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QUALITY ASSURANCE/QUALITY CONTROL AND DATA MANAGEMENT PLAN PHASE II REMEDIAL INVESTIGATION

INSTALLATION RESTORATION STUDY
NAVAL SUBMARINE BASE - NEW LONDON
GROTON, CONNECTICUT

Prepared for:

NORTHERN DIVISION
NAVAL FACILITIES ENGINEERING COMMAND
LESTER, PENNSYLVANIA

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1.0 INTRODUCTION

This Quality Assurance/Quality Control (QA/QC) and Data Management Plan has been developed by Atlantic Environmental Services, Inc. (Atlantic) for use in conjunction with the Field Sampling Plan (FSP) for the Phase II Remedial Investigation at the Naval Submarine Base-New London (NSB-NLON) in Groton, Connecticut. This work is being conducted as part of the Navy's Installation Restoration (IR) Program. This QA/QC Plan is based on guidance provided in *Sampling and Chemical Analysis Quality Assurance Requirements for the Navy Installation Restoration (IR) Program*, Naval Energy and Environmental Support Activity (NEESA) 20.2-047B.

This plan is a modification of the April 1989 QA/QC plan prepared for investigation of seven Step I and four Step II sites. The modifications, which make this plan specific to this investigation, incorporate previous comments from the United States Environmental Protection Agency (U.S. EPA) and Connecticut Department of Environmental Protection (CTDEP), and change the level of quality control from Level C to Level D wherever possible.

The purpose of this document is to specify the requirements for the control of the accuracy, precision, and completeness of data from the point of sample collection through analysis and reporting. This QA/QC Plan outlines the organization, objectives, and all QA/QC activities which will ensure achievement of desired data quality goals for sampling and analysis of inorganic and organic analytes and associated characteristics. Information on radiological analysis of ground water has also been included in Section 5.1 (Laboratory Procedures). Sampling and analyses for engineering parameters and ecological studies are discussed in Section 4.0 of the Field Sampling Plan (FSP).

1.1 Data Quality Objectives (DQO)

The program to be implemented for this investigation will be performed under NEESA Level D quality control wherever possible. Level D is equivalent to Level IV quality control as defined in the Superfund Manual *Data Quality Objectives for Remedial Response Activities* (EPA 540/G-87/003). The laboratory must successfully analyze a performance sample, undergo an audit, correct deficiencies found during the audit, and provide monthly progress reports on QA. The laboratory that performs Level D QC must also have successfully analyzed performance samples furnished by the U.S. EPA under the Superfund Contract Laboratory Program (CLP) in the past year.

Audits will be administered and evaluated by the NEESA Contract Representative (NCR). The Navy audit and performance samples are required in addition to any specified by the U.S. EPA Superfund Program.

Level D requires use of CLP procedures as defined in Contract Laboratory Program *Statement of Work for Inorganics Analysis* (U.S. EPA 1988, Rev. 3/90), and *Statement of Work for Organics* (U.S. EPA 1988, Rev. 3/90). Data validation procedures under Level D must be conducted in accordance with U.S. EPA Region I *Laboratory Data Validation Functional Guidelines* dated February 1, 1988, Rev. 7/88 for organic analyses, and June 13, 1988, Rev.

2/89 for inorganic analyses. Data validation will be performed by a qualified subcontractor.

Laboratory analyses of Non-CLP parameters will be validated under NEESA Level C Quality Control. Field laboratory analyses will be conducted and validated under Level A or B procedures as subsequently discussed in this report.

1.2 Site Description and History

The Subase was established as an official Navy yard in July 1886. The site initially moored small craft and obsolete warships and was used as a coaling station for the Atlantic Fleet. The property was officially established as a permanent submarine base in 1916. The overall base facilities were expanded and a Submarine School training facility was established in 1917; the Submarine Medical Center was established in 1918. During World Wars I and II, the Subase expanded greatly in size and in the number of buildings to support the submarine fleet.

The Subase currently provides a base command for naval submarine fleet activities in the Atlantic Ocean. Additionally, the Subase consists of naval housing, submarine training facilities, military offices, medical facilities, and facilities designed for the maintenance, repair, and overhaul of submarines.

1.3 Previous Data

Under the IR program, an Initial Assessment Study (IAS) for the Subase sites was completed in 1982. The IAS identified sites where contamination from past waste disposal or handling practices may pose health or environmental risks. The IAS recommended further investigation of three sites at the Subase. These sites included Area A, the Over Bank Disposal Area (OBDA), and the Defense Reutilization and Marketing Office (DRMO). The Verification Step of a Confirmation Study was performed from 1985-1988 on these three sites. Additionally, an investigation of petroleum contamination at the Lower Subase was performed in 1985.

Under the IR program, Atlantic conducted Step I investigations at seven sites and Step II investigations at four sites identified by the IAS. Results of the investigations are provided in the Phase I Remedial Investigation Report dated August 1992.

1.4 Project Scope

Sites included in this Phase II Remedial Investigation are in three different phases of the IR Program. These phases and associated sites are discussed below.

Supplemental Step I Investigations

Two sites are included in this category. These are sites where Step I investigations have been completed. The Step I investigations identified low levels of chemicals which were determined to pose no risk to human health and the environment. However, in responses to comments by the CTDEP and the U.S. EPA, supplemental field investigations are being

conducted to confirm that chemicals are not present at levels of concern. The sites included for Supplemental Step I Investigations are as follows:

- CBU Drum Storage Area
- Over Bank Disposal Area Northeast (OBDANE)

Step II Remedial Investigations

The Step II Remedial Investigations involve sites which have undergone an initial (i.e., Step I) field sampling/analysis program in which contamination was determined to be present. Step II investigations involve comprehensive site studies designed to determine the nature and extent of contamination and associated health and environmental risks, and to conduct feasibility studies to evaluate remedial (cleanup) options. Step II investigations will be conducted at the following sites:

- Rubble Fill at Bunker A-86
- Torpedo Shops
- Goss Cove Landfill
- Spent Acid Storage and Disposal Area

Supplemental Step II Remedial Investigations

Supplemental Step II Remedial Investigations involve sites that have undergone extensive Step II investigations. However, supplemental information is required to further define the extent of contamination and health and ecological risks. Supplemental investigations will be conducted at the following sites:

- Area A
  - Landfill
  - Wetland
  - Downstream/OBDA
  - Weapons Center
- DRMO
- Lower Subase

Step I and Special Investigations

Two additional sites, Pier 33 and Berth 16/Former Incinerator, have also been added as Step I Sites and are included in a Field Sampling Plan dated July 1992. Furthermore, a separate work plan has been prepared for a special investigation to establish background levels for inorganics in soils and to further assess the source of boron in residential wells and in NSB-NLON ground water.

2.0 PROJECT ORGANIZATION AND RESPONSIBILITIES

This project will be managed by Atlantic. Specific Atlantic personnel have been identified who are responsible for implementing the QA/QC aspects of the project. Primary responsibility rests with the Project Manager. Figure 2-1 presents the organizational structure for this investigation at NSB-NLON.

The names and addresses of the primary contacts with the Navy are given below.

Engineer-in-Charge

Deborah Stockdale
Northern Division, Naval Facilities Engineering Command
Lester, Pennsylvania
Telephone: (215) 595-0567

Point-of-Contact

William Mansfield
Naval Submarine Base - New London
Groton, CT
Attn: Code 803
Telephone: (203) 449-2276

Responsibilities of Atlantic's Project Manager and QA/QC staff are presented in the following subsections.

2.1 Principal-in-Charge

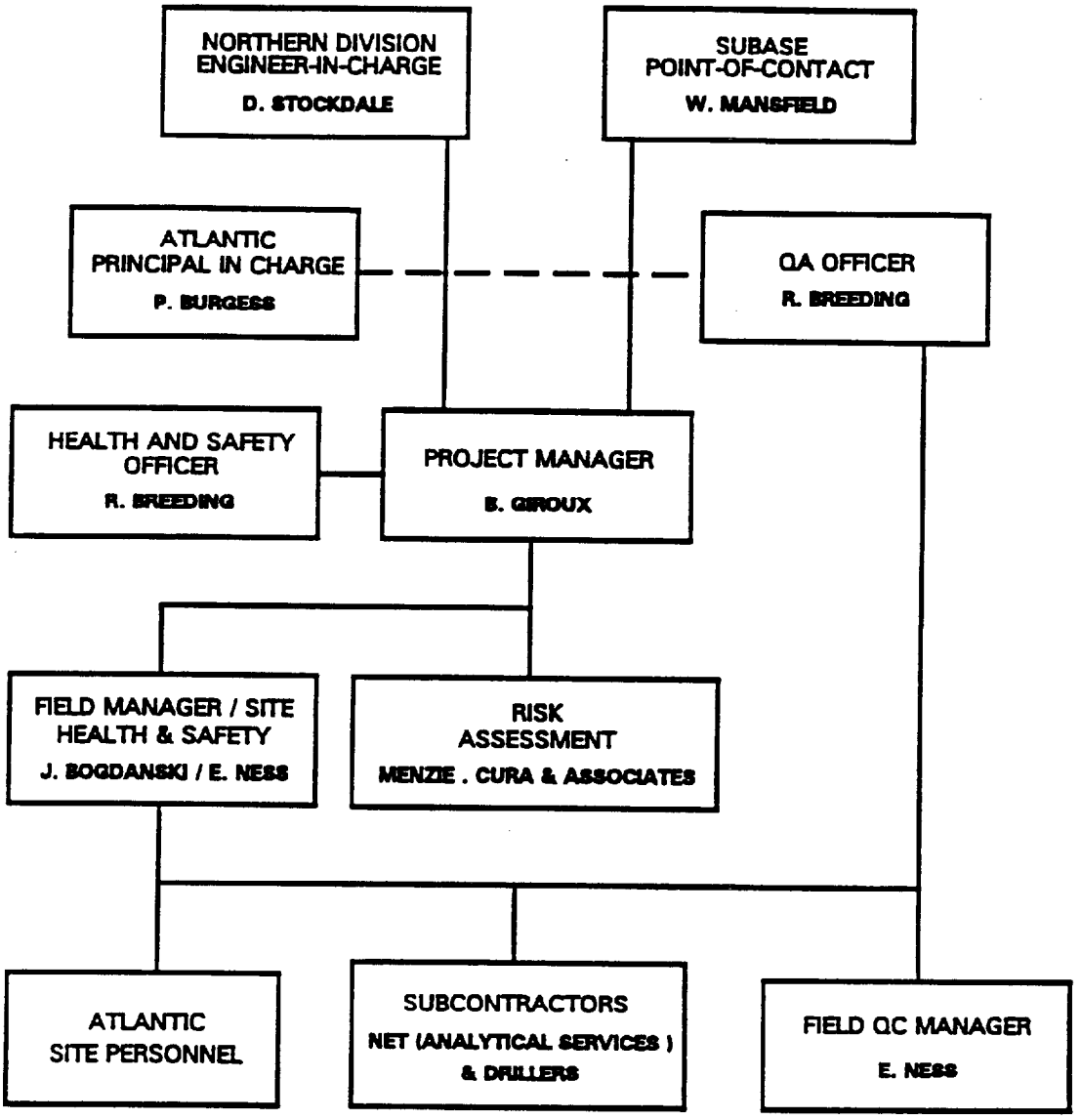
Paul Burgess is Atlantic's Principal-in-Charge for this project. As such, he is the Atlantic corporate officer who will provide final technical review of all products, ensure that all necessary materials and resources are allocated to this project, and that the Navy and oversight agencies are completely satisfied with all work products.

2.2 Project Manager's Responsibility

The Atlantic Project Manager (Barry Giroux) will provide overall direction to the project team and is responsible for overall technical, financial, scheduling and QA/QC matters. The Project Manager will be the primary contact for the Northern Division's Engineer-in-Charge (EIC) and NSB-NLON Point-Of-Contact (POC).

2.3 QA Officer's Responsibility

The Atlantic QA Officer (Robert Breeding) reports independently to Atlantic's Principal-in-Charge and has full authority to act independently from the technical management of the IR



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GROTON, CT

FIGURE 2-1
PROJECT ORGANIZATION

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program. He will serve as Atlantic's primary contact with the Northern Division's QA staff, if so requested by the EIC. He will monitor compliance of the project with the QA/QC Plan and perform any necessary audits, initiate and report corrective actions, and assist in preparing QA/QC project summaries for the Final Report.

Three field audits are planned for this project, one for each of the following activities:

- field screening
- drilling and soil sampling
- well development
- ground water sampling

2.4 Field QC Manager's Responsibilities

The Field QC Manager (Erik Ness) will work with the field team during preparations for the sampling events, and also during conductance of field work. He will be onsite to ensure all required QC field procedures are followed; will initiate informal and/or formal corrective actions, as necessary; and will maintain QC records and report results to the Atlantic Project Manager and QA Officer. Mr. Ness will be responsible for ensuring all analytical deliverables have been received and subsequently validated according to NEESA Level D or other approved guidelines.

2.5 Laboratory QC Coordinator's Responsibilities

The laboratory selected for this project is the Cambridge Division of National Environmental Testing, Inc. of Bedford, Massachusetts (NET), which will also designate a QC Coordinator (NET lists this person as QA Officer). NET's Quality Assurance Project Plan is included as Appendix A to this plan. The Laboratory QC Coordinator will perform the following, in accordance with the NEESA-approved QA/QC plan.

- Assist the Project/Task Manager in specifying QA/QC procedures to be used during the study.

- Implement QC procedures and techniques to assure that the laboratory achieves established standards of quality.

- Evaluate data quality and maintain records on related QC charts and other pertinent information.

- Monitor laboratory activities to determine conformance with authorized QA policy.

- Coordinate internal audits.

- Review performance evaluation results.
- Administer intra-laboratory QA efforts.
- Prepare QA reports to management.

3.0 SAMPLING PROCEDURES

3.1 Introduction

The following matrices may be collected for chemical analysis during these field investigations: soil, sediment, ground water, surface water, air, and biota. All sample collection and monitoring procedures are discussed in the FSP, including Atlantic's Standard Operation Procedures (SOPs) which are provided as Appendix A in the FSP. All samples collected will be handled in accordance with this QA/QC and Data Management Plan; and procedures identified in the FSP.

3.2 Selection of Sampling Locations

Samples to be collected and associated sampling locations are identified in the FSP. A summary table of the sample types, quantity and associated QA/QC requirements and samples are provided in Appendix B of this document.

3.3 Sample Collection, Handling and Shipping

Sample bottles will be prepared and shipped to the field by NET's Sample Coordinator. Where possible, preservatives will be placed in the appropriate containers by the laboratory to minimize chemical handling in the field. Sediment samples must contain greater than 30 percent solids in order for the samples to be considered valid.

Sample containers, preservatives and holding times are listed in Addendum 4 of the Laboratory Quality Assurance Project Plan (Appendix A). The only modifications to Addendum 4 are that aqueous VOC samples will be preserved with HCL, 60 ml borosilicate bottles with Teflon®-lined septums will be used to hold soil samples for VOC analyses, and 2-liter, or two 1-liter plastic containers (i.e., 2-liter volume is required per sample) will be used for ground water samples for radiological analyses.

The general listing of field QC samples to be included for this project is provided in Table 3-1.

A sequentially numbered sample label will be filled out at the time of sampling by Atlantic's field personnel according to the proper procedures. It will be attached to each container with the following information:

- Site number/project number
- Field identification or sample station number
- Date and time of collection
- Designation as grab or composite
- Matrix
- Signature of samples
- Preservation used
- General type of analysis to be conducted

TABLE 3-1 FREQUENCY OF FIELD QC SAMPLES		
TYPE OF SAMPLE	**INORGANICS[6]**	**ORGANICS[1]**
Trip Blank (for volatile organics only)	NA[2]	1/cooler
Equipment Rinsate[3]	1/day[4]	1/day[4]
Field Blank	1/source/event for all analytes	
Field Duplicate[5]	10%/media	10%/media
Referee Duplicate[5]	Collect at direction of U.S. EPA Project Manager	

1. Includes dioxin analysis where specified.
2. NA - Not Applicable
3. Samples are collected daily; however, only samples from every other day are analyzed. Other samples are held and analyzed only if evidence of contamination exists.
4. This means one per day per matrix per piece of equipment for non-dedicated equipment.
5. The duplicate must be taken from the same sample which will become the laboratory matrix/spike duplicate for organics or for the sample used as a duplicate in inorganic analysis.
6. Includes radiological analyses where specified.

After samples have been collected, they will be placed in a shipping cooler and kept cool with frozen blue ice packs. Each sample container will be wrapped in bubble packing for shipment to the laboratory by an overnight carrier service or courier. Sample containers will be secured using nylon strapping tape and custody seals.

The chain-of-custody (COC) record will accompany all samples to provide documentation of all samples collected and to trace sample possession. Chain-of-custody procedures are discussed in detail in Section 4.0 of this document.

After all the sample containers have been filled and properly stored, field testing will be performed. Five parameters will be measured in the field for all ground water samples: pH, temperature, conductivity, Eh and turbidity; and four parameters will be measured for surface water samples: pH, Eh, temperature and salinity. These measurements will be taken from a separate container which will not be submitted to the laboratory for analysis. Temperature will be measured immediately upon collection of all ground water and surface water samples, as it is subject to the most rapid change. Conductivity, salinity, Eh and pH will be measured with electronic probes, which will be cleaned with organic-free distilled water in between each usage. Atlantic will use a YS1 Model 33 SCT Meter for temperature and conductivity measurements and an ORION 407A meter for pH measurements or equivalent instruments.

The temperature of the cooler shall be measured and documented by the laboratory when received. The condition of the samples shall be documented. If any breakage or discrepancy arises between COC, sample labels, and requested analysis, the sample custodian will notify the Atlantic Project Manager. The pH of incoming samples shall be checked and documented upon receipt. Any discrepancy or improper preservation shall be noted by the laboratory as an out-of-control event and shall be documented on a corrective action request form with the corrective action taken.

3.4 Field Quality Control (QC) Samples

Trip blanks, equipment rinsates, field blanks, field duplicates, blind spikes and potential referee duplicates will be collected as part of each sampling event, in order to ascertain a measure of quality control during each sampling round. The following sections describe the purpose behind each of these types of samples, and Table 3-1 specifies the frequency of each type of QC sample.

3.4.1 Trip Blanks

Trip blanks are defined as samples which originate from analyte-free water taken from the laboratory to the sampling site and returned to the laboratory with the volatile organic analyte (VOA) samples. One trip blank will accompany each cooler containing VOAs, will be stored at the laboratory with the samples, and will be analyzed by the laboratory. Trip blanks are only analyzed for VOAs. Trip blank analytical results are used to determine the level of contamination associated with the transportation of samples.

3.4.2 Equipment Rinsates

Equipment rinsates are the final analyte-free water rinse from equipment cleaning collected daily during a sampling event (e.g., split-spoons, bailers). Initially, samples from every other day will be analyzed. If analytes pertinent to the project are found in the rinsate at such levels to cause estimation or rejection during data validation, daily samples will be analyzed until the problem is corrected. The results from the blanks will be used to flag or assess the levels of analytes in the samples. This comparison is made during data validation. The rinsates are analyzed for the same parameters as the related samples. Equipment rinsate blank analytical results are used to determine the level of contamination associated with the decontamination process.

3.4.3 Field Blanks

Field blanks consist of the source water used in decontamination and steam cleaning. At a minimum, one field blank from each source of water will be collected and analyzed for the same parameters as the related samples. Field blank analytical results are used to determine the level of contamination associated with source water used in decontamination processes.

3.4.4 Field Duplicates

Soil sample duplicates are two separate samples collected from the same source. The duplicates for water samples will be collected simultaneously. Field duplicates will be collected at a frequency of 10% per sample matrix for Level D QC. All the duplicates will be sent to the laboratory. Field duplicates are used to determine reproducibility of laboratory results.

3.4.5 Referee Duplicates

Duplicates/splits will be provided to a designated referee QA laboratory as directed by the U.S. EPA or CTDEP. These duplicates/splits are collected and analyzed in addition to the field duplicates mentioned in the previous paragraph. The results are used as an independent check of the contractor laboratory results.

3.5 Field Decontamination Procedures

Drill rigs will be steam cleaned prior to entering the Subase and drilling equipment will be decontaminated prior to moving to individual sites. Drilling equipment (e.g., augers, casings) used for multiple boreholes will be decontaminated between borings/monitor wells. All major decontamination will be conducted at the central decontamination area located in Area A. Minor decontamination such as cleaning of split-spoons and other sampling equipment will be performed at each site. All drilling will be done over tarp and, once the test borings or wells are complete, the tarp, cuttings and development water may be drummed onsite for possible offsite disposal as specified in the FSP. All contaminated drilling tools will be wrapped in plastic and moved to the central decontamination area for cleaning prior to moving to the next location. Split-spoons, along with stainless steel or Teflon® spatulas, and stainless steel mixing pans will be decontaminated using the following procedures:

- wash and scrub with Alconox detergent in tap water
- rinse with tap water
- rinse with 10 percent nitric acid or 1 percent nitric acid if carbon steel is being decontaminated (only if metals are being analyzed)
- rinse with distilled/deionized water
- rinse with methanol
- rinse with hexane
- rinse with distilled/deionized water (demonstrated to be analyte-free)
- air dry - on clean polyethylene sheeting

NOTE: The steps relating to nitric acid rinse may be omitted if sampling devices are not used for inorganic sample collection.

