, temperature, conductivity, and dissolved oxygen. Additionally, for ground water samples, field measurements also include redox and turbidity.
[2] Trip blanks will be shipped with coolers containing samples for volatile organic analyses.
[3] Equipment blanks will be collected at a frequency of 1 per 20 samples collected, per medium during subsequent sampling events.
[4] Field duplicates will be collected at a frequency of 1 per 20 samples collected, per medium during subsequent sampling events.
[5] Matrix spikes will be collected at a frequency of 1 per 20 samples collected, per medium during subsequent sampling events.
[6] MSDs or duplicates will be collected at a frequency of 1 per 20 samples collected, per medium during subsequent sampling events.
[7] Wet chemistry parameters include sulfide, chloride, alkalinity, sulfate, nitrate, and pH.
[8] Natural attenuation field parameters include dissolved oxygen, iron(II), redox, pH, temperature, specific conductance, and turbidity.

Table 3. *Analytical methods.*

Parameter	Analytical method
TCL volatiles	SW5030/SW8260
TCL semivolatiles	SW3510 or SW3520/SW8270
TCL pesticides	SW3510 or SW3520/SW8081
TAL metals (except mercury)	SW3005/SW6010
Mercury	SW7470
Nonhalogenated volatiles	Kampbel, Don H., "Analysis of Dissolved Methane, Ethane, and Ethylene in Ground Water by a Standard Gas Chromatographic Technique" (Journal of Chromatographic Science, Vol. 36, May 1998).
Hydrogen	Method AM19GAx (included as Attachment B)
Sulfide	EPA 376.1
Alkalinity	EPA 310.1
Sulfate	EPA 375.4
Chloride	EPA 325.2
Dissolved Total Organic Carbon	EPA 415.1
Nitrate	EPA 353.2
Nitrite	EPA 353.2
Field tests (pH, temperature, conductivity, redox potential, iron(II), turbidity, and dissolved oxygen)	Per Sampling Plan
SW - Test Methods for Evaluating Solid Wastes, Physical and Chemical Methods, Final Update (USEPA, December 1996). EPA - Methods for Chemical Analysis of Water and Wastes, EPA 600-4-70-020 (USEPA, 1983). AM19GAx - Analysis of Dissolved Gases From Water Following "Bubble Strip" Sampling at the Wellsite (Microseeps)	

Table 4. *Laboratory PQLs.*

Parameter	PQL (ug/L)
TCL Volatiles	
Chloromethane	1
Vinyl chloride	1
Bromomethane	1
Chloroethane	1
Acetone	10
1,1-Dichloroethene	0.5
Methylene chloride	2
Carbon disulfide	0.5
trans-1,2-Dichloroethene	0.5
1,1-Dichloroethane	0.5
2-Butanone	10
cis-1,2-Dichloroethene	0.5
Chloroform	0.5
1,1,1-Trichloroethane	0.5
Carbon tetrachloride	0.5
1,2-Dichloroethane	0.5
Benzene	0.5
Trichloroethene	0.5
1,2-Dichloropropane	0.5
Bromodichloromethane	0.5
4-Methyl-2-Pentanone	5
cis-1,3-Dichloropropene	0.5
Toluene	0.5
trans-1,3-Dichloropropene	0.5
1,1,2-Trichloroethane	0.5
Dibromochloromethane	0.5
2-Hexanone	5
Tetrachloroethene	0.5
Chlorobenzene	0.5

Table 4. *Laboratory PQLs.*

Parameter	PQL (ug/L)
Ethylbenzene	0.5
Xylene (total)	0.5
Styrene	0.5
Bromoform	0.5
1,1,2,2-Tetrachloroethane	0.5
TCLSemivolatiles	
Phenol	10
Bis(2-chloroethyl)ether	10
2-Chlorophenol	10
1,3-Dichlorobenzene	10
1,4-Dichlorobenzene	10
1,2-Dichlorobenzene	10
2-Methylphenol	10
Bis(2-chloroisopropyl)ether	10
4-Methylphenol	10
N-Nitroso-di-n-propylamine	10
Hexachloroethane	10
Nitrobenzene	10
Isophorone	10
2-Nitrophenol	10
2,4-Dimethylphenol	10
Carbazole	10
Bis(2-chloroethoxy)methane	10
2,4-Dichlorophenol	10
1,2,4-Trichlorobenzene	10
Naphthalene	10
4-Chloroaniline	10
Hexachlorobutadiene	9.3
4-Chloro-3-methylphenol	10
2-Methylnaphthalene	10
Hexachlorocyclopentadiene	5.2

Table 4. *Laboratory PQLs.*

Parameter	PQL (ug/L)
2,4,6-Trichlorophenol	10
2,4,5-Trichlorophenol	50
2-Chloronaphthalene	10
2-Nitroaniline	50
Dimethylphthalate	10
Acenaphthylene	10
2,6-Dinitrotoluene	10
3-Nitroaniline	50
Acenaphthene	10
2,4-Dinitrophenol	50
4-Nitrophenol	50
Dibenzofuran	10
2,4-Dinitrotoluene	10
Diethylphthalate	10
4-Chlorophenyl-phenylether	10
Fluorene	10
4-Nitroaniline	50
4,6-Dinitro-2-methylphenol	50
N-Nitrosodiphenylamine	10
4-Bromophenyl-phenylether	10
Hexachlorobenzene	10
Pentachlorophenol	25
Phenanthrene	10
Anthracene	10
Di-n-butylphthalate	10
Fluoranthene	10
Pyrene	10
Butylbenzylphthalate	10
3,3-Dichlorobenzidine	20
Benzo(a)anthracene	10

Table 4. *Laboratory PQLs.*

Parameter	PQL (ug/L)
Chrysene	10
Bis(2-ethylhexyl)phthalate	10
Di-n-octylphthalate	10
Benzo(b)fluoranthene	10
Benzo(k)fluoranthene	10
Benzo(a)pyrene	10
Indeno(1,2,3-cd)pyrene	10
Dibenzo(a,h)anthracene	10
Benzo(g,h,i)perylene	10
TCL Pesticides	
alpha-BHC	0.05
gamma-BHC	0.05
beta-BHC	0.05
Heptachlor	0.05
delta-BHC	0.05
Aldrin	0.05
Heptachlor epoxide	0.05
Endosulfan I	0.1
4,4'-DDE	0.1
Dieldrin	0.1
Endrin	0.1
4,4'-DDD	0.1
Endosulfan II	0.1
4,4'-DDT	0.1
Endosulfan sulfate	0.1
Endrin aldehyde	0.1
Methoxychlor	0.5
Chlordane	0.5
Toxaphene	0.5

Table 4. *Laboratory PQLs.*

Parameter	PQL (ug/L)
Nonhalogenated Volatiles	
Ethane	4
Ethylene	4
Methane	2
Dissolved Hydrogen	0.04
TAL Metals	
Aluminum	100
Antimony	60
Arsenic	5
Barium	100
Beryllium	5
Cadmium	1
Calcium	210
Chromium	10
Cobalt	50
Copper	10
Iron	50
Lead	3.0
Magnesium	1000
Manganese	50
Mercury	0.2
Nickel	50
Potassium	5000
Selenium	5
Silver	3
Sodium	1000
Thallium	10
Vanadium	50
Zinc	10

Table 4. *Laboratory PQLs.*

Parameter	PQL (ug/L)
Wet chemistry	
Sulfide	0.2 mg/L
Alkalinity	10 mg/L
Chloride	1 mg/L
Dissolved Total Organic Carbon	1 mg/L
Nitrite	0.05 mg/L
Nitrate	0.05 mg/L

Table 5A. *Quality control requirements and corrective actions, GC/MS Volatiles (VOCs) and Semivolatiles (SVOCs).*

Audit	Frequency	Control Limits	Laboratory Corrective Action
Holding Times	Samples must be extracted and analyzed within holding time.	VOCs: Analyze within 14 days. SVOCs: Extract within 7 days for aqueous samples. Analyze extracts within 40 days.	If holding times are exceeded for initial or any reanalyses required due to QC excursions, notify the Quality Assurance Officer since resampling may be required.
MS Tuning	Prior to sample analysis and every 12 hours.	VOCs: BFB or DFTPP key ions and abundance specified in the method.	1. Identify and correct problem. 2. Re-tune the mass spectrometer; samples must not be analyzed until tuning criteria are met.
Initial Calibration	Prior to start up and when criteria are exceeded for continuing calibration.	Five concentrations, one calibration standard must be at concentration less than or equal to the PQL. If RSD < 15% the average RRF may be used for quantitation. If RSD > 15% a first or second order calibration curve with a correlation coefficient > 0.990 must be used for quantitation. RRFs > 0.050 for all target compounds with the exception of acetone, 2-butanone, and 2-hexanone which must have RRFs > 0.010.	1. Identify and correct problem. 2. Recalibrate instrument; samples must not be analyzed until initial calibration criteria are met.
Continuing Calibration	Daily and every 12 hours; analyze immediately following tune.	Concentration at mid-point of calibration curve. RRF > 0.050 for all target compounds with the exception of acetone and 2-butanone which must have RRFs > 0.010. %Ds < 20% for Calibration Check Compounds (CCCs) specified in the methods.	1. Reanalyze. 2. If criteria are still not met, identify and correct problem, recalibrate; samples cannot be analyzed until criteria are met.

Table 5A. *Quality control requirements and corrective actions, GC/MS Volatiles (VOCs) and Semivolatiles (SVOCs).*

Audit	Frequency	Control Limits	Laboratory Corrective Action
Method Blank Analysis	1 per 20 samples of similar matrix extracted at the same time.	Compound concentrations must be < PQL (< 5x for acetone, methylene chloride, and phthalate compounds).	1. Reanalyze. 2. If limits are still exceeded, re-extract and reanalyze method blank and associated samples if holding times have not elapsed. 3. If holding times have elapsed, contact Qualify Assurance Officer since resampling may be required.
LCS Analysis	1 per 20 samples of similar matrix extracted at the same time. LCSs must be spiked with target compounds at concentration specified in the method.	Percent recoveries must be within laboratory control limits for 90% of the target compounds. If the percent recovery is above laboratory control limits (biased high) and the affected compound is not detected in the associated samples, corrective action is not required; document in case narrative.	1. If percent recovery is below laboratory control limits or < 10%, reanalyze the LCS one additional time. If recoveries remain below limits and other QC criteria (surrogate, internal standards, calibration) have been met, notify Qualify Assurance Officer and document in case narrative report. 2. If recoveries are below laboratory control limits and additional QC excursions are observed, locate and correct problem, recalibrate instrument and re-extract and/or re-analyze samples since last satisfactory LCS. If samples requiring re-extraction or reanalysis are over holding time requirements, notify Qualify Assurance Officer prior to proceeding since resampling may be required.
MS/MSD Analysis	1 per matrix type and every 20 samples of similar matrix. MS/MSDs must be spiked with subset of target compounds at concentration specified in the method.	Recovery and RPD within laboratory control limits for 90% of target compounds.	1. If LCS criteria are met, document in case narrative; no additional corrective action required. 2. If LCS criteria are exceeded also, examine other QC data for source of problem; ie surrogate recoveries for extraction efficiency and calibration data for instrument performance issues. 3. Take corrective action as required, re-extract or reanalyze samples and associated MS/MSD and LCSs as required.

Table 5A. *Quality control requirements and corrective actions, GC/MS Volatiles (VOCs) and Semivolatiles (SVOCs).*

Audit	Frequency	Control Limits	Laboratory Corrective Action
Surrogate Spike	Samples, blanks, MS/MSDs, and LCSs must be spiked with method specified surrogate compounds.	Recovery within laboratory control limits. VOC: Corrective action and qualification of data are required if only one surrogate is outside of control limits. SVOC: Corrective action and qualification of data are not required if only one per fraction has recovery outside control limits if the percent recovery is > 10%. In addition, corrective actions are not required if surrogate recoveries are biased high and target compounds are not detected in the samples.	1. Reanalyze. 2. If recovery is still outside control limits but > 10%, document in case narrative report. 3. If recovery is < 10% with reanalysis, re-extract and reanalyze the sample if the holding time has not elapsed. If holding time has elapsed, notify Qualify Assurance Officer prior to proceeding since resampling may be required.
Internal Standards	Samples, blanks, MS/MSDs, and LCSs must contain method specified internal standards which are spiked prior to sample injection.	Percent recovery for internal areas must be within 50% to 200% of continuing calibration standard area. Retention times must be within 0.50 minutes of continuing calibration standard.	1. Reanalyze. 2. If reanalysis does not solve problem and other QC criteria were met, submit both runs and discuss in narrative report.
Identification	Samples, blanks, and QC data.	Retention times must be within 0.06 RT units of the RRT of the standard component. Ions present in the standard mass spectrum at relative intensity of > 10% must be present in the sample spectrum. The relative intensities of ions must agree within ± 30% between standard and sample spectrum.	1. If identification criteria are not all met, but in the judgement of the GC/MS operator the target compound is present, proceed with quantitation and document reasoning in the data package.

Table 5A. *Quality control requirements and corrective actions, GC/MS Volatiles (VOCs) and Semivolatiles (SVOCs).*

Audit	Frequency	Control Limits	Laboratory Corrective Action
Quantitation	Samples, blanks, and QC data.	Internal standard method using internal standard and primary characteristic ions specified in methods. Verify concentration is within linear calibration range.	1. If concentration is above linear calibration range, dilute sample and reanalyze. Dilution should result in concentration in the upper calibration range of the instrument. 2. Perform appropriate cleanup procedures as necessary to minimize sample matrix effects.
Equipment Blank Analysis	1 per sampling equipment and after every 20 samples.	Compounds concentrations must be < PQL.	1. Investigate problem; reanalyze to verify laboratory cross contamination is not a factor. 2. Notify Qualify Assurance Officer since resampling may be necessary.
Field Duplicate Analysis	1 per matrix type and every 20 samples of similar matrix.	RPD $\leq$50% for results > 5xPQL. For Results < 5xPQL must agree within $\pm$2xPQL.	No corrective action required of the laboratory since the laboratory will not know the identity of the field duplicate samples. If these criteria are not met, sample results will be evaluated on a case by case basis during the validation process.

TABLE 5B. *Quality control requirements and corrective actions, GC pesticide analyses.*

Audit	Frequency	Control Limits	Laboratory Corrective Action
Holding Times	Samples must be extracted and analyzed within holding time.	Pesticide: Extract within 7 days for aqueous samples. Analyze extracts within 40 days.	If holding times are exceeded for initial or any reanalyses required due to QC excursions, notify Qualify Assurance Officer since resampling may be required.
Initial Calibration	Prior to start up and when criteria are exceeded for continuing calibration.	Minimally five concentrations, one calibration standard must be at concentration less than or equal to the PQL. If RSD <20% the average RRF may be used for quantitation. If RSD >20% a first or second order calibration curve with a correlation coefficient >0.990 must be used for quantitation.	1. Identify and correct problem. 2. Recalibrate instrument; samples must not be analyzed until initial calibration criteria are met.
Continuing Calibration	Calibration standards must contain target compounds at mid-range concentration. Pesticide :Minimally analyze calibration standards daily and every 12 hours. It is recommended that continuing calibration standards be analyzed more frequently (every ten samples) when instrument performance is impacted by sample matrix effects.	%D <15%.	1. Reanalyze. 2. If criteria are still not met, identify and correct problem, recalibrate; reanalyze samples back to last compliant calibration standard. Samples must be bracketed by compliant calibration standards.
Retention Time Windows	Retention time windows must be established in accordance with EPA method 8000.	Compounds must be within established retention time windows for the succeeding calibration standards.	1. Reanalyze. 2. If criteria are still not met, identify and correct problem, recalibrate; reanalyze samples back to last compliant calibration standard.

TABLE 5B. *Quality control requirements and corrective actions, GC pesticide analyses.*

Audit	Frequency	Control Limits	Laboratory Corrective Action
Method Blank Analysis	1 per 20 samples of similar matrix extracted at the same time.	Compound concentrations must be < PQL.	1. Reanalyze. 2. If limits are still exceeded, re-extract and reanalyze method blank and associated samples if holding times have not elapsed. 3. If holding times have elapsed, contact Qualify Assurance Officer since resampling may be required.
LCS Analysis	1 per 20 samples of similar matrix extracted at the same time.	Percent recoveries must be within laboratory control limits for 90% of the target compounds. If the percent recovery is above laboratory control limits (biased high) and the affected compound is not detected in the associated samples, corrective action is not required; document in case narrative.	1. If percent recovery is below laboratory control limits or < 10%, reanalyze the LCS one additional time. If recoveries remain below limits and other QC criteria (surrogate, internal standards, calibration) have been met, notify Project QA) and document in case narrative report. 2. If recoveries are below laboratory control limits and additional QC excursions are observed, locate and correct problem, recalibrate instrument and re-extract and/or re-analyze samples since last satisfactory LCS. If samples requiring re-extraction or reanalysis over holding time requirements, notify Qualify Assurance Officer prior to proceeding since resampling may be required.
MS/MSD Analysis	1 per matrix type and every 20 samples of similar matrix. MS/MSDs must be spiked with subset of target compounds at concentrations specified in the method.	Recovery and RPD within laboratory control limits for 90% of target compounds.	1. If LCS criteria are met, document in case narrative; no additional corrective action required. 2. If LCS criteria are exceeded also, examine other QC data for source of problem; ie surrogate recoveries for extraction efficiency and calibration data for instrument performance issues. 3. Take corrective action as required, re-extract or reanalyze samples and associated MS/MSD and LCSs as required.

TABLE 5B. *Quality control requirements and corrective actions, GC pesticide analyses.*

Audit	Frequency	Control Limits	Laboratory Corrective Action
Surrogate Spike	Samples, blanks, MS/MSDs, and LCSs must be spiked with method specified surrogate compounds.	Recovery within laboratory control limits. Corrective action is not required: a. If one of the two required Pesticide surrogates has recovery outside of control limits if the recovery is > 10%. b. If surrogate recoveries are biased high and target compounds are not detected in the samples.	1. Reanalyze. 2. If recovery is still outside control limits but > 10%, document in case narrative report. 3. If recovery is < 10% with reanalysis, re-extract and reanalyze the sample if the holding time has not elapsed. If holding time has elapsed, notify Qualify Assurance Officer prior to proceeding since resampling may be required.
Identification	Samples, blanks, and QC data.	Retention times must be within established retention time windows. Confirmation analysis is required for pesticides.	1. Investigate problem; reanalyze calibration standards to check for retention time shift. 2. If retention time shift is due to sample matrix, perform confirmation analysis using dissimilar GC column or GC/MS.
Quantitation	Samples, blanks, and QC data.	Internal and external standard method. Verify concentration is within linear calibration range.	1. If concentration is above linear calibration range, dilute sample and reanalyze. Dilution should result in concentration in the upper calibration range of the instrument. 2. Perform appropriate cleanup procedures as necessary to minimize sample matrix effects.
Equipment Blank Analysis	1 per sampling equipment and after every 20 samples.	Compounds concentrations must be < PQL.	1. Investigate problem; reanalyze to verify laboratory cross contamination is not a factor. 2. Notify Qualify Assurance Officer since resampling may be necessary.

TABLE 5B. *Quality control requirements and corrective actions, GC pesticide analyses.*

Audit	Frequency	Control Limits	Laboratory Corrective Action
Field Duplicate Analysis	1 per matrix type and every 20 samples of similar matrix.	RPD $\leq$50% for results >5xPQL. For Results <5xPQL must agree within $\pm$2xPQL.	No corrective action required of the laboratory since the laboratory will not know the identity of the field duplicate samples. If these criteria are not met, sample results will be evaluated on a case by case basis during the validation process.

Table 5C *Quality control requirements, metals*

Audit	Frequency	Control Limits	Corrective Action
Holding Times	Samples must be digested and analyzed within holding times.	Metals: analyze within 180 days. Mercury: analyze within 28 days.	If holding times are exceeded for initial or any reanalyses required due to QC excursions, notify Qualify Assurance Officer since resampling may be required.
Initial Calibration	Daily, prior to start up and when criteria are exceeded for continuing calibration.	Two standards for ICP and five standards for mercury analyses. Correlation coefficient for first or second order curve for furnace and mercury analyses must be $\geq$0.995.	1. Identify and correct problem. 2. Recalibrate; samples cannot be analyzed until criteria are met.
Continuing Calibration	Calibration check sample and calibration blank must be analyzed following initial calibration, every ten samples, and at the end of the analysis sequence.	Calibration Check: Percent recovery must be within the following: ICP metals: 90% to 110% Mercury: 80% to 120% Calibration blank: contaminants must be <PQL.	1. Reanalyze. 2. If criteria are still not met, identify and correct problem, recalibrate. Reanalyze samples back to last compliant continuing calibration standard or blank.
ICP Quality Control	Interference Check Sample must be analyzed at the beginning and end of sequence or a minimum of twice per 8 hours. Serial dilution analysis - 1 per 20 samples of similar matrix must be analyzed at four or five fold dilution.	Interference check sample: Percent recoveries must be within 80% to 120%. Serial dilution analysis: %D < 10% for concentrations > 50x the PQL.	1. Reanalyze. 2. If criteria are not with reanalysis for the interference check sample, stop analysis, locate and correct problem, recalibrate instrument, and reanalyze samples. 3. If criteria are not with reanalysis for serial dilution, document in narrative report.
Method Blank Analysis	1 per 20 samples of similar matrix digested at the same time.	Analytes concentrations must be <PQL.	1. Reanalyze. 2. If limits are still exceeded, re-digest and reanalyze method blank and all associated samples.

Table 5C *Quality control requirements, metals*

Audit	Frequency	Control Limits	Corrective Action
LCS Analysis	1 per 20 samples of similar matrix digested at the same time. LCSs must be spiked with target analytes.	Recovery within laboratory control limits.	1. Reanalyze. 2. If recovery is still outside limits, re-digest and reanalyze LCS and all associated samples. If holding time requirement has elapsed, contact Qualify Assurance Officer since resampling may be required.
MS/MSD Analysis	1 per matrix type and every 20 samples of similar matrix. MS/MSDs must be spiked with target analytes.	Recovery and RPD within laboratory control limits. If the sample concentration is >4x spiking concentration, recovery data are not assessed and corrective actions are not required.	1. Perform post-spike analysis.
Equipment Blank Analysis	1 per sampling event and equipment.	Analyte concentrations must be <PQL.	1. Investigate problem 2. Contact Qualify Assurance Officer since resampling may be necessary.
Field Duplicate Analysis	1 per matrix type and every 10 samples of similar matrix	RPD $\leq$50% for results >5xPQL. For Results <5xPQL must agree within $\pm$2xPQL.	No corrective action required of the laboratory since the laboratory will not know the identity of the field duplicate samples. If these criteria are not met, sample results will be evaluated on a case by case basis during the validation process.

Table 5D. *Quality control requirements, wet chemistry analyses.*

Audit	Frequency	Control Limits	Corrective Action
Holding Times	Samples must be digested and analyzed within holding times.	Nitrate, Total Organic Carbon (TOC), Chloride and Sulfate: analyze within 28 days. Nitrite: analyze within 48 hours. Alkalinity: analyze within 14 days. Sulfide: analyze within 7 days.	If holding times are exceeded for initial or any reanalyses required due to QC excursions, notify Qualify Assurance Officer since resampling may be required.
Initial Calibration	Nitrate, Nitrite, TOC, Sulfate, and Chloride: Prior to sample analysis and when criteria are exceeded for continuing calibration. Alkalinity and Sulfide: standardize titrant monthly and verify normality of titrant prior to sample analysis with reference standard or LCS.	Nitrate, Nitrite, Sulfate, and Chloride: Five point calibration, one of the calibration standards must be at concentration equal to the PQL. Correlation coefficient for first or second order curve must be ≥ 0.995. TOC: 2 point calibration in accordance with manufacturer's requirements. Alkalinity and Chloride: standard check used to verify normality of titrant must be with 5% of true value.	1. Identify and correct problem. 2. Recalibrate; samples cannot be analyzed until calibration criteria are met.
Continuing Calibration	Nitrate, Nitrite, TOC, Sulfate, and Chloride: midpoint calibration standard is analyzed every ten samples.	Percent recovery within 85% to 115%.	1. Reanalyze. 2. If criteria are still not met, identify and correct problem, recalibrate; reanalyze samples back to last compliant reference standard or continuing calibration standard.
Method Blank Analysis	1 per 20 samples of similar matrix analyzed at the same time.	Analytes < PQL.	1. Reanalyze. 2. If limits are still exceeded, clean instrument and recalibrate analytical system; reanalyze method blank and associated samples.

Table 5D. *Quality control requirements, wet chemistry analyses.*

Audit	Frequency	Control Limits	Corrective Action
Reference standard or LCS Analysis	A reference standard or LCS must be analyzed following initial calibration and every 20 samples of similar matrix analyzed at the same time.	Recovery within laboratory control limits.	1. Prepare new reference standard and reanalyze. 2. If recovery is still outside limits, stop analysis, locate and correct problem, recalibrate instrument and reanalyze samples since last satisfactory reference standard.
MS/MSD (or Lab Duplicate Analysis for alkalinity)	1 per matrix type and every 20 samples of similar matrix.	Recovery and/or RPD within laboratory control limits.	1. Reanalyze. 2. If recovery or RPD is still outside limits, document in case narrative.
Equipment Blank Analysis	1 per sampling event and equipment.	Analytes < PQL.	1. Reanalyze. 2. If analytes are still detected above PQL, contact Qualify Assurance Officer since resampling may be necessary.
Field Duplicate Analysis	1 per matrix type and every 20 samples of similar matrix.	Aqueous: RPD $\leq$50% for results >5xPQL. For Results <5xPQL must agree within $\pm$2xPQL.	No corrective action required of the laboratory since the laboratory will not know the identity of the field duplicate samples. If these criteria are not met, sample results will be evaluated on a case by case basis during the validation process.

TABLE 5E. *Quality control requirements and corrective actions, GC non-halogenated volatile and dissolved hydrogen analyses.*

Audit	Frequency	Control Limits	Laboratory Corrective Action
Holding Times	Samples must be analyzed within holding time.	Analyze within 14 days.	If holding times are exceeded for initial or any reanalyses required due to QC excursions, notify Qualify Assurance Officer since resampling may be required.
Initial Calibration	Prior to start up and when criteria are exceeded for continuing calibration.	Nonhalogenated VOCs: Minimally three standards for ethylene and ethane and six for methane at concentrations specified in the method. Dissolved Hydrogen: Minimally three standards with one standard near but above the reporting limit. If RSD <20% the average RRF may be used for quantitation. If RSD >20% a first or second order calibration curve with a correlation coefficient >0.990 must be used for quantitation.	1. Identify and correct problem. 2. Recalibrate instrument; samples must not be analyzed until initial calibration criteria are met.
Continuing Calibration	Calibration standards must contain target compounds at mid-range concentration. Analyze at frequency of 10%.	%D <20%.	1. Reanalyze. 2. If criteria are still not met, identify and correct problem, recalibrate; reanalyze samples back to last compliant calibration standard. Samples must be bracketed by compliant calibration standards.
Retention Time Windows	Retention time windows must be established in accordance with EPA method 8000.	Compounds must be within established retention time windows for the succeeding calibration standards.	1. Reanalyze. 2. If criteria are still not met, identify and correct problem, recalibrate; reanalyze samples back to last compliant calibration standard.

TABLE 5E. *Quality control requirements and corrective actions, GC non-halogenated volatile and dissolved hydrogen analyses.*

Audit	Frequency	Control Limits	Laboratory Corrective Action
Method Blank Analysis	1 per 20 samples of similar matrix extracted at the same time.	Compound concentrations must be < PQL.	1. Reanalyze. 2. If limits are still exceeded, re-extract and reanalyze method blank and associated samples if holding times have not elapsed. 3. If holding times have elapsed, contact Qualify Assurance Officer since resampling may be required.
Identification	Samples, blanks, and QC data.	Retention times must be within established retention time windows.	1. Investigate problem; reanalyze calibration standards to check for retention time shift.
Quantitation	Samples, blanks, and QC data.	Externalstandard method.	None
Equipment Blank Analysis	1 per sampling equipment and after every 10 samples.	Compounds concentrations must be < PQL.	1. Investigate problem; reanalyze to verify laboratory cross contamination is not a factor. 2. Notify Qualify Assurance Officer since resampling may be necessary.
Field Duplicate Analysis	1 per matrix type and every 10 samples of similar matrix.	RPD $\leq$50% for results > 5xPQL. For Results < 5xPQL must agree within $\pm$2xPQL.	No corrective action required of the laboratory since the laboratory will not know the identity of the field duplicate samples. If these criteria are not met, sample results will be evaluated on a case by case basis during the validation process.

Table 6. *Field equipment quality control procedures.*

Measurement/Model	Units	Frequency of Calibration	Acceptance Criteria	Corrective Action
pH YSI Model 3500 or equivalent	Standard Units	Beginning of each sampling day with three calibration standards . pH = 7.0 . pH = 10 . pH = 4	±0.2 units	Step 1. Recalibrate. Step 2. If instrument cannot be recalibrated, repair or replace instrument or probe in accordance with manufacturer's recommendations. Step 3. Document corrective action taken.
Redox YSI Model 3500 or equivalent	Millivolts	Beginning of each sampling day	Within 10%	Step 1. Calibrate or check meter response using Zobell solution Step 2. If meter does not respond, repair or replace instrument or probe in accordance with manufacturer's recommendations Step 3. Document corrective action taken.
Temperature/ YSI Model 3500 or equivalent	Degrees Centigrade	Check once/year against NIST traceable thermometer	Within ±0.2 °C	Step 1. Recheck. Step 2. If instrument cannot be recalibrated replace instrument or probe. Step 3. Document corrective action taken.
Dissolved Oxygen YSI Model 95 or equivalent	mg/L	Beginning of each sampling day . saturated air . 0.0 mg/l standard	Within ±0.2 mg/L	Step 1. Recalibrate. Step 2. If instrument cannot be recalibrated, repair or replace instrument or probe. Step 3.Document corrective action taken.

Table 6. *Field equipment quality control procedures.*

Measurement/Model	Units	Frequency of Calibration	Acceptance Criteria	Corrective Action
Specific Conductance/ YSI Model 3500 or equivalent	Micromhos/ centimeter	Check response each sampling day with calibration standard . 2 standards	Within 10%	Step 1. Recheck. Step 2. If instrument cannot be recalibrated, repair or replace instrument or probe. Step 3. Document corrective action taken.
Iron (II) Chemetrics or equivalent field test kit	mg/L	Beginning each day . Prepared Fe(II) standard	±10%	Contact test kit manufacturer.
Turbidity Meter/ HF Scientific or equivalent	NTU	Beginning of each sampling day . zero standard . 5-20 NTU standard	±5.0 %	Step 1. Recalibrate. Step 2. If instrument cannot be recalibrated, repair or replace instrument or probe. Step 3. Document corrective action taken.

O'Brien & Gere Laboratories, Inc.

5000 Brittonfield Parkway
East Syracuse, New York 13057
(315) 437-0200

Chain of Custody

Client:

Project:

Sampled by:

Client Contact: Phone #

Analysis/Method

Sample Description

Sample Location	Date Collected	Time Collected	Sample Matrix	Comp. or Grab	No. of Containers								Comments

Relinquished by:	Date:	Time:	Received by:	Date:	Time:
Relinquished by:	Date:	Time:	Received by:	Date:	Time:
Relinquished by:	Date:	Time:	Received by Lab:	Date:	Time:
Shipment Method:			Airbill Number:		

Turnaround Time Required:
Routine_____
Rush (Specify)_____

Comments:

Cooler Temperature:_____

FIGURE 1

Original-Laboratory Copy-Client

FIGURE 2

Sample Label

Sample Description:_____

_____ **Initials:**_____

Sample Date:_____ **Sample Time:**_____

Project No.:_____ **Lab No.:**_____

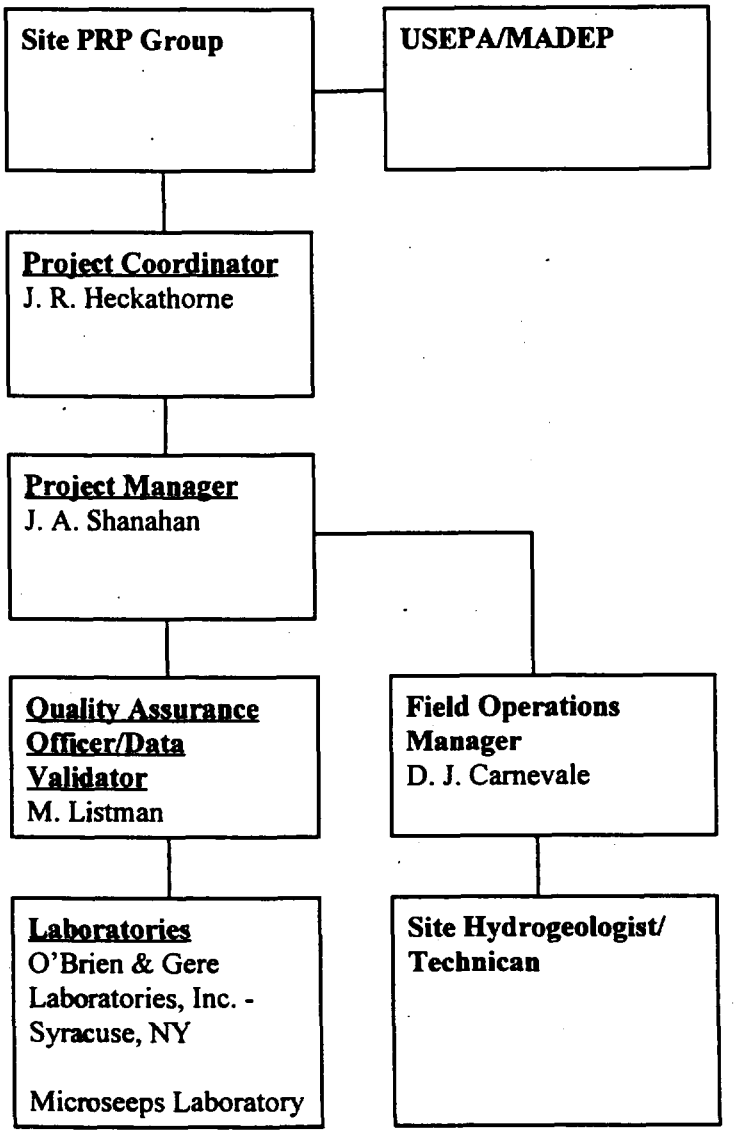
Date Received:_____ **Time Received:**_____

Preservation:_____

FIGURE 3

Barkhamsted - New Hartford Landfill Superfund Site

QA/QC Responsibilities
Organizational Chart



Attachment A

O'Brien & Gere Laboratories, Inc.
Quality Assurance Program

O'Brien & Gere Laboratories, Inc.

Quality Assurance Program

Address:	5000 Brittonfield Parkway P.O. Box 4942 Syracuse, New York 13221
Telephone:	315-437-0200
Facsimile:	315-463-7554
Internet:	http://www.obg.com
President:	David R. Hill
Vice President:	Michael N. Petterelli
Quality Assurance Coordinator:	Joseph C. Houser

CONTENTS

TABLES

FIGURES

APPENDIX

1. Statement of Policy

O'Brien & Gere Laboratories, Inc. (Laboratories) is located in the corporate headquarters of O'Brien & Gere Limited in Syracuse, New York. The firm is engaged in the chemical, radiological and microbiological analysis of contaminants in a variety of matrices. The ability of the laboratory to accurately identify and quantify these contaminants is important. The decisions or conclusions based on these data are only as good as the documented quality of the data. The purpose of this Quality Assurance Program (QAP) is to describe the procedures used to verify the high quality of the data. This QAP is designed to satisfy the applicable requirements of several regulatory agencies. Additionally, this QAP is designed to meet both ANSI/ASQC E-4 and draft NELAC standards.