4.0 CHAIN-OF-CUSTODY

Along with the sample labelling requirements presented in Section 3.3, a chain-of-custody record will be completed at the time of sampling and accompany samples between the field and the laboratory. The following information will be provided on the chain-of-custody form:

- Project name/number
- Signature of sampling personnel
- Sample site number/sample number
- Date and time of collection
- Grab or composite
- Signatures and dates and times of individuals involved in transferring samples
- Sample matrix (included in the sample number)

The field chain-of-custody is complete when samples are transferred to overnight carriers or a courier. U.S. EPA does not require overnight carriers within their organization to complete the COC. When samples are received at the laboratory, the receiver will sign the chain-of-custody form.

The sample analysis request section of the COC serves as official communication to the laboratory of the particular analysis required for each sample and provides further evidence that the COC is complete.

COC records initiated in the field shall be placed in a plastic cover and taped to the inside of the shipping container used for transport.

5.0 ANALYTICAL PROCEDURES

5.1 Laboratory Procedures

5.1.1 Organic and Inorganic Analyses

U.S. EPA-approved methods will be used for all laboratory analyses of organic and inorganic analytes performed for this investigation. Target Compound List (TCL; Tables 5-1, 5-2 and 5-3) and Target Analyte List (TAL; Table 5-4) parameters will be analyzed wherever possible using Contract Laboratory Program (CLP) protocols for both organic and inorganic analyses as specified in:

- *Contract Laboratory Program Statement of Work for Inorganic Analysis, Multi-Media, Multi-Concentration, Revision No. 7/88*
- *Contract Laboratory Program Statement of Work for Organic Analysis, Multi-Media, Multi-Concentration, Revision No. 2/88*

Procedures to be used in analyzing TCLP analytes (SW-846), low level VOCs in liquids (SW-846 - 8260) and other non-CLP parameters are contained in the following manuals (low level VOC analysis will be performed on all liquid samples):

- 40 CFR 261.20 Subpart C, *Characteristics of Hazardous Waste* (for TCLP analyses)
- *Compendium of Methods for the Determination of Toxic Organic Compounds in Ambient Air, Second Supplement*, Method T01, EPA/600/4-89/018, June 1988
- *Methods for Chemical Analysis of Water and Wastes*
- *Methods for Organic Analysis of Municipal and Industrial Wastewater*
- *Test Methods for Evaluating Solid Wastes (SW-846)*
- APHA - *Standard Methods for the Examination of Water and Wastewater*
- ASTM - *The Annual Book of ASTM Standards*
- *Determination of Organic Compounds in Drinking Water, Supplement II*, Method 524.2 Rev. 4.0, EPA/600/R-92/129, August 1992 (for analysis of low level VOCs in ground water)

In addition to the methods specified in the above list, special analytical procedures will be used for total petroleum hydrocarbons (TPH) and dioxins/dibenzofurans. TPH will be analyzed by a modified method 418.1 and dioxins will be analyzed by a version of U.S. EPA CLP SOW DFLMO1.01. These procedures for TPH and dioxin are included as Appendix C. It should be noted that boron, even though it is not a CLP TAL compound, will be analyzed by ICP methods in compliance with the CLP SOW ILM 2.0, including 02.1 rev.

TABLE 5-1
TARGET COMPOUND LIST (TCL)
VOLATILE ORGANIC COMPOUNDS (VOCs)

Acetone	1,3-Dichloropropene (cis and trans)
Benzene	Ethylbenzene
Bromodichloromethane	2-Hexanone
Bromoform	4-Methyl-2-pentanone
Bromomethane	Methylene Chloride
2-Butanone	Styrene
Carbon Disulfide	1,1,2,2-Tetrachloroethane
Carbon Tetrachloride	Tetrachloroethene
Chlorobenzene	Toluene
Chloroethane	1,1,1-Trichloroethane
Chloroform	1,1,2-Trichloroethane
Chloromethane	Trichloroethene
Dibromochloromethane	Vinyl Acetate
1,1-Dichloroethane	Vinyl Chloride
1,1-Dichloroethene	Xylenes (total)
1,2-Dichloroethane	
1,2-Dichloroethene (cis and trans)	
1,2-Dichloropropane	

TABLE 5-2
TARGET COMPOUND LIST (TCL)
SEMI-VOLATILE ORGANIC COMPOUNDS (SVOCs)

Acenaphthene	2,4-Dinitrophenol
Acenaphthylene	4,6-Dinitro-2-methylphenol
Anthracene	2,4-Dinitrotoluene
Benzo(a)anthracene	2,6-Dinitrotoluene
Benzo(b)fluoranthene	Di-n-butylphthalate
Benzo(k)fluoranthene	Di-n-octylphthalate
Benzo(g,h,i)perylene	Fluoranthene
Benzo(a)pyrene	Fluorene
Benzoic Acid	Hexachlorobenzene
Benzyl Alcohol	Hexachlorobutadiene
Bis(2-Chloroethoxy) methane	Hexachlorocyclopentadiene
Bis(2-Chloroethyl) ether	Hexachloroethane
Bis(2-Chloroisopropyl)ether	Indeno(1,2,3-cd)pyrene
Bis(2-Ethylhexyl)phthalate	Isophorone
4-Bromophenyl phenyl ether	2-Methylnaphthalene
Butyl Benzyl Phthalate	2-Methylphenol
4-Chloroaniline	4-Methylphenol
4-Chloro-3-methylphenol	Naphthalene
(para-chloro-meta-cresol)	2-Nitroaniline
2-Chloronaphthalene	3-Nitroaniline
2-Chlorophenol	4-Nitroaniline
4-Chlorophenyl phenyl ether	Nitrobenzene
Chrysene	2-Nitrophenol
Dibenzo(a,h)anthracene	4-Nitrophenol
Dibenzofuran	N-nitrosodiphenylamine
1,2-Dichlorobenzene	N-Nitrosodi-n-propylamine
1,3-Dichlorobenzene	Pentachlorophenol
1,4-Dichlorobenzene	Phenanthrene
3,3'-Dichlorobenzidine	Phenol
2,4-Dichlorophenol	Pyrene
Diethylphthalate	1,2,4-Trichlorobenzene
2,4-Dimethylphenol	2,4,5-Trichlorophenol
Dimethyl Phthalate	2,4,6-Trichlorophenol

TABLE 5-3 TARGET COMPOUND LIST (TCL) PESTICIDES, PCBs	
Pesticides	**PCBs**
alpha-BHC	Aroclor 1016
beta-BHC	Aroclor 1221
delta-BHC	Aroclor 1232
gamma-BHC (Lindane)	Aroclor 1242
Heptachlor	Aroclor 1248
Heptachlor Epoxide	Aroclor 1254
Aldrin	Aroclor 1260
Dieldrin	
Endrin	
4,4'-DDD	
4,4'-DDE	
4,4'-DDT	
Endosulfan Sulfate	
Endrin Ketone	
Endosulfan I	
Endosulfan II	
Chlordane (alpha and gamma isomers)	
Methoxychlor	
Toxaphene	

TABLE 5-4 TARGET ANALYTE LIST (TAL) INORGANICS	
Aluminum	Lead
Antimony	Magnesium
Arsenic	Manganese
Barium	Mercury
Beryllium	Nickel
Boron[1]	Potassium
Cadmium	Selenium
Calcium	Silver
Chromium	Sodium
Cobalt	Thallium
Copper	Vanadium
Cyanide	Zinc
Iron	

1. Boron is not a TAL, but will be analyzed as part of this project.

Test methods and the associated reporting limits are summarized in Tables 8.1, 8.2, and 9.1 of the Laboratory Quality Assurance Project Manual (Appendix A). Project-specific methods are highlighted by underlining in these tables for CLP parameters except low level VOC analyses of liquids, TCLP parameters, boron, and total petroleum hydrocarbons. For all other parameters, reporting limits and test methods are presented in Table 5-5. These methods or the selection thereof may be modified if requested by the U.S. EPA. The latest version of these procedures will be used at the time of analysis.

Some of the reporting limits specified in the above tables are not below biological effects levels for surface waters (Water Quality Criteria) and sediments (NOAA guidelines). For these analyses, the lowest quantitation limits achievable using CLP methods will be achieved and both contract required and method detection limits will be reported.

5.1.2 Radiological Analyses

Radiological analyses to be performed on ground water samples include:

- Gross alpha analysis
- Gross beta analysis
- Complete gamma spectrum analysis

The laboratory chosen to perform these analyses will be a participant of an independent QA program such as the National Voluntary Laboratory Accreditation Program (NVLAP).

Methods to be used in radiological analyses include:

- Method 302 (analysis of gross alpha and beta in ground water), in APHA—*Standard Methods for the Examination of Water and Wastewater*

- Gamma Spectrum Analysis using a High Purity Germanium (HPGe) or Germanium-Lithium (Ge-Li) detector.

Reporting limits and test methods for these parameters are specified in Table 5-5.

5.2 Field Procedures

Atlantic will follow U.S. EPA developed field procedures when using portable gas chromatographs in field screening for polychlorinated biphenyls (PCBs) and pesticides. Atlantic intends to use field GC analyses as a tool for the delineation of contaminated areas and to facilitate the selection of samples for laboratory analysis. The sites and associated chemicals to be included in the field analytical screening program are specified in the FSP.

Atlantic procedures to be used in GC field screening were based on procedures described in *Field Screening Methods Catalogue: A User's Guide* (U.S. EPA Report No.: EPA/540/2-88/005), and include:

TABLE 5-5 CHEMICAL ANALYSIS METHODS AND REPORTING LIMITS			
Analysis	**Method Reference**	**Method Description**	**Reporting Limits**
Organic and Inorganic Hazardous Substances			
Volatile Organics (low-level analyses for liquids)	8260[1]	GC/MS	1 to 5* ug/l
Dioxins	U.S. EPA CLP SOW DFLMO1.0[2]	High resolution GC/MS	1.0 ug/kg soil 0.01 ug/l water
Radiological			
Gross Alpha	Method 302[3]	Decay count	2 picocuries per liter
Gross Beta	Method 302[3]	Decay count	2 picocuries per liter
Gamma Spectrum Analysis	Teledyne Isotopes, Inc. Method 042-5	High purity germanium or germanium-lithium detection.	10 picocuries per liter for cobalt, isotope specific
Soils Engineering Parameters			
Grain Size Distribution	ASTM D422[4]	Sieve and hydrometer for quantitative determination of particle size distribution.	NA
Specific Gravity	ASTM D854[4]	Pycnometer method	NA
Water Content	ASTM D2216[4]	Drying and mass balance calculation.	NA
Organic Content	ASTM D2974[4]	Drying, ignition, and mass balance calculation.	NA
Total Organic Carbon Content	Walkley-Black Determination[5]	Soil digestion and titration.	0.01%
Cation Exchange Capacity	9081[1]	Sodium acetate method using A.A.	
Ground Water Engineering Parameters			
Biochemical Oxygen Demand, 5-day	405.1[6]	Five days at 20°C, dissolved oxygen depletion	4 mg/l
Chemical Oxygen Demand	410.2[6]	Calorimetric	5 mg/l
Total Organic Carbon	415.1[6]	Oxidation	1 mg/l
Oil and Grease	413.1[6]	Solvent extraction, gravimetric determination	5 mg/l
Total Suspended Solids	160.2[6]	Gravimetric, post washing of residue	4 mg/l
Ammonia, as Nitrogen	350.2[6]	Calorimetric manual distillation	0.05 mg/l
Phosphorous, Total	365.1[6]	Persulfate digestion, calorimetric	0.001 mg/l

* Please see Appendix C for a complete list of detection limits.

1. *Test Methods for Evaluating Solid Waste Physical/Chemical methods*, SW-846, U.S. EPA Office of Solid Waste and Emergency Response, 3rd edition, 1986 and updates.
2. *U.S. EPA Contract Laboratory Program Statement of Work for Dioxin Analysis*, DFLMO1.0 as modified by SAS-Dioxins-002, August 1992.
3. *American Society of Testing Materials*
4. *Standard Methods for the Examination of Water and Waste*, APHA
5. *Soil and Plant Analysis*, Piper, C.S. 1942.
6. *Methods for the Chemical Analysis of Water and Wastes*, EPA-600-79-020, revised 1983.

- Atlantic procedures 1256A, 1256B and 1256C: Based on Method FM-18, *PCB Analysis Using a Gas Chromatograph in an Onsite Laboratory - Hexane/Methanol/Water Extraction* (Note: Method FM-18 will also be used for pesticide analysis).

Selected samples will also be screened in the field for lead contamination using X-ray fluorescence (XRF). The Atlantic procedure to be followed for XRF analysis is as follows:

- Atlantic Procedure GTP002: Based on Method FM-3: *X-Ray Fluorescence for Heavy Metals (Onsite).*

The procedure will be modified for use with a Scitec Portable XRF Analyzer, which is a lead specific analyzer.

Several other field screening methods, as listed in Table 4-1 of the Field Sampling Plan, will be utilized during this investigation. Specific protocol for these methods are detailed in the specific SOP or analytical method listed in Table 4-1 of the Field Sampling Plan.

6.0 DATA VALIDATION

Data validation will be done under NEESA requirements as presented in *Sampling and Chemical Analysis Quality Assurance Requirements for the Navy Installation Restoration Program,* (NEESA 20.2-047B). Corresponding U.S. EPA data validation procedures are contained in the *Region I Laboratory Data Validation Functional Guidelines for Evaluating Organic Analyses,* February 1, 1988, Rev. 7/88 and the *Region I Laboratory Data Validation Functional Guidelines for Evaluating Inorganic Analyses,* June 13, 1988, Rev. 2/89.

All CLP laboratory analyses performed for TCL and TAL parameters will be subject to NEESA Level D requirements (EPA Level IV). Level D requires full CLP data validation.

Non-CLP laboratory analyses (non-TCL/TAL and TCLP parameters) will be validated by NEESA Level C criteria as have been approved for the NSB-NLON program.

All laboratory data will be validated by a qualified subcontractor. At a minimum, 10 percent of the CLP data will be validated using EPA Level IV validation protocol. All other data, including data generated from quantitative field instrumentation (i.e., field GC and XRF analyzer) will be reviewed using NEESA Level C criteria as applicable to the analyses performed. The data review should permit establishment of the data's range of accuracy and allow interpretation of the data within those bounds.

Use of field analytical instrumentation for development of qualitative data (i.e., FID or PID total organic vapor analyzers and Photovac GC) will involve strict calibration procedures. Photovac QA/QC will involve frequent use of calibration standards of compounds of interest, background and blank samples. Air standards representing a wide range of compounds of interest will be used in Photovac calibrations for soil gas analysis. Aqueous headspace standards will be used for sample headspace analysis. Background and calibration blank samples will be considered acceptable if no significant peaks are generated. Duplicate samples will be judged subjectively due to the impossibility of collecting a soil gas duplicate with a great degree of precision. Results will be considered acceptable if, in comparison of duplicate analyses, there is a general match of identified compounds (presence of or absence of the same compound) and if there is no significant difference in concentration, generally around an order of magnitude. Acceptance criteria for standards do not exist because retention times and response factors are rate dependent. These are variable with a system that operates in different weather conditions and must be set-up and shut-down on a daily basis. Photovac standards will be run at a minimum average of one per ten samples analyzed. Accuracy of analytical results from these field instruments may be evaluated by sending duplicate samples to the laboratory and by comparing field and laboratory analytical results.

The portable gas chromatograph (Photovac 10S50) will be calibrated at the beginning, middle and end of each day of use. Calibration will be performed by injecting a 1 ppm vol./vol. standard containing the compounds of interest. Reference standards will be obtained from either Matheson Gas Products on Scott Specialty Gases. Duplicate analysis will be performed at least two times a day or once every 70 samples.

All results will be reported in volt seconds (Vs) as indicated in Table 6-1:

TABLE 6-1 SOIL GAS RESULT REPORTING	
ND	<1.0 Vs
Trace	1.0 to 4.0 Vs
Low	4.1 to 50.0 Vs
Moderate	50.1 to 300 Vs
High	>300 Vs

Complete data packages for any analytical results will be available upon request of a reviewer. For CLP parameters, the data package will be adequate to allow EPA Level IV data validation.

7.0 DATA QUALITY OBJECTIVES

The data quality objectives for all measurements (field and laboratory) include considerations of precision, accuracy, and completeness as described below in general terms. Detailed quality control objectives can be found in Table 7.1 in the Laboratory Quality Assurance Project Manual (Appendix A). Project specific objectives have been highlighted by underlining in these tables.

7.1 Precision

The precision of a measurement is an expression of mutual agreement of multiple measurement values of the same property conducted under prescribed similar conditions. Precision reflects the repeatability of the measurement. Precision is evaluated most directly by recording and comparing multiple measurements of the same parameter on the same sample under the same conditions. Precision is usually expressed in terms of standard deviation. The precision objectives for TCL parameters are specified in the CLP protocols. Except as otherwise specified by the method, the QC objective for precision under this project will be ± 30 (aqueous sample) percent (relative percent difference) or ± 50 percent (soil samples) as determined by duplicate analyses. The relative percent difference (RPD) is calculated as:

$$RPD = \frac{1}{2} \times \frac{V1 - V2}{V1 + V2} \times 100$$

Where: V1, V2 = two values obtained by analyzing duplicates

7.2 Accuracy

The degree of accuracy of a measurement is based on a comparison of the measured value with an accepted reference or true value, or is a measure of system bias. Accuracy of an analytical procedure is best determined based on analysis of a known or "spiked" sample quantity. The degree of accuracy and the recovery of analyte to be expected for the analysis of QA samples and spiked samples is dependent upon the matrix, method of analysis, and compound or element being determined in the analysis. The concentration of the analyte relative to the detection limit is also a major factor in determining the accuracy of the measurement. Except as otherwise specified by a method, the QC objective for accuracy under this project will be 75 to 125 percent (percent recovery), as determined by sample spike recoveries. Alternatively, accuracy may be assessed through the analysis of appropriate standard reference materials, certified standards, or other samples, as available. The percent recovery is calculated as:

$$\%\ recovery = \frac{Ss - So}{S} \times 100$$

Where: Ss = Value obtained by analyzing the sample with the spike added.
So = Background value (i.e., the value obtained by analyzing the sample without a spike).
S = Concentration of the spike added to Ss.

Accuracy objectives on an analyte-specific basis are identified in Section 7.0 of the attached laboratory QA/QC plan. Project-specific objectives are highlighted by underlining in the laboratory QA/QC plan.

7.3 Completeness

Completeness is a measure of the amount of valid data obtained from the measurement system relative to the amount anticipated under ideal conditions. This project's QC objective for completeness, as determined by the percentage of valid data generated, will be $\geq$ 90 percent. The formula to be used to estimate completeness is:

$$C = 100 \frac{V}{T}$$

Where: C = Percent Completeness
V = Number of judgements determined valid
T = Total number of measurements

8.0 CORRECTIVE ACTION

Atlantic and NET recognize and have established methods to control the use of nonconforming field and analytical procedures. The NET QA/QC Plan documents its corrective action plan. Corrective actions can be of three forms: immediate, long-term and those applied to out-of-control events. Each is discussed in light of the activities planned in the IR Study at the Subase.

8.1 Immediate Corrective Action

Immediate action applies to field and analytical procedures that can be instituted as normal operating procedures that would prevent the generation of poor quality data. These types of actions are considered informal and only require noting problems and corrections in the field notebooks or laboratory notebooks. The use of trained field and laboratory personnel will increase the awareness of problems requiring immediate corrective action.

Examples of situations which would require immediate corrective action in the field include:

- drill rig throw-out bearing breaks
- HNu meter will not zero
- sampling pumps do not operate
- grout enters a well screen possibly contaminating/obstructing a well

If immediate corrective actions are not performed, then Atlantic will apply formal long-term corrective actions.

8.2 Long-Term Corrective Action

A long-term corrective action may be identified by problems with standard operating procedures, the use of control charts, or the result of performance or system audits. Any quality problem which cannot be solved by immediate corrective action falls into the long-term category. The Atlantic QA system ensures that the quality problem is reported to a person responsible for correcting it, and who is part of a closed-loop action and follow-up plan.

The essential steps in the closed-loop corrective action system are listed below:

- identify and define the problem
- assign responsibility for investigating the problem
- investigate and determine the cause of the problem
- determine a corrective action to eliminate the problem
- assign and accept responsibility for implementing the corrective action
- establish effectiveness of the corrective action and implement it
- verify that the corrective action has eliminated the problem

Documentation of the problem is important to the system. A Corrective Action Request and

Reporting Form (Figure 8-1) is provided. This form identifies the problem, possible causes, and the person responsible for action on the problem. If no person is identified as responsible for action, the QA Officer investigates the situation and determines who is responsible in each case.