O'Brien & Gere Laboratories management is committed to fully supporting the policies and procedures described and required by this QAP. Management acknowledges and is committed to having a managerial staff with the authority and resources in order to facilitate the production of analytical data of documented quality. Management shall provide the facilities, training and time necessary for employees to complete necessary tasks. Employees are responsible for performing work for clients in the most efficient manner possible, avoiding waste of resources. It is also the responsibility of the employees to proactively communicate to the appropriate member of management when unsafe or poor quality work practices exist. Management is responsible for investigating each allegation. It is against O'Brien & Gere Laboratories policy to improperly manipulate or falsify data. Any employee who knowingly manipulates and/or falsifies data or documents is subject to immediate release from employment.

O'Brien & Gere Laboratories clients' are served with impartiality and integrity. O'Brien & Gere Laboratories also recognizes that all employees of O'Brien & Gere Laboratories may be exposed to privileged information and materials of clients. All O'Brien & Gere Laboratories employee's sign a pledge of confidentiality.

1.1 Mission Statement

O'Brien & Gere Laboratories' purpose is to contribute to environmental improvement by:

- Providing analytical data that is on time, clear, accurate and concise.
- Anticipating client needs through a workplace that promotes improvement.
- Making a commitment to personal and professional growth.

1.2 Quality Assurance/Quality Control Program Objectives

Quality control is the routine monitoring of processes performed in the laboratory. Quality assurance is the systematic evaluation and review of quality control data.

The goal of the laboratory Quality Assurance Program is to produce data of adequate quality and to provide documentation to verify these results. The information required to have adequate quality includes a measurement of consistency (precision) and measurement of uncertainty (accuracy) when compared to specific requirements. These objectives are accomplished through the use of quality control samples such as duplicates, spikes, blanks,

surrogates, tracers and laboratory control samples. The laboratory performs an initial demonstration of accuracy and precision for specific methods when required. Method Detection Limits (MDLs) are determined yearly for most analytes of interest. The goal of this program is to maximize the validity of the data. Thus, the data can provide a reliable foundation on which to base decisions. An effort of the QA Program is to provide control charts and control limits for monitoring the laboratory's daily performance and to plot trends over a period of time. These charts provide an easily interpretable visual documentation showing that data collected, reported, or used by the laboratory are of known precision and accuracy.

The QA/QC activities performed at Laboratories are designed to be consistent with established federal and state protocols and guidelines as well as client-specified requirements.

1.3 Laboratory Policy on QA/QC

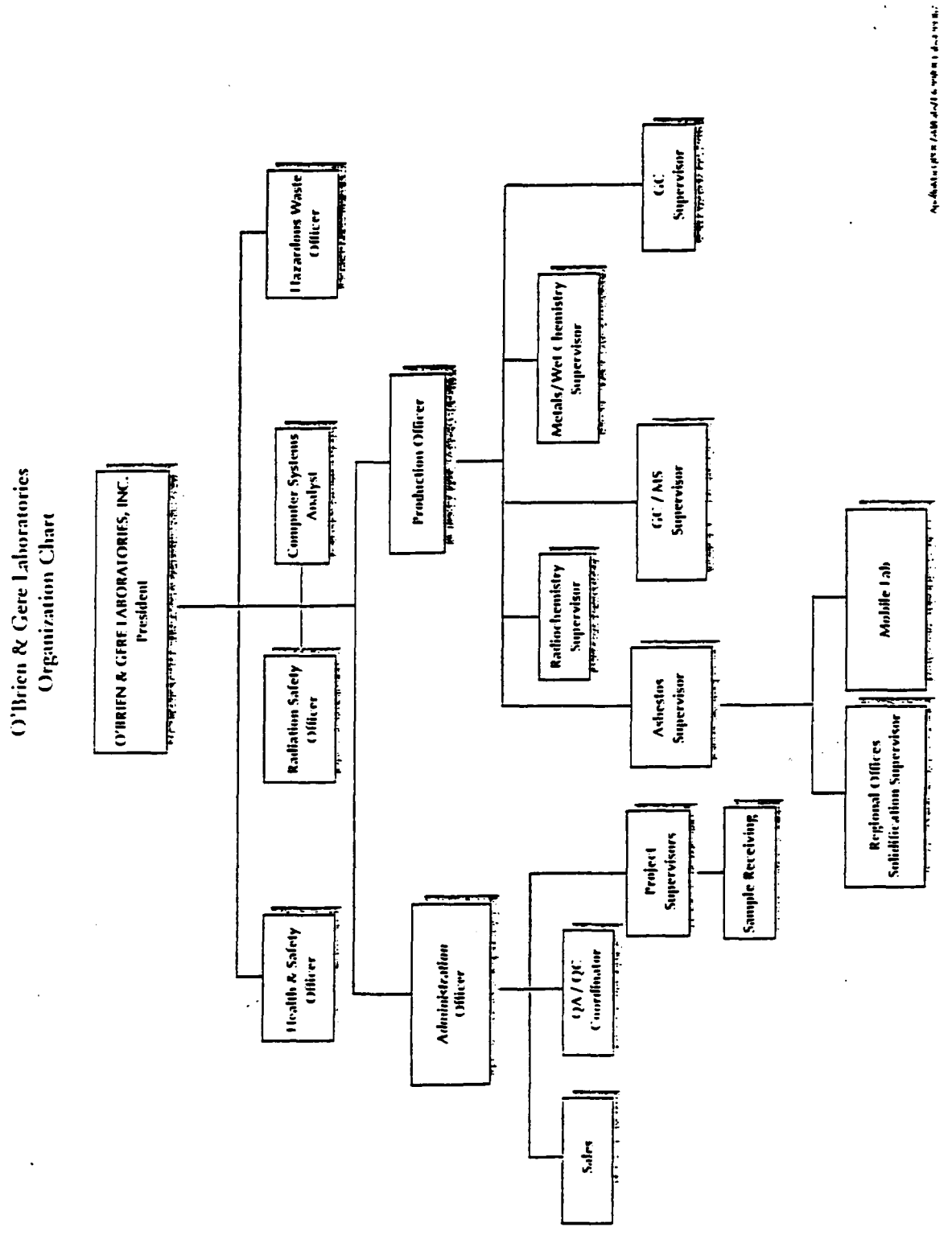
Laboratories fully supports the QA/QC program outlined in this QAP. This program has been implemented and is maintained to demonstrate that data reported by the laboratory are of known and documented quality. The technical and support personnel who contribute to any portion of the laboratory analyses follow the QA/QC procedures outlined in this manual.

The QA/QC manual is an integral part of routine laboratory practice. It is primarily intended to set control guidelines and direction for the chemical, physical, radiological and microbiological measurements performed by the laboratory for non-CLP analyses. When NYSDEC or U.S. EPA CLP protocol is required, QA/QC procedures and documentation are performed according to CLP guidelines. The contents of this manual will be reevaluated and revised annually. Additionally, requirements listed in a project specific Quality Assurance Project Plan may override this document.

2. Organizational Chart

Figure 2-1 is an organization chart of the laboratory staff.

Figure 2-1


O'Brien & Gere Laboratories
Organization Chart
O'BRIEN & GERE LABORATORIES, INC.
President
Hazardous Waste Officer
Computer Systems Analyst
Radiation Safety Officer
Health & Safety Officer
Production Officer
Administration Officer
Metals/Wet Chemistry Supervisor
GC Supervisor
Radiochemistry Supervisor
GC / MS Supervisor
Asbestos Supervisor
Mobile Lab
Regional Offices Solidification Supervisor
Project Supervisors
Sample Receiving
QA / QC Coordinator
Sales

2.1 Organization and Responsibility

Any organization consists of a number of people whose skill and responsibilities determine the quality of the final product. The product of Laboratories is analytical services. The laboratory functions as a qualitative and quantitative laboratory only. Personnel have sufficient training in their appointed positions to contribute to the analysis and reporting of high quality data. The training is achieved through formal education, selected specialty courses, internal classes, or on-the-job training.

The laboratory functions in two distinct operations, production and administrative. Administrative includes sales, marketing, QA/QC and project management with all units reporting to the Administrative Officer. All production sections report to the Production Officer. Bimonthly meetings occur between QA/QC and the Administrative Officer. This meeting focuses on operational issues; federal, state and client requirements; internal and external audits; and data quality issues including trending. The minutes of this meeting are summarized in writing and serve as a "QA Report to Management." The QA Report to Management is distributed to all officers and supervisors.

All officers and the President meet on a monthly basis to discuss a variety of issues including QA/QC. Officers and supervisors meet weekly to discuss customer expectations, the progress of in-house programs, prospective opportunities, current and anticipated workload, resource allocation, safety, and QA/QC related issues. The QA/QC agenda item for this weekly meeting addresses proficiency evaluations, SOP and MDL requirements, internal and external audit responses, project specific QA/QC requirements, and general comments related to QA/QC. The agenda for the weekly meeting is distributed to all employees. This serves as additional tool (and transfer of information) to communicate the issues itemized above to all employees. This agenda can be used to confirm the delivery schedule, data deliverables, QA levels, and project specific requirements that are incorporated onto an individuals' worklist. It is through these meeting and discussions that we resolve problems with candor and mutual confidence. This process also allows laboratory personnel to be free from undue pressures that could adversely affect the quality of their work.

Officers' responsibilities include the development and monitoring of the internal systems necessary to assure quality of the analytical data. Their duties include the planning necessary to support method development and for the acquisition of personnel and instrumentation.

Production Supervisors responsibilities include the monitoring of daily work loads and the redirection of laboratory resources to complete project deadlines. They help coordinate the distribution of the project information and manage the day-to-day scheduling and operation of their analytical areas. They report to the Production Officer. Their responsibilities include verification that analyses are conducted within method/contract holding times and implementation of corrective action procedures recommended by the QA/QC Coordinator. The Production Supervisors work daily with the QA/QC Coordinator to keep the quality control procedures accurate and up to date. Together the Production Supervisors and the QA/QC Coordinator work on revisions of procedures. In addition, Production Supervisors coordinate with the Project Supervisor to answer any questions related to the analytical requirements of the projects.

Project Supervisors are responsible for monitoring individual projects and project specific QC. They handle client contact from proposal preparation through product delivery. Project Supervisors also work with the Production Supervisors to coordinate sample receipt schedules and to meet required turn around times. Project Supervisors report to the Administrative Officer.

The QA/QC Coordinator is responsible for the implementation, monitoring, and supervision of the QA/QC program. The QA/QC Coordinator reports to the Administrative Officer. In the absence of the QA/QC Coordinator, the Administrative Officer will assume the QA/QC Coordinator's responsibilities. The QA/QC Coordinator verifies that the analyses are conducted in strict adherence to the procedures set forth in this manual. The QA/QC Coordinator's duties include:

- Developing and implementing new QA/QC programs, including statistical techniques and procedures
- Conducting regular audits and inspections of analytical procedures and applications
- Daily monitoring of analytical parameter accuracy and precision
- Discussing necessary corrective action procedures with laboratory manager and section supervisors
- Verification of corrective action implementation
- Generating control charts and setting control and warning limits
- Advising management of the status of the QA/QC program and giving recommendations for improvement
- Writing, submitting and updating Quality Assurance Plans

The QA/QC Coordinator has the authority to stop any laboratory process that does not meet the requirements of this Quality Assurance Program.

The sample custodians, who are part of the administrative staff, are responsible for initiating chain of custody procedure process. Upon receipt of samples, they verify that the samples have been properly preserved. After receipt of samples, they are responsible for keeping them in a secure and restricted location.

Laboratories has both a Safety Officer and an Radiation Safety Officer (RSO) who are responsible for the distribution of the Laboratory Safety Manual and Radiation Safety Manual and the scheduling of safety training sessions for new employees. The Safety Officer and the Radiation Safety Officer report to the President. The Safety Officers, Administrative Officer, Production Officer, Production Supervisors and Project Supervisors meet periodically to review and update manuals as necessary. Both the Laboratory Safety Manual and the Radiation Safety Manual are available upon request.

In addition to key personnel, O'Brien & Gere Laboratories, Inc. has many chemists/support personnel that are directly responsible for the production of quality analytical results and deliverables. Chemists and support personnel perform analyses according to specified methods and SOP. They are responsible for implementing the requirements of this QAP.

3. Personnel Training and Qualifications

Laboratories training program was developed to enable laboratory personnel to perform their assigned responsibilities in a manner that contributes to the analysis and reporting of high quality data.

3.1 Qualifications

Many positions in the lab require some level of experience or knowledge through the acquisition of either a high school or college degree. Depending on the position, a high school degree may be sufficient or someone with an advanced degree in chemistry or a scientific/engineering discipline (masters or doctorate) may be desired.

3.2 Training

Training is performed in accordance with SOP # AP800-005.

3.3 Documentation

The QA/QC section will keep a training file on every employee. This file will consist of a copy of the employee's internal resume, a copy of their transcript and diploma, copies of any certificates from outside training classes, a copy of the SOP reading record (Figure 3-1), and a copy of the training and proficiency record (Figure 3-2). Both the supervisors and employees are responsible for keeping training records up to date. The file is accessible to employees for this purpose.

The file will be reviewed on a routine basis. QA/QC will review the file as part of the internal section audit process. Management may review the file as they deem necessary.

3.4 Retraining and Upgrades

Employees will undergo retraining annually or when it is determined to be necessary as evidenced by a failing result on a proficiency sample or repeated failures on a laboratory control sample. Retraining would consist of reviewing the processes and techniques with the analyst. The purpose of retraining is to determine that the analyst is following details of procedures and understands the procedure accurately.

Employees will also successfully analyze a blind sample (Laboratory Control Sample, Proficiency or QA/QC internal audit) on an annual basis. Documentation of this analysis will be placed in the Training and Proficiency Record (Figure 3-2). Another facet of retraining will consist of all employees reading appropriate, revised SOPs and updating their SOP Reading Record (Figure 3-1).

Management is committed to providing the resources (*i.e.* external training classes, software and reference materials) necessary for initial training and training upgrades that are required to maintain analyst proficiency.

Figure 3-1

SOP Reading Record

Name: _____

I have read and understand the following SOPs:

AP #	Rev. #	SOP Title	Employee Initials/Date	Supervisor Initials/Date

c:\wpwin\wpdocs\training\train.wpd

Figure 3-2

Training and Proficiency Record

Name: _____

Procedure (Method/AP #)	QA/QC Check*/ Supervisor Comments	Employee Initials/Date	Supervisor Initials/Date

* Attach results of QC Check. A QC Check can be an LCS, single blind or double blind proficiency.
c:\wpwin60\wpdocs\training\train.wpd

4. QA Limits for Precision and Accuracy

Appendix A contains a table listing the statistically derived accuracy and precision limits for the methods performed in the laboratory. Also in Appendix A is a table listing the sample preparation procedures utilized in the laboratory and their applicable methods.

O'Brien & Gere Laboratories utilizes statistical, method, and client limits. If sufficient data does not exist for the determination of statistical limits, method based limits are used. The accuracy and precision limits listed in the tables are derived from in-house data. Sufficient points for some parameters may not be available at the time the limits are set due to the laboratory having analyzed only a reduced number of samples for a particular parameter. For these parameters, either the limits have been set based on previous lab experience or are derived from the applicable method. Limits that are not derived from laboratory data are flagged with an asterisk (*). As more points are added to the data base, the laboratory limits for these parameters will be established. The QA/QC Coordinator is responsible for updating the QA/QC limits in the laboratory's LIMS system. Limits are updated annually, at a minimum.

Laboratory QA/QC limits are included to give an indication of the laboratory capabilities. Method QA/QC limits, when required, will be used if they are more stringent than the laboratory limits. Limits included in the table may not be the most up-to-date limits since they are continually being updated. Laboratory SOP: AP # 800-10 "Generating Control Limits" explains the generation and updating of QA/QC limits. The most recent QA/QC limits are available from the laboratory.

Contract, method or QAPP specific QA/QC limits may take precedence over laboratory QA/QC limits. Production Supervisors and Project Supervisors are responsible for reviewing proposed Contract/QAPP QA/QC limits and determining if the laboratory is capable of achieving these limits. The Project Supervisors are responsible for notifying clients if the Contract/QAPP QA/QC limits are not achievable. The QA/QC Coordinator is responsible for the input and review of Contract/QAPP QA/QC limits into the LIMS system.

Practical quantitation limits (PQLs) are included in Appendix B. PQLs are the detection limits routinely reported by Laboratories. PQLs are listed for guidance only. The required limits vary depending upon the governing regulation and matrix. Lower detection limits may be achieved and are available upon request. Method Detection Limit (MDL) and Instrument Detection Limit (IDL) studies are available from the laboratory.

Completeness may be described as a measure of the actual amount of usable data obtained from an analytical procedure to the expected amount. The goal of Laboratories' QA/QC program is to maintain a 90% completeness rate as defined in QAPP preparation guidelines.

5. Sample Receipt and Chain of Custody

A critical concern in any project, especially those where large numbers of samples and analyses are required, is the timely maintenance of sample integrity. A sample is physical evidence of a situation at a specific place and time. Therefore, an essential part of sampling projects is proper collection and handling of the samples. Representative samples are collected through well-defined protocols. The client performs most of the sampling and thus assumes responsibility for properly obtaining, handling, and shipping the sample. Laboratories provides sampling kits to the client upon request. These

sampling kits contain sufficient packing material, instructions, site ID labels, sample containers properly labeled with preservative (if required), and chain-of-custody forms. Laboratory Standard Operating Procedure (SOP), AP #800-15 "Sample Management System," describes sample receipt and sample management procedures.

5.1 Sample Containers

When the laboratory sends out sample containers, the containers will already contain the proper preservatives, unless otherwise requested by the client. The containers are labeled with the type of preservative added. The client is responsible for verifying that the proper containers were received.

Each sample is collected in a new, pre-cleaned container to minimize contamination except for bacteriological samples. For these samples sterilized plastic bottles are used. I-Chem 300 pre-cleaned containers, or equivalent, are purchased on a project by project basis. When utilizing I-Chem 300 containers, the Certificate of Analysis Form for each lot of containers utilized is retained for future reference. Their use is documented in report case narratives and identified on the sample bottle request form (SOP: AP #800-15 "Sample Management System", Attachment #1).

5.2 Holding Times and Preservatives

Laboratories follows the holding time requirements outlined in the method/protocol being utilized, if applicable. Holding times vary depending upon matrix, protocol, and regulatory requirements. Expedient delivery and scheduling are paramount to obtain compliance with holding times. The LIMS assists in the monitoring of holding times by incorporating a due date on the schedule queue. The analysts, when reviewing their schedule, are aware not only of the workload, but also of holding time requirements.

If samples are received over their holding times, the client is notified so that resampling can be scheduled.

The lab will provide, at the client's request, the appropriate preservative in the sample containers. If preservatives are added to the sample container, it is noted on the sample bottle request form. When preservatives are added, ACS grade reagents are used. If the client requires additional preservatives, the amount requested (compliant with DOT regulations) will be put into a separate container at the same time the sample containers are prepared and shipped with the sample containers. A table of sample containers, preservatives and holding times are included in Appendix C.

Aqueous samples that required preservation at a specific pH, with the exception of volatile samples, are pH checked upon receipt in the laboratory to verify proper preservation. If samples are improperly preserved, the client will be notified and a corrective action determined and documented.

5.3 Shipment

Sample containers are shipped in coolers to the clients by common carrier or are picked up at the lab by the client. Glass bottles are wrapped in styrofoam or placed in bubble bags to prevent breakage. VOA vials are put into a vial holder to minimize breakage. Styrofoam sheets or similar packing material are used for glass jars. When the samples are returned to the lab, they are expected to be repacked into the coolers in the same manner in which they were shipped and crushed ice is added to maintain the temperature at 4°C.

Laboratories adheres to regulations governing the shipment of hazardous materials.

5.4 Chain of Custody Procedures

The laboratory follows a strict chain of custody procedure. This procedure creates an accurate and legally defensible document that can be used to trace possession of a sample from its collection through analysis and final disposal. The chain of custody form is signed by handlers of the sample. An example of a chain of custody is included as Figure 5-1. Chain of custody procedures are outlined in laboratory SOP: AP #800-15 "Sample Management System".

A sample is considered in custody if it is:

- In actual physical possession
- In view after being in physical possession
- In a locked repository
- In a secure, restricted area

During non-business hours, the storage cooler is locked, and the lab is monitored by professional security. The delivery and receipt of samples during non-business hours is addressed in laboratory SOP: AP #800-15 "Sample Management System".

Formal custody begins with the shipment of pre-cleaned properly preserved containers. The client contacts a Project Supervisor for sample bottles, and the Project Supervisor submits to the sample custodian a form requesting the proper containers. After the request is completed and signed, the form is filed in a binder and kept in the sample tagging room for future reference.

Chain of custody forms are shipped with sample bottles. The field sampler/client is responsible for filling in the sample location, date and time sampled, sample matrix, and analysis required on the chain of custody. The field sampler signs the chain of custody when relinquishing custody and includes the form with the sample containers. Any comments that the sampler has are also listed on the chain of custody form. The field sampler is also responsible for filling in the sample labels that are provided with every shipment.

If required by the project, evidence tape can be applied to each sample container in the field. At a minimum, the cooler should be sealed with evidence tape or custody seal prior to shipping to the lab.

For CLP analyses, sample custody and handling are performed as required by NYSDEC and U.S. EPA CLP protocol.

5.5 Control of Incoming Samples

Laboratories employs a sample custodian who is responsible for verifying the receipt of samples. Sample acceptance criteria are outlined in laboratory SOP: AP #800-15 "Sample Management System". When samples are received, the sample custodian follows the general steps outlined below.

1. Coolers are checked to verify that the samples listed on the chain of custody were received. A notation is made of any missing or mislabeled samples.

2. Samples are checked and a notation is made of any samples that were received broken or damaged.

3. The Chain of Custody is signed and dated to verify time of sample receipt.

4. The sample custodian records the temperature of the cooler when received and verifies proper preservation. The preservation is verified by checking and recording the pH of each aqueous sample that required preservation at a certain pH. Samples for volatile analyses are not pH checked upon receipt, but are checked at the time of analysis.

5. Coolers are checked for low level radiation with a Geiger counter. The procedure for screening, identifying, handling and documenting radioactive materials is found in sections 6.0 and 7.0 of the Radiation Safety Manual and laboratory SOP: AP#800-32 "Categorizing, Handling and Waste Handling Radioactive Materials".

6. Each sample is assigned a unique laboratory identification number to make tracking of samples easier. Each project is also assigned a unique project number that contains the client ID and job number.

7. Samples are logged into the LIMS, and the analyses are scheduled.

The observations by the sample custodians and any comments related to cooler/sample condition are noted on the chain-of-custody form or on the case file form. An example of the case file form is included as Figure 5-2. Samples are not routinely rejected by the laboratory. When problems arise, the client is notified of the deficiency, and a decision is made to continue or resample by the client. The case file form will document any decision to proceed with the analysis of samples not meeting acceptance criteria. The decision is also noted on the final report.

The sample custodian inputs each sample into the LIMS, which assigns a unique, sequential number to the sample. Laboratory sample labels are printed and affixed to the sample containers. The package/sample schedule, which is generated by the LIMS (SOP: AP #800-15 "Sample Management System", Attachment #11), is printed and filed in a three-ring

binder. This form functions as a sample receipt log book. Package/sample schedules are subsequently bound the following month.

Samples are stored in a locked, secured walk-in cooler. Samples for volatile analyses are stored separately from other samples to prevent cross contamination. When samples are removed from the cooler, the analyst signs the sample control record (SOP: AP #800-15 "Sample Management System", Attachment #10). This documents the sample location and who handled the sample throughout the analytical process.

The chain-of-custody form, bill of lading, case file form, sample control record, and original package/sample schedule are kept on file outside the walk-in cooler.

5.6 Scheduling

The purpose of scheduling is to notify appropriate personnel of the arrival of a sample; the tests to be performed; QC levels; deliverables; and expected delivery dates.

Analyses are scheduled on the LIMS by the sample custodians. A work schedule is printed every morning listing sample numbers, tests required, due dates, days left until the holding time expires, and location of a sample in storage. The analysts use the work schedule to identify what samples they are required to analyze and if there are any project specific requirements for the samples. The section supervisors review the work schedule with the analysts to confirm these priorities and holding times are being met and monitor that all questions have been answered.

5.7 Sample Tracking

Our tracking system relies on project numbers and sample numbers. Samples are primarily tracked using the laboratory sample numbers. Project status is tracked using project numbers and sample numbers. The status of samples and projects can be obtained by utilizing the LIMS system. Laboratory SOP: AP #800-16"Sample Tracking System" outlines the sample tracking system.

5.8 Storage and Disposal

All non-volatile water and solid samples are stored in a locked, walk-in cooler away from potentially contaminating sources (standards, reagents and food). A separate refrigerator is used for samples requiring volatile analysis. Air and biological samples are stored in a freezer. The temperatures of these systems are monitored twice each day. When required, samples are signed in and out of the cooler on the sample control record by the analyst performing the analysis. Sample extracts or digestates may be stored in refrigerators in the appropriate lab section. All storage systems are locked at the close of business hours.

Once analysis is completed and the results reported to the client, the samples are stored for one additional month. After one month of storage, the sample is removed from the cooler for return to the client or ultimate disposal. The samples may be stored longer if required by a client agreement or QAPP. Sample storage and disposal is addressed in laboratory SOP: AP #800-15 "Sample Management System".

5.9 Sample Transfer

If analysis of the samples is not possible at Laboratories, then the samples will be subcontracted to another approved laboratory (See Item 8). The samples will be packed in coolers at 4°C and shipped by common carrier or delivered by Laboratory personnel. A subcontract letter and a chain of custody listing Laboratories sample number, sample preparation date and tests required will accompany the samples.

Figure 5-1

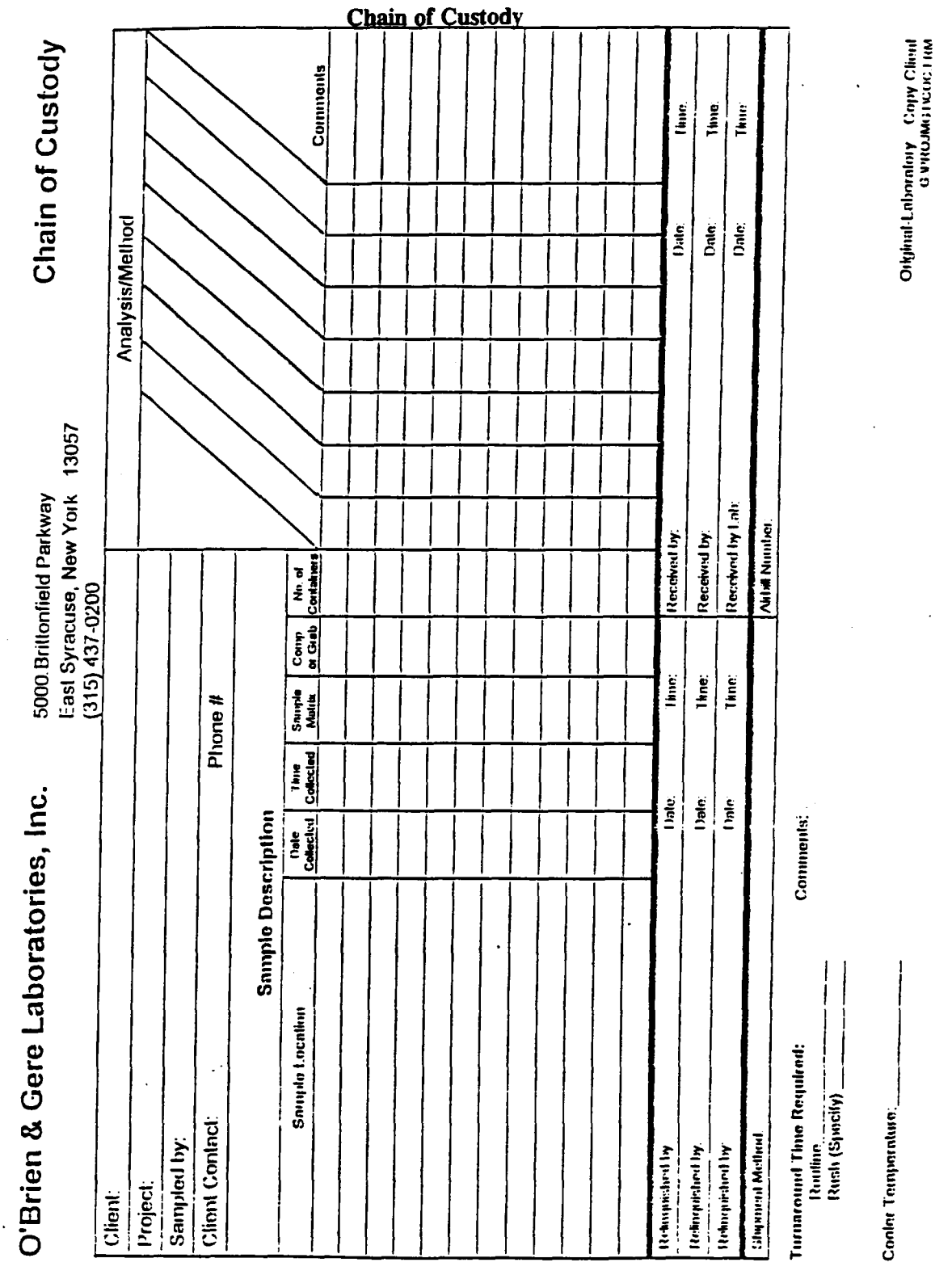

Chain of Custody
O'Brien & Gere Laboratories, Inc.
5000 Brittonfield Parkway
East Syracuse, New York 13057
(315) 437-0200
Chain of Custody
Client:
Project:
Sampled by:
Client Contact:
Phone #
Analysis/Method
Sample Description
Sample Location
Date Collected
Time Collected
Sample Matrix
Comp or Grab
No. of Containers
Comments
Relinquished by
Date:
Time:
Received by:
Date:
Time:
Relinquished by
Date:
Time:
Received by:
Date:
Time:
Relinquished by
Date
Time:
Received by Lab:
Date:
Time:
Shipment Method
AirBill Number
Turnaround Time Required:
Routine
Rush (Specify)
Comments:
Cooler Temperature:
Original-Laboratory Copy Client

Figure 5-2

Case File Form

O'BRIEN AND GERE LABORATORIES, INC.
CASE FILE FORM

PROGRAM INFORMATION

Client: _____ Div. _____ Ref. No. _____

Program: _____

Custody Seal: _____ Intact _____ Not Intact _____ NA

AFTER HOURS CUSTODY

RELINQUISHED BY:	DATE	TIME	RECEIVED BY SECURITY GUARD:	DATE	TIME
RELINQUISHED BY SECURITY GUARD TO COOLER:	DATE	TIME	RECEIVED BY SAMPLE CUSTODIAN:	DATE	TIME

COMMENTS/DISCREPANCY:

RESOLUTION/CLIENT COMMENT:

Signed: _____

Date: _____ QA/QC Approval: _____

Signed: _____

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Date: _____

COMMENTS/DISCREPANCY: (continued)

PROPOSED RESOLUTION: (continued)

CLIENT COMMENTS: (continued)

Signed: _____ Project Manager Approval: _____

Date: _____ QA/QC Approval: _____

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6. Analytical Procedures

6.1 Analytical Methods

A list of analytical methods used in the laboratory is included in Appendix B. Method numbers are cited from the following manuals:

- U.S. EPA, *Methods for Chemical Analysis of Water and Wastewater*, Revised March 1983, EPA 600/4-79-020, including all promulgated updates.
- U.S. EPA, *Test Methods for Evaluating Solid Waste, 3rd Ed.*, EPA SW-846, including all promulgated updates.
- APHA, AWWA, WPCF. *Standard Methods for the Examination of Water and Wastewater, 18th Ed.*, 1992.
- U.S. EPA, *Methods for the Determination of Organic Compounds in Drinking Water*, December 1988, EPA 600/4-88/039, including all promulgated updates.
- U.S. EPA, Federal Register, 40CFR, Part 136, October 1984.
- U.S. EPA, Federal Register, 40CFR, Part 136, (1-1-87 edition).
- U.S. EPA, Federal Register, Appendix A, 29 CFR 1926.58.
- New York State Department of Health, *Environmental Laboratory Approval Program - Certification Manual*.
- NIOSH - NIOSH Manual of Analytical Methods, Fourth Edition.
- U.S. EPA, *Interim Method for the Determination of Asbestos in Bulk Insulation Samples*, 40CFR, Part 763, Subpart F, Appendix A.
- U.S. EPA, *Method for the Determination of Asbestos in Bulk Building Materials*, EPA/600/R-93/116.
- U.S. EPA, *Interim Transmission Electron Microscopy Analytical Methods - Mandatory and Non-mandatory to Determine Completion of Response Actions*, 40CFR, Part 763, Subpart E, Appendix A.
- U.S. EPA, Environmental Monitoring and Support Laboratory: Cincinnati, OH, *Prescribed Procedures for the Measurement of Radioactivity in Drinking Water*, August 1980, EPA 600/4-80-032.
- U.S. EPA, Environmental Monitoring and Support Laboratory: Las Vegas, NV, *Radiochemical Analytical Procedures for Analysis of Environmental Samples*, March 1979, EMSL-LV-0539-17.
- U.S. EPA, Eastern Environmental Radiation Facility: Montgomery AL, *Radiochemistry Procedures Manual*, August 1984, EPA 520/5-84-006.
- U.S. DOE, Las Alamos National Laboratory: Las Alamos, NM, *Health and Environmental Chemistry: Analytical Techniques, Data Management, and Quality Assurance*, updated yearly, LA-10300-M (Volumes 1 - 4).

The laboratory also analyzes samples that require various CLP protocols including:

- United States Environmental Protection Agency Contract Laboratory Program, Statement of Work for Organic Analysis, Multi-Media, Multi-Concentration, Document Number OLM03.2.
- United States Environmental Protection Agency Contract Laboratory Program, Statement of Work for Inorganic Analysis, Multi-Media, Multi-Concentration, Document Number ILM04.0.

- New York State Department of Environmental Conservation Analytical Services Protocol, Contract Laboratory Protocol, October 1995 update.

The laboratory maintains current Standard Operating Procedures for procedures performed within the laboratory. A list of laboratory SOPs is included in Appendix D.

6.2 Waste Disposal

Laboratory workers are trained to be cautious when handling samples, spent chemicals, toxic, or dangerous materials. Laboratories has a Hazardous Waste Officer who is responsible for coordinating and overseeing the disposal of waste and the cleanup of any accidental spills. The laboratory has a hazardous waste room where waste is stored in DOT-approved drums until disposal. Hazardous wastes are currently separated into five waste streams: chlorinated solvents, non-chlorinated solvents, PCB (liquid), PCB (solid) and mineral acid. Solvent waste is collected in chemically resistant plastic coated bottles and stored in a well ventilated area until they are transferred to the appropriate labeled drum. Mineral acid wastes are collected in a polyethylene DOT-approved drum. Laboratory hazardous wastes are manifested and disposed off-site at NYSDEC- and U.S. EPA-approved disposal facilities. Sample extracts and sample digestates are handled in the same manner as solvent and acid wastes.

The method of sample disposal depends on the analytical data generated. The results are compared to RCRA criteria and local disposal ordinances, and a decision is made in coordination with the hazardous waste officer as to the means of disposal. If the sample is classified as hazardous, it is placed in the appropriate drum in the hazardous waste room. Upon filling the drum, the hazardous waste officer manifests the drum, arranges for disposal and files the disposal logs. The Radiation Safety Manual and Laboratory Standard Operating Procedure (SOP): AP #800-31 "Laboratory Hazardous Waste Management System" detail hazardous waste management and disposal procedures.