The Corrective Action Request and Reporting Form also includes a description of the corrective action planned and the date it was taken, and space for follow-up. The QA Officer checks to be sure that initial action has been taken and appears effective and, at an appropriate later date, checks again to see if the problem has been fully solved. The QA Officer receives a copy of all Corrective Action Forms and enters them in the Corrective Action Log. This log is maintained as part of the QA records for the project.

8.3 Out-of-Control Events and Corrective Action

Out-of-Control events are more likely associated with the laboratory analysis. NET provides a statement for the resolution of Out-Of-Control events in their QA/QC Plan.

FIGURE 8-1
CORRECTIVE ACTION REQUEST AND REPORTING FORM

INSTALLATION RESTORATION STUDY **NAVAL SUBMARINE BASE - NEW LONDON GROTON, CONNECTICUT**	
CORRECTIVE ACTION REQUEST FORM	
CORRECTIVE ACTION REQUEST NO. _____	
Originator:	Date:
Person Responsible for Replying:	Contract Involved:
Description of problem and when identified:	
State cause of problem, if known or suspected:	
Sequence of Corrective Action: (If no responsible person is identified, notify QA Officer immediately. Submit all CA forms to QA Officer for initial approval of CA.)	
State Date, Person, and Action Planned:	
CA Initially Approved by:	Date:
Follow-up Dates:	
Final CA Approval by:	Date:
Information copies to: RESPONSIBLE PERSON/QC COORDINATOR: _____ QA OFFICER: _____ PROJECT MANAGER: _____	

9.0 DATA MANAGEMENT PLAN

The purpose of the Data Management Plan is to document and track investigation data and results.

9.1 Laboratory Data Management

All laboratory data will be managed by the Field QC Coordinator, who will be responsible for all chain-of-custody records and the master sample log notebook. All samples will be recorded in the master sample log notebook for future reference. This will include sample site, sample number, data, time, sampling personnel, sample media, containers, parameters for analysis, date/method of shipment, and sample preservation. The notebook will also be used to document the receipt of laboratory analysis data from the laboratory.

The chain-of-custody and master sample log notebook will be kept in the files for the IR Study under the custody of the Project Manager. The removal of the documents from the file will require a signature.

Laboratory data used for the generation of figures, maps, etc. must be reviewed by another Atlantic employee. All laboratory data tables will be initialed by both the preparer and the reviewer, and kept in the files.

Laboratory data reporting formats will be as specified in Section 9.1.7 of the Work Plan (also see Appendix D of the Work Plan).

Complete data packages for any analytical results will be available upon request of a reviewer. For CLP parameters, the data packages will be adequate to allow EPA Level IV data validation.

9.2 Field Data Management

The data collected during the field investigations and sampling will be documented in field notebooks or on Atlantic data collection forms specific to the investigation/sampling activity. Field notebook entries will include the following information:

- name and title of author, date and time of entry, and weather conditions
- site name and location
- field investigation observations
- description of sample location
- sample collection method
- sample media, sample I.D. number
- sample preservation
- field measurements (pH, temperature, conductivity, salinity, turbidity)
- location (distance measurement from known field locations)
- sample description (e.g., color)

All field entries will be made in waterproof ink. The field team leader will conduct periodic checks of field entries to ensure their accuracy and completeness.

Atlantic's Project Manager will control all field notebooks. Each field notebook will receive a serialized number and be issued to the field team leader. Field notebooks when complete will be returned to the project files.

Field data used for the generation of subsequent information (e.g., boring logs, reports, ground water elevation, monitoring well logs, etc.) must be reviewed by another Atlantic technical employee and both initials are to be provided on the information.

9.3 Project Files

A summary of the project files being used for this project is provided as Appendix E.

All file information will be placed chronologically in each file. Files removed from the file cabinets must be recorded on a sign-out card. All files must be returned to the cabinet at the conclusion of each day.

9.4 Technical Calculation Review

Technical calculations will be performed on Atlantic calculation paper with the project number, date, and person recorded. All technical assumptions and references will be fully documented. All calculations will be reviewed and initialed by a technical person with required expertise in the subject matter.

APPENDIX A

LABORATORY QA/QC PLAN

National Environmental Testing Inc.,

Cambridge Division

Laboratory Quality Assurance Plan

CONFIDENTIAL

NOT TO BE DUPLICATED
WITHOUT NET AUTHORIZATION

Prepared By:

NET Cambridge Division
12 Oak Park
Bedford, Massachusetts 01730
(617) 275-3535

Approved: _____ Date: 10/21/92
NET Division Manager

Approved: _____ Date: 10/21/92
NET Director of Analytical Services

Approved: _____ Date: 10/21/92
NET QA Coordinator

Approved: _____ Date: _____
NET Director of Quality Assurance

Approved: _____ Date: _____

Approved: _____ Date: _____

INTRODUCTION

This Laboratory Quality Assurance Plan describes the quality assurance and quality control systems in place at NET Cambridge. The Quality Assurance Program at Cambridge is based on the belief that quality is the key to maintaining leadership in the analytical industry.

MANAGEMENT POLICY STATEMENT

NET subscribes to the highest standard of quality in its analytical and technical services programs. Specifically, the Company's policies are:

- To conduct laboratory operations within the context of a well defined quality assurance program;
- To communicate the scope and content of the QA Program internally, and to train each employee in its application;
- To report data to customers only when it has met NET's full QA requirements;
- To remove from commercial availability any analysis offered by a NET laboratory if that laboratory fails to demonstrate that it can consistently perform that analysis to NET's high quality standard based on the Interlaboratory Testing Program;
- To resolve to the client's full satisfaction any questions concerning validity or accuracy of analytical data reported by NET to the customer;

NET Cambridge is committed to providing quality services to our clients while complying with state and federal regulatory agencies. Implementation of the policies, principles and practices defined in the Laboratory Quality Assurance Plan is the responsibility of every NET Cambridge employee. This document provides guidance to employees for fulfilling their responsibilities and serves as a statement of the laboratory's commitment to quality to external parties.

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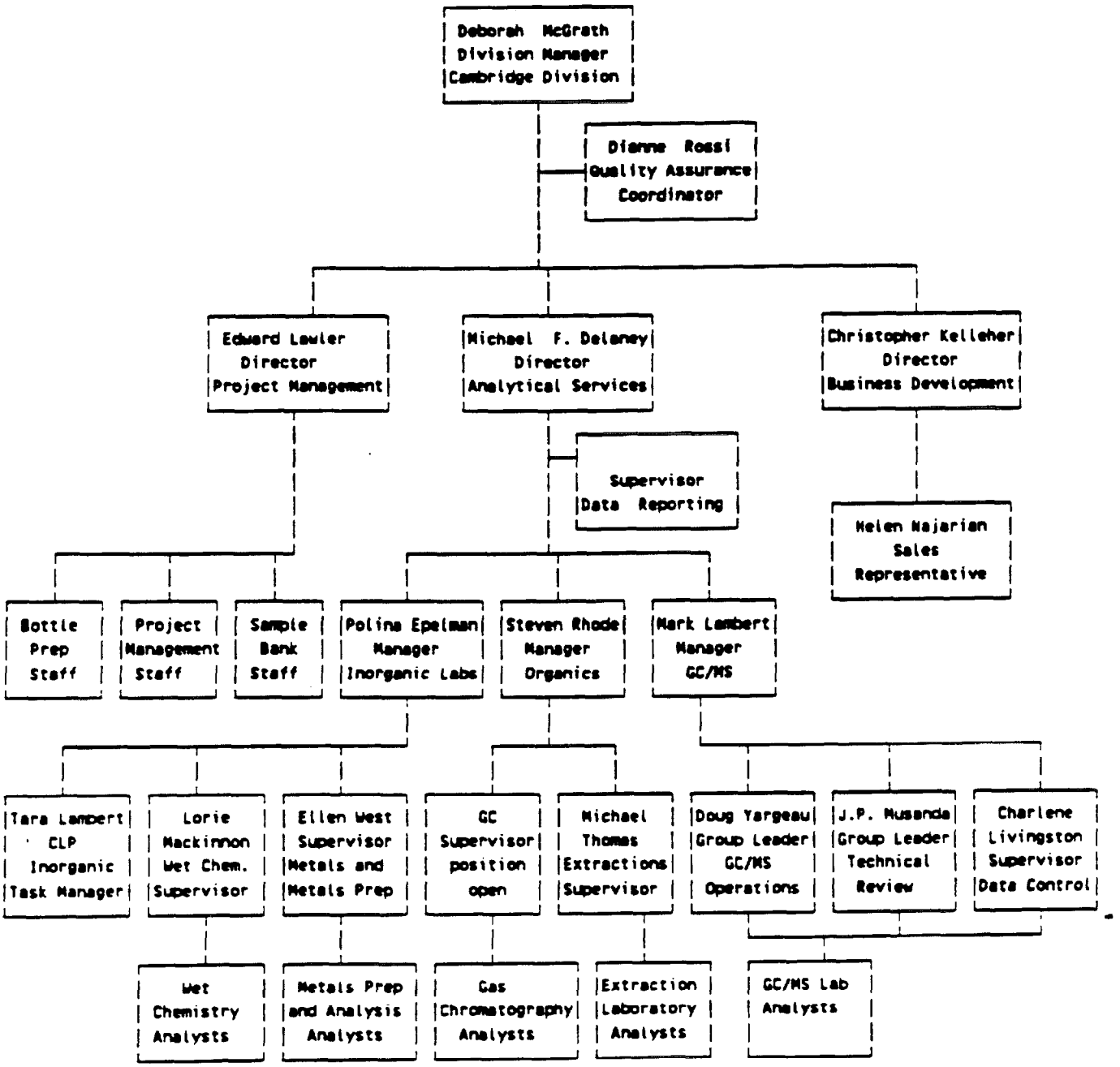
1.0 Laboratory Organization

National Environmental Testing Inc. is a nationwide network of environmental testing laboratories. The Cambridge Division formerly Cambridge Analytical Associates, was acquired by NET in September, 1989.

1.1 Cambridge Organizational Structure

Figure 1.1 is the Organizational chart for the Cambridge Division. The responsibilities of key individuals within the Cambridge Division of NET are summarized in section 1.2.

Fig. 1.1
NET Cambridge Division
Organizational Chart



1.2 Description of Responsibilities

The responsibilities of the individuals associated with this Quality Assurance/Quality Control (QA/QC) program and illustrated in Figure 4.1 are as follows:

- Division Manager

  The Division Manager oversees technical operations and business development, including marketing, capital budgeting, contract negotiation, management review and quality assurance.

- Quality Assurance Coordinator

  The Quality Assurance Coordinator is responsible for development, application, and evaluation of quality control and quality assurance procedures for environmental analytical programs. This responsibility involves:

  1. monitoring laboratory activities to determine conformance with authorized quality assurance policy, and implementing appropriate steps to ensure adherence to quality assurance programs;
  2. evaluating data quality and maintaining records on related QC charts and other pertinent information;
  3. administering intralaboratory and interlaboratory QA efforts;
  4. reviewing performance evaluation results;
  5. preparing quality assurance reports to management; and
  6. managing a corrective action system.

- Director of Project Management

  The Director of Project Management is responsible for client support and service functions, and internal technical support staff. These responsibilities include planning and managing the technical, business development, and human resource functions of the Project Management Department to meet company and program goals.

- The Project Manager

Project Managers are responsible for communication of the work plan and initiating work plan revisions in accordance with the client's directions. This responsibility includes:

1. communicating the analytical capabilities of the laboratory accurately;
2. ensuring that the expectations and requests of the client are communicated to the laboratory managers;
3. reviewing logged in jobs for accuracy and completeness, and sending the client an acknowledgement of receipt;
4. informing the client of project progress;

- Director of Analytical Services

The Director of Analytical Services is responsible for operation and coordination of the organics and inorganics laboratories. This responsibility includes:

1. organizing the personnel, equipment, and materials in the manner required to meet the objectives of the analytical tasks of the project;
2. maintaining contact with the project manager in areas of technical concern, and advising on progress, needs, and potential problems of the various tasks.

- Laboratory Managers

Laboratory Managers for GCMS, Inorganics and Extraction & GC are responsible for directing the activities and monitoring the performance of supervisors and analysts to ensure that they are adhering to high technical standards and to the budget and task schedules. This includes:

1. providing technical directions in conduct of laboratory operations and resolving day to day operation's issues; and
2. reviewing analytical data for validity, clarity, and compliance with project requirements.

- Laboratory Supervisors

Supervisors of each laboratory are responsible for ensuring that analysts are meeting the production and quality objectives of the project. This responsibility includes:

1. training analysts in specified laboratory QC and analytical procedures;

2. verifying that laboratory QC and analytical procedures are being followed as specified; and

3. reviewing sample QC data at least daily. This will include examination of raw data such as chromatograms (and checking of calculations for a minimum of 10% for the samples analyzed) as well as an inspection of reduced data, calibration curves, and laboratory notebooks.

- Laboratory Analysts

Analysts are responsible for each task identified in the scope of work. They are responsible for performing the laboratory technical activities within their tasks. In execution of their duties, the analysts are expected to:

1. conduct analyses according to standard operating procedures;

2. meet all quality control requirements of the procedure and inform supervisor when this is not achieved ;

3. perform routine maintenance on analytical equipment; and

4. document laboratory activities necessary for future review of the entire analysis.

- Sample Custodian

Sample Custodians ensure that samples are distributed and returned in accordance with internal chain-of- custody procedures. This includes:

1. signing for the incoming field samples and verify the data entered on the chain-of-custody forms;

2. entering sample information into a computerized system for tracking and reporting;

3. documenting the transfer of samples within the facility.

2. Training

2.1 Requirements

All analysts are required to demonstrate proficiency in the analyses they will be performing prior to working on actual samples. The training encompasses the analytical procedures to be utilized, the elements of quality control to be associated with the procedure, and the necessary safety information. All of these elements are included in each Standard Operating Procedure. Training is conducted by senior laboratory personnel, and requires that each analyst be familiar with the SOP associated with the task, observe an experienced analyst perform the analysis, work under direct supervision, and finally demonstrate proficiency at the analysis. In addition to this internal training, employees are encouraged to participate in short courses available from instrument manufacturers and professional development seminars.

2.2 Documentation

Each analyst has a personal file that includes a job description, a resume and a training record. All of these are reviewed and updated every six months concurrent with the employees performance planning and review schedule.

3.0 SAMPLE CUSTODY

3.1 Chain-of-Custody Procedures

The purpose of chain-of-custody procedures is to document in a legally defensible manner, the transfer of custody for each sample from collection through analysis to disposal. The sample custody procedures to be used conform to the guidelines of the U.S. EPA Contract Laboratory Program, and are performed under the supervision of the Sample Custodian. The Sample Custodian will have primary responsibility for ensuring chain-of-custody procedures are followed and all documentation is properly executed.

3.2 Sample Receipt

When samples arrive at NET-Cambridge, the Sample Custodian is responsible for signing the air bills, and documenting the condition of the locked or sealed shipping box on the custody form. He/She then checks the temperature of the cooler, and records this temperature in a logbook. Information on the condition of the samples is recorded on the chain of custody form and may also be recorded in a logbook if requested for a project of client. Sample label information is checked against the custody record, (Figure 3.1). For HAZWRAP and NEESA samples the pH of all preserved samples, except volatiles is checked and recorded. Samples are then logged into the Laboratory Information Management System (LIMS), and are assigned laboratory identification numbers in serialized ascending sequence. The sample log-in record will include the sample number, dates of collection and receipt, the condition of the samples at receipt, the assigned laboratory number, sample preparation, sample distribution and other pertinent information. Sample labels that include the laboratory's internal sample number, the job number which allows samples to be grouped appropriately, the clients name and sample identification, the date of receipt and the disposal date are generated. The sample custodian is responsible for affixing internal sample labels to each sample. The laboratories are informed that samples have been received through scheduled generation of scheduling lists.

3.3 Sample Storage and Security

The samples are secured in the Sample Bank refrigerator and maintained at approximately 4°C until they are withdrawn by laboratory analysts. All samples withdrawn from the Sample Bank must be signed for by both the issuing and receiving parties. Figure 3.2 is a copy of the internal Chain-of Custody used for this purpose. Upon withdrawal, the receiving party is responsible for maintaining the samples in his/her possession or in view at all times when the samples are outside of the storage area. Once the analyst has finished using the samples, they must be returned to the Sample Bank, and the internal Chain-of-Custody is again used to document the transfer.

The NET Cambridge facility has restricted access at all times. All doors are kept locked and guests must be signed in and escorted while in the facility.

3.4 Sample and Extract Disposal

All samples are routinely held for a minimum of 60 days after submission of the final report to the client. NET has sufficient refrigerated space to accomodate this or, if necessary, longer holding periods. NET will also provide for the return of samples to clients is this is requested. All sample waste is disposed of as hazardous material by independent contractors.

3.5 Laboratory Document Control

The goal of the Document Control Program is to assure that all documents for a group of samples will be accounted for when the project is completed, and will be maintained in such a way as to facilitate reconstruction of the receipt, preparation, analysis and reporting of each sample. For each sample delivery group, or internal job, a permanent job folder is created to maintain the following information:

- original chains of custody
- sample login record
- copy of client's order confirmation
- All raw data and results on pre-printed data sheets or copies of laboratory logbooks. All handwritten data entered in ink, and corrections are made with a single line through the error, entering the correct information, and initialing and dating the correction.
- copy of report sent to client
- documentation of important communication with the client
- copies of corrective actions and non-conformances associated with the samples

Figure 3.1
Example Chain-of-Custody

CHAIN OF CUSTODY RECORD

PROJECT NAME
COMPANY
ADDRESS
PHONE

NET NATIONAL ENVIRONMENTAL TESTING, INC.

Cambridge Division, 15 Olin Park, Bedford, MA 01730

SAMPLED BY

(Print Name) (Signature)

SAMPLE NO	DATE	TIME	SAMPLE LOCATION	CONTAINER SIZE & TYPE				SAMPLE MATRIX	PRESERVATIVE	ANALYSES										COMMENTS

Relinquished by	Date / Time	Received by	Relinquished by	Date / Time	Received by
Relinquished by	Date / Time	Received by	Relinquished by	Date / Time	Received for Laboratory by
Method of Shipment		Remarks			

PK 1 – ORIGINAL PK 2 NET Project Manager – Yellow PK 3 – Customer Copy – Pink

Figure 3.2
Internal Chain-of-Custody Form

NET : CAMBRIDGE DIVISION

INTERNAL CHAIN-OF-CUSTODY FORM

Department (Circle) EX QC IN ME SV VOA

Requested by: _____ Date/Time Needed: _____

Signing samples out of the Sample Bank	Date/Time: _____
Relinquished by: _____	Received by: _____

A	Signing samples into the Sample Bank	Date/Time: _____
Relinquished by: _____		Received by: _____

B	Signing samples into the Sample Bank	Date/Time: _____
Relinquished by: _____		Received by: _____

C	Signing samples into the Sample Bank	Date/Time: _____
Relinquished by: _____		Received by: _____

Sample Number	Matrix (type)	Preps. (type)	Returned			Depleted (check)	Comments (bar type etc.)
			A	B	C		
1.							
2.							
3.							
4							
5							
6							
7							
8							
9							
10							
11							
12							
13							
14							
15							
16							
17							

4.0 MATERIALS PROCUREMENT AND CONTROL

4.1 Standards Material Procurement

All materials for preparing standards should be of the highest quality available. The only standard certifications currently recognized by the USEPA are referred to as "USEPA Certified" and "A2LA Certified". While use of these materials is not required by USEPA, these materials are of adequately known purity and identity for use in USEPA analytical methods.

Each laboratory group will maintain a listing of acceptable standards manufacturers to be used to guide the ordering of standard materials and for providing information on the sources of materials in use.

When neat, high purity bulk materials are used to prepare standards, they will be obtained in high purity. If the purity is less than 97%, the reason for using this material will be documented as to why a higher purity material could not be obtained. Any standard solution prepared from a neat materials with a purity less than 97% will have its nominal concentration adjusted for the purity of the material.