6.3 Cleaning of Glassware

The method of glassware cleaning is adopted to both the substances that are to be removed and the determinations to be performed. Class A volumetric glassware is not baked.

6.3.1 Organic Glassware

6.3.1.1 Volatile Analysis

Glassware used for volatile analysis is cleaned in a soapy Alconox solution and then rinsed four times with carbon column water. The glassware is then rinsed with methanol and baked at 180°C overnight. Clean glassware for volatile analysis is stored in drawers in the volatile organic lab. Laboratory SOP: AP# 100-18 "Trace Organics Glassware Cleaning"details cleaning procedures.

6.3.1.2 Semivolatile Analysis

Dirty glassware is pre-rinsed in solvent and then washed with an Alconox solution and rinsed with deionized water. Allow the glassware to air dry. After the glassware is dry it is placed in a muffle furnace and is heated to

550°C. This ashing should vaporize any organics on the glassware. Clean glassware is stored in the appropriate drawers. Before use, the glassware will be solvent rinsed. Laboratory SOP: AP# 100-18 "Trace Organics Glassware Cleaning"details cleaning procedures.

6.3.2 Metals and Radiochemistry Glassware

Metals glassware is soaked in and scrubbed with an Alconox solution, followed by a deionized water rinse. The glassware is then soaked in 1:1 HNO_3 at a minimum of 2 hours and a final rinse is done with deionized water. Glassware is stored inverted in the metals digestion lab in the appropriate drawer. Pipets and volumetric flasks are stored in the metals lab. Laboratory SOP: AP# 400-41 "Trace Metals Glassware Cleaning"details cleaning procedures.

6.3.3 Inorganic Glassware

The glassware is cleaned in an Alconox solution. It is then rinsed with tap water followed by deionized water and allowed to dry. Glassware is stored inverted in drawers or a cabinet in the wet chemistry lab.

Glassware for phosphorus analysis is washed separately from other inorganic glassware. It is rinsed in an HCl solution and then rinsed with distilled water and allowed to dry. It is stored inverted in the appropriate drawer in the wet chemistry lab.

6.3.4 Asbestos Glassware

NOB Bulk Asbestos crucibles are cleaned in an Alconox solution. They are then rinsed with asbestos free deionized water and allowed to dry. Crucibles are stored in the appropriate drawer in the asbestos lab.

6.4 Quality of Lab Water

The Inorganic and Radiochemistry Sections of the laboratory use Reagent Grade (laboratory pure), deionized water. The conductivity of the deionized water is less than 1.5 micromho/cm and is used in the final rinses of glassware and to prepare reagents. The pH and conductivity of the deionized water for the wet chemistry and microbiology sections are recorded into a logbook on a daily basis. A chlorine residual test and standard plate count are performed monthly. Suitability and heavy metals analysis are done yearly and documented in the Microbiology Reagents & Quality Control laboratory notebook.

A resistance reading is taken daily from the DI water system meter of reagent grade water used in the trace metals section. The pH and conductivity is tested weekly. These readings are documented in the Trace Metals logbook.

The Organic Sections of the laboratory use organic-free water in the preparation of samples for organic analysis. Deionized water is passed through a carbon filter system and then a carbon column to remove organic compounds. The water is monitored daily for contamination from any organic compounds through the analysis of blanks.

6.5 Reagents/Solvents and Standards

ACS reagent grade chemicals and solvents shall be used unless otherwise specified by approved procedure. Reagents, solvents, and solutions not stored in commercial containers must be adequately labeled. At minimum, the label shall contain the following information: identification of contents, concentration or purity, date received, dated prepared or opened and expiration dates (if applicable), notification of special precautions or requirements, and the initials of the responsible person. If it is impractical to record the required information on the label, the label shall have a unique identifier and reference to a reagent logbook which shall contain the necessary information.

Standards are either purchased commercially or prepared from certified stock materials. Pedigrees are maintained on all purchased or prepared standards linking the working standard to a National Institute of Standards and Technology (NIST) certificate or reference. Commercially prepared standards or neat stock will have a standardized label with the following information: date received, date opened and expiration date. Labels for laboratory prepared standards will contain the following information: method reference/title, expiration date, date of preparation, preparer's initials and lot number. Standard label information, lot numbers and concentrations are logged into a standards logbook.

Stock standard solutions, intermediate standards and working standards are stored at 4°C and protected from light, if required.

All reagents, solvents, and standards shall be documented, labeled and handled according to the specifications of one of the following applicable procedures.

> AP# 100-02, *Standards: Preparation, Storage, and Disposal*
> AP# 600-02, *The Acquisition, Preparation, and Use of Standard Reference Materials in the Radiochemistry Laboratory*

Hazardous reagents and solvents shall be handled in accordance with the Laboratories' Safety Manual. Hazardous materials are stored in locations which afford ventilation, fire barriers, and segregation from incompatible materials, as required. The handling of radioactive standards and samples is covered by procedures in the Radiation Safety Manual.

7. Calibration Procedures and Frequency

7.1 Instrumentation

The laboratory is 14500 sq. ft. in size with 9600 sq. ft. dedicated to the preparation and analysis of samples and 1200 sq. ft. dedicated to the receiving and storage of samples. Laboratories maintains state-of-the-art instrumentation. The following equipment is currently in use:

- Two Hewlett Packard 5890/5972 GC/MS systems for semivolatile analysis, and one Hewlett Packard 5890/5970A GC/MS system for semivolatile sample screening. The GC/MS's are connected to a PC with ChemStation software.
- One Hewlett Packard 5890/5970 GC/MS system with Tekmar ALS 2016 and LCS 3000 concentrator and one Hewlett Packard 6890/5973 GC/MS system with Tekmar Precept closed-loop autosampler and LCS 3000 concentrator for volatile analysis. The GC/MS's are connected to a PC with ChemStation software.
- One Tracor 540 GCs with PID and HECD detectors and one Tracor 9001 GC with PID and HECD detectors for volatile analysis. The GCs are connected to PCs with Perkin Elmer TurboChrom software.
- Three Hewlett Packard HP5890 Series II GCs, one Hewlett Packard HP5880A GC and one Hewlett Packard HP5890A GC and six Hewlett Packard ECD detectors and two Hewlett Packard FID detectors for semivolatile analysis. The GCs are connected to PCs with Perkin Elmer TurboChrom software.
- One Thermo-Jarrell Ash ICAP-61E-S Trace Vacuum Spectrometer, 32 channel 0.75 meter direct reading simultaneous spectrometer for metals analysis.
- One Perkin-Elmer 5100-PC Graphite Furnace Atomic Absorption Spectrometer, Zeeman system with an optical interface for metals analysis.
- One Perkin-Elmer Model 3100 Atomic Absorption Spectrometer, used predominantly for mercury analysis by cold vapor atomic absorption techniques. Can also be used for flame atomic absorption.
- One Lachat QuikChem AE multi-channel analyzer for automated determination of nutrients and other inorganic parameters.
- One Rosemont Analytical Dohrmann DC-190 for TOC analysis.
- One ABC model 1002B GPC with UV detector.
- Hewlett Packard model 7680T supercritical fluid extractor (SFE) with controlling software, utilized for solid organic sample preparation.
- Forty continuous one-step liquid-liquid extractors.
- Model 200 Wilt Electric Glass Annealing Oven, ID: 60" X 18" X 21" temperature range 0 to 800 °C, utilized to remove trace organics from sample preparation glassware.
- One 12-vessel rotary agitation apparatus from Associated Design and Manufacturing Company, Model 3740-12, capable of rotating in an end-over-end fashion at 30 ± 2 rpm used for volatile TCLP extractions. Zero-headspace extraction vessels of stainless steel from Associated Design and Manufacturing Company, model #3745-ZHE.
- One 24-vessel rotary agitation apparatus from Associated Design and Manufacturing Company, Model 3740-24-BRE-TM, capable of rotating in an end-over-end fashion at 30 ± 2 rpm used for non-volatile TCLP extractions. Extraction vessels of borosilicate glass, 2.2 liters from Associated Design and Manufacturing Company, Model #3740-PWGB or Nalgen, fluorinated, 2 liter bottle, model BTI LRG W/M HDPE 2120-0005 (used for metals analysis only).
- One HACH 2100A turbidimeter.

- One YSI Model 32 conductivity meter.
- One YSI 51B dissolved oxygen meter.
- One Orion SA-720 and one Orion SA-710A pH meters with Corning electrodes (Corning reference electrode 476350 for fluoride analysis).
- One B&L Spectonic 21 UV-VIS spectrometer.
- One Buck Scientific fixed wavelength (3.42 μm) total hydrogen analyzer Model #404, IR spectrometer.
- One HACH DR100 colorimeter, model #41100-02 for residual chlorine analysis.
- One Lab-Crest midi distillation system, Andrews Glass Company, model 11010R.
- One Pensky-Martens closed-cup tester for flashpoint determinations.
- One Mettler AE163 and one Mettler AE200 analytical balances.
- One Philips CM-12 transmission electron microscope equipped with an EDAX PV9800 x-ray detector.
- Two Olympus BH-2 polarized light microscopes.
- One Nikon Labophot-Pol polarized light microscope.
- Four Olympus CH-2 phase contrast microscopes.
- One Denton Vacuum DV-502A Carbon Coater.
- One BioRad PT7150 RF Plasma Barrel Etcher.
- One Mettler AE100 analytical balance.
- One Retsch ZM-1 centrifical grinder.
- One Denver Instruments TR-403 top-loading balance.
- One Canberra 2401 Gas Flow Proportional Counter and detector.
- One Protean MDS Multi-Position Gas Flow Proportional Counter with four detectors.
- Four Ludlum Model 182 Lucas Cell Counters.
- One Canberra Genie Workstation with all operations and QC software required for alpha and gamma spectrometry.
- Two HPGe (p-type) Canberra gamma spectrometry detectors.
- One HPGEe (n-type) EG&G gamma spectrometry detector.
- Forty-eight Canberra 7404 alpha spectrometers and PIPS detectors.
- One water HPLC with UV and scanning fluorescence detectors.

7.2 Calibration

Accurately calibrated instruments are a prerequisite to perform accurate analyses. A brief explanation of the calibration procedures for the instruments used at Laboratories are summarized in Table 7-1. Detailed calibration procedures are described in the laboratory Standard Operating Procedures.

7.2.1 Wet Chemistry

There are many different types of analyses handled by the wet chemistry section. The wet chemistry section performs potentiometric, colorimetric, and titrametric analysis. The QC requirements vary from test to test. For colorimetric analyses, there is a standard curve consisting of 5 to 7 points, depending on the test. The correlation coefficient (r) of the standard curve must be greater than or equal to 0.997. A standard is run at the detection limit to verify accuracy at that level. A

reference sample and a blank are analyzed at the beginning of each run to ensure that the method is in control. In addition, continuing calibration standards are run at a 10% frequency to ensure that calibration is maintained throughout the analytical sequence. The continuing calibration check is generally analyzed at a level at the mid point of the detection limit.

Titrating solutions are standardized once per month or whenever the titrant is prepared. The procedures outlined in *Standard Methods, 18th Edition* are followed. The standardization is written up by the analysts in laboratory logbooks, and is checked by the group's section supervisor. A reference standard is analyzed each analysis day to verify the concentration of the standard titrant.

7.2.2 Thermometers

Thermometers used in the lab are calibrated against an NIST-certified thermometer on site once a year. They are checked at the freezing point(if applicable), boiling point(if applicable), and point of use (the temperature at which they are used). Correction factors for each thermometer are calculated and the thermometers are tagged listing the thermometer number and the correction factors. Correction factors, date calibrated, calibration temperature, temperature recordings, and initials of person performing the calibration are documented in notebook maintained by the QA/QC Coordinator.

7.2.3 Balances

Analytical balances are professionally calibrated and cleaned once a year. When the balances are professionally calibrated, a document stating the specific balance model and serial number and the date calibrated is provided by the company doing the calibration. The balances are checked daily or as used with Class S weights. The analyst's initials, date, calibration check results, room temperature, and the weights at which the balance was checked are recorded in the daily readings laboratory notebook. The acceptance range for the weights are listed on the logbook pages. If the weight is out of the control limits, the balance will be recalibrated.

7.2.4 pH Meter

A two-point calibration bracketing the pH of the samples analyzed is done daily on pH meters. The calibration is then verified with a third pH buffer. The calibration date, analyst's initials, calibration data, room temperature and pH of verification buffer are recorded in a laboratory notebook.

Table 7-1 ***Instrument Calibration***

Instrument	Measurement or Check	Frequency
GC/MS	PFTBA Autotune	If Tune Check fails
	DFTPP or BFB Tune Check	Every 12 hours

Table 7-1 ***Radiochemistry Instrument calibration***

Instrument	Measurement or Check	Frequency
	Initial Calibration	As per method
	Continuing Calibration	Every 12 hours and after Tune Check
GC Volatiles	Initial calibration	New column, instrument conditions change and/or instrument acceptance criteria are not met
	Continuing Calibration	The start of an analytical sequence (if initial calibration is not performed), 10% of an analytical run and at the end of an analytical sequence
	Retention Time Windows	Set at the first Calibration Check Standard of the day
GC Semivolatiles	Initial Calibration	New column, instrument conditions change and/or instrument acceptance criteria are not met
	Continuing Calibration	The start of an analytical sequence (if initial calibration is not performed), 10% of an analytical run and at the end of an analytical sequence
	Retention Time Windows	Set at the first Calibration Check Standard of the day
	Endrin and 4,4'-DDT (Pesticide)	Daily (during analysis)
ICP	Initial Calibration (2 point)	Daily and/or instrument acceptance criteria are not met
	Initial Calibration Verification	After each initial calibration
	Continuing Calibration	10%
	Interference Check Sample	At the start and end of each analytical sequence

Table 7-1 ***Radiochemistry Instrument calibration***

Instrument	Measurement or Check	Frequency
GFAA	Initial Calibration (4 point)	Daily and/or instrument acceptance criteria are not met
	Initial Calibration Verification	After each initial calibration
	Continuing Calibration	10%
Cold Vapor AA	Initial Calibration (6 point)	Daily and/or instrument acceptance criteria are not met
	Initial Calibration Verification	After each initial calibration
	Continuing Calibration	10%
TEM	X-ray Detector Check (Amosite standard analysis)	Daily
	Camera Constant/Magnification	Monthly
	Spot size	Quarterly
	Beam current	Quarterly
	X-ray Detector Check for: Sodium Peak in Crocidolite Magnesium and Silicon Peaks in Chrysotile	 Quarterly Quarterly
	X-ray k-factors and Manganese Resolution	Semi-annual
PCM	Resolution	Daily
	Graticle Diameter	Daily
	Centering of Phase Rings	Daily
PLM	Iris and Condenser diaphragms: focused & centered	Daily
	Polarizer and Crosshairs Alignment Check	Daily
	Objectives centered	Daily
	Refractive index oils calibrated using refractometer	Monthly
Gamma Spectroscopy	Efficiency Calibration for all Geometries (Efficiency Check/Verification)	Annually (Weekly or Prior to use)
	Energy Calibration (Energy Check/Verification)	Monthly or Prior to use (Daily or Prior to use)
	Resolution Check [3keV(FWHM) Max.@ 1.4 MeV	Daily or Prior to use

Table 7-1 ***Radiochemistry Instrument calibration***

Instrument	Measurement or Check	Frequency
	Background Measurement(500 min. minimum) Background Check/Verification	Monthly Weekly or Prior to use
Alpha Spectroscopy	Efficiency Calibration (Efficiency Check/Verification)	Annually (Monthly or Prior to use)
	Energy Calibration (Energy Check/Verification)	Quarterly or Prior to use (Weekly or Prior to use)
	Resolution Check [100 keV(FWHM) Max.]	Weekly or Prior to use
	Background Measurement	Weekly or Prior to use
Alpha/Beta Proportional Counters	Efficiencies for Specific Radionuclides	Annually
	Efficiency Check	Daily or Prior to use
	Self-absorption Curves	Annually
	Plateau (Plateau Check [$\pm \geq$50V from operating voltage])	Annually (Every Gas Change)
	Background Measurement(150 min. minimum)	Weekly or Prior to use
Liquid Scintillation	Efficiencies for Specific Radionuclides (Efficiency Check/Verification)	Annually (Daily or Prior to use)
	Quench Curves	Annually
	Interference Corrections	Annually
	Background Measurement	Daily or Prior to use
Laser Phosphorimetry	Calibration Curve over Sample Concentration Range	Semi-Annually
	Verification of Calibration (three points, one each, at extremes and center of concentration range)	Weekly or Prior to use
	Calibration Check	Each Batch

8. Procurement of Items and Services

Various customer needs and expectations dictate the probability that no one vendor is able to totally service all customers. Our laboratory must procure additional services and material from outside contractors and vendors. Laboratories is responsible for maintaining the same level of quality throughout this process. To assure this quality, the QA Coordinator and Management are responsible for reviewing a potential contractor's:

- QA/QC Manual and procedures
- Certifications
- Deliverables (report format)

- Audits (External and Internal)

Records and documentation of these items will be retained at Laboratories. In addition any on-site inspections of a contractor's facility by Laboratories will also be kept on file.

Project Supervisors identify the need to subcontract services and are responsible for notifying clients of the intent to subcontract in the form of a written and/or faxed letter. The decision to subcontract services is reviewed on a case by case basis with the Administrative Officer. The terms and conditions of the request for services letter and subcontract agreements may also reviewed by affiliated legal staff and the Administrative Officer . In situations where the exposure is several thousand dollars the agreement may be reviewed by affiliated Legal staff and the President.

Project Supervisors must notify the prospective subcontractor of their responsibilities by documenting the requirements in the form of a letter. Project Supervisors are responsible for coordinating the shipment of samples to the subcontractor and the return of documented results. When subcontractor data packages are received, they are reviewed by the Project Supervisor to confirm all appropriate requirements were met prior to submission to the client.

Any service or testing that is covered under NELAP and requires sub-contracting will be submitted only to a NELAP accredited laboratory for the service or test to be performed.

Supplies provided from outside vendors are procured through purchase orders generated by the person/section requesting the product. The Production Supervisors sign off on the purchase order. Upon receipt of a product the material is disseminated by the sample custodian to the appropriate section. The Production Supervisor and chemist verify the correctness of their order by confirming that the proper item has been received.

The sample custodian is notified of non-compliant products. Non-compliant products are returned to the sample custodian and documented in a logbook. The sample custodian is responsible for returning non-compliant materials back to the vendor or place of origin. The logbook is maintained by the sample custodian and is located in sample receiving.

9. Preventive Maintenance

9.1 Instrument Maintenance

The prevention of instrument failure is important to laboratory operation. The laboratory needs to meet certain analytical schedules and holding times and this can only be accomplished by keeping instrument downtime to a minimum. Instruments are cleaned and maintained on a regular basis to help limit downtime. A preventive maintenance schedule is followed and a maintenance log is kept on major instruments. Routine maintenance is performed to the manufacturers specifications. A list of routine maintenance is included as Table 9-1.

The lab has maintenance contracts on several major pieces of equipment. If the lab experiences a problem with an analytical instrument, a service call is made, and a certified technician is sent to correct the problem. The analysts are also trained in "troubleshooting" their instruments to determine if outside assistance is needed.

In the event that an instrument or piece of equipment cannot be calibrated or becomes inoperable, the item will be tagged and removed from service until repair. Instruments are not placed into service until performance is satisfactory as demonstrated through an acceptable calibration, verification or test. (1) Equipment that cannot be repaired is permanently removed from service. (2) In many cases there is an alternate piece of equipment that can be substituted. If there is no alternate equipment available, the sampling will be delayed if possible, or samples will be subcontracted to an alternate approved laboratory (Section 8).

9.2 Maintenance Records and Logs

Maintenance records and logs are kept on every major instrument in the lab. Instrument records and logs are located near their respective instruments. Production Supervisors shall be responsible for maintaining records and all reference materials significant to each major piece of equipment. Records include:

- Name of Item
- Manufacturer's name, model and serial number
- Date received
- Condition when received (new, used)
- Date placed in service
- Current location
- Manufacturer's instructions/specifications (instrument manuals)
- Contract, maintenance service receipts for work performed
- Documented history of damage, malfunction and modifications
- Calibration/verification records

Maintenance, whether performed by laboratory personnel or by professional maintenance personnel, is documented as an entry in the appropriate logbook. All logbook sheets will contain the name of the instrument, manufacturer's name, model and serial number. Entries into the logbook include:

- Date of maintenance activity
- Description of maintenance activity
- Individual performing maintenance

9.3 Equipment Monitoring

Where procedures dictate, the operating temperatures of ovens, incubators, water baths, refrigerators, coolers and freezers are checked daily and recorded in a laboratory notebook. A specific analyst is assigned the responsibility to perform and record these temperature checks. The initials of the analyst, date, time performed and temperature reading are recorded for ovens, refrigerators, etc. A table of the types of equipment that is monitored and the frequency that it is monitored is included as Table 9-2.

Table 9-1 *Preventive Maintenance*

Instrument	Activity	Frequency
Atomic Absorption - Furnace	Clean furnace windows	Daily
	Change graphite tube	As needed
	Check gases	Daily
	Check autosampler and tubing	Daily
ICAP	Check vacuum pump oil level	Daily
	Clean Filters	Monthly
	Record vacuum reading	Daily
	Change pump tubing	Weekly
	Clean Nebulizer/Torch	As needed
	Check Autosampler and tubing	Daily
Gas Chromatograph - Volatiles	Check Hall propanol flow	Daily
	Check Hall furnace temp.	Daily
	Check PID sensitivity	Daily
	Change lamp	As needed
	Rinse purge devices	Daily
	Bake purge devices	Daily
	Check carrier gases	Daily
	Change carrier gases	As needed
	Check column flows	Daily
	Check for gas leaks	At each column change
	Replenish electrolytic conductivity detector solvents	As needed
	Check Tekmar transfer lines	Daily
	Check valve temperatures	Daily
	Clean transfer lines	As needed
Gas Chromatograph - Volatiles	Check Hall propanol flow	Daily
	Check Hall furnace temp.	Daily
	Check PID sensitivity	Daily
	Change lamp	As needed
	Rinse purge devices	Daily
	Bake purge devices	Daily
	Check carrier gases	Daily
	Change carrier gases	As needed
	Check column flows	Daily
	Check for gas leaks	At each column change
	Replenish electrolytic conductivity detector solvents	As needed
	Check Tekmar transfer lines	Daily
	Check valve temperatures	Daily
	Clean transfer lines	As needed

Table 9-1 *Preventive Maintenance*

Instrument	Activity	Frequency
Gas Chromatograph - Semi-volatiles	Change septum	Every 100 shots or as needed
	Change carrier gas	When pressure reaches 250 psi
	Remove first foot of capillary column	As needed
	Clean ECD	As needed
	Clean Nitrogen-Phosphorous Detector	As needed
	Check system for gas leaks	At each column, liner or injection port seal change
	Replace column	As needed
	Clean FID	As needed
	Replace capillary injection port liner	At column change or as needed
	Replace capillary injection port seal	At column change or as needed
	Measure gas flow	After changing column
	Change syringe	As needed
Gas Chromatograph/ Mass Spectrometer	Change septum	Daily/as needed
	Change carrier gas	Before pressure reaches 200 psi
	Change gas filters	As needed
	Change trap on Tekmar	As needed/poor sensitivity
	Change GC column	As needed/poor sensitivity
	Clean MS ion source	As needed/poor sensitivity
	Replace ion source parts	When worn/poor sensitivity
	Check pump oil leaks	Weekly
	Check gas flows	Before initial calibration
	Cut capillary column	As needed/contamination susp.
	Replace liner	As needed/contamination susp.
	Replace BNA seal	As needed/contamination susp.
	Bake VOA autosampler	After high samples
	Clean Precept syringe	As needed
	Replace Precept sample filter	Annually/as needed
	Replace syringe plungers	When worn
	Replace Tekmar transfer lines	As needed/poor sensitivity
	Clean or replace GC weldment	As needed/poor sensitivity
	Clean or replace split vent	As needed/poor sensitivity
	Clean injector housing	As needed/poor sensitivity
	Clean electron multiplier	As needed/poor sensitivity
	Manufacturer P.M. program	Semi-annually
Lachat QuikChem AE	Coat rollers of pump with silicon spray	Weekly
	Replace pump tubes	As needed
	Clean flares at port of valve module	As needed
	Replace O-rings	As needed
	Replace unions	As needed
TOC	Replace water in IC Chamber	Daily
	Clean IC chamber	As needed
	Repack quartz wool and copper in combustible tube	As needed
	Clean TC inlet valve	As needed
	Refill acid bottle	When 2/3 empty

Table 9-1 *Preventive Maintenance*

Instrument	Activity	Frequency
GPC	Change seals and oil motor on positive displacement pump	Every 1500-2000 hours of use or bi-annually
	Repack column	When resolution criteria is not met
	Check system pressure	Check daily when operating
	Replace mesh at column effluent/influent	If torn or wrinkled
	Check calibration and solvent flow	Check weekly
IR Analyzer	Clean and inspect quartz tubes	With each use
Mercury Analyzer	Check tubing	Daily
	Record air flow rate	Daily
	Change desiccant	Daily
Proportional Counters	Check gas pressure and flow	Daily
	Change gas	As needed
	Check for leaks	When gas cylinders are changed
	Check gas line dryer	When moisture is visually present
	Clean fan filter	Annually
Gamma Spectrometers	Fill LN2	Weekly
Alpha Spectrometers	Clean NIM rack filters	Semi-annually
	Change vacuum pump oil	Semi-annually
Support Computers	Clean fan filters	Annually
Transmission Electron Microscope - Asbestos	*Fill LN2*	*Daily*
	Check vacuum status	*Daily*
	Check water temperature and pressure	*Daily*
	Check air temperature and pressure	*Daily*
Polarized Light Microscopes - Asbestos	*Check light source*	*Daily*
	Clean stage, condenser, objectives, field iris, oculars	*Weekly*
Phase Contrast Microscopes - Asbestos	*Check light source*	*Daily*
	Clean condenser, stage, objectives, oculars	*Weekly*

Table 9-2 *Equipment Monitoring*

Equipment Type	Activity	Frequency
Ovens	Temperature Monitoring	Twice Daily
Refrigerators	Temperature Monitoring	Twice Daily
Incubators	Temperature Monitoring	Twice Daily
Walk-in Cooler	Temperature Monitoring	Twice Daily

10. Quality Control Checks, Routines to Assess Precision and Accuracy, and Calculation of Method Detection Limits

When analyzing samples, the accuracy and precision of the data generated are determined through the analysis of replicates, spiked samples, laboratory control samples, and laboratory blanks with each set of samples. Results of QC samples are charted against control limits established for the current year.

10.1 Method Detection Limits

Method detection limits (MDL) are calculated for each instrument in the lab requiring MDLs. They are calculated following the procedures outlined in 40 CFR Part 136, Appendix B. Seven replicate measures are used to determine the method detection limits. MDLs are calculated and are updated yearly. A running a standard at a concentration near the MDL value is analyzed each time a calibration curve is generated.

10.2 Method Accuracy and Precision

Method accuracy is the ability to determine that the measurement of a known reference standard will be acceptably close to the defined true value. This is measured by the analysis of an external reference standard. The analytical method accuracy and matrix effects are determined by spiking a known amount of analyte into a sample. The percent recoveries are then calculated. The amount of analyte recovered from the sample reflects how the matrix effects the accuracy of the method. An acceptable trend over time indicates control of accuracy.

Method Precision is the measurement of the spread of replicate measurements relative to their established value. One would expect the distribution to be random and therefore follow normal statistics. The analytical method precision is determined by analyzing equal amounts of a split sample. Ideally, the analytical results will be identical; however, differences occur due to random variations in the procedure. A quantitative measure of these differences is assessed by calculating the relative percent differences or relative error ratios between duplicate results for each analyte.

10.3 Intralaboratory QA/QC Program

An integral part of a QA program is an interlaboratory QC program that provides a mechanism where QC procedures can be documented for review.

A quality control program is a systematic attempt to monitor the precision and accuracy of analyses by detecting and preventing the recurrence of errors. By identifying the sources of errors, confidence in the precision and accuracy of analytical results can be established, and improvements in the analytical methods can be made.

In general, Laboratories quality control program incorporates the concepts of: a) calibration to attain accuracy, b) replication to establish precision limits, and c) use of independently prepared traceable standards and spikes to confirm accuracy.

Table 10-1 contains a list of laboratory QC checks and the frequency at which they are done. If method QC requirements are more stringent than O'Brien & Gere Laboratories QC requirements, the method QC requirements will be followed.

10.3.1 Definitions of Basic Terms

There are some basic terms that are frequently used when discussing QA/QC. Below are the definitions of some common terms.

Reagent Blanks - A matrix free blank which includes all reagents used during analysis.

Preparation Blank - The preparation or method blank is an aliquot of distilled and deionized water, organic free water, or organic reagents used in the analysis of samples. The preparation blank is passed through the entire analytical procedure (including glassware and other materials that come into contact with the samples). These blanks are analyzed along with the samples to monitor: a) occurrences of false positives, or b) occurrences of cross-contamination.

Trip Blank - Trip blanks are water blanks sent from the laboratory to the sampling site and are returned to be analyzed in the same manner as the samples. They are treated in the same manner as the field samples during sampling. If the samples are to be analyzed for purgeable organics, the analysis of trip blanks provides a check on possible contamination of the samples by permeation of volatiles through the septum seal. At least one trip blank for each volatile organic method will be prepared and analyzed for each cooler used to transport the volatile samples.

Matrix Spike - Spikes are prepared by adding a known amount of analyte to a randomly selected field sample. Evaluation of analytical results provides a quantitative measure of accuracy (spiked blanks) or percent recovery (spiked samples). The spike percent recovery reflects matrix effects upon the analytical method accuracy.

Matrix Duplicate - Duplicates are prepared by splitting a field sample into equal amounts and treating them as two unique samples throughout the analytical procedure. The results of duplicate analyses provide information on overall precision of the analytical methodology. Quantitative results are obtained by calculating the relative percent difference (RPD) or relative error ratio (RER) for each analyte in the sample matrix. RPDs can only be calculated if both the sample and duplicate have results above the detection limit. RERs may be calculated and evaluated for all results.

Replicates - Replicates are the reanalysis of a field sample by a different analyst. The results of replicate analyses provide information on overall precision of the analytical methodology. Quantitative results are obtained by calculating the percent difference of the samples.

4. Calculate the warning and control limits.

$$UCL = \overline{RPD} + 3s$$
$$UWL = \overline{RPD} + 2s$$
$$LWL = \overline{RPD} - 2s$$
$$LCL = \overline{RPD} - 3s$$

The LCL is always zero since it is impossible to have a negative RPD.

10.5.2 Accuracy QC Charts

Accuracy QC charts are used for graphing the percent recoveries of laboratory control samples. The warning and control limits are calculated by using the following procedures:

1. For each laboratory control sample, calculate the percent recovery (%R).
2. Calculate the mean %R by taking the %Rs and dividing by the total number (n) of %Rs.
3. Calculate the standard deviation (s) of the percent recoveries.
4. Set the warning and control limits by the following:

$$UCL = \overline{\%R} + 3s$$
$$UWL = \overline{\%R} + 2s$$
$$LWL = \overline{\%R} - 2s$$
$$LCL = \overline{\%R} - 3s$$

10.5.3 Matrix Spike Recovery QC Charts

Matrix spike recovery QC charts are used for graphing the percent recoveries of spiked samples. The warning and control limits are calculated by using the following procedures:

1. For each spiked sample, calculate the percent recovery (%R).
2. Calculate the mean %R by taking the %Rs and dividing by the total number (n) of %Rs.
3. Calculate the standard deviation (s) of the percent recoveries.
4. Set the warning and control limits using the procedure as stated for accuracy QC charts.

Table 10-1 *Laboratory QC Checks and Frequency*

Laboratory Section	QC Sample	Frequency
GC/MS Volatiles	Laboratory Control Sample	Daily or every batch
	BFB	Every 12 hours
	Continuing Cal. Check	After BFB
	Matrix Spike	5% or Every batch
	Matrix Spike Duplicate	5% or Every batch
	Preparation Blank	Daily or every batch
	Surrogates	Every sample
	Internal Standards	Every sample
	P.E. Samples	Semi-annually
GC/MS Semivolatiles	Laboratory Control Sample	Every batch
	DFTPP	Every 12 hours
	Continuing Cal. Check	After DFTPP
	Matrix Spike	5% or Every batch
	Matrix Spike Duplicate	5% or Every batch
	Preparation Blank	Every batch
	Surrogates	Every sample
	Internal Standards	Every sample
	P.E. Samples	Semi-annually
GC Volatiles	Laboratory Control Sample	5%
	Continuing Cal. Check	10%
	Matrix Spike	5%
	Matrix Spike Duplicate	5%
	Preparation Blank	Daily or every batch
	Surrogates	Every sample
	P.E. Samples	Semi-annually
GC Semivolatiles	Laboratory Control Sample	5%
	Continuing Cal. Check	10% or 5% or every 12hrs. as per method
	Matrix Spike	5%
	Matrix Spike Duplicate	5%
	Preparation Blank	5% or every batch
	Surrogates	Every sample
	P.E. Samples	Semi-annually
Metals	Laboratory Control Sample	5% or every batch
	Continuing Cal. Check	10%
	Matrix Spike	5%
	Duplicate	5%
	Preparation Blank	5% or every batch
	P.E. Sample	Semi-annually
Wet Chemistry	Laboratory Control Sample	5% or every batch
	Continuing Cal. Check	10%
	Matrix Spike	5%
	Duplicate	5%
	Preparation Blank	5% or every batch
	P.E. Samples	Semi-annually

Table 10-1 *Laboratory QC Checks and Frequency*

Laboratory Section	QC Sample	Frequency
PCM	Known	Daily
	Duplicate	5%
	Field Blank	Every batch
	Interlaboratory Exchange	Quarterly
	P.E. Samples	Up to ten/year
PLM	Known	Daily
	Duplicate	10%
	Replicate	10%
	Interlaboratory Exchange	Quarterly
	Blank	Daily
	P.E. Samples	Up to eight/year
NOB	Duplicate	5%
	Replicate	5%
	Known	Each batch
	Blank	Each batch
	Interlaboratory Exchange	0.5%
	P.E. Samples	As submitted
TEM - Airborne	Duplicate	10%
	Replicate	10%
	Verified Count	0.5%
	Laboratory Blank	10% - (4% analyzed)
	Interlaboratory Exchange	0.5%
	P.E. Sample	Up to eight/year
Actinides	Laboratory Control Sample	Each batch or 5%
	Preparation Blank	Each batch or 5%
	Matrix Duplicate	Each batch or 5%
	Matrix Spike	Upon client's request
	Tracers (if appropriate tracer is not available, matrix spike duplicate also performed)	Each sample
Gross Alpha/Beta	Laboratory Control Sample	Each batch or 5%
	Preparation Blank	Each batch or 5%
	Matrix Duplicate	1 every 20 Samples or 5%
	Matrix Spike	1 every 20 Samples
Gamma Spectrometry	Laboratory Control Sample	Each batch or 5%
	Preparation Blank	Each batch or 5%
	Matrix Duplicate	Each batch or 5%
Radium-226/228	Laboratory Control Sample	Each batch or 5%
	Preparation Blank	Each batch or 5%
	Matrix Duplicate	Each batch or 5%
	Carriers	Every Sample
	Matrix Spike	Upon client's request

Table 10-1 *Laboratory QC Checks and Frequency*

Laboratory Section	QC Sample	Frequency
Other	Laboratory Control Sample	Each batch or 5%
	Preparation Blank	Each batch or 5%
	Matrix Duplicate	Each batch or 5%
	For all analyses where an extraction is performed, either a carrier, tracer, or matrix spike analysis shall be performed	Each batch or 5 %

11. Computers, Data Reduction, Validation and Reporting

11.1 Computers and Software

The laboratory uses computers and various types of software for the collection, processing, recording, reporting and storage of environmental data. Procedures for software verification and validation are currently being developed to comply with the EPA's Good Automated Laboratory practices. External software is validated through the manufacturer. Copies of manufacture's validation documentation are obtained when software is purchased.

Laboratories has an on-site dedicated Computer Systems Analyst. The Computer Systems Analyst is responsible for the maintenance and security of data. Various levels of system access are designated to employees through the distribution of passwords by the Computer Systems Analyst. The Computer Systems Analyst is also responsible for the generation and review of electronic deliverable data specifications. Data and information on the LIMS is backed up daily. The server is backed up on a monthly basis.

11.2 Data Reduction

Data is generated from several different sources (scientific equipment, manual calculations, or computer generated). Some of the raw data is stored in hard copy form and some of the raw data is stored on electronic media (floppy disks or tapes).

Analytical results are either calculated manually, by computer program, or a combination of the two in accordance with the method employed. Calculations include such factors as sample matrix, sample size, method detection limits, client requested detection limits and dilutions or concentrations that may have been performed.

Raw data for the Organics section of the laboratory is labeled with the sample number and date analyzed. An injection log book serves as a table of contents for each analytical run. Each sample and standard is identified in the injection logbook and on each chromatogram (where applicable). Data reduction and chromatogram identification is performed by the analysts. GC peaks and patterns are identified based on retention times.

The analysts for all sections of the laboratory are responsible for documenting observations, measurements, and data in appropriate logbooks and are also responsible for entering their

field sample and QC data into the LIMS. To ensure client confidentiality all client's are assigned a client number which is solely used for identification purposes. The usage of a client's name in all logbooks is prohibited.

11.3 Data Verification

The first step of the data verification process is when QC data are entered into the LIMS. The computer automatically compares the results to the established control limits. The analyst informs the section supervisor of an out-of-control situation. The section supervisor monitors the corrective action taken by the analyst. An exception report can be printed daily listing QC that failed to meet established criteria. The exception report can be used as a summary of the percentage of QC data that do not meet established criteria.

The second step is after the data had been entered into the LIMS system. The data is checked as required by project specific requirements by the section supervisor in charge of the laboratory section that generated the data. The section supervisor checks calculations, chromatograms, raw data, calibration curves, QC samples, and holding times. Any errors detected are reviewed with the analyst who made the error, documented and acknowledged.

The next level of review is performed by the QA/QC Coordinator. Data is checked as required by project specific requirements by the QA/QC Coordinator. The QA/QC Coordinator checks for adherence to method protocol. The QA/QC Coordinator also checks for use of the proper quality control limits, proper documentation of corrective actions and adherence to any specific requirements in the Quality Assurance Program. Calculations, whether performed manually or by computer, are also verified by the QA/QC Coordinator.

A flow chart outlining sample analysis and data validation procedures performed at Laboratories has been included as Figure 11-1.

11.4 Data Reporting and Report Format

In general, the project supervisor collects the LIMS reports of samples, associated QC samples, and raw data if required, checks them for completeness and compiles them into the client-specified report format. A case narrative is written that describes methods used and any QC excursions or anomalies. The final report is approved and signed by the project supervisor and the QA/QC Coordinator.

Appendix E outlines the order and contents of a typical validatable data package.

As a general rule, sample results are reported to two significant figures down to the PQL. Radiochemistry data are reported as calculated regardless of activity levels. EPA rounding rules are followed. That is, if the number to the right of the digit to be kept is greater than five, the number is rounded up. If the number to the right of the digit to be kept is less than five, the number is rounded down. If the number to the right is equal to five and there are no numbers to the right of the five, then the number is rounded up if is odd or rounded down if it is even.

Quality control sample results are not rounded. Raw numbers are presented on the QC sheets (solid samples will be corrected for percent solids). The percent recoveries and relative percent differences reported are rounded to whole numbers.

The lab provides, where appropriate, several different levels of reporting. Each level has different documentation requirements. The analysis report format, regardless of level includes the following information:

- Title
- Name, address and phone number of laboratory
- Client name, project and client identification number
- Client description and laboratory identification number of the sample
- Dates of sample collection, receipt, preparation and analysis
- Time of sample preparation and/or analysis for samples that have a required holding time of 48 hours or less
- Identification of method used and modifications to an accepted method
- Description of quality control failures and deviations from methods
- Identification of samples that do not meet sample acceptance criteria
- The minimum reporting limit for the test result
- The test result and any supporting measurements and units
- Date of issue
- Identification of subcontracted laboratories and results
- Signature and title of person responsible for the quality of data and how the contents of the report were produced

Reports are issued as a single identifiable document. Reports that are level 3 and above are paginated. No logos other than the O'Brien & Gere corporate logo is used on any report.

11.5 Data Review

Laboratory data goes through various levels of review prior to being released to the client. The purpose of this review is to verify the results reported are accurate and meet the client's data quality objectives. The internal review of laboratory data is detailed below.

11.5.1 Criteria

Data is reviewed against the requirements listed in the laboratory standard operating procedures.

Individual projects may have specific QA/QC criteria or variances that are applicable. These program specific requirements are communicated through a combination of codes and comments which have been integrated into the LIMS by Laboratories' Project Supervisor. This communication will often direct the analyst to a Project Supervisor provided hard copy of appropriate requirements to be followed. For example, applicable AFCEE Version 3.0 requirements and variances can be found in the binder labeled "Program Specific Requirements" that is located with the SOP binders.

11.5.2 Procedure

11.5.2.1 Section Responsibilities

The analyst is responsible for reviewing the data after it is analyzed. They are required to check that QC results are within QC limits. If the data is not within acceptance limits corrective action is initiated.

The analyst will complete a corrective action log (see Section 12) for analytical sequences. If there are any excursions or discrepancies, they will be listed on the corrective action log. The corrective action log is forwarded to section supervisors, QA/QC, and project management for review and signature.

The section supervisor is responsible for reviewing the data before it is submitted to QA/QC or to the Project Supervisor. The Production Supervisor should review 100% of the data.

The Production Supervisor will check calculations, chromatograms, raw data, calibration curves, calibration check standards, QC samples, and holding times.

11.5.2.2 QA/QC Responsibilities

QA/QC will review the data for compliance with internal, method and/or QAPP criteria. They will verify that batch related QC was performed and acceptable. Calculations and chromatograms will be spot checked. In cases where there are excursions, QA/QC will write a draft case narrative listing the anomalies. QA/QC will review, at a minimum, 10% of the data, or the amount required by project specific requirements.

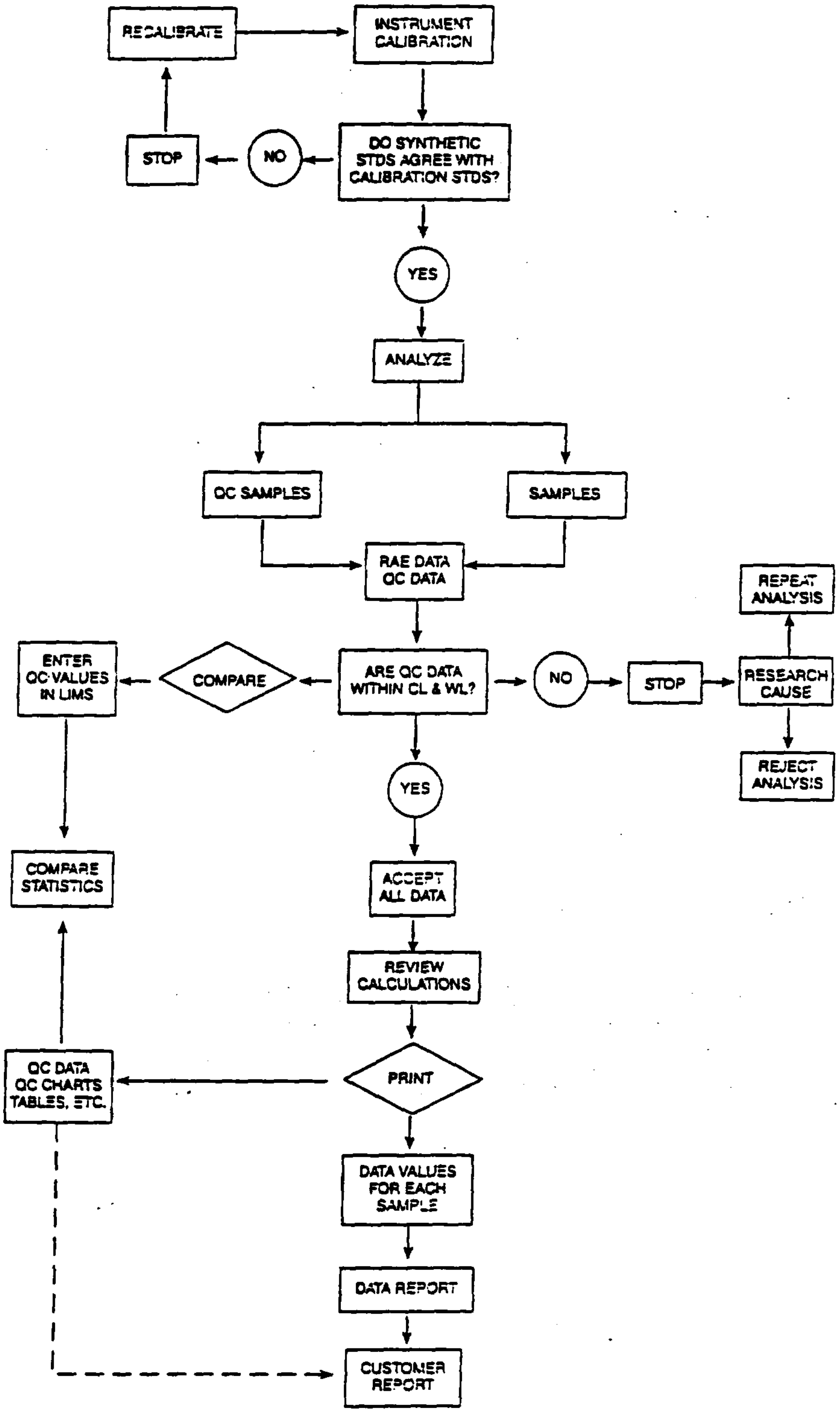
If any deficiencies are noted, the data will be returned to the section for correction.

11.5.2.3 Project Supervisor Responsibilities

Project Supervisors will check for reasonableness of the data and completeness of the results reported. They will verify that data requested by the client on the chain-of-custody was performed and is included in the report. The Project Supervisor or designee is responsible for approving reports via their signature.

Figure 11-1

Data Analysis & Verification Flow Chart



12. Corrective Actions and Complaints

12.1 Corrective Actions

Corrective actions are procedures or steps taken in response to QC data not meeting acceptance criteria, procedures not followed properly, client-specified requirements not met, or regulatory guidance not followed or met. QC samples must meet established criteria. If they fail to meet these criteria, corrective actions are taken. Corrective action procedures are discussed below and in Table 12-1.

If the calibration data fail to meet QC criteria, the problem is identified, corrected, documented and the system recalibrated. Samples cannot be analyzed until the calibration meets the QC criteria. If matrix spikes or duplicates are out of control, the data may be rejected and the samples reanalyzed or reextracted. Alternatively, the sample data may be accepted, depending upon many circumstances, including sample matrix, level of analytes, etc. The Project Supervisor is responsible for communicating QA/QC excursions to the client and ensuring that project specific criteria is met. QC anomalies will be addressed in a case narrative, which is included with validatable reports or if requested.

The analyst who is responsible for running the samples is the first to assess the quality of the data. If a problem is detected, the section supervisor is immediately notified. The quality of the data is checked by the Production Supervisor, followed by the QA/QC Coordinator, the Project Supervisor and the Administrative Officer. If samples need to be reanalyzed or reextracted, the Production Supervisor is first consulted, the Project Supervisor is notified, and the procedure is rescheduled. The analyst will compare the new result with the old one and note any differences. The results are then discussed with the Production Supervisor. If the new results meet the QC criteria, the results are then reported. If QC criteria still are not met, the results are reviewed with the Project Supervisor and the QA/QC Coordinator. The review process should not exceed twenty-four hours. The Production Supervisor, Project Supervisor, QA/QC Coordinator and Administrative Officer may recommend corrective actions. Corrective actions that are recommended during the review process and carried out are documented. The client is notified by the Project Supervisor of the QC deficiency and any resulting corrective actions. The decision is then made to accept the data or to resample. Decisions and/or instructions by the client are documented by the Project Supervisor. The decision-making process varies depending on the type of project and the ultimate use of the data. In all cases, good communication is required in order to meet data quality objectives.

There are certain corrective actions that are routinely followed by the laboratory. A list of the common QC activities, acceptance criteria, and corrective actions are included as Table 12-1.

QC data that does not meet criteria and resulting corrective actions are documented on the corrective action log. A corrective action log is filled out for each analysis, each day. An example copy of a corrective action log is included as Figure 12-1. If QC data fails any of the limits, a corrective action log is filled out by the analyst and signed by the section supervisor, the QA/QC Coordinator and the Project Supervisor. The corrective action logs are then filed in a three-ring binder and kept in the laboratory. Copies of the corrective action logs are also kept in the QA/QC Coordinator's office. A copy is sent with the final report if requested by the client.

Deficiencies and excursions discovered during on-site assessments by a client or certifying agency warrant corrective actions. Internal audit findings also require corrective action. Corrective action procedures for audit findings are discussed in section 13.2.

Corrective actions are also required for Performance Evaluation (PE) sample deficiencies. Detailed corrective action procedures for PE sample deficiencies are discussed in section 13.3.

12.2 Complaints

If a client or related business entity questions the validity of data, methods or related activities of the laboratory, procedures are followed and documented to resolve the complaint. Project Supervisors document a complaint on a Complaint Resolution Form (Figure 12-2). The Complaint Resolution Form is submitted to the appropriate Production Supervisor. The QA/QC Coordinator and Administrative Officer will also review the complaint and recommend and document on the Complaint Resolution Form corrective actions. The Production Supervisor documents corrective actions in an internal memo and forwards it to the Project Supervisor. A copy of the response is forwarded to the QA/QC Coordinator and Administrative Officer. The Project Supervisor will contact the client responsible for initializing the compliant by phone and/or fax and inform them of any corrective actions. A copy of the complaint and response is filed in a three-ring binder labeled "Client Complaints." Complaints are filed by project number for client confidentiality purposes. The Client Complaints file is available for review during external audits if requested.

The QA/QC Coordinator will review corrective action logs and complaints on a quarterly basis. The purpose of this review is to verify the outcome of the corrective actions. A summary of this review will be included as an agenda item in the QA/QC Section Meeting.

Table 12-1 *Corrective Actions*

QC Activity	Acceptance Criteria	Corrective Action
Initial Calibration	Must be within limits set by the method and/or project	Prepare new standards Recalibrate instrument
Calibration Check Standard	Must be within limits set by the method and/or project	Rerun standard Prepare new standard Recalibrate instrument

Table 12-1 *Corrective Actions*

QC Activity	Acceptance Criteria	Corrective Action
Matrix Spike	Must be within laboratory QC limits or method limits and/or project	Investigate problem, document and qualify data
Lab Duplicate	Must be within laboratory QC limits or method limits and/or project	Investigate problem, document and qualify data
Method Blank	Must be less than the reporting limit	Investigate problem and reanalyze or reextract
Laboratory Control Sample	Must be within laboratory QC limits or method limits and/or project	Investigate problem and reanalyze or reextract
Surrogate Recoveries	Must be within laboratory QC limits or method limits and/or project	Investigate problem and reanalyze or reextract
Internal Standards	Must be +100% or -50% of the initial calibration and/or greater than 10% of the continuing calibration response	Investigate problem and reanalyze or reextract
Result over highest std.	Results must be within the range of the instrument	Dilute and reanalyze
P.E. Samples	Results must be within preestablished limits	Investigate problem and document corrective action
Field Duplicate	Must be within limits specified by the client	Document
Field Blank	Must be less than the detection limit	Document

Figure 12-1

Example Corrective Action Form

CORRECTIVE ACTION LOG
TRACE METALS

Analyst: _____ Instrument: _____

Date of Analysis: _____ Method: _____

PROJECT NUMBER(S)/BATCH NUMBER(S)	EXCURSIONS	AFFECTED SAMPLES	CRITERIA COMPARISON	REASON/CORRECTIVE ACTION

Reviewed by:

Section Supervisor _____ Date _____

QA/QC Officer _____ Date _____

Project Supervisor _____ Date _____

C:\wpwin60\wpdocs\correct\corra.frm

Figure 12-2

Complaint Resolution Form

O'BRIEN AND GERE LABORATORIES, INC.
Complaint Resolution Form

Client Information

Client/Project ID#: _____ Project Manager: _____

Date of Complaint: _____

Form of Complaint: Fax _____ Letter _____ Phone Call _____

Person Receiving complaint: Signature: _____

Description of Complaint (Problem):

Submit & Discuss with Production Supervisor

Copy to QC Coordinator

Copy to Administrative Supervisor

Source/Cause of the Problem:

Corrective Action Taken:

Final Resolution/Client Comment:

Date Client Contacted and form of contact: _____

Production Supervisor Signature: _____ **Date:** _____

Project Supervisor Signature: _____ **Date:** _____

QA/QC Approval: Signed: _____ **Date:** _____

c:\wpwin60\wpdocs\corract\compa.frm

13. Performance and Systems Audits

13.1 Internal System Audits

An internal audit is performed at least annually on each section of the laboratory for overall adherence to the guidelines and procedures outlined in this manual. Follow-up audits are performed if necessary. Typically a follow up audit is performed in response to a PE failure or external audit finding. Laboratory notebooks are checked to verify signatures and dates. Calibration curves and QC samples are checked for the proper frequency and compliance with established control limits. Procedures are reviewed to verify compliance with specific methods and SOPs.

The QA/QC Coordinator is responsible for scheduling each audit. The results of the audit are presented to the Production Supervisor in an internal memo. Responses or corrective actions, if required are submitted to the QA/QC Coordinator. Officers receive a copy of each internal audit. Audits are discussed with the Production Supervisors. Changes or updates are implemented as needed. Copies of each internal audit are filed by laboratory section in the QA/QC Coordinators office. If internal audit findings cast doubt on the validity of data, clients whose work may have been affected will be notified in writing by the Project Supervisor.

13.2 External System Audits

External system audits are performed yearly by several certifying agencies including New York State Department of Health, New Jersey Department of Environmental Protection, Pennsylvania Department of Environmental Regulation and United States Air Force Center for Environmental Excellence. Some audits are unannounced, while others are scheduled in advance. The laboratory will allow audits, either planned or unplanned, during normal business hours.

Any excursions or deficiencies that are noted during an external audit are resolved to the satisfaction of the agency conducting the audit under management consent. Corrective actions and recommendations by the client or certifying agency are implemented and documented. An internal memo is sent out by the QA/QC Coordinator to each laboratory section notifying them of an agency's findings. Audit findings are reviewed with laboratory management and the QA/QC Coordinator. Production Supervisors submit, in memo format, corrective actions and implementation dates to the QA/QC Coordinator. A final response, complete with corrective actions and implementation dates is sent to the agency or client conducting the audit. A copy of the audit report and our laboratory's responses is kept on file in the laboratory. Audits performed by certifying agencies are filed in an agency specific three-ring binder, while client audits are filed in a "Client Audits" three-ring binder.

13.3 Performance Audits

The laboratory also participates in the analysis of Performance Evaluation (PE) samples. These are sent out by the U.S. EPA, U.S. DOE, a certifying state agency or a third party, or EPA approved PE provider. Results must fall within certain limits in order to be acceptable. It is by successfully completing the P.E. sample analysis that the laboratory

obtains certification to perform sample analysis. The PE sample analysis also serves as a means of comparison with other laboratories performing similar work. The laboratory participates in a variety of PE studies, which are listed in Section 13.4.

PE samples are typically addressed to the QA/QC Coordinator, who hand delivers the samples to Sample Receiving. The QA/QC Coordinator acts as Project Supervisor for all PE samples. The PE samples are integrated into the laboratory as routine samples. PE samples are not averaged unless the agency states that it (reporting average results) is an acceptable practice. Data related to the PE sample analysis and the results of the analysis are maintained by the QA/QC Coordinator and filed in three-ringed binders. If any parameters are deficient, the QA/QC Coordinator submits an internal memo to the laboratory section that analyzed the PE sample. The deficiency is investigated and a response/corrective action is generated in a return memo to the QA/QC Coordinator. A copy of the section's response is forwarded to the Production Officer. The laboratory responses are filed with the PE sample results.

13.4 PE Studies

1. New York State Department of Health for air emissions, potable water, wastewater and hazardous waste
2. New York State Department of Environmental Conservation - State Superfund
3. U.S. DOE Idaho Mixed Analyte Performance Evaluation Program
4. Corps of Engineers - Project specific approval
5. U.S. EPA - Project specific approval
6. New York State Department of Health Asbestos in Air by TEM Proficiency Tests, Fibers in Air (PCM) Proficiency Test, and Asbestos in (Bulk) Friable Material (PLM) Proficiency Test
7. American Industrial Hygiene Association Asbestos Analyst Registry and Bulk Asbestos Quality Assurance Program
8. National Institute for Occupational Safety & Health Proficiency Analytical Testing Program
9. National Voluntary Laboratory Accreditation Program Bulk Asbestos Analysis and Airborne Asbestos Analysis.
10. U.S. DOE Environmental Measurements Laboratory Radiochemistry Quality Assessment Program.

13.5 Certifications

Appendix F, is a table listing the agencies with which Laboratories holds certifications. Complete certification information is available from the laboratory.

14. Quality Assurance Reports and Management Assessment

14.1 Quality Assurance Reports

The QA/QC Coordinator is responsible for making periodic reports to management concerning QA activities. These reports serve to document lab personnel adherence to QA requirements and to discuss any updates or changes necessary to the QC program. There are informal oral reports, formal written reports and QA/QC section meeting reports. Oral

reports are given weekly during a meeting with the administrative manager. Formal written reports are given periodically and contain results of section audits and review of control charts. The QA/QC Coordinator keeps a copy of quality assurance reports, whether informal or formal.

Any significant trends in the QC data, such as data points running significantly above or below the average, may be discussed with Officers and Production Supervisors (at any time) to detect any possible problems before data gets out of control.

The QA/QC Coordinator meets with the Administrative Officer at a minimum of every six weeks to discuss several quality assurance issues. The following topics are covered every meeting:

- Section Audits
- Data Trends
- Corrective Actions
- Proficiency Samples
- QA Manual/SOP updates
- Quality Systems Issues
- Upcoming QA Events/Initiatives
- Other Laboratory Related Issues

A summary of the QA/QC section meeting minutes and any attachments becomes a "QA Report to Management" and is distributed to the President, Officers, Production Supervisors and Project Supervisors. A copy of this summary is filed in the QA/QC Coordinator's office.

External QA reports may be submitted to state or federal agencies and clients as required by contract. These reports may contain results of internal system audits, performance evaluation sample results, review of control charts and control limits, any QA/QC problems that were detected and the results of any corrective actions related to these problems.

14.2 Management Review

The Officers regularly assesses the laboratory's quality system and operations. Several tools are used to assure that program implementation is effective and that the quality for all technical work is achieved.

A weekly meeting with the President, Officers, Production Supervisors, Project Supervisors and QA/QC personnel is held. QA/QC issues are identified as a separate agenda item at these meetings. Additionally, in-house analytical programs, resource management concerns of individual groups and pending projects are reviewed and discussed. Minutes of this meeting are distributed to all O'Brien and Gere Laboratories, Inc. employees.

External and internal audits, section responses to audit findings, effectiveness of the document control program, client complaints, corrective actions, proficiency samples and personnel training and SOP reading records will be reviewed, at a minimum annually by management. This review will be documented and filed in QA/QC.

The President will present all employees with a "State of the Laboratory" address annually.

15. Document Control and Records

15.1 Record Storage

A copy of the final laboratory report is retained by the laboratory. Laboratory reports are filed by client ID number and project number. This allows for data belonging to a specific client and project to be filed together. Reports are kept at the laboratory for one year and are then stored at an access-restricted, environmentally up-kept warehouse for a minimum of five years. To ensure client confidentiality, reports may only be signed out by an O'Brien & Gere Laboratories employee.

The original chain of custody forms and case file forms are filed with the final report. If the client requested specific QC be performed, copies of the QC will also be filed with the report.

QC data is input into the LIMS. At the end of every year, QC data is copied onto disc and retained by the QA/QC Coordinator.

Raw data for lab sections is organized by date and instrument. The data is maintained in the laboratory for a period of up to 2 years. It is then stored in the secured warehouse for up to five years or as defined by project specific requirements.

Corrective action logs are maintained at the lab for one year and then stored in the secured warehouse for up to five years.

Electronic data and records are stored indefinitely in both the laboratory and secured warehouse. This data is stored away from other electronic and magnetic sources.

Current Standard Operating Procedures are maintained in the Quality Control Office. Archived SOPs are maintained by QC and stored indefinitely. This document is also maintained by QC and archived manuals are stored indefinitely.

15.2 Document Control

Laboratories has instituted a document control procedure on this document, the Radiochemistry Safety Manual and all laboratory SOPs. This is to ensure the staff is using the most current version of these documents. The QA/QC Coordinator is responsible for the distribution and maintenance of laboratory controlled documents.

SOPs that are not stamped with a controlled document stamp (in red) and numbered are not considered final versions ready for use. Any electronic copy of an SOP is not considered a final version. Laboratory SOP: AP #800-3 "Document Control" further details document control procedures.

Appendix A

QA/QC Limits and Methods

Table A-1 *Accuracy and Precision*

Method #	Matrix	Analyte/Component	Duplicate - RPD	LCS - %R	Matrix Spike - %R
EPA 305.1	Water	Acidity as $CaCO_3$	0-20*	80-120*	-
SM2320B EPA 310.1	Water	Alkalinity as $CaCO_3$	0-10	86-118	-
EPA 350.1	Water	Ammonia as N	0-19	90-114	63-121
EPA 350.1	Solid	Ammonia as N	0-16	90-114	75-125*
EPA 405.1	Water	5-day BOD	0-27	85-115	-
EPA 405.1	Water	5-day CBOD	0-22	85-115	-
EPA 410.4	Water	COD	0-17	86-114	69-140
EPA 410.4	Solid	COD	0-32	86-114	84-116
SM4500-Cl-D EPA 325.2 EPA 9251	Water	Chloride	0-8	91-115	80-123
EPA 9251	Solid	Chloride	0-19	91-115	85-158
SM4500-Cl-G EPA 330.5	Water	Total residual chlorine	0-10	82-111	-
EPA 110.2	Water	Color	0-10	-	-
EPA 335.2 EPA 335.4 EPA 9010A EPA 9010B/9014	Water	Cyanide	0-14	80-120	70-131
EPA 9010A EPA 9010B/9014	Solid	Cyanide	0-28	80-120	71-140
EPA 335.1 EPA 9010A EPA 9010B/9014	Water	Amenable cyanide	0-20*	80-120*	75-125*
NYSDOH 310-30	Water	Ethylene Glycol	0-41	77-123	69-133
SM4500-F-C EPA 340.2	Water	Fluoride, total	0-18	85-117	75-119
EPA 340.2	Solid	Fluoride, total	0-23	85-117	66-104
NIOSH 3500	Water	Formaldehyde	0-15	75-127	78-113
NIOSH 3500	Solid	Formaldehyde	0-20*	80-120*	75-125*
EPA 130.2	Water	Hardness as $CaCO_3$	0-14	90-109	-
SM3500-Cr-D EPA 7196A	Water	Hexavalent Chromium	0-16	89-110	85-115
EPA 7196A	Solid	Hexavalent Chromium	0-8	89-110	65-126
EPA 150.1 EPA 9040B	Water	Hydrogen Ion (pH)	0-1	+/- 0.2 pH units	-
EPA 9045C	Solid	Hydrogen Ion (pH)	0-1	+/- 0.2 pH units	-
EPA 351.2	Water	Kjeldahl nitrogen, total as N	0-16	79-122	60-136
EPA 351.2	Solid	Kjeldahl nitrogen, total as N	0-13	79-122	92-116
EPA 353.2	Water	Nitrite plus nitrate	0-11	92-110	68-125
EPA 353.2	Solid	Nitrite plus nitrate	0-20*	92-110	75-125*
EPA 353.2	Water	Nitrite	0-17	87-115	83-119
EPA 353.2	Solid	Nitrite	0-56	87-115	86-114

Table A-1 *Accuracy and Precision*

Method #	Matrix	Analyte/Component	Duplicate - RPD	LCS - %R	Matrix Spike - %R
Subtraction	Water	Nitrate	-	-	-
Subtraction	Solid	Nitrate	-	-	-
EPA 140.1	Water	Odor	0-20*	-	-
EPA 413.1 EPA 9070	Water	Oil and grease, total recoverable	0-20	68-114	27-113
EPA 9070	Solid	Oil and grease, total recoverable	0-34	68-114	64-97
EPA 415.1	Water	Organic carbon, total	0-22	87-112	66-127
EPA 365.1	Water	Orthophosphate	0-7	90-115	64-125
EPA 365.1	Solid	Orthophosphate	0-20*	90-115	75-125*
EPA 360.1	Water	Oxygen dissolved	0-18	-	-
EPA 420.1 EPA 9065	Water	Phenols	0-14	77-118	58-135
EPA 9065	Solid	Phenols	0-24	72-119	67-130
EPA 365.4	Water	Phosphorus, total	0-21	82-117	69-126
EPA 365.4	Solid	Phosphorus, total	0-20*	82-117	75-125*
Sec. 7.3 EPA 9010A EPA 9014	Solid	Reactive Cyanide	0-20*	50-150*	40-140*
Sec. 7.3 EPA 9030A EPA 9034	Solid	Reactive Sulfide	0-20*	50-150*	40-140*
SM2540C EPA 160.1	Water	Residue, dissolved	0-10	85-115	-
EPA 160.3	Water	Residue, total	0-6	85-116	-
SM2540-G	Solid	Residue, total	0-6	-	-
EPA 160.2	Water	Residue, suspended	0-18	75-113	-
EPA 160.4	Water	Residue, volatile	0-9	79-137	-
SM2540-G	Solid	Residue, volatile	0-39	-	-
EPA 160.5	Water	Residue, settable	0-20	-	-
SM4500-Si-D EPA 370.1	Water	Silica	0-23	91-110	64-132
SM2510B EPA 120.1	Water	Specific Conductance	0-12	93-109	-
SM2710-F	Water	Specific Gravity	0-20*	80-120*	-
SM2710-F	Solid	Specific Gravity	0-20*	80-120*	-
SM4500-SO_4-D EPA 375.4	Water	Sulfate, as SO_4	0-15	88-111	77-129
EPA 375.3	Solid	Sulfate, as SO_4	0-22	88-111	73-143
EPA 376.1	Water	Sulfide	0-35	75-130	54-120
EPA 376.1	Solid	Sulfide	0-20*	75-130	75-125*
EPA 377.1	Water	Sulfite, as SO_3	0-20*	80-120*	75-125*
EPA 425.1	Water	Surfactants	0-14	78-119	84-122
EPA 425.1	Solid	Surfactants	0-20*	78-119	75-125*

Table A-1 *Accuracy and Precision*

Method #	Matrix	Analyte/Component	Duplicate - RPD	LCS - %R	Matrix Spike - %R
SM2550B EPA 170.1	Water	Temperature	-	-	-
EPA 418.1	Water	Total Petroleum Hydrocrabons	0-25	64-107	60-107
EPA 418.1	Solid	Total Petroleum Hydrocarbons	0-13	72-126	66-132
EPA 180.1	Water	Turbidity	0-10	90-108	-
EPA 1010	Water	Waste Ignitability	-	-	-
EPA 1010	Solid	Waste Ignitability	-	-	-
EPA 1110	Water	Waste Corrosivity	-	-	-
EPA 1110	Solid	Waste Corrosivity	-	-	-

Table A-1 *Accuracy and Precision*

Method #	Matrix	Analyte/Component	Duplicate - RPD	LCS - %R	Matrix Spike - %R
EPA 200.7	Water	Aluminum	0-20	86-117	82-116
EPA 6010A		Antimony	0-23	85-108	78-110
EPA 6010B		Arsenic	0-30	89-105	83-109
		Barium	0-11	90-104	81-108
		Beryllium	0-15	90-111	81-114
		Boron	0-10	88-108	78-118
		Cadmium	0-10	89-104	75-104
		Calcium	0-10	88-106	65-123
		Chromium	0-21	91-104	79-112
		Cobalt	0-28	91-107	81-106
		Copper	0-26	92-108	87-110
		Iron	0-16	89-108	70-117
		Lead	0-16	91-107	81-111
		Magnesium	0-10	89-103	69-119
		Manganese	0-10	91-104	76-110
		Molybdenum	0-10	91-107	86-104
		Nickel	0-13	91-107	80-110
		Potassium	0-12	88-106	71-130
		Selenium	0-27	88-108	78-115
		Silver	0-14	84-106	82-103
		Sodium	0-10	99-124	70-143
		Thallium	0-29	91-107	85-110
		Tin	0-20*	81-117	75-125*
		Vanadium	0-24	93-106	80-110
		Zinc	0-28	90-105	82-105

Table A-1 *Accuracy and Precision*

Method #	Matrix	Analyte/Component	Duplicate - RPD	LCS - %R	Matrix Spike - %R
EPA 6010A	Solid	Aluminum	0-33	66-134	60-128
EPA 6010B		Antimony	0-25	10-190	60-109
		Arsenic	0-28	71-129	68-105
		Barium	0-34	69-131	72-110
		Beryllium	0-20	68-132	73-110
		Boron	0-20*	73-127	75-125*
		Cadmium	0-32	71-128	62-108
		Calcium	0-38	75-125	63-122
		Chromium	0-36	73-127	67-110
		Cobalt	0-34	79-120	73-109
		Copper	0-33	78-123	71-118
		Iron	0-33	48-152	58-107
		Lead	0-35	75-126	55-124
		Magnesium	0-30	79-122	52-128
		Manganese	0-28	79-121	56-119
		Molybdenum	0-39	71-129	70-103
		Nickel	0-25	79-122	62-115
		Potassium	0-23	73-127	64-127
		Selenium	0-36	66-134	68-108
		Silver	0-15	74-126	75-104
		Sodium	0-24	62-138	81-145
		Thallium	0-47	57-143	68-110
		Tin	0-20*	64-136	75-125*
		Vanadium	0-30	68-131	71-109
		Zinc	0-37	70-130	61-116
EPA 206.2 EPA 7060A	Water	Arsenic	0-28	66-125	59-131
EPA 7060A	Solid	Arsenic	0-31	71-129	60-132
EPA 239.2 EPA 7421	Water	Lead	0-39	80-123	59-143
EPA 7421	Solid	Lead	0-40	75-126	76-147
EPA 245.1 EPA 7470A	Water	Mercury	0-20	81-114	75-131
EPA 7471A	Solid	Mercury	0-38	68-132	63-133
EPA 270.2 EPA 7740	Water	Selenium	0-32	79-112	53-138
EPA 7740	Solid	Selenium	0-15	66-134	50-115
EPA 279.2 EPA 7841	Water	Thallium	0-30	82-108	64-122
EPA 7841	Solid	Thallium	0-20	57-143	76-110