4.2 Reagent Quality Control

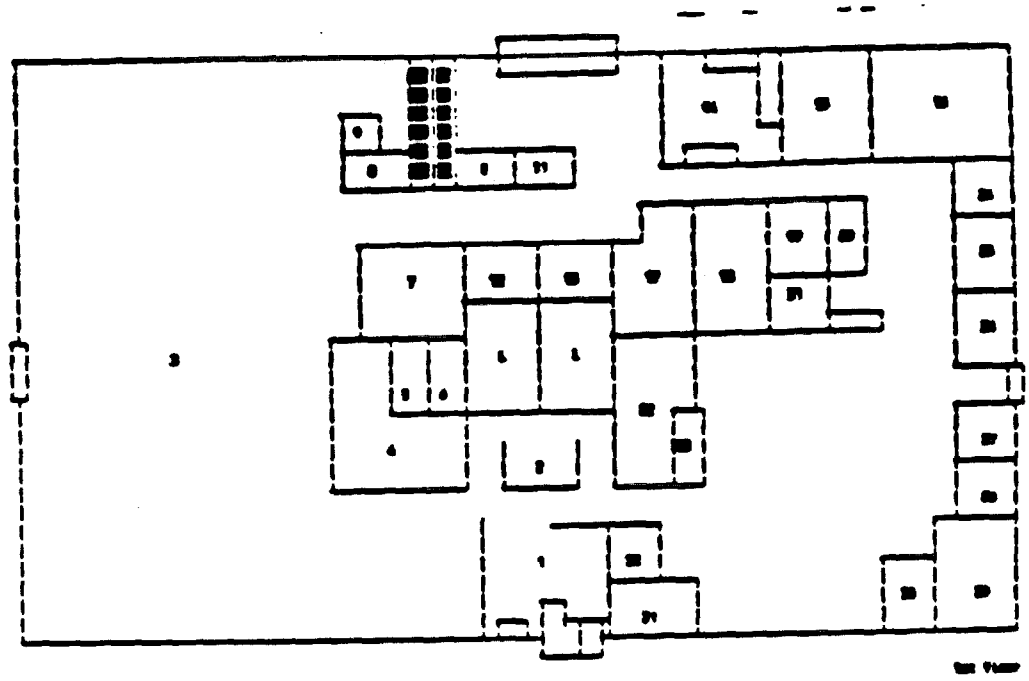
Reagents used in the laboratory are of analytical reagent grade or higher purity. Reagent lots are checked for acceptable purity by the analysis of reagent blanks. NET has arranged for its vendors to set aside reagent lots which have been checked for purity so that subsequent orders can be filled from the already QCed lots. Reagents are dated upon receipt and stored in a designated reagent storage room which is equipped with ventilated solvent cabinets, blow out windows, epoxy flooring, and a diked perimeter. Smaller quantities are stored in ventilated solvent cabinets in the laboratories and in accordance with the MSDS storage requirements.

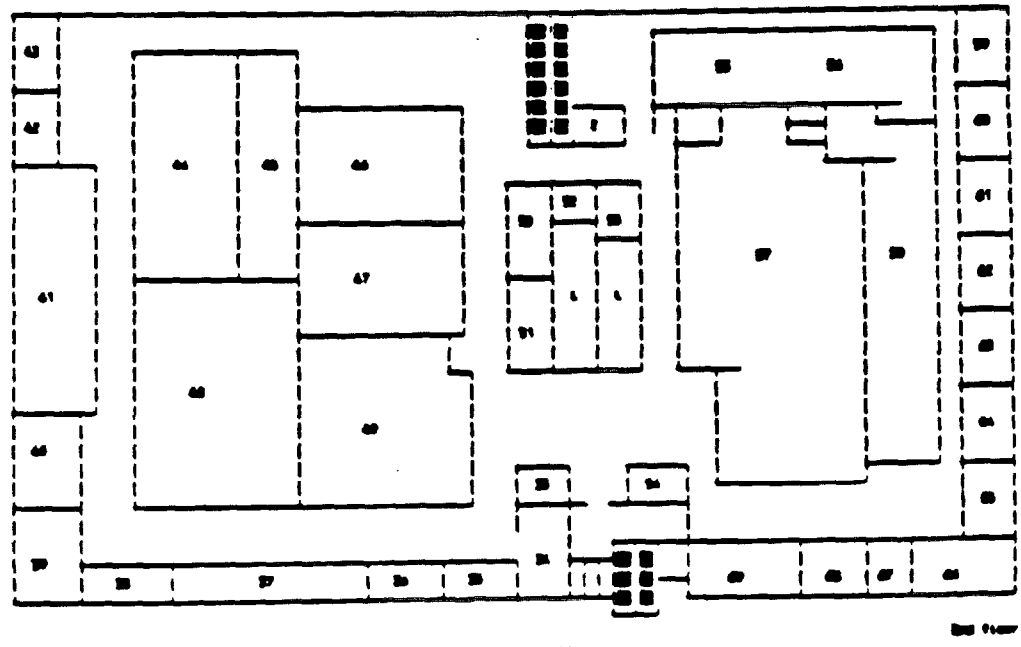
4.3 Sample Container Quality Control

5.0 FACILITIES AND EQUIPMENT

NET continues to invest in new facilities and equipment to support the internal growth of its businesses, to maintain an appropriate level of protection for its staff, and to improve the safety and efficiency of the work environment. trong demand for analytical services requires continual expansion of capacity, and the increasingly stringent quality demands of the industry often require refit of existing laboratories to perform new procedures. The Cambridge Division of NET is situated in a new 40,000 sq.ft. custom designed laboratory. A floor plan is presented as Figure 5.1.

Figure 5.1
Cambridge Floor Plan





Cambridge Division

(1st Floor)

#	Area	# sq. ft.
1	Reception	420
2	Copy Area	200
3	Storage	9,000
4	Accounting	430
5	Personnel	88
6	Office	88
7	Bottle Preparation/Storage	352
8	Effluent pH Adjustment Equipment	129
9	Electrical Room	82
10	Loading Dock	511
11	Elevator Room	76
12	Electrical Closet	139
13	Service Closet	108
14	Hazardous Waste Storage	243
15	Solvent Storage	115
16	Mechanical Room	675
17	Log-in/Sample Bank	412
18	Walk-in Refrigerator	451
19	Walk-in Freezer	208
20	Storage	139
21	Sampling Equipment	116
22	Cafeteria	260
23	Computer Room	193
24	Hazardous Waste Coordinator	81
25	Office	93
26	Conference Room	105
27	Director, Business Development	81
28	Administrative Assistant	81
29	Vice President/Division Manager	250
30	Director of Program Management	104
31	Office	216
32	Library	104
L	Lavatory	
E	Elevator	

(2nd Floor)

#	Area	# sq. ft.
33	Computer Room	95
34	Conference Room	270
35	Office	93
36	Office	81
37	Office	308
38	Office	80
39	Office	122
40	Office	108
41	Office	555
42	Office	94
43	Office	149
44	Pesticide Laboratory	852
45	Glassware Cleaning	500
46	Conventional Chemistry Laboratory	648
47	Metals Preparation Laboratory	648
48	Organics Preparation Laboratory	1,480
49	Metals Preparation Laboratory	971
50	Records Storage	200
51	Ash Analysis Laboratory	154
52	Utilities	69
53	Storage	93
54	Copy Center	116
55	GC Laboratory	600
56	Semivolatiles GC/MS Laboratory	634
57	Volatile Organics Laboratory	2,100
58	GC/MS Data Processing	1,030
59	Project Manager	116
60	Project Manager	81
61	Project Manager	104
62	Project Manager	104
63	Supervisor, GC/MS Operations	104
64	Office	104
65	Office	93
66	Director, Analytical Services	250
67	Office	93
68	Quality Assurance Director	180
L	Lavatory	
E	Elevator	

5.2 Major Instrumentation

Table 5.1 lists the major instrumentation used at NET Cambridge

Table 5.1

NET Cambridge Division

YEAR MANUFACTURED	INSTRUMENT MODEL	USE	SERIAL NUMBER
1986	HP5970-MS	ABN Analysis	2637A01576
1987		"	2807A10979
	HP5890-GC	ABN Analysis	2631A09163
		"	2750A16248
1986	HP5970-MS	VOC Analysis	2604A01220
"	"	"	2716A10346
"	"	"	2716A10357
1987	"	"	2905A12115
"	"	"	2905A12116
1987	HP5890-GC	VOC Analysis	2618A07866
"	"	"	2728A12606
"	"	"	2728A12607
1989	"	"	2921A23814
	"	"	2921A23815
1984	HP5995C GC/MS	VOC Analysis	2413A00479
1983	HP5830	VOA Screening	1728A03191
1983	HP5890	Pesticides,	2413A06104
	HP5890	"	2518A05170
	HP5890	"	2518A05226
1985	HP5890	"	2750A17912
	HP5890	"	2908A21578
	HP5890	"	29175P00022
1985,1985,	HP5880	Pesticides and PHCs	1941A00519 21417A03257 2303A04978 2417A06599
1991	ABC Labs 1002B GPC	org. extract cleanup	8548254
1986	Waters HPLC	Organics	712000744

Table 5.1

NET Cambridge Division			
YEAR MANUFACTURED	INSTRUMENT MODEL	USE	SERIAL NUMBER
1989	JY 50 ICP	Metals	609
1991	Jarrell-Ash AtomScan ICP	Metals	36582
1985,1986 1986	PE-5000 GFAA	Metals	124347 126282
1984	PR-2380 a) Autosampler	Metals	126914
1992	PE-	Metals	51002L8123
1984	Spectro-Products Hg Analyzer	Mercury	587
1987	PE 1310 IR	TPH/OG	133751
1987	Dionex QIC Ion Chromatograph	Inorganics	0258

In addition to this major instrumentation, all laboratories are fully eq
meters, spectrophotometers, extraction glassware, balances) required for
facilities contain appropriate benches, hoods, and safety equipment whic
Corporate safety managers.

6.0 INSTRUMENT MAINTENANCE

NET-Cambridge follows a well-defined program to prevent the failure of laboratory equipment or instrumentation during use. This program of preventive maintenance helps to avoid delays due to instrument downtime. Adequate supplies of spare parts such as GC columns, syringes, septa, injection port liners, and electronic parts are maintained in the laboratories so that they're available when needed.

Routine preventive maintenance procedures such as lubrication, source cleaning, detector cleaning and the frequency of such maintenance are performed according to the procedures outlined in the manufacturer's instrument manual. Chromatographic carrier gas purification traps, injector liners, and septa are cleaned or replaced regularly. Precision and accuracy data are examined for trends and excursions beyond established control limits that suggest instrument malfunction. Maintenance must be performed by laboratory analysts when there is evidence of degradation of peak resolution, shifting of the calibration curves, decreased sensitivity, or failure to meet one or more of the quality control criteria. The preventive maintenance performed on major laboratory instrumentation is summarized in Table 6.1.

Instrument logbooks are maintained by all the laboratories at NET Cambridge. They are used to record instrument use, calibration, maintenance and repairs.

Table 6.1
Routine Maintenance for Major Instrumentation

Instrument	Maintenance Procedure/Schedule	Spare Parts
Gas Chromatography/ Mass Spectrometry (GC/MS)	1. Replace pump oils as needed 2. Change septa as needed 3. Change gas line dryers as needed 4. Replace electron multiplier as needed	1. Syringes 2. Septa 3. Various electronic components 4. Plumbing supplies tube fittings
Gas Chromatograph (GC)	1. Change septa as needed 2. Change gas line dryers as needed 3. Leak check when installing new analytical column 4. Periodically check inlet system for residue buildup	1. Syringes 2. Septa 3. Various electron components 4. Plumbing supplies tube fittings
Purge and Trap Sample Concentrator	1. Replace trap as needed 2. Decontaminate system as required by blank analysis 3. Leak check system	1. Spare traps 2. Electronic components and circuit boards 3. Plumbing supplies tube fittings
Graphite Furnace Atomic Absorption Spectrophotometer	1. Change graphite contact rings as necessary 2. Change D2 background connection lamp as necessary 3. Clean quartz windows as necessary	1. Contact rings 2. D2 arc lamp
Inductively Coupled Plasma Spectrometer (ICP)	1. Clean torch assembly and mixing chamber when discolored or after 8 hours of running high dissolved solids samples 2. ICAPs are under service contracts which provide for quarterly routine maintenance service.	1. Spare torch and argon chamber 2. Spare coil

Table 6.1 (cont'd.)
Maintenance Procedures and Schedule For Major Instrumentation

Instrument	Maintenance Procedure/Schedule	Spare Parts
Spectroproducts Hg Analyzer	1. Clean tubing and quartz cell as necessary 2. Clean aspirator as necessary	1. Quartz cells 2. Aspirator
Technicon Autoanalyzer II	1. Inspect pump tubes after each 8 hour run: replace if discolored or distorted	1. Pump tubes, glass coil, flow cells
pH Analyzer	1. After use in solutions containing free oil and water, wash the electrode in an electrode cleaning solution and water.Rinse thoroughly with water. Immerse the lower third of the electrode in 1+9 HCl for 10 minutes to remove any film formed. Rinse thoroughly with water. 2. Keep electrode properly filled with appropriate filling solution.	1. Filling solution
Total Organic Carbon Analyzer	1. Replace tubing as needed. 2. Replace injecton septum after every 100 injections or when leakage is apparent. 3. Prepare fresh reagent daily. 4. Check scrubber daily, repack tube when tin is one-half consumed.	1. Tubing 2. Septa 3. 20-mesh granular tin

7.0 QUALITY ASSURANCE OBJECTIVES

Quality control and quality assurance objectives are used to provide analytical data of known, consistent, and defensible quality. Data quality is defined in terms of data quality objectives. These are the qualitative and quantitative statements reflecting the end-user's requirements for precision, accuracy, completeness, representativeness, and comparability.

NET Cambridge employs a well defined internal Quality Control (QC) program, a system of specific activities designed and implemented by the laboratory to ensure that a high level of quality is achieved. These include blanks, spikes, duplicates, laboratory control samples, and calibration verification standards which are submitted for analysis at regular frequencies, in order to ensure that the end-user's data quality objectives are met.

Analytical environmental work is regulation driven. Therefore, control limits listed in this LQAP are established by EPA methods and protocols or are experimentally determined NET Cambridge criteria. The quality control objectives and the quality control measures and frequencies are outlined in Tables 7.1 and 7.2 respectively.

7.1 Accuracy

Accuracy is a measure of the degree of agreement between an analyzed value and the true or accepted reference value where it is known. Accuracy is usually expressed in terms of error, bias, or percent recovery. Accuracy in the laboratory is assessed by the regular analysis of known standards.

7.2 Precision

Precision is a measure of the mutual agreement among individual measurements of the same parameter under similar conditions. It is an estimate of variability of measurements. Common analytical terms used to describe precision include <u>repeatability</u>, which is associated with a single analyst (within- laboratory) and <u>reproducibility</u>, which is associated with different analysts in different laboratories (between laboratory). Precision for within-laboratory measurements is expressed as standard deviation, coefficient of variation, or relative percent difference. Precision in the laboratory is assessed by the regular analysis of duplicate samples.

7.3 Completeness

Completeness is a measure of the amount of valid data obtained from the analytical measurement system. Completeness is expressed as a percentage of the number of valid measurements that should have been or were planned to be collected.

Ideally, all the expected measurements will be obtained, and all will be valid. However, realistically, some samples may be lost in laboratory accidents or some results may be deemed questionable based on internal QC procedures. Due to the variable nature of the completeness value, the objective will be to have data completeness for all samples received for analysis as high as possible.

7.4 Representativeness

Representativeness is a measure of how closely the measured results reflect the actual concentration or distribution of the chemical compounds in the sample. Sampling will be performed by the client. Sample handling protocols (e.g., storage, preservation and transportation) have been developed to preserve the representativeness of the collected samples. Proper documentation will establish that protocols have been followed and that sample identification and integrity have been assured.

7.5 Comparability

Comparability is a measure of how closely sample data generated by NET Cambridge compares with sample data generated by another organization. NET Cambridge will achieve comparability by operating within the instrument linear range and by strict adherence to analytical protocols. The use of published analytical methods, standard reporting units and thorough documentation will ensure meeting this objective. Our participation in EPA and state administered PEs provides a frequent check on the comparability of our data.

7.6 Quality Control Objectives

The quality control objectives associated with specific analyses are described in Table 7.1.

Table 7.1
Volatile Organic Compounds - CLP 3/90 Protocols

QC Check	Frequency	Analyte/Parameter Checked	Control Limit	
BFB Tune	once per 12 hour sequence	Relative Ion Abundances	per 3/90 CLP criteria specified in OLM01.0, D-26/VOA	
Holding Blank	one per week	Any project analyte	≤ 5 x CRQL	
Method Blank	one per analytical sequence of up to 12 hours	2- butanone	≤ 5 x CRQL	
		methylene chloride	≤ 5 x CRQL	
		acetone	≤ 5 x CRQL	
		any other project analyte	≤ CRQL	
Cont. Calibration Verification	one per 12 hour sequence	all target compounds minimum RF, Maximum % D	per 3/90 CLP criteria specified in OLM01.2, D-29/VOA	
			Aqueous	Soils
Surrogate Spike Recoveries	every sample, blank, and standard is spiked	d_4-1,2-dichloroethane	76-114%	70-121%
		d_8-toluene	88-110%	84-138%
		4-bromofluorobenzene	86-115%	59-113%
Matrix Spike Recoveries [1]	one set per 20 samples of similar matrix, per case of field samples received, whichever is more frequent	1,1-dichloroethylene	61-145%	59-172%
		trichloroethylene	71-120%	62-137%
		benzene	76-127%	66-142%
		toluene	76-125%	59-139%
		chlorobenzene	75-130%	60-133%
Precision [1]	one MS/MSD pair per 20 samples of similar matrix, or per case of field samples received, whichever is more frequent	1,1-dichloroethylene	≤ 14 RPD	≤ 22 RPD
		trichloroethylene	≤ 14 RPD	≤ 24 RPD
		benzene	≤ 11 RPD	≤ 21 RPD
		toluene	≤ 13 RPD	≤ 21 RPD
		chlorobenzene	≤ 13 RPD	≤ 21 RPD

RRF- Relative Response Factor
CRQL - Contract Required Detection Limit
RPD- Relative % Difference

[1] matrix spike recoveries and precision limits are advisory only - per OLM01.2 E-20/VOA

Table 7.1
Volatile Organic Compounds - Modified Method 624/8240

QC Check	Frequency	Analyte/Parameter Checked	Control Limit	
BFB Tune	once per 24 hour sequence	Relative Ion Abundances	per 3/90 CLP criteria specified in OLM01.0, D-26/VOA	
Initial Calibration	initally and when CCV fails	all target compounds	minimum RF and maximum % RSD per OLM01.0, D-29/VOA	
Method Blank	one per day per instrument	2- butanone	≤ 5 x RL	
		methylene chloride	≤ 5 x RL	
		acetone	≤ 5 x RL	
		any other project analyte	≤ RL	
Cont. Calibration Verification	one per 24 hour sequence	all target compounds minimun RF, Maximum % D	per 3/90 CLP criteria specified in OLM01.2, D-29/VOA	
			Aqueous	Soils
Surrogate Spike Recoveries*	every sample, blank, and standard is spiked	d_4-1,2-dichloroethane	76-114%	70-121%
		d_8-toluene	88-110%	84-138%
		4-bromofluorobenzene	86-115%	59-113%
Matrix Spike Recoveries*	one set per 20 samples of similar matrix	1,1-dichloroethylene	61-145%	59-172%
		trichloroethylene	71-120%	62-137%
		benzene	76-127%	66-142%
		toluene	76-125%	59-139%
		chlorobenzene	75-130%	60-133%
Precision	one duplicate spike per 20 samples of similar matrix	matrix spike compounds	≤ 25% RPD	

RF- Response Factor
%D- Percent Difference
RPD- Relative % Difference

* surrogate and matrix spike recoveries are based on EPA CLP advisory limits.