Table A-1 *Accuracy and Precision*

Method #	Matrix	Analyte/Component	Duplicate - RPD	LCS - %R	Matrix Spike - %R
EPA 8010B/8020A	Water	Chloromethane	0-20	59-131	58-133
EPA 8021A		Bromomethane	0-22	63-129	67-126
EPA 8021B		Vinyl Chloride	0-19	62-125	70-128
		Chloroethane	0-17	70-124	73-125
		Methylene Chloride	0-14	78-124	81-122
		Trichlorofluoromethane	0-18	65-119	72-126
		1,1-Dichloroethene	0-15	75-122	79-119
		1,1-Dichloroethane	0-14	83-125	81-122
		cis-1,2-Dichloroethene	0-13	74-113	82-122
		trans-1,2-Dichloroethene	0-14	78-125	81-120
		Chloroform	0-15	80-118	82-119
		1,2-Dichloroethane	0-15	78-124	80-119
		1,1,1-Trichloroethane	0-15	76-113	80-123
		Carbon Tetrachloride	0-14	74-121	81-119
		Bromodichloromethane	0-16	80-122	78-124
		1,2-Dichloropropane	0-17	79-120	79-121
		cis-1,3-Dichloropropene	0-14	78-115	82-117
		Trichloroethene	0-14	77-117	77-126
		Dibromochloromethane	0-13	80-121	80-119
		1,1,2-Trichloroethane	0-15	82-120	82-120
		Benzene	0-10	79-117	80-115
		trans-1,3-Dichloropropene	0-12	85-128	83-114
		2-Chloroethylvinylether	0-30	51-143	10-108
		Bromoform	0-17	75-128	74-126
		Tetrachloroethene	0-14	78-117	83-120
		1,1,2,2-Tetrachloroethane	0-19	77-129	74-129
		Toluene	0-10	80-116	81-117
		Chlorobenzene	0-15	80-120	82-119
		Ethylbenzene	0-10	77-116	80-116
		Xylene (total)	0-10	76-120	82-115
		1,2-Dichlorobenzene	0-18	76-128	78-129
		1,3-Dichlorobenzene	0-17	74-122	76-124
		1,4-Dichlorobenzene	0-18	77-125	79-127
		Dichlorodifluoromethane	0-17	55-127	60-123
		Benzyl chloride	0-30*	89-148	77-114
		Bromobenzene	0-30*	86-109	79-108
		2-Chlorotoluene	0-30*	84-116	50-150*
		4-Chlorotoluene	0-30*	93-104	50-150*

Table A-1 *Accuracy and Precision*

Method #	Matrix	Analyte/Component	Duplicate - RPD	LCS - %R	Matrix Spike - %R
EPA 8010B/8020A	Water	Dibromomethane	0-30*	84-125	50-150*
EPA 8021A		1,1,1,2-Tetrachloroethane	0-30*	60-140*	50-150*
EPA 8021B		1,2,3-Trichloropropane	0-12	81-122	81-106
		Bis(2-chloroethoxy)methane	0-30*	60-140*	50-150*
		1-Chlorohexane	0-30*	81-122	81-118
		Chloromethylmethyl ether	0-30*	31-100	50-150*

Table A-1 *Accuracy and Precision*

Method #	Matrix	Analyte/Component	Duplicate - RPD	LCS - %R	Matrix Spike - %R
EPA 601/602	Water	Chloromethane	0-20	59-131	50-131
		Bromomethane	0-30	63-129	66-124
		Dichlorodifluoromethane	0-17	55-127	55-123
		Vinyl Chloride	0-19	62-125	64-128
		Chloroethane	0-17	70-124	69-125
		Methylene Chloride	0-14	78-124	81-120
		Trichlorofluoromethane	0-18	65-119	78-118
		1,1-Dichloroethene	0-15	75-122	75-124
		1,1-Dichloroethane	0-14	83-125	80-121
		cis-1,2-Dichlorothene	0-13	74-113	78-117
		trans-1,2-Dichloroethene	0-14	78-215	78-117
		Chloroform	0-15	80-118	84-118
		1,2-Dichloroethane	0-15	78-124	80-122
		1,1,1-Trichloroethane	0-15	76-113	76-126
		Carbon Tetrachloride	0-14	74-121	78-121
		Bromodichloromethane	0-16	80-122	80-122
		1,2-Dichloropropane	0-17	79-120	76-123
		cis-1,3-Dichloropropene	0-14	78-115	75-123
		Trichloroethene	0-14	77-117	81-124
		Benzene	0-10	79-117	78-111
		Dibromochloromethane	0-13	80-121	84-117
		1,1,2-Trichloroethane	0-15	82-120	86-122
		trans-1,3-Dichloropropene	0-12	85-128	81-119
		2-Chloroethyl vinyl ether	0-30	51-143	10-132
		Bromoform	0-17	75-128	74-126
		1,1,2,2-Tetrachloroethane	0-19	77-129	86-124
		Tetrachloroethene	0-14	78-117	85-121
		Toluene	0-10	80-116	71-115
		Chlorobenzene	0-15	80-120	77-123
		Ethylbenzene	0-10	77-116	80-109
		Xylene (total)	0-10	76-120	79-109
		1,2-Dichlorobenzene	0-18	76-128	75-127
		1,3-Dichlorobenzene	0-17	74-122	76-122
		1,4-Dichlorobenzene	0-18	77-125	78-123

Table A-1 *Accuracy and Precision*

Method #	Matrix	Analyte/Component	Duplicate - RPD	LCS - %R	Matrix Spike - %R
EPA 8010B/8020A	Solid	Chloromethane	0-15	59-131	46-135
EPA 8021A		Bromomethane	0-21	63-129	72-126
EPA 8021B		Vinyl Chloride	0-25	62-125	65-123
		Chloroethane	0-15	70-124	78-122
		Methylene Chloride	0-15	78-124	74-124
		Trichlorofluoromethane	0-15	65-119	65-127
		1,1-Dichloroethene	0-19	75-122	63-130
		1,1-Dichloroethane	0-13	83-125	70-125
		cis-1,2-Dichloroethene	0-14	74-113	69-123
		trans-1,2-Dichloroethene	0-16	78-125	67-127
		Chloroform	0-11	80-118	71-129
		1,2-Dichloroethane	0-19	78-124	68-120
		1,1,1-Trichloroethane	0-13	76-113	79-129
		Carbon Tetrachloride	0-11	74-121	69-129
		Bromodichloromethane	0-17	80-122	71-129
		1,2-Dichloropropane	0-12	79-120	60-126
		cis-1,3-Dichloropropene	0-17	78-115	67-128
		Trichloroethene	0-20	77-117	61-138
		Dibromochloromethane	0-14	80-121	62-121
		1,1,2-Trichloroethane	0-14	82-120	75-120
		Benzene	0-11	79-117	74-127
		trans-1,3-Dichloropropene	0-17	85-128	63-122
		2-Chloroethylvinylether	0-21	51-143	28-145
		Bromoform	0-19	75-128	75-118
		Tetrachloroethene	0-16	78-117	64-140
		1,1,2,2-Tetrachloroethane	0-27	77-129	73-115
		Toluene	0-13	80-116	74-122
		Chlorobenzene	0-19	80-120	75-123
		Ethylbenzene	0-15	77-116	77-116
		Xylene (total)	0-13	76-120	79-116
		1,2-Dichlorobenzene	0-35	76-128	75-131
		1,3-Dichlorobenzene	0-27	74-122	52-129
		1,4-Dichlorobenzene	0-30	77-125	62-134
		Dichlorodifluoromethane	0-29	55-127	44-132
		Benzyl chloride	0-30*	60-140*	50-150*
		Bromobenzene	0-30*	60-140*	50-150*
		2-Chlorotoluene	0-30*	60-140*	50-150*
		4-Chlorotoluene	0-30*	60-140*	50-150*

Table A-1 *Accuracy and Precision*

Method #	Matrix	Analyte/Component	Duplicate - RPD	LCS - %R	Matrix Spike - %R
EPA 8010B/8020A	Solid	Dibromomethane	0-30*	60-140*	50-150*
EPA 8021A		1,1,1,2-Tetrachloroethane	0-30*	60-140*	50-150*
EPA 8021B		1,2,3-Trichloropropane	0-12	77-117	69-119
		Bis(2-chloroethoxy)methane	0-30*	60-140*	50-150*
		1-Chlorohexane	0-30*	60-140*	50-150*
		Chloromethylmethyl ether	0-30*	60-140*	50-150*

Table A-1 *Accuracy and Precision*

Method #	Matrix	Analyte/Component	Duplicate - RPD	LCS - %R	Matrix Spike - %R
EPA 8240B	Water	Chloromethane	0-13	63-122	78-122
		Bromomethane	0-23	58-137	62-140
		Vinyl Chloride	0-13	62-134	85-123
		Chloroethane	0-13	74-128	88-121
		Methylene Chloride	0-10	82-125	81-116
		Acetone	0-28	42-155	46-151
		Carbon Disulfide	0-10	74-133	80-130
		1,1-Dichloroethene	0-10	89-135	85-124
		1,1-Dichloroethane	0-11	84-129	91-120
		cis-1,2-Dichloroethene	0-12	70-131	88-118
		trans-1,2-Dichloroethene	0-10	84-147	90-118
		Chloroform	0-10	87-124	87-119
		1,2-Dichloroethane	0-12	80-124	82-115
		2-Butanone	0-25	62-135	77-129
		1,1,1-Trichloroethane	0-11	85-137	91-120
		Carbon Tetrachloride	0-10	88-134	93-120
		Vinyl Acetate	0-18	51-132	43-126
		Bromodichloromethane	0-10	86-123	87-117
		1,2-Dichloropropane	0-10	86-122	90-113
		cis-1,3-Dichloropropene	0-10	76-139	87-117
		Trichloroethene	0-11	87-131	84-120
		Dibromochloromethane	0-11	79-122	84-119
		1,1,2-Trichloroethane	0-12	80-126	84-123
		Benzene	0-10	84-126	89-118
		trans-1,3-Dichloropropene	0-12	73-146	84-122
		Bromoform	0-13	75-128	72-126
		Tetrachloroethene	0-11	82-132	88-119
		1,1,2,2-Tetrachloroethane	0-13	71-128	76-132
		Toluene	0-10	87-126	88-120
		Chlorobenzene	0-10	86-122	85-116
		Ethylbenzene	0-10	80-127	89-119
		Styrene	0-10	79-124	86-116
		Xylene (total)	0-10	78-128	88-118
		4-Methyl-2-pentanone	0-16	62-131	67-137
		2-Hexanone	0-16	58-127	63-143

Table A-1 *Accuracy and Precision*

Method #	Matrix	Analyte/Component	Duplicate - RPD	LCS - %R	Matrix Spike - %R
EPA 624	Water	Chloromethane	0-30*	63-125	10-273*
		Bromomethane	0-30*	58-137	10-242*
		Vinyl Chloride	0-30*	62-134	10-251*
		Chloroethane	0-30*	74-128	14-231*
		Methylene Chloride	0-30*	82-125	10-221*
		Trichlorofluoromethane	0-30*	79-126	17-181*
		1,1-Dichloroethene	0-30*	89-135	10-234*
		1,1-Dichloroethane	0-30*	84-129	59-155*
		cis-1,2-Dichloroethene	0-22	70-131	88-118
		trans-1,2-Dichloroethene	0-11	84-147	89-118
		Chloroform	0-30*	87-124	51-138*
		1,2-Dichloroethane	0-30*	80-124	49-155*
		1,1,1-Trichloroethane	0-30*	85-137	52-162*
		Carbon Tetrachloride	0-30*	88-134	70-140*
		Bromodichloromethane	0-30*	86-123	35-155*
		1,2-Dichloropropane	0-30*	86-122	10-210*
		cis-1,3-Dichloropropene	0-30*	76-139	10-227*
		Trichloroethene	0-30*	87-131	71-157*
		Benzene	0-30*	84-126	37-151*
		Dibromochloromethane	0-30*	79-122	53-149*
		trans-1,3-Dichloropropene	0-30*	73-146	17-183*
		1,1,2-Trichloroethane	0-30*	80-126	52-150*
		2-Chloroethylvinyl ether	0-30*	48-143	10-350*
		Bromoform	0-30*	75-128	45-169*
		Tetrachloroethene	0-30*	82-132	64-148*
		1,1,2,2-Tetrachloroethane	0-30*	71-128	46-157*
		Toluene	0-30*	87-126	47-150*
		Chlorobenzene	0-30*	86-122	37-160*
		Ethylbenzene	0-30*	80-127	37-162*
		Xylene (total)	0-30*	78-128	73-144*
		1,3-Dichlorobenzene	0-30*	84-130	59-156*
		1,2-Dichlorobenzene	0-30*	83-127	18-190*
		1,4-Dichlorobenzene	0-30*	85-128	18-190*

Table A-1 *Accuracy and Precision*

Method #	Matrix	Analyte/Component	Duplicate - RPD	LCS - %R	Matrix Spike - %R
EPA 8240B	Solid	Chloromethane	0-15	53-136	75-134
		Bromomethane	0-23	58-137	62-140
		Vinyl Chloride	0-26	60-137	78-131
		Chloroethane	0-21	68-132	82-128
		Methylene Chloride	0-16	83-133	84-123
		Acetone	0-25	56-137	39-166
		Carbon Disulfide	0-15	79-127	93-123
		1,1-Dichloroethene	0-14	89-132	85-130
		1,1-Dichloroethane	0-13	84-132	87-125
		cis-1,2-Dichloroethene	0-12	70-131	88-118
		trans-1,2-Dichloroethene	0-12	87-142	85-125
		Chloroform	0-10	87-124	87-119
		1,2-Dichloroethane	0-10	86-122	85-116
		2-Butanone	0-22	55-144	66-145
		1,1,1-Trichloroethane	0-11	91-133	91-124
		Carbon Tetrachloride	0-12	87-140	93-128
		Vinyl Acetate	0-44	46-135	10-139
		Bromodichloromethane	0-10	88-124	91-116
		1,2-Dichloropropane	0-10	89-125	92-116
		cis-1,3-Dichloropropene	0-13	70-147	83-121
		Trichloroethene	0-10	91-128	78-127
		Dibromochloromethane	0-15	80-119	85-124
		1,1,2-Trichloroethane	0-10	85-123	84-122
		Benzene	0-10	91-122	89-121
		trans-1,3-Dichloropropene	0-12	78-140	86-119
		Bromoform	0-14	76-128	78-127
		Tetrachloroethene	0-13	84-129	82-123
		1,1,2,2-Tetrachloroethane	0-17	75-124	74-126
		Toluene	0-13	91-123	85-121
		Chlorobenzene	0-10	87-118	86-117
		Ethylbenzene	0-16	83-121	83-121
		Styrene	0-14	80-122	71-129
		Xylene (total)	0-19	85-124	80-123
		4-Methyl-2-pentanone	0-23	70-126	70-147
		2-Hexanone	0-10	55-132	65-150

Table A-1 *Accuracy and Precision*

Method #	Matrix	Analyte/Component	Duplicate - RPD	LCS - %R	Matrix Spike - %R
EPA 8260A	Water	Chloromethane	0-13	63-122	78-122
EPA 8260B		Bromomethane	0-16	52-141	71-127
		Vinyl Chloride	0-13	62-134	85-123
		Chloroethane	0-13	74-128	88-121
		Methylene Chloride	0-10	82-125	81-116
		Acetone	0-28	42-155	46-151
		Carbon Disulfide	0-10	74-133	80-130
		Trichlorofluoromethane	0-10	71-134	91-123
		1,1-Dichloroethene	0-10	89-135	85-124
		1,1-Dichloroethane	0-11	84-129	91-120
		cis-1,2-Dichloroethene	0-12	70-131	88-118
		trans-1,2-Dichloroethene	0-10	84-147	90-118
		Chloroform	0-10	84-123	87-116
		1,2-Dichloroethane	0-12	80-124	82-115
		2-Butanone	0-25	62-135	77-129
		1,1,1-Trichloroethane	0-11	85-137	91-120
		Carbon Tetrachloride	0-10	88-134	93-120
		Vinyl Acetate	0-18	51-132	43-126
		Bromodichloromethane	0-10	86-123	87-117
		1,2-Dichloropropane	0-10	86-122	90-113
		cis-1,3-Dichloropropene	0-10	76-139	87-117
		Trichloroethene	0-11	87-131	84-120
		Dibromochloromethane	0-11	79-122	84-119
		1,1,2-Trichloroethane	0-12	80-126	84-123
		Benzene	0-10	84-126	89-118
		trans-1,3-Dichloropropene	0-12	73-146	84-122
		Bromoform	0-13	75-128	72-126
		Tetrachloroethene	0-11	82-132	88-119
		1,1,2,2-Tetrachloroethane	0-13	71-128	76-132
		Toluene	0-10	87-126	88-120
		Chlorobenzene	0-10	86-122	85-116
		Ethylbenzene	0-10	80-127	89-119
		Styrene	0-10	79-124	86-116
		Xylene (total)	0-10	78-128	88-118
		4-Methyl-2-pentanone	0-16	62-131	67-137
		2-Hexanone	0-16	58-127	63-143
		Dichlorodifluoromethane	0-10	43-128	75-122
		2,2-Dichloropropane	0-10	81-137	90-122

Table A-1 *Accuracy and Precision*

Method #	Matrix	Analyte/Component	Duplicate - RPD	LCS - %R	Matrix Spike - %R
EPA 8260A	Water	Bromochloromethane	0-11	81-129	87-116
EPA 8260B		1,1-Dichloropropene	0-10	85-131	95-116
		Dibromomethane	0-11	85-124	80-119
		1,2-Dibromoethane	0-14	76-132	84-122
		1,3-Dichloropropane	0-10	80-123	83-114
		1,1,1,2-Tetrachloroethane	0-10	78-127	91-118
		Isopropylbenzene	0-10	84-131	96-120
		1,2,3-Trichloropropane	0-17	75-131	79-126
		Bromobenzene	0-13	85-127	90-117
		n-Propylbenzene	0-10	82-124	94-115
		2-Chlorotoluene	0-10	86-125	89-115
		4-Chlorotoluene	0-10	85-128	91-118
		1,3,5-Trimethylbenzene	0-11	83-133	86-126
		tert-Butylbenzene	0-11	82-132	94-120
		1,2,4-Trimethylbenzene	0-12	81-133	90-121
		sec-Butylbenzene	0-10	81-132	93-124
		1,3-Dichlorobenzene	0-10	84-130	91-115
		p-Isopropyltoluene	0-10	77-133	90-121
		1,4-Dichlorobenzene	0-10	85-128	91-112
		n-Butylbenzene	0-13	76-142	82-133
		1,2-Dichlorobenzene	0-10	83-127	90-115
		1,2-Dibromo-3-chloropropane	0-20	68-132	66-132
		1,2,4-Trichlorobenzene	0-17	79-124	71-124
		Hexachlorobutadiene	0-16	74-136	87-124
		Naphthalene	0-21	60-131	59-128
		1,2,3-Trichlorobenzene	0-19	64-138	70-129

Table A-1 *Accuracy and Precision*

Method #	Matrix	Analyte/Component	Duplicate - RPD	LCS - %R	Matrix Spike - %R
EPA 8260A	Solid	Chloromethane	0-15	53-136	75-134
EPA 8260B		Bromomethane	0-23	58-137	62-140
		Vinyl Chloride	0-26	60-137	78-131
		Chloroethane	0-21	68-132	82-128
		Methylene Chloride	0-16	83-133	84-123
		Acetone	0-25	56-137	39-166
		Carbon Disulfide	0-15	79-127	93-123
		Trichlorofluoromethane	0-10	73-136	83-133
		1,1-Dichloroethene	0-14	89-132	85-130
		1,1-Dichloroethane	0-13	84-132	87-125
		cis-1,2-Dichloroethene	0-10	73-137	89-121
		trans-1,2-Dichloroethene	0-12	87-142	85-125
		Chloroform	0-10	87-124	87-119
		1,2-Dichloroethane	0-10	86-122	85-116
		2-Butanone	0-22	55-144	66-145
		1,1,1-Trichloroethane	0-11	91-133	91-124
		Carbon Tetrachloride	0-12	87-140	93-128
		Vinyl Acetate	0-44	46-135	10-139
		Bromodichloromethane	0-10	88-124	91-116
		1,2-Dichloropropane	0-10	89-125	92-116
		cis-1,3-Dichloropropene	0-13	70-147	83-121
		Trichloroethene	0-10	91-128	78-127
		Dibromochloromethane	0-15	80-119	85-124
		1,1,2-Trichloroethane	0-10	85-123	84-122
		Benzene	0-10	91-122	89-121
		trans-1,3-Dichloropropene	0-12	78-140	86-119
		Bromoform	0-14	76-128	78-127
		Tetrachloroethene	0-13	84-129	82-123
		1,1,2,2-Tetrachloroethane	0-17	75-124	74-126
		Toluene	0-13	91-123	85-121
		Chlorobenzene	0-10	87-118	86-117
		Ethylbenzene	0-16	83-121	83-121
		Styrene	0-14	80-122	71-129
		Xylene (total)	0-19	85-124	80-123
		4-Methyl-2-pentanone	0-23	70-126	70-147
		2-Hexanone	0-10	55-132	65-150
		Dichlorodifluoromethane	0-13	40-132	63-146
		2,2-Dichloropropane	0-13	89-130	87-127

Table A-1 *Accuracy and Precision*

Method #	Matrix	Analyte/Component	Duplicate - RPD	LCS - %R	Matrix Spike - %R
EPA 8260A	Solid	Bromochloromethane	0-12	89-124	88-122
EPA 8260B		1,1-Dichloropropene	0-10	86-134	83-128
		Dibromomethane	0-10	89-125	90-117
		1,2-Dibromoethane	0-10	85-127	85-122
		1,3-Dichloropropane	0-11	80-121	83-123
		1,1,1,2-Tetrachloroethane	0-11	82-119	84-123
		Isopropylbenzene	0-14	85-136	76-147
		1,2,3-Trichloropropane	0-24	77-134	42-131
		Bromobenzene	0-13	82-135	79-138
		n-Propylbenzene	0-19	85-127	85-128
		2-Chlorotoluene	0-14	84-131	83-128
		4-Chlorotoluene	0-10	89-124	81-135
		1,3,5-Trimethylbenzene	0-18	87-128	77-142
		tert-Butylbenzene	0-16	80-137	75-138
		1,2,4-Trimethylbenzene	0-19	83-134	75-141
		sec-Butylbenzene	0-15	90-127	75-131
		1,3-Dichlorobenzene	0-11	80-121	83-123
		p-Isopropyltoluene	0-17	77-134	70-137
		1,4-Dichlorobenzene	0-12	90-123	89-116
		n-Butylbenzene	0-21	78-137	61-138
		1,2-Dichlorobenzene	0-10	85-127	89-119
		1,2-Dibromo-3-chloropropane	0-23	65-134	62-145
		1,2,4-Trichlorobenzene	0-21	76-133	56-127
		Hexachlorobutadiene	0-24	84-130	45-129
		Naphthalene	0-22	71-133	31-142
		1,2,3-Trichlorobenzene	0-24	77-134	42-131

Table A-1 *Accuracy and Precision*

Method #	Matrix	Analyte/Component	Duplicate - RPD	LCS - %R	Matrix Spike - %R
EPA 8270B	Water	Phenol	0-22	60-121	30-136
EPA 8270C		Bis(2-chloroethyl)ether	0-22	67-111	58-112
		2-Chlorophenol	0-14	66-117	65-115
		1,3-Dichlorobenzene	0-18	57-105	54-88
		1,4-Dichlorobenzene	0-16	53-101	53-98
		Benzyl Alcohol	0-19	79-120	72-117
		1,2-Dichlorobenzene	0-28	59-101	45-100
		2-Methylphenol	0-20	64-113	60-115
		Bis(2-chloroisopropyl)ether	0-21	53-125	45-129
		4-Methylphenol	0-19	64-114	59-118
		N-Nitroso-di-n-propylamine	0-19	62-130	57-136
		Hexachloroethane	0-28	47-102	47-91
		Nitrobenzene	0-13	71-115	55-122
		Isophorone	0-15	66-106	56-102
		2-Nitrophenol	0-21	73-114	71-110
		2,4-Dimethylphenol	0-29	52-110	49-119
		Benzoic Acid	0-36	20-117	49-131
		Bis(2-chloroethoxy)methane	0-18	69-104	59-103
		2,4-Dichlorophenol	0-18	73-111	72-109
		1,2,4-Trichlorobenzene	0-17	60-105	48-107
		Naphthalene	0-14	60-103	63-95
		4-Chloroaniline	0-17	48-125	24-131
		Hexachlorobutadiene	0-27	58-103	49-95
		4-Chloro-3-methylphenol	0-16	69-119	64-123
		2-Methylnaphthalene	0-19	64-111	71-100
		Hexachlorocyclopentadiene	0-33	27-106	20-102
		2,4,6-Trichlorophenol	0-16	82-108	72-117
		2,4,5-Trichlorophenol	0-14	75-113	74-116
		2-Chloronaphthalene	0-17	64-115	71-102
		2-Nitroaniline	0-16	61-133	62-130
		Dimethylphthalate	0-12	52-134	82-107
		Acenaphthylene	0-17	67-112	71-105
		2,6-Dinitrotoluene	0-13	79-119	82-111
		3-Nitroaniline	0-31	52-138	37-144
		Acenaphthene	0-13	66-117	55-118
		2,4-Dinitrophenol	0-14	60-132	52-145
		4-Nitrophenol	0-13	51-153	54-153
		Dibenzofuran	0-14	73-114	78-106

Table A-1 *Accuracy and Precision*

Method #	Matrix	Analyte/Component	Duplicate - RPD	LCS - %R	Matrix Spike - %R
EPA 8270B	Water	2,4-Dinitrotoluene	0-11	79-118	70-120
EPA 8270C		Diethylphthalate	0-13	61-129	61-128
		4-Chlorophenyl phenyl ether	0-15	67-122	68-119
		Fluorene	0-18	64-114	67-106
		4-Nitroaniline	0-17	75-125	42-135
		4,6-Dinitro-2-methylphenol	0-12	65-137	80-121
		N-Nitrosodiphenylamine	0-17	92-161	61-129
		4-Bromophenyl phenyl ether	0-12	74-123	76-120
		Hexachlorobenzene	0-12	76-120	68-117
		Pentachlorophenol	0-16	74-126	67-132
		Phenanthrene	0-20	69-114	69-106
		Anthracene	0-21	72-116	70-108
		Di-n-butylphthalate	0-14	71-120	69-115
		Fluoranthene	0-11	73-116	53-121
		Pyrene	0-12	69-121	35-141
		Butylbenzylphthalate	0-16	71-128	69-122
		3,3'-Dichlorobenzidine	0-47	32-150	22-103
		Benzo(a)anthracene	0-28	72-118	65-117
		Chrysene	0-12	71-144	60-151
		Bis(2-ethylhexyl)phthalate	0-31	67-132	33-151
		Di-n-octylphthalate	0-27	61-142	51-160
		Benzo(b)fluoranthene	0-33	70-127	61-130
		Benzo(k)fluoranthene	0-22	66-126	60-124
		Benzo(a)pyrene	0-32	71-119	63-116
		Indeno(1,2,3-cd)pyrene	0-15	64-125	45-122
		Dibenz(a,h)anthracene	0-16	61-125	52-116
		Benzo(g,h,i)perylene	0-33	54-132	39-124

Table A-1 *Accuracy and Precision*

Method #	Matrix	Analyte/Component	Duplicate - RPD	LCS - %R	Matrix Spike - %R
EPA 625	Water	N-Nitrosodimethylamine	0-30*	61-122	50-150*
		Phenol	0-30*	60-121	10-112*
		bis (2-Chloroethyl) ether	0-30*	67-111	12-158*
		2-Chlorophenol	0-30*	66-117	23-134*
		1,3-Dichlorobenzene	0-30*	57-105	17-172*
		1,4-Dichlorobenzene	0-30*	53-101	20-124*
		1,2-Dichlorobenzene	0-30*	59-101	32-129*
		bis (2-Chloroisopropyl) ether	0-30*	53-125	36-166*
		N-nitroso-di-n-propylamine	0-30*	62-130	14-230*
		Hexachloroethane	0-30*	47-102	40-113*
		Nitrobenzene	0-30*	71-115	35-180*
		Isophorone	0-30*	66-106	21-196*
		2-Nitrophenol	0-30*	73-114	29-182*
		2,4-Dimethylphenol	0-30*	50-110	32-119*
		bis (2-Chloroethoxy) methane	0-30*	69-104	33-184*
		2,4-Dichlorophenol	0-30*	73-111	39-135*
		1,2,4-Trichlorobenzene	0-30*	60-105	44-142*
		Naphthalene	0-30*	60-103	21-133*
		Hexachlorobutadiene	0-30*	58-103	24-116*
		4-Chloro-3-methylphenol	0-30*	69-119	22-147*
		Hexachlorocyclopentadiene	0-30*	27-106	25-150*
		2,4,6-Trichlorophenol	0-30*	82-108	37-144*
		2-Chloronaphthalene	0-30*	64-115	60-118*
		Dimethylphthalate	0-30*	52-134	10-112*
		Acenaphthylene	0-30*	67-112	33-145*
		Acenaphthene	0-30*	66-117	47-145*
		2,4-Dinitrophenol	0-30*	60-132	10-191*
		4-Nitrophenol	0-30*	51-153	10-132*
		2,4-Dinitrotoluene	0-30*	79-118	39-139*
		2,6-Dinitrotoluene	0-30*	79-119	50-158*
		Diethylphthalate	0-30*	61-129	10-114*
		4-Chlorophenyl phenylether	0-30*	67-122	25-158*
		Fluorene	0-30*	64-114	59-121*
		1,2-Diphenylhydrazide	0-30*	64-123	50-150*
		4,6-Dinitro-2-methyphenol	0-30*	65-137	10-181*
		N-Nitrosodiphenylamine	0-30*	92-161	50-150*
		4-Bromophenyl phenylether	0-30*	74-123	53-127*
		Hexachlorobenzene	0-30*	76-120	10-150*

Table A-1 *Accuracy and Precision*

Method #	Matrix	Analyte/Component	Duplicate - RPD	LCS - %R	Matrix Spike - %R
EPA 625	Water	Pentachlorophenol	0-30*	74-126	14-176*
		Phenanthrene	0-30*	69-114	54-120*
		Anthracene	0-30*	72-116	27-133*
		Di-n-butylphthalate	0-30*	71-120	10-118*
		Fluoranthene	0-30*	73-116	26-137*
		Benzidine	0-30*	36-124	25-150*
		Pyrene	0-30*	69-121	52-115*
		Butyl benzylphthalate	0-30*	71-128	10-152*
		3,3'-Dichlorobenzidine	0-30*	32-150	10-262*
		Benzo (a) anthracene	0-30*	72-118	33-143*
		Bis (2-Ethylhexyl) phthalate	0-30*	67-132	10-158*
		Chrysene	0-30*	71-144	17-168*
		Di-n-octylphthalate	0-30*	61-142	10-146*
		Benzo(b)fluoranthene	0-30*	70-127	24-159*
		Benzo(k)fluoranthene	0-30*	66-126	11-162*
		Benzo(a)pyrene	0-30*	71-119	17-163*
		Indeno(1,2,3-cd)pyrene	0-30*	64-125	10-171*
		Dibenz(a,h)anthracene	0-30*	61-125	10-227*
		Benzo(g,h,i)perylene	0-30*	54-132	10-219*

Table A-1 *Accuracy and Precision*

Method #	Matrix	Analyte/Component	Duplicate - RPD	LCS - %R	Matrix Spike - %R
EPA 8270B	Solid	Phenol	0-15	64-122	43-136
EPA 8270C		Bis(2-chloroethyl)ether	0-14	62-116	56-111
		2-Chlorophenol	0-18	72-116	26-148
		1,3-Dichlorobenzene	0-12	59-109	54-106
		1,4-Dichlorobenzene	0-19	57-117	49-113
		Benzyl Alcohol	0-14	68-122	61-128
		1,2-Dichlorobenzene	0-12	59-117	57-109
		2-Methylphenol	0-14	66-120	61-123
		Bis(2-chloroisopropyl)ether	0-17	51-128	54-119
		4-Methylphenol	0-13	67-123	65-126
		N-Nitroso-di-n-propylamine	0-17	63-124	50-129
		Hexachloroethane	0-25	61-113	21-126
		Nitrobenzene	0-16	62-117	58-118
		Isophorone	0-15	58-101	55-108
		2-Nitrophenol	0-14	70-109	63-109
		2,4-Dimethylphenol	0-16	48-125	63-136
		Benzoic Acid	0-44	10-114	10-137
		Bis(2-chloroethoxy)methane	0-16	61-105	57-108
		2,4-Dichlorophenol	0-13	71-112	63-122
		1,2,4-Trichlorobenzene	0-19	62-110	54-112
		Naphthalene	0-14	52-116	52-116
		4-Chloroaniline	0-34	20-104	10-103
		Hexachlorobutadiene	0-17	60-109	54-108
		4-Chloro-3-methylphenol	0-14	74-119	24-155
		2-Methylnaphthalene	0-23	64-116	53-124
		Hexachlorocyclopentadiene	0-37	42-102	10-93
		2,4,6-Trichlorophenol	0-13	74-109	65-124
		2,4,5-Trichlorophenol	0-18	75-112	66-120
		2-Chloronaphthalene	0-19	68-110	67-118
		2-Nitroaniline	0-15	63-138	68-134
		Dimethylphthalate	0-17	76-114	68-117
		Acenaphthylene	0-20	64-113	59-125
		2,6-Dinitrotoluene	0-13	77-116	68-119
		3-Nitroaniline	0-23	33-111	16-118
		Acenaphthene	0-19	68-113	56-122
		2,4-Dinitrophenol	0-29	29-107	10-126
		4-Nitrophenol	0-17	61-147	42-140
		Dibenzofuran	0-12	70-118	63-129

Table A-1 *Accuracy and Precision*

Method #	Matrix	Analyte/Component	Duplicate - RPD	LCS - %R	Matrix Spike - %R
EPA 8270B	Solid	2,4-Dinitrotoluene	0-14	76-116	64-111
EPA 8270C		Diethylphthalate	0-14	73-121	64-123
		4-Chlorophenyl phenyl ether	0-14	67-123	68-121
		Fluorene	0-10	63-115	53-125
		4-Nitroaniline	0-17	55-128	33-136
		4,6-Dinitro-2-methylphenol	0-19	26-120	10-112
		N-Nitrosodiphenylamine	0-16	98-157	57-131
		4-Bromophenyl phenyl ether	0-17	75-118	77-120
		Hexachlorobenzene	0-13	75-116	73-118
		Pentachlorophenol	0-35	53-105	10-93
		Phenanthrene	0-26	69-112	61-120
		Anthracene	0-20	68-116	64-123
		Di-n-butylphthalate	0-14	74-121	71-121
		Fluoranthene	0-17	71-115	50-117
		Pyrene	0-18	68-121	52-144
		Butylbenzylphthalate	0-17	71-125	82-145
		3,3'-Dichlorobenzidine	0-22	26-120	21-102
		Benzo(a)anthracene	0-21	71-118	64-127
		Chrysene	0-19	70-148	56-144
		Bis(2-ethylhexyl)phthalate	0-17	72-128	75-148
		Di-n-octylphthalate	0-23	59-141	63-129
		Benzo(b)fluoranthene	0-15	68-129	65-143
		Benzo(k)fluoranthene	0-17	64-126	69-141
		Benzo(a)pyrene	0-16	75-115	62-125
		Indeno(1,2,3-cd)pyrene	0-16	61-122	41-117
		Dibenz(a,h)anthracene	0-17	59-125	38-122
		Benzo(g,h,i)perylene	0-19	51-126	30-118

Table A-1 *Accuracy and Precision*

Method #	Matrix	Analyte/Component	Duplicate - RPD	LCS - %R	Matrix Spike - %R
EPA 8080A	Water	alpha-BHC	0-17	81-124	63-132
EPA 8081		Lindane	0-23	86-125	51-130
		beta-BHC	0-14	82-117	72-116
		Heptachlor	0-21	73-114	47-126
		delta-BHC	0-18	84-122	40-139
		Aldrin	0-14	76-117	40-122
		Heptachlor Epoxide	0-13	75-121	56-129
		Endosulfan I	0-14	82-117	57-133
		4,4'-DDE	0-22	77-124	52-118
		Dieldrin	0-24	88-122	63-123
		Endrin	0-17	82-145	44-159
		4,4'-DDD	0-12	92-119	60-117
		Endosulfan II	0-21	78-113	45-136
		4,4'-DDT	0-30	77-120	33-146
		Endosulfan Sulfate	0-24	69-139	42-158
		Endrin Aldehyde	0-31	56-149	63-125
		Methoxychlor	0-28	81-125	63-149
		a-Chlordane	0-30*	60-140*	50-150*
		y-Chlordane	0-30*	60-140*	50-150*
		Toxaphene	0-30	76-106	41-126
		PCB-1016	0-21	71-141	61-144
		PCB-1221	0-64	95-120	14-139
		PCB-1232	0-42	69-110	46-158
		PCB-1242	0-23	72-126	66-134
		PCB-1248	0-12	76-122	57-147
		PCB-1254	0-13	80-130	32-130
		PCB-1260	0-20	67-140	48-145

Table A-1 *Accuracy and Precision*

Method #	Matrix	Analyte/Component	Duplicate - RPD	LCS - %R	Matrix Spike - %R
EPA 8081A	Water	alpha-BHC	0-17	81-124	63-132
		Lindane	0-23	86-125	51-130
		beta-BHC	0-14	82-117	72-116
		Heptachlor	0-21	73-114	47-126
		delta-BHC	0-18	84-122	40-139
		Aldrin	0-14	76-117	40-122
		Heptachlor Epoxide	0-13	75-121	56-129
		Endosulfan I	0-14	82-117	57-133
		4,4'-DDE	0-22	77-124	52-118
		Dieldrin	0-24	88-122	63-123
		Endrin	0-17	82-145	44-159
		4,4'-DDD	0-12	92-119	60-117
		Endosulfan II	0-21	78-113	45-136
		4,4'-DDT	0-30	77-120	33-146
		Endosulfan Sulfate	0-24	69-139	42-158
		Endrin Aldehyde	0-31	56-149	63-125
		Methoxychlor	0-28	81-125	63-149
		a-Chlordane	0-30*	60-140*	50-150*
		y-Chlordane	0-30*	60-140*	50-150*
		Toxaphene	0-30	76-106	41-126
EPA 8082	Water	PCB-1016	0-21	71-141	61-144
		PCB-1221	0-64	95-120	14-139
		PCB-1232	0-42	69-110	46-158
		PCB-1242	0-23	72-126	66-134
		PCB-1248	0-12	76-122	57-147
		PCB-1254	0-13	80-130	32-130
		PCB-1260	0-20	67-140	48-145

Table A-1 *Accuracy and Precision*

Method #	Matrix	Analyte/Component	Duplicate - RPD	LCS - %R	Matrix Spike - %R
EPA 608	Water	4,4-DDD	0-30*	73-122	31-141*
		4,4-DDE	0-30*	72-121	30-145*
		4,4-DDT	0-30*	63-126	25-160*
		Aldrin	0-30*	63-117	42-122*
		Chlordane	0-30*	72-128	45-119*
		Dieldrin	0-30*	65-128	36-146*
		Endosulfan I	0-30*	67-122	45-153*
		Endosulfan II	0-30*	70-111	10-202*
		Endosulfan Sulfate	0-30*	79-121	26-144*
		Endrin	0-30*	61-147	30-147*
		Endrin Aldehyde	0-30*	58-126	25-150*
		Heptachlor	0-30*	60-109	34-111*
		Heptachlor Epoxide	0-30*	70-116	37-142*
		Lindane	0-30*	51-132	32-127*
		PCB-1016	0-30*	46-121	50-114*
		PCB-1221	0-30*	35-110	15-178*
		PCB-1232	0-30*	73-126	10-215*
		PCB 1242	0-30*	56-147	39-150*
		PCB-1248	0-30*	79-112	38-158*
		PCB-1254	0-30*	60-131	29-131*
		PCB-1260	0-30*	56-114	10-127*
		Toxaphene	0-30*	90-113	41-126*
		a-BHC	0-30*	57-128	37-134*
		b-BHC	0-30*	69-117	17-147*
		d-BHC	0-30*	66-123	19-140*

Table A-1 *Accuracy and Precision*

Method #	Matrix	Analyte/Component	Duplicate - RPD	LCS - %R	Matrix Spike - %R
EPA 8080A	Solid	alpha-BHC	0-18	61-128	46-116
EPA 8081		Lindane	0-14	67-129	48-119
		beta-BHC	0-13	73-119	45-109
		Heptachlor	0-11	76-118	51-126
		delta-BHC	0-18	79-126	44-126
		Aldrin	0-14	75-121	50-115
		Heptachlor Epoxide	0-17	76-118	46-117
		Endosulfan I	0-14	76-122	46-116
		4,4'-DDE	0-18	83-118	45-130
		Dieldrin	0-13	79-130	63-127
		Endrin	0-14	85-152	65-149
		4,4'-DDD	0-22	79-127	51-140
		Endosulfan II	0-16	80-111	51-117
		4,4'-DDT	0-24	80-122	45-123
		Endosulfan Sulfate	0-31	74-132	42-132
		Endrin Aldehyde	0-23	61-120	45-134
		Methoxychlor	0-23	83-137	49-151
		a-Chlordane	0-30*	60-140*	50-150*
		y-Chlordane	0-30*	60-140*	50-150*
		Toxaphene	0-38	39-138	37-156
		PCB-1016	0-25	76-137	78-135
		PCB-1221	0-18	86-138	66-160
		PCB-1232	0-32	75-128	63-114
		PCB-1242	0-17	83-121	83-130
		PCB-1248	0-22	82-133	59-129
		PCB-1254	0-15	74-133	85-132
		PCB-1260	0-27	69-143	58-158

Table A-1 *Accuracy and Precision*

Method #	Matrix	Analyte/Component	Duplicate - RPD	LCS - %R	Matrix Spike - %R
EPA 8081A	Solid	alpha-BHC	0-18	61-128	46-116
		Lindane	0-14	67-129	48-119
		beta-BHC	0-13	73-119	45-109
		Heptachlor	0-11	76-118	51-126
		delta-BHC	0-18	79-126	44-126
		Aldrin	0-14	75-121	50-115
		Heptachlor Epoxide	0-17	76-118	46-117
		Endosulfan I	0-14	76-122	46-116
		4,4'-DDE	0-18	83-118	45-130
		Dieldrin	0-13	79-130	63-127
		Endrin	0-14	85-152	65-149
		4,4'-DDD	0-22	79-127	51-140
		Endosulfan II	0-16	80-111	51-117
		4,4'-DDT	0-24	80-122	45-123
		Endosulfan Sulfate	0-31	74-132	42-132
		Endrin Aldehyde	0-23	61-120	45-134
		Methoxychlor	0-23	83-137	49-151
		a-Chlordane	0-30*	60-140*	50-150*
		y-Chlordane	0-30*	60-140*	50-150*
		Toxaphene	0-38	39-138	37-156
EPA 8082	Solid	PCB-1016	0-25	76-137	78-135
		PCB-1221	0-18	86-138	66-160
		PCB-1232	0-32	75-128	63-114
		PCB-1242	0-17	83-121	83-130
		PCB-1248	0-22	82-133	59-129
		PCB-1254	0-15	74-133	85-132
		PCB-1260	0-27	69-143	58-158

Table A-1 *Accuracy and Precision*

Method #	Matrix	Analyte/Component	Duplicate - RPD	LCS - %R	Matrix Spike - %R
EPA 8150B	Water	Dalapon	0-30*	25-130*	25-130*
EPA 8151		MCPP	0-30*	25-130*	25-130*
EPA 8151A		Dicamba	0-30*	25-130*	25-130*
		MCPA	0-30*	25-130*	25-130*
		Dichloroprop	0-30*	25-130*	25-130*
		2,4-D	0-30*	25-130*	25-130*
		2,4,5-TP (Silvex)	0-30*	25-130*	25-130*
		2,4,5-T	0-30*	25-130*	25-130*
		Dinoseb	0-30*	25-130*	25-130*
		2,4-DB	0-30*	25-130*	25-130*
EPA 8150B	Solid	Dalapon	0-30*	25-130*	25-130*
EPA 8151		MCPP	0-30*	25-130*	25-130*
EPA 8151A		Dicamba	0-30*	25-130*	25-130*
		MCPA	0-30*	25-130*	25-130*
		Dichloroprop	0-30*	25-130*	25-130*
		2,4-D	0-30*	25-130*	25-130*
		2,4,5-TP (Silvex)	0-30*	25-130*	25-130*
		2,4,5-T	0-30*	25-130*	25-130*
		Dinoseb	0-30*	25-130*	25-130*
		2,4-DB	0-30*	25-130*	25-130*

* QA targets derived from literature values

Table A-2 *Surrogate Recoveries*

Analyte	Matrix	Method	Surrogate %R
2-Chloropropane	Water	8010/8021	69-118
	Solid	8010/8021	59-128
	Water	601	69-118
Fluorobenzene	Water	8020/8021	90-110
	Solid	8020/8021	90-110
	Water	602	90-110
Bromofluorobenzene	Water	8240	86-118
	Solid	8240	74-127
	Water	624	86-118
	Water	8260	86-118
	Solid	8260	74-127
Toluene-d8	Water	8240	94-119
	Solid	8240	80-125
	Water	624	94-119
	Water	8260	94-119
	Solid	8260	80-125
Dibromofluoromethane	Water	8240	93-121
	Solid	8240	88-128
	Water	624	93-121
	Water	8260	93-121
	Solid	8260	88-128
2-Fluorophenol	Water	8270	31-121
	Solid	8270	44-119
	Water	625	31-121
2,4,6-Tribromophenol	Water	8270	58-112
	Solid	8270	27-116
	Water	625	58-112
Nitrobenzene-d5	Water	8270	44-130
	Solid	8270	41-129
	Water	625	44-130
2-Fluorobiphenyl	Water	8270	43-122
	Solid	8270	52-118
	Water	625	43-122
Terphenyl-d14	Water	8270	31-134
	Solid	8270	49-136
	Water	625	31-134
Phenol-d5	Water	8270	46-147
	Solid	8270	54-120
	Water	625	46-117
2,4,5,6-Tetrachloro-m-xylene	Water	8080/8081/8082	56-131
	Solid	8080/8081/8082	54-135
	Water	608	56-131
Decachlorobiphenyl	Water	8080/8081/8082	57-126
	Solid	8080/8081/8082	42-138
	Water	608	57-126
2,4-Dichlorophenyl acetic acid	Water	8150/8151	50-150
	Solid	8150/8151	30-120
Tetracosane	Water	Mod. 8100, 310.13	28-169
	Solid	Mod. 8100, 310.13	55-136

Table A-3 *Sample Prep and Cleanup Methods*

Sample Prep. Method	Description	Matrix	Applicable Methods
EPA 3005	Acid Digestion	Water	6010
EPA 3010	Acid digestion	Water	6010
EPA 3020	Acid digestion	Water	7041, 7131, 7421, 7841
EPA 3050	Acid digestion	Solid	7041, 7131, 7421, 7841, 6010
EPA 1310	EPTOX	Solid	SW-846 methods
EPA 1311	TCLP	Solid	SW-846 methods
EPA 3540	Soxhlet extraction	Solid	9071
EPA 5030	Purge and Trap	Water & Solid	8010, 8020, 8021, 8240, 8260
EPA 5035	Closed Loop Purge and Trap	Solid	8260
EPA 3510	Liquid-Liquid	Water	8080, 8081, 8270
EPA 3520	Continuous Extraction	Water	8080, 8081, 8270
EPA 3550	Sonication	Solid	8080, 8081, 8270
EPA 3640	GPC	Water & Solid	8080, 8270, 8150
EPA 9011	Cyanide Extraction	Solid	9010

Appendix B

Practical Quantitation Limits

Table B-1 *Practical Quantitation Limits*

Method #	Matrix	Analyte/Component	PQL
EPA 305.1	Water	Acidity as $CaCO_3$	1. mg/L
EPA 310.1	Water	Alkalinity as $CaCO_3$	1. mg/L
EPA 350.1	Water	Ammonia as N	.05 mg/L
EPA 350.1	Solid	Ammonia as N	5. mg/L
EPA 405.1	Water	5-day BOD	5. mg/L
EPA 405.1	Water	5-day CBOD	5. mg/L
EPA 410.4	Water	COD	10. mg/L
EPA 410.4	Solid	COD	100. mg/kg
EPA 325.2 EPA 9251	Water	Chloride	1. mg/L
EPA 9251	Solid	Chloride	100. mg/kg
EPA 330.5	Water	Total residual chlorine	.1 mg/L
EPA 110.2	Water	Color	5. PCU
EPA 335.2 EPA 9010A EPA 9010B/9014	Water	Cyanide	.01 mg/L
EPA 9010A EPA 9010B/9014	Solid	Cyanide	.5 mg/kg
EPA 335.1 EPA 9010A EPA 9010B/9014	Water	Amenable cyanide	.01 mg/L
NYSDOH 310-30	Water	Ethylene Glycol	.05 mg/L
EPA 340.2	Water	Fluoride, total	.1 mg/L
EPA 340.2	Solid	Fluoride, total	10. mg/kg
NIOSH 3500	Water	Formaldehyde	.1 mg/L
NIOSH 3500	Solid	Formaldehyde	10. mg/kg
SM2340B	Water	Hardness as $CaCO_3$	1. mg/L
EPA 130.2	Water	Hardness as $CaCO_3$	10. mg/L
SM3500-Cr-D EPA 7196A	Water	Hexavalent Chromium	.01 mg/L
EPA 7196A	Solid	Hexavalent Chromium	1. mg/kg
EPA 150.1 EPA 9040B	Water	Hydrogen Ion (pH)	.1 std. units
EPA 9045C	Solid	Hydrogen Ion (pH)	.1 std. units
EPA 351.2	Water	Kjeldahl nitrogen, total as N	.4 mg/L
EPA 351.2	Solid	Kjeldahl nitrogen, total as N	40. mg/kg
EPA 353.2	Water	Nitrite plus nitrate	.05 mg/L
EPA 353.2	Solid	Nitrite plus nitrate	5. mg/kg
EPA 353.2	Water	Nitrite	.05 mg/L
EPA 353.2	Solid	Nitrite	5. mg/kg

Table B-1 *Practical Quantitation Limits*

Method #	Matrix	Analyte/Component	PQL
Subtraction	Water	Nitrate	.05 mg/L
Subtraction	Solid	Nitrate	5. mg/kg
EPA 140.1	Water	Odor	1. TON
EPA 413.1 EPA 9070	Water	Oil and grease, total recoverable	5. mg/L
EPA 9070	Solid	Oil and grease, total recoverable	100. mg/kg
EPA 415.1	Water	Organic carbon, total	1. mg/L
EPA 365.1	Water	Orthophosphate	.05 mg/L
EPA 365.1	Solid	Orthophosphate	5. mg/kg
EPA 360.1	Water	Oxygen dissolved	.1 mg/L
EPA 420.1 EPA 9065	Water	Phenols	.005 mg/L
EPA 9065	Solid	Phenols	.5 mg/kg
EPA 365.4	Water	Phosphorus, total	.1 mg/L
EPA 365.4	Solid	Phosphorus, total	10. mg/kg
EPA 9010A EPA 9014	Solid	Reactive Cyanide	.25 mg/kg
EPA 9030A EPA 9034	Solid	Reactive Sulfide	5. mg/kg
EPA 160.1	Water	Residue, dissolved	10. mg/L
EPA 160.3	Water	Residue, total	10. mg/L
SM2540-G	Solid	Residue, total	1. %
EPA 160.2	Water	Residue, suspended	1. ml/L
EPA 160.4	Water	Residue, volatile	10. mg/L
SM2540-G	Solid	Residue, volatile	1. %
EPA 160.5	Water	Residue, settable	.1 mg/L
EPA 370.1	Water	Silica	.1 mg/L
EPA 120.1	Water	Specific Conductance	1 umho/cm
SM2710-F	Water	Specific Gravity	.001
SM2710-F	Solid	Specific Gravity	.001
EPA 375.3	Water	Sulfate, as SO_4	1. mg/L
EPA 375.3	Solid	Sulfate, as SO_4	100. mg/kg
EPA 376.1	Water	Sulfide	.2 mg/L
EPA 376.1	Solid	Sulfide	20. mg/kg
EPA 377.1	Water	Sulfite, as SO_3	2. mg/L
EPA 425.1	Water	Surfactants	.1 mg/L
EPA 425.1	Solid	Surfactants	10. mg/kg
EPA 170.1		Temperature	

Table B-1 *Practical Quantitation Limits*

Method #	Matrix	Analyte/Component	PQL
EPA 418.1	Water	Total Petroleum Hydrocrabons	1. mg/L
EPA 418.1	Solid	Total Petroleum Hydrocarbons	50. mg/kg
EPA 180.1	Water	Turbidity	.1 NTU

Table B-1 *Practical Quantitation Limits*

Method #	Matrix	Analyte/Component	PQL
EPA 200.7	Water	Aluminum	.1 mg/L
EPA 6010A		Antimony	.06 mg/L
EPA 6010B		Arsenic	.005 mg/L
		Barium	.1 mg/L
		Beryllium	.01 mg/L
		Boron	.5 mg/L
		Calcium	1. mg/L
		Chromium	.01 mg/L
		Cobalt	.05 mg/L
		Copper	.01 mg/L
		Cadmium	.01 mg/L
		Iron	.05 mg/L
		Lead	.005 mg/L
		Magnesium	1. mg/L
		Manganese	.05 mg/L
		Molybdenum	.05 mg/L
		Nickel	.05 mg/L
		Potassium	5. mg/L
		Selenium	.005 mg/L
		Silver	.01 mg/L
		Sodium	1. mg/L
		Thallium	.005 mg/L
		Tin	.5 mg/L
		Vanadium	.05 mg/L
		Zinc	.01 mg/L

Table B-1 *Practical Quantitation Limits*

Method #	Matrix	Analyte/Component	PQL
EPA 6010A	Solid	Aluminum	10. mg/kg
EPA 6010B		Antimony	6. mg/kg
		Arsenic	.5 mg/kg
		Barium	10. mg/kg
		Beryllium	1. mg/kg
		Boron	50. mg/kg
		Calcium	100. mg/kg
		Chromium	1. mg/kg
		Cobalt	5. mg/kg
		Copper	1. mg/kg
		Cadmium	1. mg/kg
		Iron	5. mg/kg
		Lead	.5 mg/kg
		Magnesium	100. mg/kg
		Manganese	5. mg/kg
		Molybdenum	5. mg/kg
		Nickel	5. mg/kg
		Potassium	500. mg/kg
		Selenium	.5 mg/kg
		Silver	1. mg/kg
		Sodium	100. mg/kg
		Thallium	.5 mg/kg
		Tin	.5 mg/kg
		Vanadium	5. mg/kg
		Zinc	1. mg/kg

Table B-1 *Practical Quantitation Limits*

Method #	Matrix	Analyte/Component	PQL
EPA 206.2 EPA 7060A	Water	Arsenic	.005 mg/L
EPA 7060A	Solid	Arsenic	.5 mg/kg
EPA 239.2 EPA 7421	Water	Lead	.003 mg/L
EPA 7421	Solid	Lead	.5 mg/kg
EPA 245.1 EPA 7470A	Water	Mercury	.0002 mg/L
EPA 7471A	Solid	Mercury	0.1 mg/kg
EPA 270.2 EPA 7740	Water	Selenium	.005 mg/L
EPA 7740	Solid	Selenium	.5 mg/kg
EPA 279.2 EPA 7841	Water	Thallium	.005 mg/L
EPA 7841	Solid	Thallium	.5 mg/kg

Table B-1 *Practical Quantitation Limits*

Method #	Matrix	Analyte/Component	PQL
EPA 8010B/8020A	Water	Chloromethane	10. ug/L
EPA 8021A		Bromomethane	10. ug/L
EPA 8021B		Vinyl Chloride	1. ug/L
		Chloroethane	1. ug/L
		Methylene Chloride	1. ug/L
		Trichlorofluoromethane	1. ug/L
		1,1-Dichloroethene	1. ug/L
		1,1-Dichloroethane	1. ug/L
		cis-1,2-Dichloroethene	1. ug/L
		trans-1,2-Dichloroethene	1. ug/L
		Chloroform	1. ug/L
		1,2-Dichloroethane	1. ug/L
		1,1,1-Trichloroethane	1. ug/L
		Carbon Tetrachloride	1. ug/L
		Bromodichloromethane	1. ug/L
		1,2-Dichloropropane	1. ug/L
		cis-1,3-Dichloropropene	1. ug/L
		Trichloroethene	1. ug/L
		Dibromochloromethane	1. ug/L
		1,1,2-Trichloroethane	1. ug/L
		Benzene	1. ug/L
		trans-1,3-Dichloropropene	1. ug/L
		2-Chloroethylvinylether	10. ug/L
		Bromoform	10. ug/L
		Tetrachloroethene	1. ug/L
		1,1,2,2-Tetrachloroethane	1. ug/L
		Toluene	1. ug/L
		Chlorobenzene	1. ug/L
		Ethylbenzene	1. ug/L
		Xylene (total)	3. ug/L
		1,2-Dichlorobenzene	5. ug/L
		1,3-Dichlorobenzene	5. ug/L
		1,4-Dichlorobenzene	5. ug/L
		Dichlorodifluoromethane	10. ug/L
		Benzyl chloride	10. ug/L
		Bromobenzene	5. ug/L
EPA 8010B/8020A	Water	2-Chlorotoluene	5. ug/L

Table B-1 *Practical Quantitation Limits*

Method #	Matrix	Analyte/Component	PQL
EPA 8021A		4-Chlorotoluene	5. ug/L
EPA 8021B		Dibromomethane	10. ug/L
		1,1,1,2-Tetrachloroethane	1. ug/L
		1,2,3-Trichloropropane	1. ug/L
		Bis(2-chloroethoxy)methane	500. ug/L
		1-Chlorohexane	10. ug/L
		Chloromethylmethyl ether	100. ug/L

Table B-1 *Practical Quantitation Limits*

Method #	Matrix	Analyte/Component	PQL
EPA 601/602	Water	Chloromethane	10. ug/L
		Bromomethane	10. ug/L
		Dichlorodifluoromethane	10. ug/L
		Vinyl Chloride	1. ug/L
		Chloroethane	1. ug/L
		Methylene Chloride	1. ug/L
		Trichlorofluoromethane	1. ug/L
		1,1-Dichloroethene	1. ug/L
		1,1-Dichloroethane	1. ug/L
		cis-1,2-Dichloroethene	1. ug/L
		trans-1,2-Dichlorothene	1. ug/L
		Chloroform	1. ug/L
		1,2-Dichloroethane	1. ug/L
		1,1,1-Trichloroethane	1. ug/L
		Carbon Tetrachloride	1. ug/L
		Bromodichloromethane	1. ug/L
		1,2-Dichloropropane	1. ug/L
		cis-1,3-Dichloropropene	1. ug/L
		Trichloroethene	1. ug/L
		Benzene	1. ug/L
		Dibromochloromethane	1. ug/L
		1,1,2-Trichloroethane	1. ug/L
		trans-1,3-Dichloropropene	1. ug/L
		2-Chloroethyl vinyl ether	10. ug/L
		Bromoform	10. ug/L
		1,1,2,2-Tetrachloroethane	1. ug/L
		Tetrachloroethene	1. ug/L
		Toluene	1. ug/L
		Chlorobenzene	1. ug/L
		Ethylbenzene	1. ug/L
		Xylene (total)	3. ug/L
		1,2-Dichlorobenzene	5. ug/L
		1,3-Dichlorobenzene	5. ug/L
		1,4-Dichlorobenzene	5. ug/L

Table B-1 *Practical Quantitation Limits*

Method #	Matrix	Analyte/Component	PQL
EPA 502.2	Water	1,1,1,2-Tetrachloroethane	.5 ug/L
		1,1,1-Trichloroethane	.5 ug/L
		1,1,2,2-Tetrachloroethane	.5 ug/L
		1,1,2-Trichloroethane	.5 ug/L
		1,1-Dichloroethane	.5 ug/L
		1,1-Dichloroethylene	.5 ug/L
		1,1-Dichloropropene	.5 ug/L
		1,2,3-Trichlorobenzene	.5 ug/L
		1,2,3-Trichloropropane	.5 ug/L
		1,2,4-Trichlorobenzene	.5 ug/L
		1,2,4-Trimethylbenzene	.5 ug/L
		1,2-Dibromoethane	.5 ug/L
		1,2-Dichlorobenzene	.5 ug/L
		1,2-Dichloroethane	.5 ug/L
		1,2-Dichloropropane	.5 ug/L
		1,3,5-Trimethylbenzene	.5 ug/L
		1,3-Dichlorobenzene	.5 ug/L
		1,3-Dichloropropane	.5 ug/L
		1,4-Dichlorobenzene	.5 ug/L
		2,2-Dichloropropane	.5 ug/L
		2-Chlorotoluene	.5 ug/L
		4-Chlorotoluene	.5 ug/L
		4-Isopropyltoluene	.5 ug/L
		Benzene	.5 ug/L
		Bromobenzene	.5 ug/L
		Bromochloromethane	.5 ug/L
		Bromodichloromethane	.5 ug/L
		Bromoform	.5 ug/L
		Bromomethane	.5 ug/L
		Carbon tetrachloride	.5 ug/L
		Chlorobenzene	.5 ug/L
		Chloroethane	.5 ug/L
		Chloroform	.5 ug/L
		Chloromethane	.5 ug/L
		Dibromochloromethane	.5 ug/L
		Dibromomethane	.5 ug/L
EPA 502.2	Water	Dichlorodifluoromethane	.5 ug/L

Table B-1 *Practical Quantitation Limits*

Method #	Matrix	Analyte/Component	PQL
		Dichloromethane	.5 ug/L
		Ethylbenzene	.5 ug/L
		Hexachlorobutadiene	.5 ug/L
		Isopropylbenzene	.5 ug/L
		Naphthalene	.5 ug/L
		Styrene	.5 ug/L
		Tetrachloroethylene	.5 ug/L
		Toluene	.5 ug/L
		Trichloroethylene	.5 ug/L
		Trichlorofluoromethane	.5 ug/L
		Vinyl chloride	.5 ug/L
		cis-1,2-Dichloroethylene	.5 ug/L
		cis-1,3-Dichloropropylene	.5 ug/L
		m-Xylene	.5 ug/L
		n-Butylbenzene	.5 ug/L
		n-Propylbenzene	.5 ug/L
		o-Xylene	.5 ug/L
		p-Xylene	.5 ug/L
		sec-Butylbenzene	.5 ug/L
		tert-Butylbenzene	.5 ug/L
		trans-1,2-Dichloroethylene	.5 ug/L
		trans-1,3-Dichloropropylene	.5 ug/L

Table B-1 *Practical Quantitation Limits*

Method #	Matrix	Analyte/Component	PQL
EPA 8010B/8020A	Solid	Chloromethane	10. ug/kg
EPA 8021A		Bromomethane	10. ug/kg
EPA 8021B		Vinyl Chloride	1. ug/kg
		Chloroethane	1. ug/kg
		Methylene Chloride	1. ug/kg
		Trichlorofluoromethane	1. ug/kg
		1,1-Dichloroethene	1. ug/kg
		1,1-Dichloroethane	1. ug/kg
		cis-1,2-Dichloroethene	1. ug/kg
		trans-1,2-Dichloroethene	1. ug/kg
		Chloroform	1. ug/kg
		1,2-Dichloroethane	1. ug/kg
		1,1,1-Trichloroethane	1. ug/kg
		Carbon Tetrachloride	1. ug/kg
		Bromodichloromethane	1. ug/kg
		1,2-Dichloropropane	1. ug/kg
		cis-1,3-Dichloropropene	1. ug/kg
		Trichloroethene	1. ug/kg
		Dibromochloromethane	1. ug/kg
		1,1,2-Trichloroethane	1. ug/kg
		Benzene	1. ug/kg
		trans-1,3-Dichloropropene	1. ug/kg
		2-Chloroethylvinylether	10. ug/kg
		Bromoform	10. ug/kg
		Tetrachloroethene	1. ug/kg
		1,1,2,2-Tetrachloroethane	1. ug/kg
		Toluene	1. ug/kg
		Chlorobenzene	1. ug/kg
		Ethylbenzene	1. ug/kg
		Xylene (total)	3. ug/kg
		1,2-Dichlorobenzene	5. ug/kg
		1,3-Dichlorobenzene	5. ug/kg
		1,4-Dichlorobenzene	5. ug/kg
		Dichlorodifluoromethane	10. ug/kg
		Benzyl chloride	10. ug/kg
		Bromobenzene	5. ug/kg
EPA 8010B/8020A	Solid	2-Chlorotoluene	5. ug/kg

Table B-1 *Practical Quantitation Limits*

Method #	Matrix	Analyte/Component	PQL
EPA 8021A		4-Chlorotoluene	5. ug/kg
EPA 8021B		Dibromomethane	10. ug/kg
		1,1,1,2-Tetrachloroethane	1. ug/kg
		1,2,3-Trichloropropane	1. ug/kg
		Bis(2-chloroethoxy)methane	500. ug/kg
		1-Chlorohexane	10. ug/kg
		Chloromethylmethyl ether	100. ug/kg

Table B-1 *Practical Quantitation Limits*

Method #	Matrix	Analyte/Component	PQL
EPA 624	Water	Chloromethane	10. ug/L
		Bromomethane	10. ug/L
		Vinyl Chloride	10. ug/L
		Chloroethane	10. ug/L
		Methylene Chloride	5. ug/L
		Trichlorofluoromethane	5. ug/L
		1,1-Dichloroethene	5. ug/L
		1,1-Dichloroethane	5. ug/L
		1,2-Dichloroethene (total)	5. ug/L
		Chloroform	5. ug/L
		1,2-Dichloroethane	5. ug/L
		1,1,1-Trichloroethane	5. ug/L
		Carbon Tetrachloride	5. ug/L
		Bromodichloromethane	5. ug/L
		1,2-Dichloropropane	5. ug/L
		cis-1,3-Dichloropropene	5. ug/L
		Trichloroethene	5. ug/L
		Benzene	5. ug/L
		Dibromochloromethane	5. ug/L
		trans-1,3-Dichloropropene	5. ug/L
		1,1,2-Trichloroethane	5. ug/L
		2-Chloroethylvinyl ether	10. ug/L
		Bromoform	5. ug/L
		Tetrachloroethene	5. ug/L
		1,1,2,2-Tetrachloroethane	5. ug/L
		Toluene	5. ug/L
		Chlorobenzene	5. ug/L
		Ethylbenzene	5. ug/L
		Xylene (total)	5. ug/L
		1,3-Dichlorobenzene	5. ug/L
		1,2-Dichlorobenzene	5. ug/L
		1,4-Dichlorobenzene	5. ug/L

Table B-1 *Practical Quantitation Limits*

Method #	Matrix	Analyte/Component	PQL
EPA 8260A	Water	Dichlorofluoromethane	1. ug/L
EPA 8260B	25 mL purge	Chloromethane	1. ug/L
		Bromomethane	1. ug/L
		Vinyl Chloride	1. ug/L
		Chloroethane	1. ug/L
		Trichlorofluoromethane	1. ug/L
		Methylene Chloride	2. ug/L
		Acetone	10. ug/L
		Carbon Disulfide	.5 ug/L
		1,1-Dichloroethene	.5 ug/L
		1,1-Dichloroethane	.5 ug/L
		cis-1,2-Dichloroethene	.5 ug/L
		trans-1,2-Dichloroethene	.5 ug/L
		Chloroform	.5 ug/L
		1,2-Dichloroethane	.5 ug/L
		2-Butanone	10. ug/L
		1,1,1-Trichloroethane	.5 ug/L
		Carbon Tetrachloride	.5 ug/L
		Vinyl Acetate	2. ug/L
		Bromodichloromethane	.5 ug/L
		1,2-Dichloropropane	.5 ug/L
		cis-1,3-Dichloropropene	.5 ug/L
		Trichloroethene	.5 ug/L
		Dibromochloromethane	.5 ug/L
		1,1,2-Trichloroethane	.5 ug/L
		Benzene	.5 ug/L
		trans-1,3-Dichloropropene	.5 ug/L
		Bromoform	.5 ug/L
		Tetrachloroethene	.5 ug/L
		1,1,2,2-Tetrachloroethane	.5 ug/L
		Toluene	.5 ug/L
		Chlorobenzene	.5 ug/L
		Ethylbenzene	.5 ug/L
		Styrene	.5 ug/L
		4-Methyl-2-pentanone	5. ug/L
		2-Hexanone	5. ug/L
EPA 8260A	Water	2,2-Dichloropropane	.5 ug/L

Table B-1 *Practical Quantitation Limits*

Method #	Matrix	Analyte/Component	PQL
EPA 8260B	25 mL purge	Bromochloromethane	.5 ug/L
		1,1-Dichloropropene	.5 ug/L
		Dibromomethane	.5 ug/L
		1,2-Dibromoethane	.5 ug/L
		1,3-Dichloropropane	.5 ug/L
		1,1,1,2-Tetrachloroethane	.5 ug/L
		Isopropylbenzene	.5 ug/L
		1,2,3-Trichloropropane	.5 ug/L
		m&p-Xylene	.5 ug/L
		o-Xylene	.5 ug/L
		Bromobenzene	.5 ug/L
		n-Propylbenzene	.5 ug/L
		2-Chlorotoluene	.5 ug/L
		4-Chlorotoluene	.5 ug/L
		1,3,5-Trimethylbenzene	.5 ug/L
		tert-Butylbenzene	.5 ug/L
		1,2,4-Trimethylbenzene	.5 ug/L
		sec-Butylbenzene	.5 ug/L
		1,3-Dichlorobenzene	.5 ug/L
		p-Isopropyltoluene	.5 ug/L
		1,4-Dichlorobenzene	.5 ug/L
		n-Butylbenzene	.5 ug/L
		1,2-Dichlorobenzene	.5 ug/L
		1,2-Dibromo-3-chloropropane	.5 ug/L
		1,2,4-Trichlorobenzene	.5 ug/L
		Hexachlorobutadiene	.5 ug/L
		Naphthalene	.5 ug/L
		1,2,3-Trichlorobenzene	.5 ug/L