Table 7.1
Volatile Organic Compounds - Modified Method 524.2

QC Check	Frequency	Analyte/Parameter Checked	Control Limit
BFB Tune	once per sequence of up to 24 hours	relative ion abundances	per 3/90 CLP criteria specified in DLM01.0, D-26/VOA
Initial Calibration	initially and when CCVs fail	5 point curve % RSD for all analytes	20 % RSD allowing up to 5 compounds >20% but < 50% RSD
Method Blank	one per analytical sequence	524 analytes	≤ QL
Cont. Calibration Verification	one per day of analysis	RF of all analytes excepting up to 5	RF 70-130% initial calibration
Surrogate Spike Recoveries	added to each sample, blank, and standard	D4-1,2 Dichlorobenzene-d4 Bromofluorobenzene	80 - 100% 80- 100%
Matrix Spike Recoveries	one MS/MSD per set of 20 samples	1,1-dichloroethylene trichloroethylene benzene toluene chlorobenzene	61-145% 71-120% 76-127% 76-125% 75-130%
Precision	one per 20 samples	matrix spike compounds	≤ 25% RPD

QL - Quantitation Limit
RF - Response Factor
RPD - Relative Percent Difference

Table 7.1
Extractable Organic Compounds - CLP 3/90 Protocols

QC Check	Frequency	Analyte/Parameter Checked		Control Limit	
DFTPP Tune	once per 12 hour sequence	relative ion abundances		per 3/90 CLP criteria specified in OLM01.0, D-40/SV	
Initial Calibration	initially and when CCV fails	TCL analytes		min. RF, Max. %RSD, and max. % Diff per OLM01.0,D-47-48/SV	
Method Blank	one per batch of up to 20 samples	phthalate esters of TCL analytes		≤ 5 x CRQL	
		all other analytes		≤ CRQL	
Cont. Calibration Verification	one per 24 hour sequence	TCL analytes		min. RF, Max. %RSD, and max. % Diff per OLM01.0,D-47-48/SV	
				Aqueous	Soils
Surrogate Spike Recoveries [1]	added to each sample, blank and standard	d5-nitrobenzene	(base/neut.)	35-114%	23-120%
		2-fluorobiphenyl	"	43-116%	30-115%
		p-terphenyl	"	33-141%	18-137%
		d-phenol	(acid)	10-110%	24-113%
		2-fluorophenol	"	21-110%	25-121%
		2,4,6-tribromophenol	"	10-123%	19-122%
Matrix Spike Recoveries [2]	one set per every 20 samples of similar matrix, or per case of samples received, whichever is more frequent	1,2,4-trichlorobenzene		39-98%	38-107%
		acenaphthene		46-118%	31-137%
		2,4-dinitrotoluene		24-96%	28-89%
		pyrene		26-127%	35-142%
		N-nitroso-di-n-propylamine		41-116%	41-126%
		1,4-dichlorobenzene		36-97%	28-104%
		pentachlorophenol		9-103%	17-109%
		phenol		12-110%	26-90%
		2-chlorophenol		27-123%	25-102%
		4-chloro-3-methylphenol		23-97%	26-103%
		4-nitrophenol		10-80%	11-114%
Precision	every MS/MSD pair	1,2,4-trichlorobenzene		≤28 RPD	≤23 RPD
		acenapthene		<31 RPD	≤19 RPD
		pyrene		≤31 RPD	≤36 RPD
		2,4-dinitrotoluene		≤38 RPD	≤47 RPD
		N-nitroso-di-n-propylamine		<38 RPD	<38 RPD
		4-dichlorobenzene		<28 RPD	≤27 RPD
		pentachlorophenol		≤50 RPD	≤47 RPD
		phenol		≤42 RPD	≤35 RPD
		2-chlorophenol		<40 RPD	<50 RPD
		4-chloro-3-methylphenol		<42 RPD	≤33 RPD
		4-nitrophenol		<50 RPD	<50 RPD

[1] a maximum of one acidic and one basic surrogate may be out of specified limits
[2] matrix spike recoveries and precision limits are advisory only per OLM01.2, E-26/SV

Table 7.1
Extractable Organic Compounds - Modified Method 625/8270

QC Check	Frequency	Analyte/Parameter Checked	Control Limit	
DFTPP Tune	once per 24 hour sequence	relative ion abundances	per 3/90 CLP criteria specified in OLM01.0, D-40/SV	
Initial Calibration	initially and when CCV fails	TCL analytes	min. RF, Max. %RSD, and max. % Diff per OLM01.0,D-47-48/SV	
Method Blank	one per batch of up to 20 samples	phthalate esters	≤ 5 x QL	
		all other 625 analytes	≤ QL	
Cont. Calibration Verification	one per 24 hour sequence	TCL analytes	min. RF, Max. %RSD, and max. % Diff per OLM01.0,D-47-48/SV	
			Aqueous	Soils
Surrogate Spike Recoveries[1]	added to each sample, blank and standard	d5-nitrobenzene (base/neutral)	35-114%	23-120%
		2-fluorobiphenyl "	43-116%	30-115%
		p-terphenyl "	33-141%	18-137%
		d-phenol (acidic)	10-110%	24-113%
		2-fluorophenol "	21-110%	25-121%
		2,4,6-tribromophenol "	10-123%	19-122%
Matrix Spike Recoveries[2]	one set per every 20 samples of similar matrix	1,2,4-trichlorobenzene	39-98%	38-107%
		acenaphthene	46-118%	31-137%
		2,4-dinitrotoluene	24-96%	28-89%
		pyrene	26-127%	35-142%
		N-nitroso-di-n-propylamine	41-116%	41-126%
		1,4-dichlorobenzene	36-97%	28-104%
		pentachlorophenol	9-103%	17-109%
		phenol	12-110%	26-90%
		2-chlorophenol	27-123%	25-102%
		4-chloro-3-methylphenol	23-97%	26-103%
		4-nitrophenol	10-80%	11-114%
Precision	one MSD per every 20 samples of similar matrix	1,2,4-trichlorobenzene	≤28 RPD	≤23 RPD
		acenapthene	<31 RPD	≤19 RPD
		pyrene	≤31 RPD	≤36 RPD
		2,4-dinitrotoluene	≤38 RPD	≤47 RPD
		N-nitroso-di-n-propylamine	≤38 RPD	≤38 RPD
		4-dichlorobenzene	<28 RPD	≤27 RPD
		pentachlorophenol	≤50 RPD	≤47 RPD
		phenol	≤42 RPD	≤35 RPD
		2-chlorophenol	≤40 RPD	≤50 RPD
		4-chloro-3-methylphenol	<42 RPD	≤33 RPD
		4-nitrophenol	<50 RPD	<50 RPD

[1] a maximum of one acidic and one basic surrogate may be out of specified limits
[2] matrix spike recoveries and precision limits are advisory only per OLM01.2, E-26/SV

Table 7.1
Pesticides and PCBs- CLP 3/90 Protocols

QC Check	Frequency	Analyte/Parameter Checked	Control Limit	
Linearity	once per calibration sequence	CFs of 3 concentrations of of each single response analytes	% RSD < 20 (up to two compounds >20 % but < 30%)	
Continuing Calibration Verification	every 12 hours	all target compounds	≤ 25% RPD	
		Resolution of peaks	100% for PEM compounds 90% for ind A or B compounds	
		Breakdown	DDT and Endrin ≤20% or combined ≤ 30%	
Instrument Blank	every 12 hours	all target compounds	< .5 CRQL	
Method Blank	one per 20 samples of similar matrix or per extraction batch	all target compounds	≤ CRQL	
Surrogate Spike Recoveries	added to each sample blank and standard	Tetrachloro-m-xylene Decachlorobiphenyl	60-150 % recovery (advisory)	
			Aqueous	Soil
Matrix Spike and Duplicate (advisory only)	one per 20 samples of similar matrix	Lindane	56-123%	46-127%
		Heptachlor	40-131%	35-130%
		Aldrin	40-120%	34-132%
		Dieldrin	52-126%	31-134%
		Endrin	56-121%	42-139%
		4,4'-DDT	38-127%	23-134%
Precision	one MSD per 20 samples of similar matrix	Lindane	≤15 RPD	≤50 RP
		Heptachlor	≤20 RPD	≤31 RPD
		Aldrin	≤22 RPD	≤43 RPD
		Dieldrin	≤18 RPD	≤38 RPD
		Endrin	≤21 RPD	≤45 RPD
		4,4'-DDT	≤27 RPD	≤50 RPD
		PCB 1248 *	≤30 RPD	≤30 RPD

CF - Calibration Factor
CRQL - Contract Required Calibration Limit
RSD - Relative Standard Deviation
RPD - Relative Percent Difference

Table 7.1
Pesticides and PCBs- Modified Method 608[2]/8080[3]

QC Check	Frequency	Analyte/Parameter Checked	Control Limit	
Linearity	once per calibration sequence	CFs of 5 concentrations of of each single response analytes	0.995 correlation coefficient	
		CFs of 3 concentrations of each PCB of interest	0.995 correlation coefficient	
Continuing Calibration Verification	every 12 hours	all target compounds	≤ 25% RPD	
Instrument Blank	every 12 hours	all target compounds	< .5 RL	
Method Blank	one per 20 samples of similar matrix or per extraction batch	all target compounds	≤ RL	
Surrogate Spike Recoveries	added to each sample blank and standard	Tetrachloro-m-xylene Decachlorobiphenyl	60-150 % recovery (advisory)	
Laboratory Control Sample	one per 20 samples of similar matrix or per extraction batch	single response analytes or PCB 1016 and 1260	limits to be developed using lab generated data	
			Aqueous	Soil
Matrix Spike and Duplicate (advisory only)	one per 20 samples of similar matrix	Lindane	56-123%	46-127%
		Heptachlor	40-131%	35-130%
		Aldrin	40-120%	34-132%
		Dieldrin	52-126%	31-134%
		Endrin	56-121%	42-139%
		4,4'-DDT	38-127%	23-134%
		PCB 1248*	50-150%	50-150%
Precision	one MSD per 20 samples of similar matrix	Lindane	≤15 RPD	≤50 RP
		Heptachlor	≤20 RPD	≤31 RPD
		Aldrin	≤22 RPD	≤43 RPD
		Dieldrin	≤18 RPD	≤38 RPD
		Endrin	≤21 RPD	≤45 RPD
		4,4'-DDT	≤27 RPD	≤50 RPD
		PCB 1248 *	≤30 RPD	≤30 RPD

* - performed only for sample sets known to have PCB contamination
CF - Calibration Factor
RPD - Relative Percent Difference

Table 7.1
Herbicides- Modified Method 8150[3] and 509B

QC Check	Frequency	Analyte/Parameter Checked	Control Limit
Method Blank	one per batch of up to 20 samples of similar matrix	all method compounds	≤ RL
Initial Calibration	one per day of analysis	all method compounds	20% RSD
Continuing Calibration Verification	one per 10 samples	all method compounds	70 - 130% expected value
Surrogate Spike	added to each sample, blank and standard	DCPAA	40 - 115%
Laboratory Control Sample	one per extraction batch	all method compounds	40 - 130%

RL - Reporting Limit

Metals * /90 Protocols

QC Check	Frequency		Checked	Control Limit
Preparation Blank	one per 20 sample of similar matrix			≤ CRDL
Initial Calibration Verification	once per instrument calibration	Hg All others		80-120% 90-110%
Initial Calibration Blank	once per instrument calibration	All metals		≤ CRDL
Interference Check Sample	once per calibration	ICP metals		80-120%
Matrix Spike	one per 20 samples of similar matrix	All metals		75-125%
Laboratory Control Sample	one per 20 samples	All metals		80-120% **
Duplicate Sample	one per 20 samples of similar matrix	All metals		≤ 20% RPD
Continuing Calibration Verification	one per 10 analyses	Hg All others		80-120% 90-110%

* metals include all CLP TAL analytes and boron

Table 7.1
Metals Analyses

QC Check	Frequency	Analyte/Parameter Checked	Control Limit
Preparation Blank	one per 20 samples of similar matrix	All metals	≤ 5 x RL
Initial Calibration Verification	once per instrument calibration	Hg All others	80-120% 90-110%
Initial Calibration Blank	once per instrument calibration	All metals	≤ 5x IDL
Interference Check Sample	once per calibration	ICP metals	80-120%
Matrix Spike	one per 20 samples of similar matrix	Hex. Chrom. All others	60-130% * 75-125% *
Analytical Spike	one per 20 samples of similar matrix	All spiked metals	75-125%
Laboratory Control Sample	one per 20 samples of similar matrix	Ag, Sb Hex. Chrom. All others	80-120% ** 65-125% ** 80-120%
Duplicate Sample	one per 20 samples of similar matrix	All metals	≤ 20% RPD
Continuing Calibration Verification	one per 10 analyses	Hg All others	80-120% 90-110%
Initial Calibration Blank	after each CCV	All metals	≤ 5x IDL

RL - Reporting Limit
RPD - Relative Percent Difference
IDL - Instrument Detection Limit

The absolute value of the blank must be < RL or < 10 times the lowest sample concentration in the preparation batch.

*Advisory limit - There is no corrective action if outside the limit, it is considered an indication of matrix interference.

** Advisory limit

Table 7.1
Conventional Chemistry Analyses

QC Check	Frequency	Analyte/Parameter Checked	Control Limit
Initial Calibration Curve	one per day of analysis	All analyses	0.995 Correlation Coefficient
Calibration Blank	one per calibration	All analyses	≤ 5 x DL
Preparation Blank	one per 20 samples of similar matrix or per batch of < 20 samples	All analyses	≤ 5 x DL
Initial Calibration Verification	one per calibration	All analyses	85-115%
Continuing Calibration Verification	one per 10 analyses	All analyses	85-115%
Matrix Spike Recovery	one per 20 samples of similar matrix or per batch of < 20 samples	All analyses	75-125%
Duplicate Precision	one per 20 samples of similar matrix or per batch of < 20 samples	All analyses	20% RPD
Laboratory Control Sample Recovery	one per 20 samples of similar matrix or per batch of < 20 samples	TKN and TP All others	75-125% 80-120%

DL - Detection Limit

RPD - Relative Percent Difference

Table 7.1
Total Petroleum Hydrocarbons

Audits Required	Frequency Audits	Limits	Corrective Actions
1. Calibrate Spectrophotometer (wavelength) using styrene film	Daily	Must meet manufacturer's specification for wavelength	Call for help from manufacturer's representative.
2. Prepare a calibration plot of absorbance vs. mg petroleum hydrocarbons per 50 ml solution (.01 mg/50 ml to 1.0 mg/50 ml	Daily	Correlation Coefficient >.995	Make new working standards and prepare new calibration plot.
3. Method Blank	1 per 10 analytical samples	≤2 times DL	If >2 times DL, determine source of contamination and reanalyze blank. Limits must be met prior to analysis.
4. Laboratory Duplicate (Separate preparation of sample)	1 per 10 analytical samples	±20%	If not ±20%, rerun duplicate. If out of limit, proceed.
5. Matrix spike 0.20 mg/50 ml reference oil solution	1 per 10 analytical samples	80%-120% recovery	If not within limits repeat if not again proceed
6. Continuing Check Standard 0.20 mg/ 50 ml std reference oil solution	1 per 10 samples and at the end of analysis	±10%	If outside limits, recalibrate and rerun all samples run since last acceptable calibration check.
7. Separation check sample (Lauramide/ Ref oil mixture)	1 per 20 samples	No ore than +10% of reference oil concentration	If outside limit reseparate all related samples with new SiO_2 column since last compliant check.

References

[1] US EPA Contract Laboratory Statement of Work for Organics Analysis, Multi-Media, Multi-Concentration, Revision 3/90

[2] US EPA,1984. Methods for Organic Chemical Analysis of Municipal and Industrial Wastewater. Appendix A. 40 CFR Part 136. Federal Register,Volume 49, No.209 1984.

[3] US EPA, 1986. Test Methods for Evaluating Solid Waste Physical/Chemical Methods. SW-846 Third Edition. Office of Solid Waste, US EPA, Washington DC.

[4] US EPA,1990. Method 1311 Toxicity Characteristic Leaching Procedure (TCLP). Appendix II. 40 CFR Parts 261,264,265, 268,271,302. Federal Register, Volume 55, N. 126 6/29/1990

[5] US EPA, 1986. Methods for the Determination of Organic Compounds in Finished Drinking Water and Raw Source Water. EPA/EMSL, Cincinnati, Ohio.

[6] APHA, 1985. Standard Methods for the Examination of Water and Wastewater. Sixteenth Edition. American Public Health Association, Washington DC.

[7] US EPA, 1979. Methods for Chemical Analysis of Water and Wastes. EPA 600/4-79-020 (revised March 1983). EPA/EMSL, Cincinnati, Ohio.

[8] US EPA, 1988. Contract Laboratory Program Inorganic Analysis for Multi-Media, Multi-Concentration, Statement of Work, Revision 3/90. US Contract Laboratory Program . EPA/CLP, Washington DC.

8. ANALYTICAL PROCEDURES

The analytical methods routinely employed by NET Cambridge are summarized in Table 8.1. In addition to these analytical methods NET Cambridge is prepared to use current CLP protocols for the analysis of volatiles, semivolatiles, pesticides, PCBs, metals, and cyanide. NET-Cambridge is prepared to use methods other than those listed below should the client request it. If alternate methods are required, QC procedures will be provided as a revision to this QA plan.

Table 8.1
Organic Analytical Methods

Constituent	Method Reference	Method Description
Volatile Organic Compounds	Modified Method 624/8240 [1,2]	Purge and trap, gas chromatography mass spectrometry (GC/MS)
Volatile Organic Compounds	Modified Method 524.2 [5]	Purge and trap, gas chromatography mass spectrometry (GC/MS)
CLP Volatile Organics	SOW 3/90 [6]	Purge and trap, GC/MS
Volatile Extractables	Method 504 [4]	Microextraction GC/ECD analysis
Semivolatile Organics-Acid/Base/ Neutral Extractables	Modified Method 625/8270 [1,2]	Two phase extraction, gas chromatography mass spectrometry analysis
CLP Semivolatile Organics	SOW 3/90 [6]	Single phase solvent extraction
Pesticides/PCBs	Modified Method 608/8080 [1,2]	Solvent extraction, gas chromatography/ electron capture
CLP Pesticides	SOW 3/90 [6]	Solvent extraction, ECD analysis
Pesticides	505[4] 508[4]	Microextraction/ GC/ECD analysis Solvent extraction/ GC/ECD analysis
Herbicides (Aqueous)	Modified Method 615/509B/8150 [5,2]	Solvent extraction, derivatization, gas chromatography/electron capture detection (GC/ECD)
TCLP/ZHE Extraction	Method 1311 [2]	Acidic leaching procedure
Petroleum Hydrocarbons, Total	Modified Methods 418.1 [3]	Solvent extraction, IR spectrometry
Petroleum Hydrocarbon Fingerprinting		Solvent extraction, gas chromatography/flame ionization detection (GC/FID)
Oil and Grease	Method 413.1 [3,5] Method 413.2 [3]	Solvent extraction, gravimetric determination Solvent extraction, infrared spectrophotometry (IR)

Organics Methods References

[1]US EPA, 1984. Methods for Organic Chemical Analysis of Municipal and Industrial Wastewater. Appendix A. 40CFR Part 136. Federal Register, Volume 49, No. 209, 1984.

[2]US EPA, 1986. Test Methods for Evaluating Solid Waste-Physical/Chemical Methods. SW-846 Third Edition. Office of Solid Waste, US EPA, Washington, DC.

[3]US EPA, 1979. Methods for Chemical Analysis of Water and Wastes. EPA 600/4-79-020 (Revised, March 1983). EPA/EMSL, Cincinnati, Ohio.

[4]US EPA, 1986. Methods for the Determination of Organic Compounds in Finished Drinking Water and Raw Source Water. EPA/EMSL, Cincinnati, Ohio.

[5]APHA, 1985. Standard Methods for the Examination of Water and Wastewater. Sixteenth Edition. American Public Health Association, Washington, DC.

[6]US EPA, 1988. Organic Analysis for Multi-Media, Multi-Concentration, Statement of Work, Revision 3/90. US Contract Laboratory Program. EPA/CLP, Washington, DC.

Table 8.2
Summary of Inorganic Methods

Constituent	Method Reference	Method Description
Sample Digestion	Method 3010/3020/3050 [2]	Acid Digestion
EP Toxicity	Method 1320 [2]	Toxicity Extraction
TCLP Extraction	Method 1311 [2]	Acidic Leaching Procedure
Aluminum	Method 200.7/6010 [1,2]	Inductively Coupled Argon Emission Spectroscopy (ICP)
Antimony	Method 200.7/6010 [1,2]	ICP
	Method 204.2/7041	Graphite Furnace Atomic Absorption Spectrophotometry (GFAAS)
Arsenic	Method 200.7/6010 [1,2]	ICP
	Method 206.2/7060	GFAAS
	Method 206.3	Hydride generation
Barium	Method 200.7/6010 [1,2]	ICP
Beryllium	Method 200.7/6010 [1,2]	ICP
Cadmium	Method 200.7/6010 [1,2]	ICP
	Method 213.2/7131 [1,2]	GFAAS
Calcium	Method 200.7/6010 [1,2]	ICP
Chromium	Method 200.7/6010 [1,2]	ICP
Cobalt	Method 200.7/6010 [1,2]	ICP
Copper	Method 200.7/6010 [1,2]	ICP
Iron	Method 200.7/6010 [1,2]	ICP
Lead	Method 200.7/6010 [1,2]	ICP
	Method 239.2/7421 [1,2]	GFAAS
Magnesium	Method 200.7/6010 [1,2]	ICP
Manganese	Method 200.7/6010 [1,2]	ICP
Mercury	Method 245.1/7470 [1,2]	Cold-Vapor AA Spectroscopy
Molybdenum	Method 200.7/6010 [1,2]	ICP
Nickel	Method 200.7/6010 [1,2]	ICP
Potassium	Method 200.7/6010 [1,2]	ICP
Selenium	Method 200.7/6010 [1,2]	ICP
	Method 270.2/7740	GFAAS
Silver	Method 200.7/6010 [1,2]	ICP
	Method 272.2	GFAAS
Sodium	Method 200.7/6010 [1,2]	ICP
Thallium	Method 200.7/6010 [1,2]	ICP
	Method 279.2/7841 [1,2]	GFAAS
Vanadium	Method 200.7/6010 [1,2]	ICP
Zinc	Method 200.7/6010 [1,2]	ICP
CLP Metals	SOW 3/90 [4]	ICP/GFAAS

and boron

Table 8.2 (cont.)
Inorganic Analytical Methods

Constituent	Method Reference	Method Description
Alkalinity	Method 310.1 [1]	Potentriometric Titration
Ammonia	Method 350.1 [1]	Automated colorimetric
	Method 351.2 [1]	Colorimetric Semi-automated Block Digester
Biochem. Oxygen Demand (BOD)	Method 405.1 [1]	5 days at 20°C
Carbonaceous BOD	Method 405.1 [1] inhibited	5 days at 20°C; nitrogen
Chemical Oxygen Demand (COD)	Method 410.4 [1]	Colorimetric
Chloride	Method 300.1/325.2 [1]	Ion chromatography; titrimetric
Color	Method 110.2 [1]	Colorimetric, Pt-Co
Conductivity	Method 120.1 [1]	Specific conductance
Cyanide, Total	Method 335.2/.3[1,2] Method 9012	Distillation,colorimetric automated
Cyanide, Amenable	Method 335.1/9012[1,2]	Chlorination, distillation colorimetric
Cyanide, CLP	SOW 3/90 [4]	Distillation,colorimetric automated
Fluoride	Method 300.1/340.2 [1]	Ion chromatography, ion selective electrode
Hardness	Method 23408 [3]	ICP, by calculation
Hexavalent Cr	Mod.Method 218.5/7195 [1,2]	Co-precipitation, ICP
Nitrate	Method 300.0/353.2 [1]	Ion chromatography, automated colorimetric
Nitrite	Method 300.0/353.2 [1]	Ion chromatography, automated colorimetric
Orthophosphate	Method 365.3 [1]	Manual two reagent
pH	Method 150.1/9040[1,2]	Potentriometric
Phenolics	Method 420.2 [1]	Colorimetric, automated
Phosphorus, Total	Method 365.3 [1]	Colorimetric, ascorbic acid
Silica	Method 200.7 [1]	Filtration, ICP

Table 8.2 (cont.)
Inorganic Analytical Methods

Analysis	Method Reference	Method Description
Solids		
Dissolved (TDS)	Method 160.1 [1]	Gravimetric, dry at 180 C
Suspended (TSS)	Method 160.2 [1]	Gravimetric, dried at 103-105oC
Total (TS)	Method 160.3 [1]	Gravimetric, dried at 103-105oC
Volatile (TVS)	Method 160.4 [1]	Gravimetric, ignition 550oC
Settleable (SS)	Method 160.5 [1]	Volumetric, Imhoff Cone
Sulfide	Method 376.1/9030 [1,2]	Titrimetric, iodine
Sulfate	Method 300.0 [1] Method 375.4/9038 [1,2]	Ion chromatography, Turbidimetric
Total Organic Carbon	Method 415.2/9060 [1,2]	Persulfate oxidation, UV promoted
Total Kjeldahl Nitrogen	Method 351.2 [1]	Semi-automated colorimetric
Turbidity	Method 180.1 [1]	Nephelometric

Inorganic Methods References

[1]US EPA, 1979. Methods for Chemical Analysis of Water and Wastes. EPA 600/4-79-020 (Revised, March 1983). EPA/EMSL, Cincinnati, Ohio.

[2]US EPA, 1986. Test Methods for Evaluating Solid Waste-Physical/Chemical Methods. SW-846 Third Edition. Office of Solid Waste, US EPA, Washington, DC.

[3]APHA, 1985. Standard Methods for the Examination of Water and Wastewater. Sixteenth Edition. American Public Health Association, Washington, DC.

[4]US EPA, 1988. Contract Laboratory Program Inorganic Analysis for Multi-Media, Multi-Concentration, Statement of Work, Revision 3/90. US Contract Laboratory Program. EPA/CLP, Washington, DC.

9.0 Detection and Reporting Limits

9.1 Instrument Detection Limits

The concentration equivalent of the smallest signal which is distinguishable from background instrument noise. The determination of IDL's is done for metals quarterly per CLP protocols. The IDL is 3 times the average of 3 standard deviations each independently determined on non-consecutive days by 7 replicate analyses of a spiked reagent water standard under normal instrument operating conditions

9.2 Method Detection Limits

The Method Detection Limits is defined as the minimum concentration of a substance that can be measured and reported with a 99% confidence that the analyte concentration is greater than zero. This concentration is determined through multiple analyses (including all sample preparation steps) of a sample of a given matrix. The standard deviation of the results of these analyses is multiplied by 3, and the resulting value is considered the method detection limit. This procedure for determining the MDL is from 40 CFR Part 136 Appendix B Federal Register Vol. 49, No. 209 - 10/26/84). MDLs are done annually.

9.3 Reporting Limits

The reporting limit is the concentration down to which the laboratory can confidently report quantitative data. Reporting limits must always be greater or equal to the MDL or IDL. The judgement of the analysts, and the needs of the client are considered when determining reporting limits. The reporting limits for specific methods and matrices are listed in Table 9.1.

9.4 Contract Required Quantitation Limits

The CRQLs are the reporting limits required for EPA CLP analyses. These are defined in the CLP Statements of Work, and are listed in Table 9.1 for each CLP analysis performed.

Table 9.1
Analytes and Reporting Limits

VOLATILES	CAS No.	CLP SOW 3/90 [1] CRQL Water ug/L	CRQL Low Soil ug/Kg	CRQL Medium Soil ug/Kg
1. Chloromethane	74-87-3	10	10	1200
2. Bromomethane	74-83-9	10	10	1200
3. Vinyl Chloride	75-01-4	10	10	1200
4. Chloroethane	75-00-3	10	10	1200
5. Methylene Chloride	75-09-2	10	10	1200
6. Acetone	67-64-1	10	10	1200
7. Carbon Disulfide	75-15-0	10	10	1200
8. 1,1-Dichloroethene	75-35-4	10	10	1200
9. 1,1-Dichloroethane	75-34-3	10	10	1200
10. 1,2-Dichloroethene (total)	540-59-0	10	10	1200
11. Chloroform	67-66-3	10	10	1200
12. 1,2-Dichloroethane	107-06-2	10	10	1200
13. 2-Butanone	78-93-3	10	10	1200
14. 1,1,1-Trichloroethane	71-55-6	10	10	1200
15. Carbon Tetrachloride	56-23-5	10	10	1200
16. Bromodichloromethane	75-27-4	10	10	1200
17. 1,2-Dichloropropane	78-87-5	10	10	1200
18. cis-1,3-Dichloropropene	10061-01-5	10	10	1200
19. Trichloroethene	79-01-6	10	10	1200
20. Dibromochloromethane	124-48-1	10	10	1200
21. 1,1,2-Trichloroethane	79-00-5	10	10	1200
22. Benzene	71-43-2	10	10	1200
23. trans-1,3-Dichloropropene	10061-02-6	10	10	1200
24. Bromoform	75-25-2	10	10	1200
25. 4-Methyl-2-pentanone	108-10-1	10	10	1200
26. 2-Hexanone	591-78-6	10	10	1200
27. Tetrachloroethene	127-18-4	10	10	1200
28. 1,1,2,2-Tetrachloroethane	79-34-5	10	10	1200
29. Toluene	108-88-3	10	10	1200
30. Chlorobenzene	108-90-7	10	10	1200
31. Ethyl Benzene	100-41-4	10	10	1200
32. Styrene	100-42-5	10	10	1200
33. Xylenes (total)	1330-20-7	10	10	1200

Table 9.1
Analytes and Reporting Limits (cont'd.)

VOLATILES	CAS No.	Modified Method 624[2]/8240[3] QL ug/L	Modified Method 8240[3] QL ug/Kg	TCLP Method 1311[4] Modified 8240[3] QL ug/L
1. Acetone	76-64-1	5	5	-
2. Benzene	71-43-2	5	5	25
3. Bromodichloromethane	75-27-4	5	5	-
4. Bromoform	75-25-2	5	5	-
5. Bromomethane	74-83-9	5	5	-
6. 2-Butanone	78-93-3	5	5	100
7. Carbon disulfide	75-15-0	5	5	-
8. Carbon Tetrachloride	56-23-5	5	5	25
9. Chlorobenzene	108-90-7	5	5	25
10. Chloroethane	75-00-3	5	5	-
11. 2-Chloroethylvinyl ether	100-75-8	5	5	-
12. Chloroform	67-66-3	5	5	25
13. Chloromethane	74-87-3	5	5	-
14. Dibromochloromethane	124-48-1	5	5	-
15. 1,2-Dichlorobenzene	95-50-1	5	5	-
16. 1,3-Dichlorobenzene	541-73-1	5	5	-
17. 1,4-Dichlorobenzene	106-46-7	5	5	-
18. 1,1-Dichloroethane	75-34-3	5	5	-
19. 1,2-Dichloroethane	107-06-2	5	5	25
20. 1,1-Dichloroethene	75-35-4	5	5	25
21. trans 1,2-Dichloroethene	540-59-0	5	5	-
22. 1,2-Dichloropropane	78-87-5	5	5	-
23. cis-1,3-Dichloropropene	10061-01-5	5	5	-
24. trans-1,3-Dichloropropene	10061-02-6	5	5	-
25. Ethyl Benzene	100-41-4	5	5	-
26. 2-hexanone	591-78-6	5	5	-
27. 4-methyl-2-pentanone	108-10-1	5	5	-
28. Methylene Chloride	75-09-2	5	5	-
29. styrene	100-42-5	5	5	-
30. 1,1,2,2-Tetrachloroethane	79-34-5	5	5	-
31. Tetrachloroethene	127-18-4	5	5	25
32. Toluene	108-88-3	5	5	-
33. 1,1,1-Trichloroethane	71-55-6	5	5	-
34. 1,1,2-Trichloroethane	79-00-5	5	5	-
35. Trichloroethene	79-01-6	5	5	25

Table 9.1
Analytes and Reporting Limits (cont'd.)

VOLATILES	CAS No.	Modified Method 624[2]/8240[3] QL ug/L	Modified Method 8240[3] QL ug/Kg	TCLP Method 1311[4] Modified 8240[3] QL ug/L
36. Trichlorfluoromethane	75-69-4	5	5	-
37. Vinyl acetate		5	5	-
38. Vinyl Chloride	75-01-4	5	5	100
39. m-xylene *	108-38-3	5	5	-
40. o-xylene *	95-47-6	5	5	-
41. p-xylene *	106-42-3	5	5	-

* HSL extended analysis required

QL - quantitation limit

Quantitation Limits listed for soil/sediment are based on wet weight. Those calculated by the laboratory are on a dry weight basis, and will be higher.

Table 9.1
Analytes and Reporting Limits (cont'd.)

VOLATILES	CAS No.	Method 524[5] QL Water ug/L
1. Benzene	71-43-2	0.2
2. Bromobenzene	108-86-1	0.4
3. Bromochloromethane	75-01-4	0.4
4. Bromodichloromethane	75-27-4	0.4
5. Bromoform	75-25-2	0.3
6. Bromomethane	74-83-9	0.3
7. n-Butylbenzene	104-51-8	0.4
8. sec-Butylbenzene	135-98-8	0.2
9. tert-Butylbenzene	98-06-6	0.3
10. Carbon Tetrachloride	56-23-5	0.6
11. Chlorobenzene	108-90-7	0.2
12. Chloroethane	75-00-3	0.4
13. Chloroform	67-66-3	0.7
14. Chloromethane	74-87-3	0.5
15. 2-Chlorotoluene	95-49-8	0.4
16. 4-Chlorotoluene	106-43-4	0.3
17. 1,2-Dibromo-3-Chloropropane	96-12-18	0.8
18. Dibromochloromethane	124-48-1	0.3
19. 1,2-Dibromoethane	106-93-4	0.3
20. Dibromomethane	74-95-3	0.3
21. 1,2-Dichlorobenzene	95-50-1	0.4
22. 1,3 Dichlorobenzene	541-73-1	0.2
23. 1,4 Dichlorobenzene	106-46-7	0.5
24. Dichlorodifluoromethane	75-71-8	1.5
25. 1,1-Dichloroethane	75-34-3	0.3
26. 1,2-Dichloroethane	107-06-2	0.7
27. 1,1-Dichloroethene	75-35-4	1.3
28. cis-1,2-Dichloroethene	156-59-4	0.4
29. trans-1,2-Dichloroethene	156-60-5	0.2
30. 1,2-Dichloropropane	78-87-5	0.3
31. 1,3-Dichloropropane	142-28-9	0.3
32. 2,2-Dichloropropane	590-20-7	0.6
33. 1,1-dichloropropene	563-58-6	0.3
34. cis-1,3-Dichloropropene	10061-01-5	0.4
35. trans-1,3-Dichloropropene	10061-02-6	0.4

Table 9.1
Analytes and Reporting Limits (cont'd.)

VOLATILES	CAS No.	Method 524[5] QL Water ug/L
36. Ethyl Benzene	100-41-4	0.3
37. Hexachlorobutadiene	87-68-3	0.6
38. Isopropyl benzene	98-82-8	0.4
39. 4-Isopropyltoluene	99-87-6	0.4
40. Methylene Chloride	75-09-2	1.7
41. Napthalene	91-20-3	2.8
42. n-Propylbenzene	103-65-1	0.4
43. styrene	100-42-5	0.4
44. 1,1,1,2-Tetrachloroethane	630-20-6	0.5
45. 1,1,2,2-Tetrachloroethane	79-34-5	0.3
46. Tetrachloroethene	127-18-4	0.4
47. Toluene	108-88-3	0.2
48. 1,2,3-Trichlorobenzene	87-61-6	0.9
49. 1,2,4-Trichlorobenzene	120-82-1	0.7
50. 1,1,1-Trichloroethane	71-55-6	0.5
51. 1,1,2-Trichloroethane	79-00-5	0.2
52. Trichloroethene	79-01-6	0.3
53. Trichlorfluoromethane	75-69-4	0.6
54. 1,2,4-Trimethylbenzene	95-63-6	0.4
55. 1,3,5-Trimethylbenzene	108-67-8	0.4
56. 1,2,3-Trichloropropane	96-18-4	0.6
57. Vinyl Chloride	75-01-4	0.4
58. m-Xylene	108-38-3	0.7
59. o-Xylene	95-47-6	0.4
60. p-Xylene	106-42-3	0.7

QL - Quantitation Limit

Specific detection limits are highly matrix dependent. The Quantitation Limits listed provided for guidance and may not always be achievable.

Table 9.1
Analytes and Reporting Limits (cont'd.)

VOLATILES	CAS No.	Method 504[5] Water ug/L
1. 1,2-Dibromoethane (EDB)	106-93-4	1
2. 1,2-Dibromo-3-Chloropropane (DBCP)	96-12-8	2

QL - Quantitation Limit

Specific detection limits are highly matrix dependent. The Quantitation Limits listed provided for guidance and may not always be achievable.

Table 9.1
Analytes and Reporting Limits (cont'd.)

SEMIVOLATILES	CAS No.	CLP SOW 3/90[1] CRQL Water ug/L	CRQL Low Soil ug/Kg	CRQL Medium Soil ug/Kg
1. Phenol	108-95-2	10	330	10,000
2. bis(2-chloroethyl)ether	111-44-4	10	330	10,000
3. 2-Chlorophenol	95-57-8	10	330	10,000
4. 1,3-Dichlorobenzene	541-73-1	10	330	10,000
5. 1,4-Dichlorobenzene	106-46-7	10	330	10,000
6. 1,2-Dichlorobenzene	95-50-1	10	330	10,000
7. 2-Methylphenol	95-48-7	10	330	10,000
8. 2,2'-oxybis 1-Chloropropane	108-60-1	10	330	10,000
9. 4-Methylphenol	106-44-5	10	330	10,000
10. N-nitroso-di-n-dipropylamine	621-64-7	10	330	10,000
11. Hexachloroethane	67-72-1	10	330	10,000
12. Nitrobenzene	98-95-3	10	330	10,000
13. Isophorone	78-59-1	10	330	10,000
14. 2-Nitrophenol	88-75-5	10	330	10,000
15. 2,4-Dimethylphenol	105-67-9	10	330	10,000
16. bis(2-chloroethoxy)methane	111-91-1	10	330	10,000
17. 2,4-Dichlorophenol	120-83-2	10	330	10,000
18. 1,2,4-Trichlorobenzene	120-82-1	10	330	10,000
19. Naphthalene	91-20-3	10	330	10,000
20. 4-Chloroaniline	106-47-8	10	330	10,000
21. Hexachlorobutadiene	87-68-3	10	330	10,000
22. 4-Chloro-3-methylphenol	59-50-7	10	330	10,000
23. 2-Methylnaphthalene	91-57-6	10	330	10,000
24. Hexachlorocyclopentadien	77-47-4	10	330	10,000
25. 2,4,6-Trichlorophenol	88-06-2	10	330	10,000
26. 2,4,5-Trichlorophenol	95-95-4	25	800	25,000
27. 2-Chloronaphthalene	91-58-7	10	330	10,000
28. 2-Nitroaniline	88-74-4	25	800	25,000
29. Dimethylphthalate	131-11-3	10	330	10,000
30. Acenaphthalene	208-96-8	10	330	10,000
31. 2,6-Dinitrotoluene	606-20-2	10	330	10,000
32. 3-Nitroaniline	99-09-2	25	800	25,000
33. Acenaphthene	83-32-9	10	330	10,000
34. 2,4-Dinitrophenol	51-28-5	25	800	25,000
35. 4-Nitrophenol	100-02-7	25	800	25,000

Table 9.1
Analytes and Reporting Limits (cont'd.)

SEMIVOLATILES	CAS No.	CLP SOW 3/90[1] CRQL Water ug/L	CRQL Low Soil ug/Kg	CRQL Medium Soil ug/Kg
36. Dibenzofuran	132-64-9	10	330	10,000
37. 2,4-Dinitrotoluene	121-14-2	10	330	10,000
38. Diethylphthalate	84-66-2	10	330	10,000
39. 4-Chlorophenyl-phenylether	7005-72-3	10	330	10,000
40. Fluorene	86-73-7	10	330	10,000
41. 4-Nitroaniline	100-01-6	25	800	25,000
42. 4,6-Dinitro-2-methylphenol	534-52-1	25	800	25,000
43. N-nitrosodiphenylamine	6-30-6	10	330	10,000
44. 4-Bromophenyl-phenylether	101-55-3	10	330	10,000
45. Hexachlorobenzene	118-74-1	10	330	10,000
46. Pentachlorophenol	87-86-5	25	800	25,000
47. Phenanthrene	85-01-8	10	330	10,000
48. Anthracene	120-12-7	10	330	10,000
49. Carbazole	86-74-8	10	330	10,000
50. Di-n-butylphthalate	84-74-2	10	330	10,000
51. Fluoranthene	206-44-0	10	330	10,000
52. Pyrene	129-00-0	10	330	10,000
53. Butylbenzylphthalate	85-68-7	10	330	10,000
54. 3,3'-Dichlorobenzidine	91-94-1	10	330	10,000
55. Benzo(a)anthracene	56-55-3	10	330	10,000
56. Chrysene	218-01-9	10	330	10,000
57. bis(2-Ethylhexyl)phthalate	117-81-7	10	330	10,000
58. Di-n-octylphthalate	117-84-0	10	330	10,000
59. Benzo(b)fluoranthene	205-99-2	10	330	10,000
60. Benzo(k)fluorathene	207-08-9	10	330	10,000
61. Benzo(a)pyrene	50-32-8	10	330	10,000
62. Indeno(1,2,3-cd)pyrene	193-39-5	10	330	10,000
63. Dibenz(a,h)anthrace	53-70-3	10	330	10,000
64. Benzo(g,h,i)perylene	191-24-2	10	330	10,000

Specific Quantitation Limits are highly matrix dependent. The Quantitation Limits listed herein are provided for guidance and may not always be achievable.

Table 9.1
Analytes and Reporting Limits (cont'd.)

SEMIVOLATILES	CAS No.	Modified Method 625[2]/8270[3] QL Water ug/L	Modified Method 8270[3] QL Soil ug/Kg	TCLP Method 1311[4] Modified 8270[3] QL Leachate ug/L
1. Acenaphthene	83-32-9	2	40	-
2. Acenaphthylene	208-96-8	2	40	-
3. Anthracene	120-12-7	2	40	-
4. Benzo (a) anthracene	56-55-3	2	40	-
5. Benzo(a)pyrene	50-32-8	2	40	-
6. Benzo(b)fluoranthene	205-99-2	2	40	-
7. Benzo(g,h,i)perylene	191-24-2	2	40	-
8. Benzo(k)fluorathene	207-08-9	2	40	-
9. Benzoic Acid *	65-85-0	2	40	-
10. Benzyl Alcohol *	100-51-6	2	40	-
11. 4-Bromophenyl-phenylether	101-55-3	2	40	-
12. Butylbenzylphthalate	85-68-7	2	40	-
13. 4-Chloro-3-methylphenol	59-50-7	2	40	20
14 (para-chloro-meta-cresol)				
15. 4-Chloroaniline *	106-47-8	2	40	-
16. bis(2-chloroethoxy)methane	111-91-1	2	40	-
17. bis(2-chloroethyl)ether	111-44-4	2	40	-
18. bis(2-chloroisopropyl)ether	108-60-1	2	40	-
19. 2-Chloronaphthalene	91-58-7	2	40	-
20. 2-Chlorophenol	95-57-8	2	40	-
21. 4-Chlorophenylphenylether	7005-72-3	2	40	-
22. Chrysene	218-01-9	2	40	-
23. Di-n-butylphthalate	84-74-2	2	40	-
24. Di-n-octylphthalate	117-84-0	2	40	-
25. Dibenz(a,h)anthracene	53-70-3	2	40	-

QL - Quantitation Limit

* - HSL compound extended analysis required

Specific quantitation limits are highly matrix dependent. The quantitation limits listed herein are provided for guidance and may not always be achievable.