Table B-1 *Practical Quantitation Limits*

Method #	Matrix	Analyte/Component	PQL
EPA 8260A	Water	Dichlorofluoromethane	5. ug/L
EPA 8260B	5 mL purge	Chloromethane	5. ug/L
		Bromomethane	5. ug/L
		Vinyl Chloride	5. ug/L
		Chloroethane	5. ug/L
		Trichlorofluoromethane	5. ug/L
		Methylene Chloride	2.5 ug/L
		Acetone	10. ug/L
		Carbon Disulfide	2.5 ug/L
		1,1-Dichloroethene	2.5 ug/L
		1,1-Dichloroethane	2.5 ug/L
		cis-1,2-Dichloroethene	2.5 ug/L
		trans-1,2-Dichloroethene	2.5 ug/L
		Chloroform	2.5 ug/L
		1,2-Dichloroethane	2.5 ug/L
		2-Butanone	10. ug/L
		1,1,1-Trichloroethane	2.5 ug/L
		Carbon Tetrachloride	2.5 ug/L
		Vinyl Acetate	5. ug/L
		Bromodichloromethane	2.5 ug/L
		1,2-Dichloropropane	2.5 ug/L
		cis-1,3-Dichloropropene	2.5 ug/L
		Trichloroethene	2.5 ug/L
		Dibromochloromethane	2.5 ug/L
		1,1,2-Trichloroethane	2.5 ug/L
		Benzene	2.5 ug/L
		trans-1,3-Dichloropropene	2.5 ug/L
		Bromoform	2.5 ug/L
		Tetrachloroethene	2.5 ug/L
		1,1,2,2-Tetrachloroethane	2.5 ug/L
		Toluene	2.5 ug/L
		Chlorobenzene	2.5 ug/L
		Ethylbenzene	2.5 ug/L
		Styrene	2.5 ug/L
		4-Methyl-2-pentanone	5. ug/L
		2-Hexanone	5. ug/L
EPA 8260A	Water	2,2-Dichloropropane	2.5 ug/L

Table B-1 *Practical Quantitation Limits*

Method #	Matrix	Analyte/Component	PQL
EPA 8260B	5 mL purge	Bromochloromethane	2.5 ug/L
		1,1-Dichloropropene	2.5 ug/L
		Dibromomethane	2.5 ug/L
		1,2-Dibromoethane	2.5 ug/L
		1,3-Dichloropropane	2.5 ug/L
		1,1,1,2-Tetrachloroethane	2.5 ug/L
		Isopropylbenzene	2.5 ug/L
		1,2,3-Trichloropropane	2.5 ug/L
		m&p-Xylene	2.5 ug/L
		o-Xylene	2.5 ug/L
		Bromobenzene	2.5 ug/L
		n-Propylbenzene	2.5 ug/L
		2-Chlorotoluene	2.5 ug/L
		4-Chlorotoluene	2.5 ug/L
		1,3,5-Trimethylbenzene	2.5 ug/L
		tert-Butylbenzene	2.5 ug/L
		1,2,4-Trimethylbenzene	2.5 ug/L
		sec-Butylbenzene	2.5 ug/L
		1,3-Dichlorobenzene	2.5 ug/L
		p-Isopropyltoluene	2.5 ug/L
		1,4-Dichlorobenzene	2.5 ug/L
		n-Butylbenzene	2.5 ug/L
		1,2-Dichlorobenzene	2.5 ug/L
		1,2-Dibromo-3-chloropropane	2.5 ug/L
		1,2,4-Trichlorobenzene	2.5 ug/L
		Hexachlorobutadiene	2.5 ug/L
		Naphthalene	2.5 ug/L
		1,2,3-Trichlorobenzene	2.5 ug/L

Table B-1 *Practical Quantitation Limits*

Method #	Matrix	Analyte/Component	PQL
EPA 8260A	Solid	Dichlorofluoromethane	5. ug/kg
EPA 8260B		Chloromethane	5. ug/kg
		Bromomethane	5. ug/kg
		Vinyl Chloride	5. ug/kg
		Chloroethane	5. ug/kg
		Trichlorofluoromethane	2.5 ug/kg
		Methylene Chloride	2.5 ug/kg
		Acetone	10. ug/kg
		Carbon Disulfide	2.5 ug/kg
		1,1-Dichloroethene	2.5 ug/kg
		1,1-Dichloroethane	2.5 ug/kg
		cis-1,2-Dichloroethene	2.5 ug/kg
		trans-1,2-Dichloroethene	2.5 ug/kg
		Chloroform	2.5 ug/kg
		1,2-Dichloroethane	2.5 ug/kg
		2-Butanone	10. ug/kg
		1,1,1-Trichloroethane	2.5 ug/kg
		Carbon Tetrachloride	2.5 ug/kg
		Vinyl Acetate	5. ug/kg
		Bromodichloromethane	2.5 ug/kg
		1,2-Dichloropropane	2.5 ug/kg
		cis-1,3-Dichloropropene	2.5 ug/kg
		Trichloroethene	2.5 ug/kg
		Dibromochloromethane	2.5 ug/kg
		1,1,2-Trichloroethane	2.5 ug/kg
		Benzene	2.5 ug/kg
		trans-1,3-Dichloropropene	2.5 ug/kg
		Bromoform	2.5 ug/kg
		Tetrachloroethene	2.5 ug/kg
		1,1,2,2-Tetrachloroethane	2.5 ug/kg
		Toluene	2.5 ug/kg
		Chlorobenzene	2.5 ug/kg
		Ethylbenzene	2.5 ug/kg
		Styrene	2.5 ug/kg
		4-Methyl-2-pentanone	5. ug/kg
		2-Hexanone	5. ug/kg
EPA 8260A	Solid	2,2-Dichloropropane	2.5 ug/kg

Table B-1 *Practical Quantitation Limits*

Method #	Matrix	Analyte/Component	PQL
EPA 8260B		Bromochloromethane	2.5 ug/kg
		1,1-Dichloropropene	2.5 ug/kg
		Dibromomethane	2.5 ug/kg
		1,2-Dibromoethane	2.5 ug/kg
		1,3-Dichloropropane	2.5 ug/kg
		1,1,1,2-Tetrachloroethane	2.5 ug/kg
		Isopropylbenzene	2.5 ug/kg
		1,2,3-Trichloropropane	2.5 ug/kg
		m&p-Xylene	2.5 ug/kg
		o-Xylene	2.5 ug/kg
		Bromobenzene	2.5 ug/kg
		n-Propylbenzene	2.5 ug/kg
		2-Chlorotoluene	2.5 ug/kg
		4-Chlorotoluene	2.5 ug/kg
		1,3,5-Trimethylbenzene	2.5 ug/kg
		tert-Butylbenzene	2.5 ug/kg
		1,2,4-Trimethylbenzene	2.5 ug/kg
		sec-Butylbenzene	2.5 ug/kg
		1,3-Dichlorobenzene	2.5 ug/kg
		p-Isopropyltoluene	2.5 ug/kg
		1,4-Dichlorobenzene	2.5 ug/kg
		n-Butylbenzene	2.5 ug/kg
		1,2-Dichlorobenzene	2.5 ug/kg
		1,2-Dibromo-3-chloropropane	2.5 ug/kg
		1,2,4-Trichlorobenzene	2.5 ug/kg
		Hexachlorobutadiene	2.5 ug/kg
		Naphthalene	2.5 ug/kg
		1,2,3-Trichlorobenzene	2.5 ug/kg

Table B-1 *Practical Quantitation Limits*

Method #	Matrix	Analyte/Component	PQL
EPA 8021A	Water	Benzene	1. ug/L
(V-PET)		Toluene	1. ug/L
		Ethylbenzene	1. ug/L
		Xylene (total)	1. ug/l
		tert-Methyl butyl ether	10. ug/L
		Gasoline	100. ug/L
		Mineral Spirits	200. ug/L
		#1 Kerosone and/or #2 Fuel	1000. ug/l
EPA 8021A	Solid	Benzene	1. ug/kg
(V-PET)		Toluene	1. ug/kg
		Ethylbenzene	1. ug/kg
		Xylene (total)	1. ug/kg
		tert-Methyl butyl ether	10. ug/kg
		Gasoline	100. ug/kg
		Mineral Spirits	200. ug/kg
		#1 Kerosene and/or #2 Fuel	1000. ug/kg

Table B-1 *Practical Quantitation Limits*

Method #	Matrix	Analyte/Component	PQL
EPA 8270B	Water	Phenol	10. ug/L
EPA 8270C		Bis(2-chloroethyl)ether	10. ug/L
		2-Chlorophenol	10. ug/L
		1,3-Dichlorobenzene	10. ug/L
		1,4-Dichlorobenzene	10. ug/L
		Benzyl Alcohol	10. ug/L
		1,2-Dichlorobenzene	10. ug/L
		2-Methylphenol	10. ug/L
		Bis(2-chloroisopropyl)ether	10. ug/L
		4-Methylphenol	10. ug/L
		N-Nitroso-di-n-propylamine	10. ug/L
		Hexachloroethane	10. ug/L
		Nitrobenzene	10. ug/L
		Isophorone	10. ug/L
		2-Nitrophenol	10. ug/L
		2,4-Dimethylphenol	10. ug/L
		Benzoic Acid	50. ug/L
		Bis(2-chloroethoxy)methane	10. ug/L
		2,4-Dichlorophenol	10. ug/L
		1,2,4-Trichlorobenzene	10. ug/L
		Naphthalene	10. ug/L
		4-Chloroaniline	10. ug/L
		Hexachlorobutadiene	10. ug/L
		4-Chloro-3-methylphenol	10. ug/L
		2-Methylnaphthalene	10. ug/L
		Hexachlorocyclopentadiene	10. ug/L
		2,4,6-Trichlorophenol	10. ug/L
		2,4,5-Trichlorophenol	50. ug/L
		2-Chloronaphthalene	10. ug/L
		2-Nitroaniline	50. ug/L
		Dimethylphthalate	10. ug/L
		Acenaphthylene	10. ug/L
		2,6-Dinitrotoluene	10. ug/L
		3-Nitroaniline	50. ug/L
		Acenaphthene	10. ug/L
		2,4-Dinitrophenol	50. ug/L
EPA 8270B	Water	4-Nitrophenol	50. ug/L

Table B-1 *Practical Quantitation Limits*

Method #	Matrix	Analyte/Component	PQL
EPA 8270C		Dibenzofuran	10. ug/L
		2,4-Dinitrotoluene	10. ug/L
		Diethylphthalate	10. ug/L
		4-Chlorophenyl phenyl ether	10. ug/L
		Fluorene	10. ug/L
		4-Nitroaniline	50. ug/L
		4,6-Dinitro-2-methylphenol	50. ug/L
		N-Nitrosodiphenylamine	10. ug/L
		4-Bromophenyl phenyl ether	10. ug/L
		Hexachlorobenzene	10. ug/L
		Pentachlorophenol	50. ug/L
		Phenanthrene	10. ug/L
		Anthracene	10. ug/L
		Di-n-butylphthalate	10. ug/L
		Fluoranthene	10. ug/L
		Pyrene	10. ug/L
		Butylbenzylphthalate	10. ug/L
		3,3'-Dichlorobenzidine	20. ug/L
		Benzo(a)anthracene	10. ug/L
		Chrysene	10. ug/L
		Bis(2-ethylhexyl)phthalate	10. ug/L
		Di-n-octylphthalate	10. ug/L
		Benzo(b)fluoranthene	10. ug/L
		Benzo(k)fluoranthene	10. ug/L
		Benzo(a)pyrene	10. ug/L
		Indeno(1,2,3-cd)pyrene	10. ug/L
		Dibenz(a,h)anthracene	10. ug/L
		Benzo(g,h,i)perylene	10. ug/L

Table B-1 *Practical Quantitation Limits*

Method #	Matrix	Analyte/Component	PQL
EPA 625	Water	N-Nitrosodimethylamine	10. ug/L
		Phenol	10. ug/L
		bis (2-Chloroethyl) ether	10. ug/L
		2-Chlorophenol	10. ug/L
		1,3-Dichlorobenzene	10. ug/L
		1,4-Dichlorobenzene	10. ug/L
		1,2-Dichlorobenzene	10. ug/L
		bis (2-Chloroisopropyl) ether	10. ug/L
		N-nitroso-di-n-propylamine	10. ug/L
		Hexachloroethane	10. ug/L
		Nitrobenzene	10. ug/L
		Isophorone	10. ug/L
		2-Nitrophenol	10. ug/L
		2,4-Dimethylphenol	10. ug/L
		bis (2-Chloroethoxy) methane	10. ug/L
		2,4-Dichlorophenol	10. ug/L
		1,2,4-Trichlorobenzene	10. ug/L
		Naphthalene	10. ug/L
		Hexachlorobutadiene	10. ug/L
		4-Chloro-3-methylphenol	10. ug/L
		Hexachlorocyclopentadiene	10. ug/L
		2,4,6-Trichlorophenol	10. ug/L
		2-Chloronaphthalene	10. ug/L
		Dimethylphthalate	10. ug/L
		Acenaphthylene	10. ug/L
		Acenaphthene	10. ug/L
		2,4-Dinitrophenol	50. ug/L
		4-Nitrophenol	50. ug/L
		2,4-Dinitrotoluene	10. ug/L
		2,6-Dinitrotoluene	10. ug/L
		Diethylphthalate	10. ug/L
		4-Chlorophenyl phenylether	10. ug/L
		Fluorene	10. ug/L
		1,2-Diphenylhydrazide	10. ug/L
		4,6-Dinitro-2-methyphenol	50. ug/L
		N-Nitrosodiphenylamine	10. ug/L
EPA 625	Water	4-Bromophenyl phenylether	10. ug/L

Table B-1 *Practical Quantitation Limits*

Method #	Matrix	Analyte/Component	PQL
		Hexachlorobenzene	10. ug/L
		Pentachlorophenol	50. ug/L
		Phenanthrene	10. ug/L
		Anthracene	10. ug/L
		Di-n-butylphthalate	10. ug/L
		Fluoranthene	10. ug/L
		Benzidine	50. ug/L
		Pyrene	10. ug/L
		Butyl benzylphthalate	10. ug/L
		3,3'-Dichlorobenzidine	20. ug/L
		Benzo (a) anthracene	10. ug/L
		Bis (2-Ethylhexyl) phthalate	10. ug/L
		Chrysene	10. ug/L
		Di-n-octylphthalate	10. ug/L
		Benzo (b) fluoranthene	10. ug/L
		Benzo (k) fluoranthene	10. ug/L
		Benzo (a) pyrene	10. ug/L
		Indeno (1,2,3-cd) pyrene	10. ug/L
		Dibenzo (a,h) anthracene	10. ug/L
		Benzo (g,h,i) perylene	10. ug/L

Table B-1 *Practical Quantitation Limits*

Method #	Matrix	Analyte/Component	PQL
EPA 8270B	Solid	Phenol	330. ug/kg
EPA 8270C		Bis(2-chloroethyl)ether	330. ug/kg
		2-Chlorophenol	330. ug/kg
		1,3-Dichlorobenzene	330. ug/kg
		1,4-Dichlorobenzene	330. ug/kg
		Benzyl Alcohol	330. ug/kg
		1,2-Dichlorobenzene	330. ug/kg
		2-Methylphenol	330. ug/kg
		Bis(2-chloroisopropyl)ether	330. ug/kg
		4-Methylphenol	330. ug/kg
		N-Nitroso-di-n-propylamine	330. ug/kg
		Hexachloroethane	330. ug/kg
		Nitrobenzene	330. ug/kg
		Isophorone	330. ug/kg
		2-Nitrophenol	330. ug/kg
		2,4-Dimethylphenol	330. ug/kg
		Benzoic Acid	1600. ug/kg
		Bis(2-chloroethoxy)methane	330. ug/kg
		2,4-Dichlorophenol	330. ug/kg
		1,2,4-Trichlorobenzene	330. ug/kg
		Naphthalene	330. ug/kg
		4-Chloroaniline	330. ug/kg
		Hexachlorobutadiene	330. ug/kg
		4-Chloro-3-methylphenol	330. ug/kg
		2-Methylnaphthalene	330. ug/kg
		Hexachlorocyclopentadiene	330. ug/kg
		2,4,6-Trichlorophenol	330. ug/kg
		2,4,5-Trichlorophenol	1600. ug/kg
		2-Chloronaphthalene	330. ug/kg
		2-Nitroaniline	1600. ug/kg
		Dimethylphthalate	330. ug/kg
		Acenaphthylene	330. ug/kg
		2,6-Dinitrotoluene	330. ug/kg
		3-Nitroaniline	1600. ug/kg
		Acenaphthene	330. ug/kg
		2,4-Dinitrophenol	1600. ug/kg
EPA 8270B	Solid	4-Nitrophenol	1600. ug/kg

Table B-1 *Practical Quantitation Limits*

Method #	Matrix	Analyte/Component	PQL
EPA 8270C		Dibenzofuran	330. ug/kg
		2,4-Dinitrotoluene	330. ug/kg
		Diethylphthalate	330. ug/kg
		4-Chlorophenyl phenyl ether	330. ug/kg
		Fluorene	330. ug/kg
		4-Nitroaniline	1600. ug/kg
		4,6-Dinitro-2-methylphenol	1600. ug/kg
		N-Nitrosodiphenylamine	330. ug/kg
		4-Bromophenyl phenyl ether	330. ug/kg
		Hexachlorobenzene	330. ug/kg
		Pentachlorophenol	1600. ug/kg
		Phenanthrene	330. ug/kg
		Anthracene	330. ug/kg
		Di-n-butylphthalate	330. ug/kg
		Fluoranthene	330. ug/kg
		Pyrene	330. ug/kg
		Butylbenzylphthalate	330. ug/kg
		3,3'-Dichlorobenzidine	660. ug/kg
		Benzo(a)anthracene	330. ug/kg
		Chrysene	330. ug/kg
		Bis(2-ethylhexyl)phthalate	330. ug/kg
		Di-n-octylphthalate	330. ug/kg
		Benzo(b)fluoranthene	330. ug/kg
		Benzo(k)fluoranthene	330. ug/kg
		Benzo(a)pyrene	330. ug/kg
		Indeno(1,2,3-cd)pyrene	330. ug/kg
		Dibenz(a,h)anthracene	330. ug/kg
		Benzo(g,h,i)perylene	330. ug/kg

Table B-1 *Practical Quantitation Limits*

Method #	Matrix	Analyte/Component	PQL
EPA 8080A	Water	alpha-BHC	.05 ug/L
EPA 8081		gamma-BHC	.05 ug/L
EPA 8081A		beta-BHC	.05 ug/L
		Heptachlor	.05 ug/L
		delta-BHC	.05 ug/L
		Aldrin	.05 ug/l
		Heptachlor Epoxide	.05 ug/L
		Endosulfan I	.1 ug/L
		4,4'-DDE	.1 ug/L
		Dieldrin	.1 ug/L
		Endrin	.1 ug/L
		4,4'-DDD	.1 ug/L
		Endosulfan II	.1 ug/L
		4,4'-DDT	.1 ug/L
		Endosulfan Sulfate	.1 ug/L
		Endrin Aldehyde	.1 ug/L
		Methoxychlor	.5 ug/L
		Chlordane	.5 ug/L
		Toxaphene	.5 ug/L
		PCB-1016	.5 ug/L
		PCB-1221	.5 ug/L
		PCB-1232	.5 ug/L
		PCB-1242	.5 ug/L
		PCB-1248	.5 ug/L
		PCB-1254	.5 ug/L
		PCB-1260	.5 ug/L

Table B-1 *Practical Quantitation Limits*

Method #	Matrix	Analyte/Component	PQL
EPA 8150B	Water	Dalapon	50. ug/L
EPA 8151		MCPP	2000. ug/L
EPA 8151A		Dicamba	2. ug/L
		MCPA	2000. ug/L
		Dichloroprop	20. ug/L
		2,4-D	20. ug/L
		2,4,5-TP (Silvex)	2. ug/L
		2,4,5-T	2. ug/L
		Dinoseb	10. ug/L
		2,4-DB	20. ug/L
EPA 8150B	Solid	Dalapon	1.67 mg/kg
EPA 8151		MCPP	66.7 mg/kg
EPA 8151A		Dicamba	.0667 mgkg
		MCPA	66.7 mg/kg
		Dichloroprop	.667 mg/kg
		2,4-D	.667 mg/kg
		2,4,5-TP (Silvex)	.0667 mg/kg
		2,4,5-T	.0667 mg/kg
		Dinoseb	.333 mg/kg
		2,4-DB	.667 mg/kg

Appendix C

Sample Containers, Preservations and Holding Times

Table C-1 *Sample Containers, Preservations and Holding Times*

Parameter	Container/Pres.	Method Numbers	Holding Time	Volume Required	Comments
		Organics - Drinking Water			
THM Formation Potential	Bost Round/none	mod. EPA 510.1	14 days to dose, 7 days incubation, 14 days analysis after quenching	250 mL (2)	Cool 4° C, set QC trip blanks in dup.
THM	40 ml vial/Ascorbic Acid	EPA 502.2	14 days from coll.	40 mL (2)	Cool 4° C, set QC trip blanks in dup.
EDB/DBCP	40 ml vial/$Na_2S_2O_3$ 1:1 HCl/Teflon Liner	EPA 504	28 days from coll.	40 mL (3)	Cool 4° C, set QC trip blanks in dup.
Pesticides	Glass Liter/none Teflon Liner	EPA 508	7 days extraction (from coll.) 14 days analysis	1 L	Cool 4° C
Herbicides	Glass Liter/none Teflon Liner	EPA 515.1	7 days extraction (from coll.) 14 days analysis	1 L	Cool 4° C
Volatile Organic Chemicals	40 ml vial/Ascorbic Acid [1:1 HCl, pH<2]	EPA 502.2	14 days from coll.	40 mL (3)	Cool 4° C, set QC trip blanks in dup.
		Organics - Non-potable Water and Hazardous Waste			
Volatiles (water)	40 ml vial/1:1 HCl Teflon Lined Septum	EPA 601/602	14 days from coll.	40 mL (2)	Cool 4° C
		EPA 8010/8020\\8021	14 days from coll.		
		EPA 624	14 days from coll.		
		EPA 8240	14 days from coll.		
		EPA 8260	14 days from coll.	40 mL (3)	
		ASP CLP 95-1	10 days VTSR	40 mL (2)	
		EPA CLP OLM03.2	10 days VTSR		
		ASP CAT A or B (all methods)	10 days VTSR		
Volatiles (solid)	4 oz glass/none Teflon Lined Cap	EPA 8010/8020\\8021	14 days from coll.	Fill with minimal headspace without compaction	Cool 4° C
		EPA 8240	14 days from coll.		
		EPA 8260	14 days from coll.		
		ASP CLP 95-1	10 days VTSR		
		EPA CLP OLM03.2	10 days VTSR		
		ASP CAT A or B (all methods)	10 days VTSR		

Table C-1 *Sample Containers, Preservations and Holding Times*

Parameter	Container/Pres.	Method Numbers	Holding Time	Volume Required	Comments
AE/BN (water)	Glass Liter/none Teflon Liner	EPA 625	7 days extraction (from coll.) 40 days analysis from extr.	1 L	Cool 4° C
		EPA 8270	7 days extraction (from coll.) 40 days analysis from extr.		
		ASP CLP 95-2	5 days extraction (from VTSR) (start) 40 days analysis (from coll.)		
		EPA CLP OLM03.2	5 days extraction (from VTSR) (start) 40 days analysis (from coll.)		
		ASP CAT A or B (all methods)	5 (7) days extraction (from VTSR) 40 days analysis (from coll.)		
AE/BN (solid)	Sed. Jar/none Teflon Liner	EPA 8270	14 days extraction (from coll.) 40 days analysis from extr.	200 g	Cool 4° C
		ASP CLP 95-2	10 days extraction (from VTSR) (comp.) 40 days analysis from extr.		
		EPA CLP OLM03.2	10 days extraction (from VTSR) (comp.) 40 days analysis from extr.		
		ASP CAT A or B (all methods)	5 (7) days extraction (from VTSR) 40 days analysis from extr.		
Volatile Petroleum Hydrocarbons (water)	40 ml vial/1:1 HCl Teflon Lined Septum	EPA 8021 ASP CAT A or B	14 days from coll. 10 days (from VTSR)	40 mL (2)	Cool 4° C
Volatile Petroleum Hydrocarbons (solid)	4 oz Glass/none Teflon Lined Cap	EPA 8021 ASP CAT A or B	14 days from coll. 10 days (from VTSR)	Fill with minimal headspace without compaction	Cool 4° C
Pesticide/PCB (water)	Glass Liter/none Teflon Liner	EPA 608	7 days extraction (from coll.) 40 days analysis from extr.	1 L	Cool 4° C
		EPA 8080\\8081	7 days extraction (from coll.) 40 days analysis from extr.		
		ASP CLP 95-3	5 days extraction (from VTSR) (start) 40 days analysis from extr.		
		EPA CLP OLM03.2	5 days extraction (from VTSR) (start) 40 days analysis from extr.		
		ASP CAT A or B (all methods)	5 (7) days extraction (from VTSR) 40 days analysis from extr.		

Table C-1 *Sample Containers, Preservations and Holding Times*

Parameter	Container/Pres.	Method Numbers	Holding Time	Volume Required	Comments
Pesticide/PCB (solid)	Sed. Jar/none Teflon Liner	EPA 8080\\8081	14 days extraction (from coll.) 40 days analysis from extr.	200 g	Cool 4° C
		ASP CLP 95-3	10 days extraction (from VTSR) (comp.) 40 days analysis from extr.		
		EPA CLP OLM03.2	10 days extraction (from VTSR) (comp.) 40 days analysis from extr.		
		ASP CAT A or B (all methods)	5 (7) days extraction (from VTSR) 40 days analysis from extr.		
PCB (oil)	40 ml vial/none Solid Cap	EPA 8080\\8081	14 days extraction (from coll.) 40 days analysis from extr.	5 mL	Cool 4° C
Herbicides (water)	Glass Liter/none Teflon Liner	EPA 8150\\8151	7 days extraction (from coll.) 40 days analysis from extr.	1 L	Cool 4° C
		ASP CAT A or B (all methods)	5 (7) days extraction (from VTSR) 40 days analysis from extr.		
Herbicides (solid)	Sed. Jar/none Teflon Liner	EPA 8150\\8151	14 days extraction (from coll.) 40 days analysis from extr.	200 g	Cool 4° C
		ASP CAT A or B (all methods)	5 (7) days extraction (from VTSR) 40 days analysis from extr.		
PAH (water)	Glass Liter/none Teflon Liner	mod. EPA 8100	7 days extraction (from coll.) 40 days analysis from extr.	1 L	Cool 4° C
PAH (solid)	Sed. Jar/none Teflon Liner	mod. EPA 8100	14 days extraction (from coll.) 40 days analysis from extr.	200 g	Cool 4° C
Petroleum Fingerprint (water)	Glass Liter/none Teflon Liner	NYSDOH 310.13	7 days from coll.	1 L	Cool 4° C
Petroleum Fingerprint (solid)	Sed. Jar/none Teflon Liner	NYSDOH 310.13	14 days from coll.	200 g	Cool 4° C
Alcohols (water)	40 ml vial/none Teflon Liner	mod. EPA 8015	14 days from coll.	40 mL (2)	Cool 4° C
Alcohols (solid)	Sed. Jar/none Teflon Liner	mod. EPA 8015	14 days from coll.	200 g	Cool 4° C
Air - Solvents	Carbon tubes, 5 spare for QC and from same Lot #	NIOSH 1501, 1003	Undetermined	1 tube	Freeze

Table C-1 *Sample Containers, Preservations and Holding Times*

Parameter	Container/Pres.	Method Numbers	Holding Time	Volume Required	Comments
TOX	8 oz. glass/H_2SO_4 Teflon Liner	EPA 9020	28 days from collection	240 mL (2)	Cool 4° C
		Trace Metals			
Trace Metals (water)	P or G/HNO_3 pH < 2	EPA 200 series EPA 6000/7000 series ASP - All methods EPA CLP ILM04.0	6 months from coll. 6 months from coll. 6 months from VTSR 6 months from VTSR	300 mL	
Trace Metals (solid)	Sed. Jar/none	EPA 6000/7000 series ASP - All methods EPA CLP ILM04.0	6 months from coll. 6 months from VTSR 6 months from VTSR	200 g	Cool 4° C
Mercury (water)	P or G/HNO_3 pH < 2	EPA 245.1 EPA 7470A ASP CLP - All methods EPA CLP ILM04.0	28 days from coll. 28 days from coll. 26 days VTSR 26 days VTSR	300 mL	
Mercury (solid)	Sed. Jar/none	EPA 7471A ASP CLP - All methods EPA CLP ILM04.0	28 days from coll. 26 days from VTSR 26 days from VTSR	200 g	Cool 4° C
Chromium-Hexavalent (water)	P or G/none	SM3500-Cr-D EPA 7196A	24 hours from coll.	200 mL	Cool 4° C
Chromium-Hexavalent (solid)	Sed. jar	EPA 7196A	24 hours from coll.	100 g	Cool 4° C
		Inorganics - Non-Metallics			
Acidity	P or G/none	EPA 305.1 EPA 305.1 (ASP)	14 days from coll. 12 days from VTSR	100 mL	Cool 4° C
Alkalinity	8 oz. Glass/none Teflon Liner	SM2320B, EPA 310.1 SM2320B, EPA 310.1 (ASP)	14 days from coll. 12 days from VTSR	100 mL	Cool 4° C
Ammonia as N (water)	P or G/1 ml H_2SO_4 pH < 2	EPA 350.1 EPA 350.1 (ASP)	28 days from coll. 26 days from VTSR	400 mL	Cool 4° C
Ammonia as N (solid)	Sed. jar/none	mod. EPA 350.1 mod. EPA 350.1 (ASP)	28 days from coll. 26 days from VTSR	100 g	Cool 4° C

Table C-1 *Sample Containers, Preservations and Holding Times*

Parameter	Container/Pres.	Method Numbers	Holding Time	Volume Required	Comments
BOD	P or G/none	EPA 405.1 EPA 405.1 (ASP)	48 hours from coll. 24 hours from VTSR	1000 mL	Cool 4° C
CBOD	P or G/none	EPA 405.1 EPA 405.1 (ASP)	48 hours from coll. 24 hours from VTSR	1000 mL	Cool 4° C
COD (water)	P or G/1 ml H_2SO_4 pH<2	EPA 410.4 EPA 410.4 (ASP)	28 days from coll. 26 days from VTSR	100 mL	Cool 4° C
COD (solid)	Sed. jar/none	mod. EPA 410.4 mod. EPA 410.4 (ASP)	28 days from coll. 26 days from VTSR	100 g	Cool 4° C
Chloride (water)	P or G/none	SM4500-Cl-D, EPA 325.2, EPA 9251 ASP - All methods	28 days from coll. 26 days from VTSR	50 mL	Cool 4° C
Chloride (solid)	Sed. jar/none	EPA 9251 EPA 9251 (ASP)	28 days from coll. 26 days from VTSR	50 g	Cool 4° C
Residual chlorine (water)	P or G/none	SM4500-Cl-G, EPA 330.5	Analyze immediately	200 mL	Cool 4° C
Residual chlorine (solid)	Sed. jar/none	mod. EPA 330.5	Analyze immediately	200 g	Cool 4° C
Cyanide (total - water)	Plastic/1 ml NaOH pH > 12 [if res. Cl, then ascorbic acid, NaOH pellets]	EPA 335.2, EPA 335.4 EPA 9010A ASP - All methods EPA CLP ILM04.0	14 days from coll. (24 hrs if S^-) 14 days from coll. (24 hrs if S^-) 12 days from VTSR 12 days from VTSR	500 mL	Cool 4° C
Cyanide (solid)	Sed. jar/none	EPA 9010A ASP - All methods EPA CLP ILM04.0	14 days from coll. 12 days from VTSR 12 days from VTSR	100 g	Cool 4° C
Cyanide - amenable (water)	Plastic/1 ml NaOH pH > 12	EPA 335.1, EPA 9010A EPA 335.1, 9010A (ASP)	14 days from coll. 12 days from VTSR	500 mL	Cool 4° C
Cyanide - amenable (solid)	Sed. jar/none	EPA 9010A EPA 9010A (ASP)	14 days from coll. 12 days from VTSR	100 g	Cool 4° C
Ethylene Glycol	Glass/HCl pH<2	NYSDOH 310-30	28 days from coll.	20 mL	Cool 4° C
Fluoride (water)	P or G/none	SM4500-F-C, EPA 340.2 ASP - All methods	28 days from coll. 26 days from VTSR	300 mL	Cool 4° C

Table C-1 *Sample Containers, Preservations and Holding Times*

Parameter	Container/Pres.	Method Numbers	Holding Time	Volume Required	Comments
Fluoride (solid)	Sed. jar/none	mod. EPA 340.2 mod. EPA 340.2 (ASP)	28 days from coll. 26 days from VTSR	100 g	Cool 4° C
Kjeldahl nitrogen, total (water)	P or G/1 ml H_2SO_4 pH < 2	EPA 351.2 EPA 351.2 (ASP)	28 days from coll. 26 dyas from VTSR	500 mL	Cool 4° C
Kjeldahl nitrogen, total (solid)	Sed. jar/none	mod. EPA 351.2 mod. EPA 351.2 (ASP)	28 days from coll. 26 days from VTSR	100 g	Cool 4° C
Nitrite plus Nitrate (water)	P or G/1 ml H_2SO_4 pH < 2	EPA 353.2 EPA 353.2 (ASP)	28 days from coll. 26 days from VTSR	100 mL	Cool 4° C
Nitrite plus Nitrate (solid)	Sed. jar/none	mod. EPA 353.2 mod. EPA 353.2 (ASP)	28 days from coll. 26 days from VTSR	100 g	Cool 4° C
Nitrite (water)	P or G/none	EPA 353.2 EPA 353.2 (ASP)	48 hours from coll. 24 hours from VTSR	100 mL	Cool 4° C
Nitrite (solid)	Sed. jar/none	mod. EPA 353.2 mod. EPA 353.2 (ASP)	48 hours from coll. 24 hours from VTSR	100 g	Cool 4° C
Oil and Grease (water)	Glass Quart/1 ml H_2SO_4 pH < 2; Teflon Liner	EPA 413.1, 9070, 1664 EPA413.1, 9070, 1664 (ASP)	28 days from coll. 26 days from VTSR	1000 mL	Cool 4° C
Oil and Grease (solid)	Sed. jar/none Teflon Liner	EPA 9070 EPA 9070 (ASP)	28 days from coll. 26 days from VTSR	100 g	Cool 4° C
Organic Carbon, total	P or G/1 ml H_2SO_4 pH < 2	EPA 415.1, EPA 9060 EPA 415.1, EPA 9060 (ASP)	28 days from coll. 26 days from VTSR	100 mL	Cool 4° C
Orthophosphate (water)	P or G/none Filter immediately	EPA 365.1 EPA 365.1 (ASP)	48 hours from coll. 24 hours from VTSR	100 mL	Cool 4° C
Orthophosphate (solid)	Sed. jar/none	mod. EPA 365.1 mod. EPA 365.1 (ASP)	48 hours from coll. 24 hours from VTSR	100 g	Cool 4° C
Phenols	Glass Quart/1 ml H_2SO_4 Ph < 2; Teflon Liner	EPA 420.1, EPA 9065 EPA 420.1, EPA 9065 (ASP)	28 days from coll. 26 days from VTSR	500 mL	Cool 4° C
Phenols	Sed jar./none Teflon Liner	EPA 9065 EPA 9065 (ASP)	28 days from coll. 26 days from VTSR	100 g	Cool 4° C
Total Phosphorous (water)	P or G/1 ml H_2SO_4 pH < 2	EPA 365.4 EPA 365.4 (ASP)	28 days from coll. 26 days from VTSR	500 mL	Cool 4° C