Quantitation limits for soil/sediments are based on wet weight. The quantitation limits calculated by the laboratory are on a dry weight basis and will be higher.

Table 9.1
Analytes and Reporting Limits (cont'd.)

SEMIVOLATILES	CAS No.	Modified Method 625[2]/8270[3] QL Water ug/L	Modified Method 8270[3] QL Soil ug/Kg	TCLP Method 1311[4] Modified 8270[3] QL Leachate ug/L
26. Dibenzofuran	132-64-9	2	40	-
27. 1,2-Dichlorobenzene	95-50-1	2	40	-
28. 1,3-Dichlorobenzene	541-73-1	2	40	-
29. 1,4-Dichlorobenzene	106-46-7	2	40	20
30. 3,3'-Dichlorobenzidine	91-94-1	2	40	-
31. 2,4-Dichlorophenol	120-83-2	2	40	-
32. Diethylphthalate	84-66-2	2	40	-
33. Dimethyl phthalate	131-11-3	2	40	-
34. 2,4-Dimethylphenol	105-67-9	2	40	-
35. 4,6-Dinitro-2-methylphenol	534-52-1	2	40	-
36. 2,4-Dinitrophenol	51-28-5	2	40	-
37. 2,4-Dinitrotoluene	121-14-2	2	40	20
38. 2,6-Dinitrotoluene	606-20-2	2	40	-
39. bis-2 Ethylhexyl phthalate	117-81-7	2	40	-
40. Fluorene	86-73-7	2	40	-
41. Fluoranthene	206-44-0	2	40	-
42. Hexachlorobenzene	118-74-1	2	40	20
43. Hexachlorobutadiene	87-68-3	2	40	20
44. Hexachlorocyclopentadiene	77-47-4	2	40	-
45. Hexachloroethane	67-72-1	2	40	20
46. Indeno(1,2,3-cd)pyrene	193-39-5	2	40	-
47. Isophorone	78-59-1	2	40	-
48. 2-Methylnapthalene *	91-57-6	2	40	-
49. 2-Methylphenol *	95-48-7	2	40	-
50. 4-Methylphenol *	106-44-5	2	40	-

QL - Quantitation Limit

* - HSL compound extended analysis required

Specific quantitation limits are highly matrix dependent. The quantitation limits listed herein are provided for guidance and may not always be achievable.

Quantitation limits for soil/sediments are based on wet weight. The quantitation limits calculated by the laboratory are on a dry weight basis and will be higher.

Table 9.1
Analytes and Reporting Limits (cont'd.)

SEMIVOLATILES	CAS No.	Modified Method 625[2]/8270[3] QL Water ug/L	Modified Method 8270[3] QL Soil ug/Kg	TCLP Method 1311[4] Modified 8270[3] QL Leachate ug/L
51. N-nitroso-di-n dipropylamine	621-64-7	2	40	-
52. N-nitrosodimethylamine	62-75-9	2	40	-
53. N-nitrosodiphenylamine	6-30-6	2	40	-
54. Naphthalene	91-20-3	2	40	-
55. 2-Nitroaniline *	88-74-4	2	40	-
56. 3-Nitroaniline *	99-09-2	2	40	-
57. 4-Nitroaniline	100-01-6	2	40	-
58. Nitrobenzene	98-95-3	2	40	20
59. 2-Nitrophenol	88-75-5	2	40	-
60. 4-Nitrophenol	100-02-7	2	40	-
61. Pentachlorophenol	87-86-5	2	40	20
62. Phenanthrene	85-01-8	2	40	-
63. Phenol	108-95-2	2	40	-
64. Pyrene	129-00-0	2	40	-
65. Pyridine	110-86-1	-	-	20
66. 1,2,4-Trichlorobenzene	120-82-1	2	40	-
67. 2,4,5- Trichlorophenol *	95-95-4	2	40	20
68. 2,4,6-Trichlorophenol	88-06-2	2	40	20

QL - Quantitation Limit

* - HSL compound extended analysis required

Specific quantitation limits are highly matrix dependent. The quantitation limits listed herein are provided for guidance and may not always be achievable.

Quantitation limits for soil/sediments are based on wet weight. The quantitation limits calculated by the laboratory are on a dry weight basis and will be higher.

Table 9.1
Analytes and Reporting Limits (cont'd.)

PESTICIDES/PCBs	CAS No.	CLP SOW 3/90[1] CRQL Water ug/L	CLP SOW 3/90[1] CRQL Soil ug/Kg
1. alpha-BHC	319-84-6	0.05	1.7
2. beta-BHC	319-86-8	0.05	1.7
3. delta-BHC	319-86-8	0.05	1.7
4. gamma-BHC (lindane)	58-89-9	0.05	1.7
5. Heptachlor	76-44-8	0.05	1.7
6. Aldrin	309-00-2	0.05	1.7
7. Heptachlor epoxide	1024-57-3	0.05	1.7
8. Endosulfan I	959-98-8	0.05	1.7
9. Dieldrin	60-57-1	0.10	3.3
10. 4,4'DDE	72-55-9	0.10	3.3
11. Endrin	72-20-8	0.10	3.3
12. Endosulfan II	33213-65-9	0.10	3.3
13. 4,4'DDD	72-54-8	0.10	3.3
14. Endosulfan Sulfate	1031-07-8	0.10	3.3
15. 4,4'-DDT	50-29-3	0.10	3.3
16. Methoxychlor	72-43-5	0.50	17.0
17. Endrin ketone	53494-70-5	0.10	3.3
18. Endrin aldehyde	7421-36-3	0.10	3.3
19. alpha-Chlordane	5103-71-9	0.05	1.7
20. gamma-Chlordane	5103-74-2	0.05	1.7
21. Toxaphene	8001-35-2	5.0	170.0
22. Aroclor-1016	12674-11-2	1.0	33.0
23. Aroclor-1221	11104-28-2	2.0	67.0
24. Aroclor-1232	11141-16-5	1.0	33.0
25. Aroclor-1242	53469-21-9	1.0	33.0
26. Aroclor-1248	12672-29-6	1.0	33.0
27. Aroclor-1254	11097-69-1	1.0	33.0
28. Aroclor-1260	11096-82-5	1.0	33.0

There is no differentiation in the preparation of low and medium soil samples in this method for the analysis of pesticides and aroclors.

Table 9.1
Analytes and Reporting Limits (cont'd.)

PESTICIDES/PCBs	CAS No.	Modified Method 608[2]/8080[3] QL Water ug/L	Modified Method 8080[3] QL Soil ug/Kg	TCLP Method 1311[4] Modified 8080[3] QL Leachate ug/L
1. alpha-BHC	319-84-6	0.10	4.0	-
2. beta-BHC	319-86-8	0.10	4.0	-
3. delta-BHC	319-86-8	0.10	4.0	-
4. gamma-BHC (lindane)	58-89-9	0.10	4.0	2.0
5. Heptachlor	76-44-8	0.10	4.0	4.0
6. Aldrin	309-00-2	0.10	4.0	-
7. Heptachlor epoxide	1024-57-3	0.10	4.0	4.0
8. Endosulfan I	959-98-8	0.10	4.0	-
9. Dieldrin	60-57-1	0.10	4.0	-
10. 4,4'DDE	72-55-9	0.10	4.0	-
11. Endrin	72-20-8	0.10	4.0	2.0
12. Endosulfan II	33213-65-9	0.10	4.0	-
13. 4,4'DDD	72-54-8	0.10	4.0	-
14. Endosulfan Sulfate	1031-07-8	0.10	4.0	-
15. 4,4'-DDT	50-29-3	0.10	4.0	-
16. Methoxychlor	72-43-5	0.5	4.0	20
17. Endrin aldehyde	7421-36-3	0.10	4.0	-
18. Chlordane	57-74-9	1.0	200	20
19. Toxaphene	8001-35-2	1.0	70	20
20. Aroclor-1016	12674-11-2	1.0	70	-
21. Aroclor-1221	11104-28-2	1.0	70	-
22. Aroclor-1232	11141-16-5	1.0	70	-
23. Aroclor-1242	53469-21-9	1.0	70	-
24. Aroclor-1248	12672-29-6	1.0	70	-
25. Aroclor-1254	11097-69-1	1.0	70	-
26. Aroclor-1260	11096-82-5	1.0	70	-

Specific Quantitation Limits are highly matrix dependent. The Quantitation Limits listed herein are provided for guidance and may not always be achievable.

Quantitation Limits listed for soil/sediment are based on wet weight. The Quantitation Limits calculated by the laboratory for soil/sediment, calculated on a dry weight basis, will be higher.

Table 9.1
Analytes and Reporting Limits (cont'd.)

HERBICIDES	Modified Method 509b[6]/8150[3] QL Water ug/L	Modified Method 8150[3] QL Soil ug/Kg	TCLP Method 1311[4] Modified 8150[3] QL Leachate ug/L
1. 2,4-D	0.1	20	20
2. Silvex	0.1	20	2.0
3. 2,4-DB	0.1	20	
4. 2,4,5-T	0.1	20	
5. Dalapon	0.1	20	
6. Dicamba	0.1	20	
7. Dichloroprop	0.1	20	
8. Dinoseb	0.1	20	
9. MCPA	25	5000	
10. MCPP	25	5000	

MISCELLANEOUS ANALYSES	QL	QL
1. PHCs "Fingerprinting"	(ug/L)	(ug/g)
gasoline	100	2
mineral spirits	100	2
kerosene	100	2
#2 Fuel Oil/Diesel	100	2
#4 Fuel Oil	100	2
#6 Fuel Oil	100	2
Lubricating Oil	100	2
coal tar	100	2
2. TPHs (418.1)	2.0 mg/L	100 mg/Kg (20 g sample)
3. Oil and Grease		QL
Infra-red (Method 413.2[7])	2 mg/L	100 mg/Kg
gravimetric (Modified Method 413.1[7])	5 mg/L	250 mg/Kg
4. PCBs in Oil	1 mg/Kg	

QL - Quantitation Limit

Table 9.1
Analytes and Reporting Limits (cont'd.)

Analyte	CLP SOW 3/90[8] CRDL ug/L	CRDL ug/g
1. Aluminum	200	40
2. Antimony	60	12
3. Arsenic	10	2
4. Barium	200	40
5. Beryllium	5	1
6. Cadmium	5	1
7. Calcium	5000	1000
8. Chromium	10	2
9. Cobalt	50	10
10. Copper	25	5
11. Iron	100	20
12. Lead	3	.6
13. Magnesium	5000	1000
14. Manganese	15	3
15. Mercury (HGCVA)	0.2	.04
16. Nickel	40	8
17. Potassium	5000	1000
18. Selenium	5	1
19. Silver	10	2
20. Sodium	5000	1000
21. Thallium	10	2
22. Vanadium	50	10
23. Zinc	20	4
boron	500	100

The CLP CRDL are the instrument detection limits obtained in pure water. The detection limits for samples may be considerably higher depending on the sample matrix.

Table 9.1
Analytes and Reporting Limits (cont'd.)

		TCLP Method 1311[4] Method 6010[3] QL	ICAP Analysis Methods 200.7[7]/6010[3] IDL		Furnace Analysis 7000 Series[3] IDL	
		mg/L	ug/L	mg/kg	ug/L	mg/kg
1.	Aluminum	-	50	10	-	-
2.	Antimony	-	30	6.0	6.0	1.2
3.	Arsenic	0.5	100	20	2.0	0.40
4.	Barium	10.0	10	2.0	-	-
5.	Beryllium	-	1.0	0.20	-	-
6.	Boron	-	100	20	-	-
7.	Cadmium	0.1	3.0	0.60	1.0	0.20
8.	Calcium	-	100	20	-	-
9.	Chromium	0.5	5.0	1.0	2.0	0.40
10.	Cobalt	-	5.0	1.0	-	-
11.	Copper	-	5.0	1.0	1.0	0.20
12.	Hex. Chromium	-	50	0.50	-	-
13.	Iron	-	10	2.0	-	-
14.	Lead	0.5	100	200	2.0	0.40
15.	Magnesium	-	100	20	-	-
16.	Manganese	-	5.0	1.0	-	-
17.	Mercury	0.01	0.2*	0.10*	-	-
18.	Molybdenum	-	100	20	-	-
19.	Nickel	-	5.0	1.0	-	-
20.	Potassium	-	500	100	-	-
21.	Selenium	0.2	100	20	1.0	0.20
22.	Silver	0.1	5.0	1.0	1.0	0.20
23.	Sodium	-	100	20	-	-
24.	Thallium	-	100	20	2.0	0.40
25.	Tin	-	50	10	10	2.0
26.	Vanadium	-	5.0	1.0	-	-
27.	Zinc	-	5.0	1.0	-	-

Instrument detection limits are updated quarterly.

* Mercury analysis by Methods 245.1[7]/7470[3]

Table 9.1
Analytes and Reporting Limits (cont'd.)

Analyte	Quantitation Limits Aqueous		Soil	
1. Acidity	20	mg/L	-	
2. Alkalinity	2.0	mg/L	-	
3. Ammonia	0.10	mg/L	1	mg/Kg
4. Biochemical Oxygen Demand (BOD)	4.0	mg/L	-	
5. Biochemical Oxygen Demand, Carbonaceous (CBOD)	6.0	mg/L	-	
6. Chemical Oxygen Demand (COD)	10	mg/L	-	
7. Chloride	0.10	mg/L	1	mg/Kg
8. Color	5.0	color units	-	
9. Cyanide, Total	0.010	mg/L	0.5	mg/Kg
10. Cyanide, Amenable	0.010	mg/L	0.5	mg/Kg
11. Fluoride	0.10	mg/L	0.5	mg/Kg
12. Hardness	1.0	mg/L	-	
13. Hydrogen Ion (pH)	0.20	pH units	-	
14. Kjeldahl Nitrogen, Total (TKN)	0.5	mg/L	25	mg/Kg
15. Nitrate	0.10	mg/L	1	mg/Kg
16. Nitrate/Nitrite	0.020	mg/L	0.2	mg/Kg
17. Organic Carbon, Total (TOC)	0.10	mg/L	-	
18. Orthophosphate	0.010	mg/L	0.1	mg/Kg
19. Phenols	0.010	mg/L	0.2	mg/Kg
20. Phosphorus, Total	0.010	mg/L	1	mg/Kg
21. Residue, Total (TS)	5.0	mg/L	-	
22. Residue, Non-Filterable (TSS)	5.0	mg/L	-	
23. Residue, Settleable	0.10	mg/L/hour	-	
24. Residue, Volatile (TVS)	5.0	mg/L	-	
25. Residue, Filterable (TDS)	5.0	mg/L	-	
26. Specific Conductance	5.0	umho/cm2	-	
27. Sulfate	0.5	mg/L	4	mg/Kg
28. Sulfide	1.0	mg/L	10	mg/Kg
29. Sulfite	5.0	mg/L	-	
30. Turbidity	0.50	units	-	

Limits of detection may vary with sample matrices.

10.0 CALIBRATION PROCEDURES AND FREQUENCY

This section describes the calibration procedures and frequency for the instrumentation which will be used in the determination of the parameters of interest.

10.1 Laboratory Standards

Materials used for calibration, internal standards and surrogate standards will be of the highest purity available and will be obtained through the U.S. Environmental Protection Agency Pesticide and Industrial Chemicals Repository or a suitable commercial source. The calibration procedures outlined here are those routinely used in the laboratory. The frequency of calibration is also included in Table 7.1.

10.2 Standards Traceability

All materials, whether high purity bulk materials or prepared solutions, will have the following information, at a minimum, recorded into an analytical standards logbook: identity, supplier, catalog number, production lot number, date received, reported purity or concentration, and expiration date. This information will be recorded when the material is received, or no later than the first time the material is used.

All analytical standards and spiking solutions will have a unique identification consisting of a name, number and the preparation or received date. This identification will be clearly recorded on the label of any bottle containing this material. By consistently using this identification, the material can be traced back to the original source material.

Documentation of all standard preparations will be recorded in logbooks. The volume and numerical reference of all analytical standards or spiking solutions used in the preparation of another standard will be recorded in the standard preparation logbook.

All calibration standards must be verified against and independently prepared standard from a second manufacturer, or a different lot from the same manufacturer.

10.3 GCMS Calibration Procedure

The full calibration procedure outlined below is performed initially and then again whenever the criteria for the continuing calibration check are not met. The tuning procedure is done every 12 hours for as long as the calibration is valid, and prior to an initial calibration.

1. At the beginning of each shift that volatile organics analyses are performed, the GC/MS system must be checked to verify that acceptable performance criteria are obtained for bromofluorobenzene (BFB). The performance test must be passed before analyzing any samples, blanks or standards. A tune with decafluorotriphenyl phosphine (DFTPP) is used prior on instruments dedicated to semivolatile analyses.

2. Analyze a five point initial calibration sequence using standards prepared following EPA protocols. Calibration check compounds (CCCs) criteria must be met before sample analysis may begin.

3. Analyze a continuing calibration check standard prepared following EPA procedures. If the CCC and System Performance Check Compounds (SPCC) do not meet the criteria stated in the CLP SOW 3/90 (OLM01.2), the source of the problem must be identified and corrected before sample analysis can begin. If these criteria cannot be met, the instrument must have a new initial calibration performed following any necessary maintenance.

4. Record all values for the initial and subsequent calibration verifications.

10.4 Gas Chromatograph Calibration Procedures

A full initial calibration procedure is done when continuing calibration criteria are not met or when any major change in instrument hardware or instrument parameters is made.

1. Analyze a Resolution Check Mixture standard to ensure that the following criteria is met: The depth of the valley between two adjacent peaks must be greater than or equal to 60% of the height of the shorter peak.

2. Analyze a Performance Evaluation Mixture to check endrin and DDT breakdown which must not exceed 20% for either compound or 30% for combined breakdown:

3. Analyze Arochlor and toxaphene standards. One concentration of each is analyzed and the retention time and calibration factor for each is determined using a set of 3-5 major peaks.

4. Analyze 3 concentrations of Individual Standard Mixtures (5 concentrations for SW846 analyses) containing all of the target list pesticides. The linearity of each compound is determined by calculating the %RSD of the calibration factors. The RSD for each compound should not exceed 20%. (Up to two compounds per column can exceed 20% , but must be less than 30% RSD.)

5. Analyze an Instrument Blank. The concentration of any target analyte in this blank must be less than .5 X CRQL.

6. Analyze a Performance Evaluation Mixture. The calculated concentrations of each analyte in this mixture should be within 75-125 % of the expected value. The breakdown products, retention time window drift, and peak resolution are also checked. Peaks in the Performance Evaluation Mixture must be 100% resolved. Retention times must fall within the windows specified in the CLP SOW for each compound using the mean retention time from each of the Individual Mixes as the center of each window.

7. Samples are run once all of the above standards are run and the acceptance criteria are met.

8. No later than 12 hours after the injection of the Instrument Blank, another Instrument Blank followed by the medium level of each of the Individual Standard Mixtures must be run to assess the validity of the continuing calibration. The blank results must be as specified in step #6 above, and the individual standard mixture results must be within 25% of the expected value for each analyte. Resolution between peaks must be > 90%.

9. If the continuing calibration check (step 9 above) meets the acceptance criteria specified sample analysis may continue for another 12 hours (from the time of the Instrument Blank injection) before repeating the continuing calibration check this time using a Performance Evaluation Mixture rather than the Individual Standard Mixtures.

10. Continue analyzing samples and checking the continuing calibration alternately using both Individual mixtures and the Performance Evaluation Mixture

10.5 ICP Calibration Procedure

1. Calibrate the instrument using a blank and one concentration of each element.

2. After the calibration standards are run, verify the initial calibration for each element of interest using an EPA Quality Control concentrate or other independent standard at a concentration within the calibration range. If the reported values for the calibration check sample exceed the control limits of 90-110% expected value, the analysis is terminated and corrective action taken.

3. Once the system is satisfactorily calibrated, verify the low end of the calibration with an initial calibration blank. The result of this blank analysis must be ± 5x the IDL for for each element of interest for commercial work or ± CRDL for CLP analyses.

4. To assure calibration accuracy throughout each analysis run, the calibration check standard must be analyzed after each set of 10 analyses. The calibration check sample is also analyzed after the last analytical sample. If the calibration check sample is out of the control limits of 90-110% expected value, the analysis must be terminated and the instrument recalibrated. All samples analyzed since the last in control calibration check must be reanalyzed.

5. To assure low end stability, a blank must be run after each continuing calibration verification sample. The result of the blank analysis must be ± the detection limit of each element of interest.

6. All values for the initial and subsequent calibrations are reported on a computer generated print out of the analytical sequence.