Table C-1 *Sample Containers, Preservations and Holding Times*

Parameter	Container/Pres.	Method Numbers	Holding Time	Volume Required	Comments
Total Phosphorous (solid)	Sed. jar/none	mod. EPA 365.4 mod. EPA 365.4 (ASP)	28 days from coll. 26 days from VTSR	100 g	Cool 4° C
Silica	Plastic only/none	EPA 370.1 EPA 370.1 (ASP)	28 days from coll. 26 days from VTSR	100 mL	Cool 4° C
Sulfate (water)	P or G/none	SM4500-SO4-D, EPA 375.3, 375.4 ASP - All methods	28 days from coll. 26 days from VTSR	100 mL	Cool 4° C
Sulfate (solid)	Sed. jar/none	mod. EPA 375.3 mod. EPA 375.3 (ASP)	28 days from coll. 26 days from VTSR	100 g	Cool 4° C
Sulfide (water)	P or G/1 ml ZnAc+NaOH pH > 9	EPA 376.1 EPA 376.1 (ASP)	7 days from coll. 5 days from VTSR	500 mL	Cool 4° C
Sulfide (solid)	Sed. jar/none	mod. EPA 376.1 mod EPA 376.1 (ASP)	7 days from coll. 5 days from VTSR	100 g	Cool 4° C
Sulfite	P or G/none	EPA 377.1	Analyze Immediately	100 mL	-
Surfactants (MBAS) (water)	P or G/none	EPA 425.1 EPA 425.1 (ASP)	48 hours from coll. 24 hours from VTSR	100 mL	Cool 4° C
Surfactants (MBAS) (solid)	Sed/jar/none	mod. EPA 425.1 mod. EPA 425.1 (ASP)	48 hours from coll. 24 hours from VTSR	100 g	Cool 4° C
Total Petroleum Hydrocarbons (water)	Glass Quart/HCl	EPA 418.1	28 days from coll.	1000 mL	Cool 4° C
Total Petroleum Hydrocarbons (solid)	Sed. jar/none	mod. EPA 418.1	28 days from coll.	200 g	Cool 4° C
		Physical Properties			
Color	Plastic/none	EPA 110.2 EPA 110.2 (ASP)	48 hours from coll. 24 hours from VTSR	100 mL	Cool 4° C
Conductance	Plastic/none	SM2510B, EPA 120.1 SM2510B, EPA 120.1 (ASP)	28 days from coll. - filtered 24 hours from coll. - unfiltered 26 days from VTSR	100 mL	Cool 4° C

Table C-1 *Sample Containers, Preservations and Holding Times*

Parameter	Container/Pres.	Method Numbers	Holding Time	Volume Required	Comments
Hardness	Plastic/HNO_3 pH < 2	SM2340B EPA 130.2	6 months from coll.	200 mL	
Odor	Glass/none	EPA 140.1	24 hours from coll.	200 mL	Cool 4° C
pH	P or G/none	EPA 150.1 EPA 9040C & 9045B	Analyze Immediately	100 mL/100 g	-
Residue - Dissolved	Plastic/none	SM2540C, EPA 160.1 SM2540C, EPA 160.1 (ASP)	7 days form coll. 24 hours from VTSR	500 mL	Cool 4° C
Residue - Total	Plastic/none	EPA 160.3 EPA 160.3 (ASP)	7 days from coll. 5 days from VTSR	500 mL	Cool 4° C
Residue - Suspended	Plastic/none	EPA 160.2 EPA 160.2 (ASP)	7 days from coll. 5 days from VTSR	500 mL	Cool 4° C
Residue - Volatile	Plastic/none	EPA 160.4 EPA 160.4 (ASP)	7 days from coll. 5 days from VTSR	500 mL	Cool 4° C
Residue - Settleable	P or G/none	EPA 160.5 EPA 160.5 (ASP)	48 hours from coll. 24 hours from VTSR	1000 mL	Cool 4° C
Turbidity	P or G/none	EPA 180.1 EPA 180.1 (ASP)	48 hours from coll. 24 hours from VTSR	100 mL	Cool 4° C
Characteristic Testing					

Table C-1 *Sample Containers, Preservations and Holding Times*

Parameter	Container/Pres.	Method Numbers	Holding Time	Volume Required	Comments
TCLP	Sed. jar/none Teflon liner	Volatiles	14 days TCLP prep from coll. 14 days analysis from TCLP	200 g	Cool 4° C
	Sed. jar/none Teflon liner (one container for sv & metals)	Semivolatiles	14 days TCLP prep from coll. 7 days extraction from TCLP 40 days analysis from extraction	200 g (one container for sv & metals)	
		Mercury	28 days TCLP prep from coll. 28 days analysis from TCLP		
		Metals	180 days TCLP prep from coll. 180 days analysis from TCLP		
	Sed. jar/none Teflon liner	ASP Volatiles	7 days TCLP prep from VTSR 7 days analysis from TCLP	200 g	
	Sed. jar/none Teflon liner (one container for sv & metals)	ASP Semivolatiles	5 days TCLP prep from VTSR 7 days extraction from TCLP 40 days analysis from extraction	200 g (one container for sv & metals)	
		ASP Mercury	5 days TCLP prep from VTSR 28 days analysis from TCLP		
		ASP Metals	180 days prep extraction from VTSR 180 days analysis from TCLP		
Reactive Cyanide (water)	Plastic/none	SW-846 Ch. 7	14 days from coll.	500 mL	Cool 4° C
Reactive Cyanide (solid)	Sed. jar/none	SW-846 Ch. 7	14 days from coll.	100 g	Cool 4° C
Reactive Sulfide (water)	P or G/none	SW-846 Ch. 7	7 days from coll.	500 mL	Cool 4° C
Reactive Sulfide (solid)	Sed. jar/none	SW-846 Ch. 7	7 days from coll.	100 g	Cool 4° C
Waste Ignitability (water)	P or G/none	EPA 1010	Not specified - as soon as possible	100 mL	Cool 4° C
Waste Ignitability (solid)	Sed. jar/none	EPA 1010/ASTM	Not specified - as soon as possible	100 g	Cool 4° C
Waste Corrosivity (water)	P or G/none	EPA 1110 EPA 9040C	Not specified - as soon as possible 24 hours	100 mL	Cool 4° C
Waste Corrosivity (solid)	Sed. jar/none	EPA 9045C	24 hours	100 g	Cool 4° C
			Radiological		
Gross Alpha	P or G/HNO_3 pH<2	EPA 900 EPA 9310	6 months	1 L	-
Gross Beta	P or G/HNO_3 pH<2	EPA 900 EPA 9310	6 months	1 L	-

Table C-1 *Sample Containers, Preservations and Holding Times*

Parameter	Container/Pres.	Method Numbers	Holding Time	Volume Required	Comments
Uranium	Plastic/HNO_3 pH<2	SM17th 7500	6 months	1 L	-
		Biological Properties			
Total Coliform & Escherichia Coliform	Plastic 4 oz sterilized/ $Na_2S_2O_3$	SM9222B SM9223 (Colilert)	24 hours	100 mL	Cool 4° C
Fecal Coliform	Plastic 4 oz sterilized/ $Na_2S_2O_3$	SM9222C	6 hours	120 mL	Cool 4° C
Fecal Streptococcus	Plastic 4 oz sterilized/ $Na_2S_2O_3$	SM9230C	6 hours	120 mL	Cool 4° C
Standard Plate Count	Plastic 4 oz sterilized/ $Na_2S_2O_3$	SM9215B	30 hours	120 mL	Cool 4° C
Suitability	Glass autoclave sterilized/none	SM14th 905B paragraph 22	14 days	500 mL	Cool 4° C

Appendix D

Laboratory Standard Operating Procedures

Table D-1 *Laboratory Standard Operating Procedures*

SOP Title	AP #	Rev.
The Toxicity Characteristic Leaching Procedure for Volatile Organic Compounds	100-01	2
Standards- Preparation, Storage and Disposal	100-02	0
Microextractables - EDB and DBCP	100-06	2
Organochlorine Pesticides and PCBs Sample Extraction - Continous Extractor	100-09	4
Organochlorine Pesticides and PCBs Sample Extraction - Continous Extractor	100-09A	1
Organochlorine Pesticides and PCBs Sample Extraction - Sonication	100-12	4
Organochlorine Pesticides and PCBs Sample Extraction - Sonication	100-12A	1
Trace Organics Glassware Cleaning	100-18	2
Petroleum Products in Environmental Matrices by GC FID	100-21	1
Organochlorine Pesticides and Aroclors - USEPA CLP	100-24	2
Extraction of Chlorinated Herbicides - Method 8151A	100-27	1
Organochlorine Pesticides and Aroclors - NYSDEC ASP CLP 91-3	100-33	2
Organochlorine Pesticides and PCBs - Method 608	100-36	1
Chlorinated Herbicides - Method 8150B	100-40	0
Petroleum Hydrocarbon Scan - Continuous Extractor & Sonication	100-43	1
Petroleum Hydrocarbon Scan - Continuous Extractor & Sonication	100-43A	1
Chlorinated Herbicides - Method 8151A	100-46	1
PCBs Sample Extraction - Oil	100-49	1
PCBs Sample Extraction - Surface Area	100-52	1
Organochlorine Pesticides - Method 8081A	100-55A	1
PCBs - Method 8082	100-55B	1
Total Lipid Determination	100-58	0
Method for Determination of Petroleum Range Organics (FL-PRO)	100-61	0
Petroleum Range Organics - FL-PRO - Continous Extractor & Sonication	100-64	0
Waste Dilution	100-67	0
Acidity	200-03	1
Alkalinity (Total, Phenolphthalein, Carbonate, Bicarbonate, and Hydroxide)	200-06	3
Balance	200-09	2
Biochemical Oxygen Demand	200-12	2
Chemical Oxygen Demand (COD)	200-18	1
Chloride	200-21	1

Table D-1 *Laboratory Standard Operating Procedures*

SOP Title	AP #	Rev.
Chlorine, Residual and Free	200-24	2
Chromium-Hexavalent	200-27	2
Color	200-30	2
Total Cyanide - Method 335.2/SM4500-CN-E	200-33	2
Total Cyanide - Method 9010A	200-34	3
Total Cyanide - Method 335.2 CLP-M	200-35	3
Dissolved Oxygen (Winkler Azide Modification)	200-36	1
Deionized Water Production	200-37	0
Flashpoint	200-39	2
Ignitability of Solids	200-40	0
Fluoride	200-42	2
Formaldehyde	200-45	1
Ammonia	200-48	4
Ammonia (Low Level)	200-49	0
Methylene Blue Active Substances (MBAS)	200-54	2
Nitrite Nitrogen	200-57	2
Nitrate-Nitrite Nitrogen	200-60	3
Ethylene Glycol	200-63	1
Odor	200-66	2
Oil and Grease	200-69	2
Orthophosphate	200-72	3
pH	200-75	4
Petroleum Hydrocarbons in Environmental Matrices by Infrared Spectroscopy	200-78	2
Total and Volatile Solids in Solid and Semisolid Samples	200-81	2
Phenol	200-84	2
Reactivity	200-87	2
Reactivity	200-87A	1
Specific Gravity	200-90	2
Silica	200-93	2
Settable Matter	200-96	2
Specific Conductance	200-99	5

Table D-1 *Laboratory Standard Operating Procedures*

SOP Title	AP #	Rev.
Total and Volatile Suspended Solids	200-102	3
Sulfate	200-105	1
Sulfate, Turbidimetric	200-106	2
Sulfite	200-108	2
Sulfide	200-111	3
Total Kjeldahl Nitrogen	200-114	4
Digestion Procedure for TKN and TP	200-115	1
Total Organic Carbon	200-117	4
Total Phosphorus	200-120	3
Turbidity	200-123	2
Total and Volatile Dissolved Solids	200-126	3
Total and Volatile Solids	200-129	2
Bacteria - Colilert	200-132	1
Cyanide Amenable to Chlorination/Free Cyanide	200-135	1
Total Coliform - Membrane Filter Procedure	200-138	0
Fecal Coliform - Membrane Filter Procedure	200-141	0
Hardness - Titrimetric, EDTA	200-147	0
Volatile Organic Compounds by Gas Chromatography/Mass Spectrometry (GC/MS) - Method 624	300-03	3
Semivolatile Organic Compounds by Gas Chromatography/Mass Spectrometry (GC/MS) - Method 8270C	300-12A	2
Semivolatile Organic Compounds by Gas/Chromatography/Mass Spectrometry (GC/MS) Sample Extraction - Continous Extractor	300-15	4
Semivolatile Organic Compounds by Gas/Chromatography/Mass Spectrometry (GC/MS) Sample Extraction - Continous Extractor	300-15A	2
Semivolatile Organic Compounds by Gas/Chromatography/Mass Spectrometry (GC/MS) Sample Extraction - Sonication	300-18	4
Semivolatile Organic Compounds by Gas/Chromatography/Mass Spectrometry (GC/MS) Sample Extraction - Sonication	300-18A	1
Volatile Organics by Gas Chromatography/Mass Spectrometry (GC/MS) - Method 8260B	300-27A	2
Volatile Organics by Gas Chromatography/Mass Spectromtry (GC/MS) - Method NYSDEC 95-1	300-30	4
Semivolatile Organic Compounds by Gas Chromatography/Mass Spectrometry (GC/MS) - Method 625	300-33	2

Table D-1 *Laboratory Standard Operating Procedures*

SOP Title	AP #	Rev.
Semivolatile Organics by Gas Chromatography/Mass Spectrometry (GC/MS) - Method NYSDEC 95-2	300-36	3
Volatile Organics by Gas Chromatography/Mass Spectrometry (GC/MS) - Method USEPA-CLP	300-39	3
Semivolatile Organics by Gas Chromatography/Mass Spectrometry (GC/MS) - Method USEPA-CLP	300-41	3
Low-Level Volatile Organics by Gas Chromatography/Mass Spectrometry (GC/MS) - Method OLC02.1	300-44	0
Furnace Atomic Absorption (NYSASP Superfund CLP))	400-03	6
Furnace Atomic Absorption (SW-846)	400-06	6
Trace Metals Sample Preparation (NYSASP and USEPA Superfund CLP)	400-09	6
ICP Atomic Emission (NYSASP Superfund CLP)	400-12	5
ICP Atomic Emission - Method 6010B	400-15A	2
Cold Vapor Mercury (NYSASP Superfund CLP)	400-18	5
Cold Vapor Mercury - Methods 7470A and 7471A	400-21	5
Trace Metals Sample Preparation (SW-846 Methods 3005A, 3010A, 3020A and 3050A)	400-24	5
Trace Metals Sample Preparation (SW-846 Methods 3005A, 3010A, 3020A and 3050B)	400-24A	1
Filtering	400-30	2
Jaw Crushing	400-33	1
Trace Metals Air Sample Preparation	400-36	1
Toxicity Characteristic Leaching Procedure (TCLP) - Non-Volatiles	400-39	1
Trace Metals Glassware Cleaning	400-41	1
Turbidity for Trace Metals Drinking Waters	400-53	0
Furnace Atomic Absorption (USEPA Superfund CLP)	400-56	2
ASTM - Shake Extraction of Solid Waste with Water	400-59	1
Synthetic Precipitation Leaching Procedure (SPLP) - Non-Volatiles	400-62	1
ICP Atomic Emission (Superfund CLP)	400-65	2
Cold Vapor Mercury (USEPA - Superfund CLP)	400-68	2
Preparation of Biota Samples for Trace Metals Analysis	400-71	0
Procedure for the Analysis of Volatile Halogenated and Aromatic Hydrocarbons by Purge and Trap/GC - Methods 601/602	500-04	3

Table D-1 *Laboratory Standard Operating Procedures*

SOP Title	AP #	Rev.
Procedure for the Analysis of Volatile Organic Compounds in Water by Purge & Trap/GC. Capillary Column Gas Chromatography with Photoionization and Electrolytic ConductivityDetectors in series. EPA Method 502.2	500-07	1
Procedure for the Analysis of Volatile Halogenated and Aromatic Hydrocarbons by Purge & Trap/GC - EPA Method 8021B	500-24	1
The Acquisition, Preparation, and Use of Standard Reference Materials	600-02	0
Sample Preparation Procedures	600-10	0
Calibration of Low-Background Alpha/Beta Proportional Counters	600-20	0
Calibration of Gamma Spectrometers	600-21	0
Calibration of Alpha Spectrometers	600-22	0
Calibration of Liquid Scintillation Counters	600-23	0
Calibration of Lucas Cell Counters	600-24	0
Determination of Gross Alpha/Beta Activity	600-30	0
Determination of Gross Alpha Radium Activity in Aqueous Samples	600-31	0
Determination of Total Alpha Radium Activity in Aqueous Samples	600-32	0
Determination of Radium-228 Activity in Aqueous Samples	600-33	0
Determination of Strontium-89/90 Activity	600-35	0
Determination of Carbon-14 Activity	600-38	0
Determination of Total Uranium Activity	600-39	0
Determination of Gamma Emitting Isotopes	600-50	0
Determination of Radon-222 Activity in Charcoal Canisters	600-52	0
Determination of Selected Actinide Activities - Ion Exchange Separation	600-60	0
Determination of Polonium-210 Activity -Galvanic Deposition	600-66	0
Determination of Radium-226 Activity in Aqueous Samples	600-80	0
Sequential Determination of Radium-226 and Radium-228 Activity in Aqueous Samples	600-81	0
Airborne Asbestos Analysis by Transmission Electron Microscopy	650-01	5
Airborne Asbestos Filter Preparation for Transmission Electron Microscopy Analysis	650-04	5
Non-Friable Organically Bound Materials	650-07	4
Airborne Asbestos by Phase Contrast Microscopy	650-10	5
Asbestos Identification in Bulk Samples	650-13	9
Asbestos by TEM - NIOSH Method 7402	650-19	0

Table D-1 *Laboratory Standard Operating Procedures*

SOP Title	AP #	Rev.
Preparation of Analytical Standard Operating Procedures	800-01	2
Preparation of Administrative Standard Operating Procedures	800-02	0
Document Control	800-03	0
Training	800-05	2
Corrective Action	800-06	0
Complaint Resolution	800-07	0
Non-Conformance/Supply Verification	800-08	0
Evaluation of Quality Control Data	800-09	0
Generating Control Limits	800-10	2
Generating Quality Control Charts	800-13	1
Sample Management System	800-15	4
Sample Tracking System	800-16	0
Disk Deliverable - BEM/RPIMS 3.0	800-18	0
Disk Deliverable - GIS	800-21	0
Software Validation	800-22	0
LIMS Modification - Verification	800-23	0
Additional Procedures for the Analysis of North Carolina Samples	800-25	0
Method Detection Limits	800-26	0
Thermometer Calibration	800-27	0
Laboratory Hazardous Waste Management System	800-31	0
Classification and Handling Protocols for Radioactive Samples	800-32	0
Preparation of Laboratory Data Reports	800-33	0
Internal Review of Laboratory Data	800-36	0
SW-846 Update III Low/High Level Soil Field Preservation Container Kit	800-39	0

Appendix E

Order of Data Package Deliverables

ORDER OF DATA PACKAGE DELIVERABLES

SAMPLE DATA SUMMARY PACKAGE

All non-CLP results (analytical and quality control) must be entered into the LIMS and LIMS forms submitted with the package.
CLP refers to both EPA and ASP Superfund.

NYSDEC Data Package Summary Forms (Superfund/Cat B)

Narrative

Cross Reference Table (not required if NYSDEC forms are used)

Analytical Results (CLP FORM 1) (in order of sample number by fraction)(include confirmation)

Quality Control Results

Organic Surrogate results (CLP FORM 2) (by fraction) (not required if on LIMS)
MS/MSD (CLP FORM 3 or 5 & 6)
Matrix Spike Blank/Prep Blank Spike (by fraction)
LCS (by fraction)
Prep Blanks (CLP FORM 4 and CLP FORM 1 or CLP FORM 3)
GC/MS Internal Standards (CLP FORM 8)

Laboratory Corrective Action Logs

Chain of Custody

External Chain of Custody (by date received)
Client chain of custody
Case File Form
Sample Control Record
Airbill

Internal Chain of Custody (by fraction)

Record of Communication (where applicable)

SAMPLE DATA PACKAGE

Narrative

Cross Reference Table (not required if NYSDEC forms used)

NYSDEC Data Package Summary Forms (Cat B)

SECTION 1 **GC/MS Volatile Data**

QC SUMMARY:

Surrogate results (CLP only or if required)
MS/MSD
Matrix spike blank (if required)
LCS
Prep Blanks (CLP FORM 4)
Tune (CLP FORM 5) (CLP only or if required)
Internal Standards
MDLs/IDLs

RAW DATA:

ORDER OF DATA PACKAGE DELIVERABLES

SAMPLE DATA
- *Sample results and sample raw data*

STANDARDS DATA
- *Initial Calibrations*
- *Continuing Calibrations*
- *Internal Standards*

RAW QC DATA
- *Tune Raw Data*
- *Prep Blanks*
- *Matrix Spike Blank*
- *Matrix Spike*
- *Matrix Spike Duplicate*
- *LCS*

LABORATORY WORKSHEETS
- *Example Calculations*
- *Extraction Log*
- *Injection Log*
- *Standards Log*

SECTION 2 GC/MS Semivolatile Data

QC SUMMARY:
- *Surrogate results (CLP only or if required)*
- *MS/MSD*
- *Matrix spike blank (if required)*
- *LCS*
- *Prep Blanks (CLP FORM 4)*
- *Tune (CLP FORM 5) (CLP only or if required)*
- *Internal Standards*
- *MDLs/IDLs*

RAW DATA:

SAMPLE DATA
- *Sample results and sample raw data*

STANDARDS DATA
- *Initial Calibrations*
- *Continuing Calibrations*
- *GPC UV Trace (CLP only)*
- *Internal Standards*

RAW QC DATA
- *Tune Raw Data*
- *Prep Blanks*
- *Matrix Spike Blank*
- *Matrix Spike*
- *Matrix Spike Duplicate*
- *LCS*

LABORATORY WORKSHEETS
- *Example Calculations*
- *Extraction Log*
- *GPC Log*
- *GPC UV Trace (non-CLP)*

Injection Log
Standards Log

SECTION 3 Pesticide/PCB Data

QC SUMMARY:
- *Surrogate results (CLP only or if required)*
- *MS/MSD*
- *Matrix spike blank (if required)*
- *LCS*
- *Prep Blanks*
- *MDLs/IDLs*

RAW DATA:
- SAMPLE DATA
  - *Sample results and sample raw data (primary and conf.)*
- STANDARDS DATA
  - *PEM Summary*
  - *Retention Time Windows*
    - *Initial*
    - *Daily*
  - *DCBP/TCMX Shift (if required)*
  - *Initial Calibrations (primary and conf.)*
    - *Initial Cal Summary & Plots*
    - *Chromatograms (PEM and standards)*
  - *Continuing Calibrations (primary and conf.)*
    - *Cont Cal Summary*
    - *Chromatograms*
  - *GPC UV Trace (CLP only)*
- RAW QC DATA
  - *Prep Blanks*
  - *Matrix Spike Blank*
  - *Matrix Spike*
  - *Matrix Spike Duplicate*
  - *LCS*
- LABORATORY WORKSHEETS
  - *Example Calculations*
  - *Extraction Log*
  - *GPC Log*
  - *GPC UV Trace (non-CLP)*
  - *Injection Log*
  - *Standards Log*

SECTION 4 GC Organic Data

QC SUMMARY:
- *Surrogate results (if required)*
- *MS/MSD*
- *Matrix spike blank (if required)*
- *LCS*
- *Prep Blanks*
- *MDLs/IDLs*

RAW DATA:

SAMPLE DATA
- *Sample results and sample raw data (primary and conf.)*

STANDARDS DATA
- *Retention Time Windows*
  - *Initial*
  - *Daily (if requested)*
- *Initial Calibrations (primary and conf.)*
  - *Initial Cal Summary & Plots*
  - *Chromatograms*
- *Continuing Calibrations (primary and conf.)*
  - *Cont Cal Summary*
  - *Chromatograms*

RAW QC DATA
- *Prep Blanks*
- *Matrix Spike Blank*
- *Matrix Spike*
- *Matrix Spike Duplicate*
- *LCS*

LABORATORY WORKSHEETS
- *Example Calculations*
- *Extraction Log*
- *Injection Log*
- *Standards Log*

SECTION 5 Trace Metals Data

ANALYTICAL RESULTS

QC SUMMARY: (LIMS or WARDS)
- *Initial and Continuing Calibration Verification Summary*
- *CRDL Summary (CLP only)*
- *Initial and Continuing Calibration Blank Summary*
- *Prep Blank*
- *ICP Interference Check Sample Summary*
- *Matrix Spike Recovery*
- *Post Digestion Spike Recovery (CLP only)*
- *Duplicates*
- *Matrix Spike Blank*
- *LCS Summary*
- *MSA Summary (CLP only)*
- *ICP Serial Dilution*
- *MDLs/IDLs*
- *Interelement Correction Factors (CLP only)*
- *Linear Range*
- *Preparation Log (Form 13) (CLP only)*
- *Analysis Run Log (Form 14) (CLP only)*

RAW DATA:
- *ICP Raw Data (by date)*
- *Furnace Raw Data (by element, in date order)*
- *Mercury Raw Data*
- *Cyanide Raw Data (if applicable (ASP/CLP))*

ORDER OF DATA PACKAGE DELIVERABLES

LABORATORY WORKSHEETS
Digestion Log (by method/by date)
Standards Log

SECTION 6 Wet Chemistry Data
ANALYTICAL RESULTS
QC SUMMARY:
Initial and Continuing Calibration Verification/Blank Summary
Prep Blank
Matrix Spike Recovery
Duplicate
LCS Summary
MDLs
RAW DATA:
LABORATORY WORKSHEETS
Analytical Runs (by parameter in alphabetical order by date)
include if applicable:
instrument printouts
copy of curves

Use CLP Forms or LIMS.

Each volume should be preceded by a Cover Page and a Table of Contents.

Items in **BOLD** should be included in the Table of Contents. Number the sections consecutively. If a fraction is not required, skip it and use that section number for the next fraction.

Not all items are required for all reports (i.e. NYSDEC Data Package Summary Forms, matrix spike blank). Include items that are required in the order specified.

NYSDEC forms should be typed on WordPerfect tables available on the H:/ drive.

Individual sections of reports consist of raw data in format specified, internal case narrative (on G drive), corrective action logs, and NYSDEC forms (if applicable).

All items in **bold** in the Sample Data Summary Package (starting with **Analytical Results)** and all items in CAPS in the Sample Data Package should have dividers.

In one volume reports there is no separation of summary and data packages.

For level II reports, just include the sample data summary package information, in the proper order. Narratives are not required. Corrective action logs should be included.

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Appendix F

State Certifications

Table F-1 *State Certifications*

State Agency	Cert. No.	Category*							Comments
		WS	WP	HW	SW	M	R	A	
Colorado									State certification not required to perform analysis
Connecticut	PH0634	X	X	X	X				
Delaware									State certification not required to perform analysis
Florida	E87280	X	X	X					
Georgia									State certification not required to perform analysis
Illinois									State certification not required to perform analysis
Kentucky									State certification not required to perform analysis
Louisiana									State certification not required to perform analysis
Maryland	239	X							Drinking Water certification only
Massachusetts	NY034	X	X				X		Hazardous/Solid Waster certification not available
Michigan		X							Drinking Water certification only
Missouri									State certification not required to perform analysis
New Jersey	73361	X	X	X	X				
New York	10155	X	X	X	X	X	X	X	
North Carolina	315	X	X						Hazardous/Solid Waste certification not available
Ohio									State certification not required to perform analysis
Pennsylvania	68-285	X						X	Drinking Water certification only
South Carolina	91007	X	X	X	X				
Utah			X	X	X				

WS=Water Supply, WP=Water Pollution, HW=Hazardous Waste, SW=Solid Waste, M=Microbiological, R=Radiochemistry, A=Asbestos

Table F-1 *State Certifications*

State Agency	Cert. No.	Category*							Comments
		WS	WP	HW	SW	M	R	A	
Tennessee	02942	X							Drinking Water certification only
Texas									State certification not required to perform analysis
Vermont									State certification not required to perform analysis
Virginia	00244	X					X		Drinking Water certification only
Wyoming									State certification not required to perform analysis

WS=Water Supply, WP=Water Pollution, HW=Hazardous Waste, SW=Solid Waste, M=Microbiological, R=Radiochemistry, A=Asbestos

Attachment B

Analysis of Dissolved Gases from Water Following "Bubble Strip" Sampling at the Well Site

ANALYTICAL METHOD AM19GAx

ANALYSIS OF DISSOLVED GASES FROM WATER
FOLLOWING " BUBBLE STRIP" SAMPLING AT THE WELLSITE

1.0 Scope and Application

1.1 Method AM19GAx is used to determine the concentration of dissolved gases in water samples. Specifically, Method AM19GAx is used to determine the dissolved concentration of the following gases:

Carbon dioxide		Methane
Oxygen	Hydrogen	Ethane
Nitrogen		Ethene

1.2 This method is recommended for use by, or under the supervision of, analysts experienced in sample preparation, the operation of gas chromatographs and in the interpretation of chromatograms.

2.0 Summary of Method

2.1 Analysis of dissolved gases in a water sample is accomplished by collecting the water sample by the ▒bubble strip▒ method described by Chapelle et. al. in the paper ▒Practical Considerations for Measuring Hydrogen Concentrations in Groundwater▒ or an equivalent method. After equilibration, the headspace gases are analyzed with a gas chromatograph capable of simultaneous analysis of all of the target analytes from a single 10 mL gas sample. A single injection of headspace gas from integral, simultaneously filled sample loops is used to assure consistent injection volume. The permanent gases are analyzed using a thermal conductivity detector (TCD). The light hydrocarbons are analyzed using a flame ionization detector (FID). Hydrogen is analyzed using a reduction gas detector (RGD). The data are transferred to a microcomputer, converted to digital format, stored, and processed using a chromatography data system.

3.0 Interferences

3.1 The most likely source of "interference" is ambient air. Due to the relatively high concentrations of oxygen and nitrogen, a very small amount of air as a contaminant will seriously skew the results. The analyst must take great care to ensure that air is flushed from the gas tight syringe before sample preparation and that no air has entered the syringe or needle prior to injection of the sample into the gas chromatograph.

3.2 Contamination by carryover can occur whenever high-level and low-level samples are sequentially analyzed. An unrestricted flow of

pure carrier gas from a 10 psig source should be allowed to flow through each sample loop for 30 seconds prior to each analysis.

3.3 As required, the analyst should demonstrate the absence of carryover contamination by analysis of the contents of the sample loop when purged with carrier gas. This demonstration should be performed when carryover contamination is suspected (after high samples). In the event that `ghost peaks' (peaks similar to previous sample) appear when a pure carrier gas sample is analyzed, measures should be taken to eliminate the carryover contamination.

4.0 Apparatus and Materials

4.1 Sample vials (Supelco, Inc, Bellefonte, PA or equivalent).

4.2 Peristaltic pump (Geotech Series II or equivalent).

4.3 Bubble Strip Cell(Supelco, Inc. Bellefonte, PA or equivalent).

4.4 Syringe: locking gas tight

4.5 Gas Chromatograph: The chromatograph designed and built by Microseeps is equipped with multiple packed columns and multiport valves, a thermal conductivity detector, a flame ionization detector, a reduction gas detector, and multiple sample loops. This instrument provides rapid turn-around for consecutive analyses and a clean baseline for accurate, reproducible results. The flame ionization detector, which is also built by Microseeps, is of a special design which allows considerably more sensitivity than commercially available models.

4.6 Data Collection: The output of the chromatograph is directed to a microcomputer where the signal is converted to digital format, stored, and processed using a chromatography data system.

4.7 Automated valve control: Digital control is provided by the microcomputer though the chromatography data system software. This control provides constant start and stop times for directing carrier gas flow. The event times are programmed and saved using the method editor module of the software.

5.0 Sample Preparation and Analysis

5.1 After the well is purged, connect the flow-through-cell(bubble strip cell) to the well and fill the cell completely with water eliminating all headspace and bubbles, then continue to pump with the cell mounted at a 30^{o} angle downward from the inlet to the outlet. Pump three cell volumes through the cell at 300-600mL/min. While continuing to pump, inject 40mL of laboratory supplied inert gas

through the septum port at the inlet end of the cell. Pump an additional 30 min.

5.2 Using a gas tight locking syringe,which has been filled and purged with the laboratory supplied inert gas, withdraw 12-15mL of headspace gas from the flow through cell into the syringe, lock and remove the syringe needle from the septum and contain the sample in one of the two following ways.

5.3 If the sample is to be analyzed in the on-site laboratory, plug the needle by inserting it into a rubber septum which has been provided by Microseeps. Continue to pump an additional five minutes and take a second aliquot of gas. After the duplicate sample has been collected, both samples should be immediately transported to Microseeps onsite lab for analysis as described in 5.5.

5.4 If the sample is to be analyzed in Microseeps fixed laboratory in Pittsburgh, PA, a 10 cc portion of the sample is injected into a sample vial provided by Microseeps. After pumping for an additional 5 minutes, a duplicate sample is taken and contained in a second sample vial using the procedure just described. To minimize the potential for leakage, care should be taken to insure that the syringe needle is plunged squarely into and withdrawn squarely from the sample vial so as not to tear the septum. Both sample vials should be labled and shipped to Microseeps laboratory at 220 William Pitt Way, Pittsburgh, PA 15238 for analysis.

5.5 In either the on site or fixed laboratory, slowly inject 10mL of headspace gas through the gas chromatograph sample loops via the septum fitting of the injection port. The flow through the sample loop is monitored by a flow meter connected to the sample loop vent port on the gas chromatograph. In the fixed laboratory, 10 mL of sample gas may be removed from the shipped sample vial by simultaneously injecting distilled water into the sample vial while removing 10 mL of sample gas.

6.0 Calibration and Results

6.1 The standard calibration gas should be introduced in the same manner as described in section 5.5 above. Measured peak areas are converted to concentrations using certified commercial gas standards traceable to NIST standards. (Matheson Gas Products and Scott Specialty Gases). Dilutes may be made to achieve multi point calibration curves.

6.2 Initial calibration is accomplished by analyzing multiple standards of appropriate calibration ranges. The results should agree to within 10% RPD. These results will be used to establish a multipoint calibration curve.

6.3 A Continuing Calibration Verification (CCV) standard will be run for every 20 samples (or more frequently if contractually required). If the instrument response for any CCV standard varies by more than 20%, the analyst will not analyze samples until the reason is determined and the problem is corrected.

6.4 Concentration of analytes in the headspace gas in percent by volume (for permanent gases) and parts per million by volume (for light hydrocarbons and hydrogen) are converted to the original analyte concentration in the water (mg/l for permanent gases, nM/l for hydrogen, and ng/l for light hydrocarbons) using Henry's Law.

7.0 Quality Control

7.1 If the requirements set forth in section 6.3 are not met, the analytical program will be terminated until the cause is determined and a solution is effected.

7.2 The analyst should demonstrate the absence of ambient air in the sample preparation system by filling a sample syringe with inert gas and injecting 10mL of the inert gas into the sample loops in the same manner as a sample. The results of this 'syringe blank' should show all analyte levels below the minimum detection limits.

7.3 Before and during sample analysis, instrument blanks (sample loop filled with flush inert gas) should be analyzed to assure the absence of interferences as described in section 3.0 above.

7.4 All chromatograms should be examined by an experienced analyst.

7.5 Throughout analysis the gas samples are injected mechanically utilizing a sample loop to achieve a uniform sample size from a flow directly from the sample preparation syringe. The uniform sample size achieved using the sample loop assures consistent and accurate results.

7.6 Calibration records are generated in electronic and hard copy formats and stored. All such records will be maintained in the laboratory during the course of the project and thereafter as determined by the client.

8.0 Instrument Conditions

Gas Chromatograph:

Injection Port Temperature: ambient
Thermal Conductivity Detector Temperature: ambient
Flame Ionization Detector Temperature: ambient
Reduction Gas Detector Temperature: 280^{o}C
Oven Temp. 100 ^{o}C. isothermal
TCD Signal Range: 1
FID Signal Range: variable depending on concentrations
RGD Signal Range: 1
He Carrier Gas Regulator Pressure: 60 psig
Sample carrier flow: 30 mL/min.
Reference flow: 30 mL/min.
N2 Carrier Gas Regulator Pressure: 25 psig
Sample carrier flow: 25 mL/min
Valve Air Pressure: 60 psig.