10.6 Graphite Furnace Calibration Procedure

1. Calibrate the instrument beginning with a blank and three standards, working toward the highest standard.

2. After the system is calibrated, verify the initial calibration for each element of interest using an EPA Quality Control concentrate or other independent source at a concentration within the calibration range. The result of the ICV should be within 10% of the expected value. If it is not, the analysis must be terminated and corrective action taken.

3. Once the system is satisfactorily calibrated, verify the low end of the calibration with an initial calibration blank. The result if this blank analysis must be ± 5X the IDL for each element of interest for commercial work and ± CRDL for CLP analyses.

4. To assure calibration accuracy throughout each analysis run, the calibration check standard must be analyzed at a frequency of 10% or every 2 hours during an analysis run, whichever is more frequent. The calibration check sample is also analyzed after the last analytical sample. If the calibration check sample is outside the control limits of 90-100% expected value, the analysis must be terminated and the instrument recalibrated. All samples analyzed since the last time the calibration check was in control must be reanalyzed.

5. To assure low end stability, a blank must be run after each continuing calibration verification sample. The result of the blank analysis must be ± the detection limit of each element of interest.

6. All calibration quality control sample results will be printed on the computer generated analysis run information.

10.7 pH Meter Calibration

1. Perform an initial operating check of the electrode and meter according to manufacturer's instructions.

2. Calibrate the meter according to the operating instructions. Use the standards prepared above.

3. Analyze a quality control standard to verify instrument calibration.

4. Record all values for initial and subsequent calibration verifications.

10.8 Auto-Analyzer

1. Calibrate the instrument using the blank and the standards.

2. After the instrument is calibrated verify and document the initial calibration using an EPA quality control concentrate or other independent standard at a concentration other than that used for calibration but within the calibration range.

3. If the reported values for the calibration check sample exceed the control limits, the analysis is terminated and the problem corrected.

4. To assure calibration accuracy throughout each analysis sequence, the calibration check standard must be analyzed at a frequency of 10%. The calibration check sample is also analyzed after the last sample in the sequence. If the calibration check sample is outside the control limits, the analysis must be terminated and the instrument recalibrated. All samples analyzed since the last time the calibration check was in control must be reanalyzed.

10.9 Total Organic Carbon Analyzer Calibration Procedure

1. Calibrate the instrument according to the procedures in the manufacturer's operating manual.

2. Use these working standards at the start of each analysis day to verify that the instrument is functioning properly.

3. Analyze an EPA quality control concentrate or other appropriate laboratory control sample. If the results are within the established control limits, the analysis may proceed.

4. Document all standard preparations and instrument operating parameters.

10.10 Ion Chromatograph Calibration Procedures

1. Calibrate the instrument beginning with the blank and working toward the highest standard.

2. After the system is calibrated, verify and document the initial calibration for each analyte of interest using an EPA Quality Control concentrate or other independent standard at a concentration other than that used for calibration but within the calibration range.

3. If the reported values for the calibration check sample exceed the control limits, the analysis is terminated and the problem corrected.

4. To assure calibration accuracy throughout each analysis run, the calibration check sample must be analyzed at the frequency specified in Table 5.3. The calibration check sample must also be analyzed after the last analytical sample. If the calibration check sample is outside the control limits, the analysis must be terminated and the instrument recalibrated. All samples analyzed since the last time the calibration check sample was in control must be reanalyzed.

5. Record all values for the initial and subsequent calibration verifications.

10.11. Mercury Analyzer Calibration Procedure

1. Calibrate the instrument beginning with the blank and working toward the highest standard.

2. After the system is calibrated, verify and document the initial calibration using an EPA Quality Control concentrate or other independent standard at a concentration other than that used for calibration but within the calibration range.

3. If the reported values for the calibration check sample exceed the control limits, the analysis is terminated and the problem corrected.

4. To assure calibration accuracy throughout each analysis run, the calibration check must be analyzed at a frequency of 10% or every 2 hours during an analysis run, whichever is more frequent. The calibration check sample is also analyzed after the last sample. If the calibration check sample is outside the control limits, the analysis must be terminated and the instrument recalibrated. All samples analyzed since the last time the calibration check was inside the control limit must be reanalyzed.

10.12 Analytical Balances Calibration

Each analytical balance is calibrated each day of use by weighing at least 3 weights in the appropriate the range of intended use. and certifying that the balance is capable of accurately determining the weight to one decimal point beyond what the intended use requires. The weight sets maintained in the laboratories are checked periodically against a set of Class S certified weights maintained by the QA Coordinator. Daily calibration information is kept in a logbook for each balance, and QA maintains records of its weights inspections. In addition, all analytical balances are under manufacturer service contracts and are inspected by a certified service representative yearly.

10.13 Oven Temperature Check

Two separate types of ovens are maintained for the analysis of samples. Each oven is vented and has an exhaust fume hood. One is used for low temperature (<200°C) desiccation and evaporation. This oven has a thermoelectric potentiometer to maintain operating temperature. The temperature is monitored daily with a laboratory grade mercury thermometer and that information is recorded in a logbook.

The other oven is a muffle furnace used for volatile solids and ash determinations. This furnace operates at high temperatures (>200°C) +2°C. The oven temperature is monitored on each day of use and the information is recorded in a log book. Thermometers are calibrated against precision thermometers certified by the National Bureau of Standards. All calibration information is recorded and each thermometer is given a unique ID.

10.14 Refrigerator Temperature Check

Refrigerators are kept at a constant 4° C as measured by a calibrated thermometer. The temperature is monitored at least once daily and this information is recorded in a refrigerator specific log book. Thermometers used to monitor refrigerator temperatures are immersed in water to ensure readings that are representative of sample and extract temperature conditions.

11.0 GLASSWARE WASHING

Glassware from each group must be separately maintained in order to avoid contamination. There are designated work areas in the dishwashing room for inorganics and organics glassware, and each glassware technician is assigned to only one department at a time.

In addition,

- Glassware containing soil from samples should be rinsed into a waste container -- <u>not</u> down the drain.
- Glassware which has been moistened by organic solvents should be allowed to air-dry in a hood before being rinsed.

11.1. Inorganic Glassware

All volumetrics, graduated cylinders, pipettes, beakers, glass and plasticware used in the trace metal or priority pollutant analyses are cleaned by the following procedures:

1. Remove visible dirt by washing with tap water
2. Wash glassware/plastic ware with tap water and glassware soap using scrub brushes. The automatic dishwasher can also be used if available. If the dishwasher is used two rinse cycles are necessary to remove all soap.
3. Rinse hand washed items thoroughly with tap water.
4. Alternately acid and DI rinse in the following order:

   1:1 HNO_3
   DI water
   1:1 HCl
   DI water

   This should be done in a sink with an acid trap.

5. All beakers and watchglasses must be acid refluxed on a hot plate for one hour using 10 ml of concentrated HNO_3. This is done in the laboratory hood by the glassware technician.
6. Rinse all glass/plastic ware (including the beakers and watchglasses that have been acid refluxed) three times with deionized water.
7. Allow glass/plastic ware to dry in clean hood.
8. Store clean plasticware in plastic bags.

11.2 Organic Glassware

1. Rinse the glassware at least twice with water prior to washing. Use brush to loosen any visible dirt from surface.

2. Wash fragile and large pieces with soap and water in the dishroom sink using scrub brushes.

3. Any item that is not too fragile or large can be washed in the automatic dishwasher. Make sure that all items are placed securely and that no items will bump into each other. NOTE: Do not put small plastic items in the dishwasher. This will cause jamming and possible breakage of the machine.

4. Add 1/3 cup of granular soap to the dishwasher and allow it to run full cycle.

5. All glassware, handwashed and dishwasher washed, must be methanol rinsed. This is done by the glassware technician in the fume hood. The waste is collected for disposal in the appropriate waste solvent drum.

6. Glassware is allowed to dry in the dish room hood and then is returned to the laboratory drawers.

7. Prior to initiating any procedures, the laboratory analyst must rinse all glassware with methylene chloride at least three times.

8. If another solvent is going to be used in the glassware, an additional rinse with that solvent should be done after the methylene chloride rinses.

12.0 QUALITY CONTROL SAMPLES

Several different types of QC samples are used to document the validity of the generated data. Quality control objectives and QC frequencies are outlined in Table 7.1. The following are definitions of the various types of QC samples routinely incorporated into analyses.

12.1 Blank Samples

a. Field Blank - (Equipment Blank, Rinsate Blank) A sample of laboratory deionized water which proceeds through all the sample collection equipment after the equipment has been decontaminated. Field blanks should be collected once during a sampling event.

b. Trip Blank - A sample of laboratory water which is placed in an appropriate sample container, handled in the same manner as field samples, and returned to the laboratory with the samples, to assess the possible contamination introduced in transport.

c. Holding Blank - A sample of laboratory water or solid matrix which is placed in an appropriate sample container and stored along with the samples in the refrigerator or storage container to asses any contamination which may be introduced in storage.

d. Method Blanks - A sample of laboratory water or suitable solid matrix that is carried through the entire analytical procedure (digested or extracted, and analyzed). These blanks are handled using the same reagents, surrogates, etc. as the samples in order to assess possible contamination during the analytical process.

e. Calibration Blanks - A sample of laboratory DI water or solvent containing the same reagents at the same concentration as the calibration standards. This blank is used to "zero" the instrument.

12.2 Spiked Samples

a. Surrogate Spike (SS) - Compounds which are added to every blank, sample, matrix spike, matrix spike duplicate and standard in order to evaluate the analytical efficiency of the method in individual sample matrices. The surrogate compounds are chemically similar to the target compounds.

b. Analytical Spike (AS) - An aliquot of digested sample into which a known amount of compound is added. The analytical spike is analyzed immediately and the recovery is calculated in order to assess the matrix efffect on the analytical system.

c. Blank Spike - Also called an LCS , this is a volume of laboratory deionized water or clean solid matrix into which a known amount of compound is added. The blank spike is subjected to the entire analytical procedure, and the percent recovery of the spiked compounds is calculated in order to assess the efficiency of the extraction and analysis.

d. Matrix Spike (MS) - (Digestion Spike) An aliquot of sample (water, soil, or sludge) into which a known amount of compounds are added. The matrix spike is subjected to the entire extraction and analytical procedure. The percent recovery of the spiked compounds is calculated in order to assess the appropriateness of the method for that matrix.

e. Matrix Spike Duplicate (MSD) - A second aliquot of the same sample as the the matrix spike that also has a known amount of compound added and is taken through the entire procedure. The percent recoveries of the spiked compounds for both the matrix spike and the matrix spike duplicate are compared in order to assess the precision of the method for that matrix.

12.3 Initial Calibration Verification Standard (ICV)

An independent reference standard made from a source different than that of the calibration standards, which is run after each calibration of an instrument to verify that the instrument and standards are operating properly.

12.4 Continuing Calibration Verification Standard (CCV)

An analytical standard which is run at a specified frequency (e.g. every 10 samples, or every 2 hours, etc.) to verify the calibration of the analytical system.

12.5 Duplicate Samples

A second aliquot of a sample which is carried through sample preparation and analysis procedures to verify the precision of the analytical method for that matrix.

12.6 Internal Standards (IS)

Compounds added to every standard, blank, matrix spike, matrix spike duplicate, sample (for VOA), and sample extract (for semi-VOA) at a known concentration prior to the analysis. The internal standards are used as the basis for quantitation of the target compounds.

12.7 Interference Check Standard (ICS)

An standard used in ICAP analysis that contains low concentrations of analytes of interest, and high concentrations of interfering elements. The ICS is run at the beginning and at the end of an analysis sequence to ensure that the procedures used to eliminate interfering responses are operating properly.

13. CONTROL CHART PROGRAM

Control charts are an important and useful part of a QA/QC program. They are also regarded as a significant tool of a total quality management (TQM) program. In addition to containing a large amount of information of the performance of a process over time, the visual aspect of a control chart allows this information to be expediently understood and used. A control chart is able to display trends in the performance of the system and when these trends are detected they can often be addressed before more serious events occur.

13.1 General Policy for Control Charts

1. Control chart must reflect the actual performance of the system. What is charted must be relevant to the system performance. The information must be timely so that trends can be detected in a proactive manner before the process gets completely out of control and a large amount of unacceptable "product", is produced. For an environmental testing laboratory the product is analytical results. These results must be accurate, precise, representative, and comparable to be useful to the client.

2. Presently the NET Cambridge control chart program is based on laboratory control samples (LCS) and method blank surrogate recoveries. An LCS is a clean sample matrix spiked with (or containing) a known amount of certain target analytes. The advantage of using an LCS is that the LCS is carried through the entire analytical process, both samples preparation and analysis, along with the client samples. The recovery of target analytes in the LCS is indicative of the performance of the analytical system, apart from any effects from field sample matrices. For metals, mercury, wet chemistry, pesticides, and PCBs the LCS containing target analytes or elements is used. For volatiles and semivolatiles the surrogates in the blank are plotted on the control charts.

3. Another important aspect of the NET Cambridge control chart program is analyst involvement. To be truly useful, the personnel involved with carrying out the analyses must know how the system is performing. By this direct involvement they will participate in detecting out-of-control conditions and will be actively responsible for correcting any conditions causing the analytical system to perform poorly.

13.2 Types of Control Charts Used

A control chart is a graph of a quality control parameter over time. As currently defined the Control Chart Program will use what are referred to as "X" charts since the individual observations are plotted. The charts will contain all LCS or blank surrogate recoveries for a given analysis and matrix (water or soil) with no averaging or sub-sampling. All out of control LCS values are to be included on the control charts but will not be used in the calculation of limits if there is an assignable cause. In addition to the individual data points, and a line connecting these points, the chart will also contain the following horizontal lines:

- Upper control limit (UCL) -- the mean plus three standard deviations as calculated from a representative set of 25 data points

- Lower control limit (LCL) -- the mean minus three standard deviations as calculated from a representative set of 25 data points

13.3 Analyses Charted

Metals EVERY LCS for all furnace metals, at least 3 ICP metals, and mercury (except those LCSs that are associated with unacceptable calibration QC) each matrix plotted separately

- plotted by digestion date and digestion batch ID

CN EVERY CYANIDE LCS recovery for each matrix separately (Since there are many ways to do cyanide we have decided to plot only the types of analyses that are used for CLP type work, i.e., no physiological or DEP cyanide).

- Plotted by preparation/analysis date

VOA ALL 3 SURROGATES IN EVERY METHOD BLANK ON EVERY INSTRUMENT, each matrix plotted separately,

- plotted by run file ID indicating instrument and date of analysis

SemiVoa ALL 6 SURROGATES IN EVERY METHOD BLANK ON EVERY INSTRUMENT, each matrix plotted separately

- plotted by extraction date

Pest. EVERY LCS RECOVERY OF DDT AND HEPTACHLOR except those associated with unuseable initial calibrations, each matrix plotted separately

- plotted by extraction date

PCBs EVERY LCS RECOVERY OF PCB 1260 and 1016 except those associated with unuseable initial calibrations, each matrix plotted separately

- plotted by extraction date

TPH EVERY LCS RECOVERY except those associated with unuseable initial calibrations, each matrix plotted separately

- plotted by extraction date

13.4 Generating Control Charts

Control charts are prepared by using SQC a statistical software accessed through the network There are several choices in the Software which affect the style and content of control charts. The user is allowed some flexibility but all control charts must meet the following criteria:

- The vertical axis (y-axis) of the chart is for the LCS recovery, in percent. The range must encompass the lower and upper allowable limits as defined by the analytical method. The horizontal axis (x-axis) is for the date of LCS preparation (or analysis for volatiles).
- Each chart must be identified by the analyte or element being plotted and the appropriate matrix.
- There should be only one LCS type per chart.
- The points on the chart must be identified by date and be accompanied by their corresponding recovery value.

13.4 Interpreting Control Charts

As the chart is updated, the person preparing the chart is responsible for examining the chart for the out-of-control conditions defined below. Any out-of-control conditions are to be reported immediately to the Supervisor, and a documented corrective action investigation must follow.

- Any one point is outside the control limits (above the UCL or below the LCL).
- Any seven consecutive points are on the same side of the mean.
- Any seven consecutive points are successively larger, or smaller, than its immediate predecessor.
- Any obvious cyclic pattern is seen in the points.

13.5 Review of Control Charts

On a weekly basis, the chart is to be reviewed by the Supervisor. This will include seeing that the chart is up to date, is being properly prepared, and that no out-of-control conditions have been overlooked by the analyst.

On a monthly basis, the chart is to be reviewed by the Section Manager. This will include seeing that the chart is up to date, is being properly prepared, and that no out-of-control conditions have been overlooked by the analyst. The Section Manager will ensure that a laboratory non-conformance report is filed for any out-of-control conditions. At this time the Section Manager will ensure that the current control charts are provided to the QAC for inclusion in any required internal or external QA reports (e.g. Monthly Progress Reports).

On a quarterly basis, the Control Chart Program will be reviewed by the QAC and the Laboratory Director. At this time the need for changes in the program will be considered.

13.6 Responding to Out of Control Conditions

All out of control conditions noted from control charts need to be documented, reported, and investigated. The proper format for this report is the "Laboratory Non-Conformance Report".

Only LCS or blank surrogate recoveries that exceed the allowable limits defined by the method protocol will result in decisions to reject sample data. These recoveries should still included in the control charts, with an annotation that this point should not be included in any recomputed control limits.

14.0 CORRECTIVE ACTION

An important part of any quality assurance program is a well-defined effective policy for correcting problems. NET Cambridge employs a corrective action system which operates under the direction of the Division QA Coordinator. While the entire quality assurance program is designed to avoid problems, it also serves to identify and correct the problems that do exist. Usually these quality problems fall into two categories, immediate corrective action or long-term corrective action.

14.1 Immediate Corrective Action

Specific quality control limits are in place to help analysts recognize the need for corrective action. Any quality control indicators that are outside of the acceptable criteria presented in Table 7.1 require some form of corrective action. Often an analysts experience will allow him/her to initiate immediate corrective action at the bench level. All that is required in these instances is that the incident be documented in the sample preparation or analysis record.

14.1 Long Term Corrective Action

The need for more formal corrective action may be identified by performance evaluation sample results, control chart trends, or internal or external audits. Any quality problem which cannot be solved by immediate corrective action falls into this category. The Division Quality Assurance Coordinator is responsible for managing the corrective action process for long term corrective actions. The Quality Control Coordinator may,with the support of the Division Manager,delegate responsibilities for investigating problems and implementing solutions to appropriate operational groups or individuals.

The essential steps in the closed loop corrective action system are:

- identification of the problem;
- assignment of responsibility for investigating the problem;
- determination of the cause of the problem through investigation;
- formulation of a corrective action plan;
- monitoring the effectiveness of the corrective action plan;
- verifying the elimination of the problem; and
- documenting the processes involved in the above.

14.3 Documentation of Corrective Actions

The documentation of corrective actions and the maintenance of all corrective action reports is the responsibility of the QA Coordinator. The documentation consists of a logbook containing the following:

- corrective action form (see Figure 14.1)
- a brief description of the problem
- analyses or operation affected
- location of further documentation such as a case or job folder
- date when corrective action completed

Figure 14.1
Corrective Action Form

NET Atlantic Inc. Cambridge Division
22 Oak Park Bedford, MA 01730
(617) 275-3535

Analysis	Origin/Nature of Problem	Communication
_____ Volatiles	_____ Scope	Discovered_____
_____ Semivolatiles	_____ Receiving	By_____
_____ Pesticides	_____ Login	Dates reported to:
_____ Wet	_____ Sample prep	_____ supervisor (or manager
_____ Metals	_____ Analysis	_____ project mgr
_____ oil and grease	_____ Reporting	_____ QA
_____ TPH	_____ Other	_____ Client

1) Description of Problem:

_____

_____

_____

_____

_____

2) Which samples were affected and how?

_____

_____

_____

_____

3) Corrective Action taken: Date of Corrective Action:_____

_____

_____

_____

_____

_____
Laboratory Manager

_____
Laboratory Director

_____
Laboratory QA Coordinator

cc.
QA file
sample record
NPR

15.0 DATA EVALUATION, AND REPORTING

15.1 Data Reduction

Analysis results will be reduced to the concentration units specified in the analytical procedures using the equations provided in the analytical references listed in Section 9. These calculations are an integral part of the analysis and as such are the responsibility of laboratory analysts. All calculations will be checked by laboratory supervisors. Laboratory managers will routinely check approximately 10% of all data for valid QC. The full data set is checked for completeness by the project manager.

15.2 Data Evaluation

Data evaluation is the process by which analytical data are accepted or rejected based on a set of criteria. NET-Cambridge personnel use the following criteria in the evaluation of laboratory data:

- use of published or approved analytical procedures;
- use of properly operating and calibrated instruments;
- precision and accuracy achieved comparable to that achieved in similar analytical programs;
- precision, accuracy and blank contamination meeting project specific criteria outlined in Table 5.2 and 5.3;
- completeness of the data set.

All data will be evaluated by laboratory supervisors prior to being released for reporting purposes to the NET project manager. The persons evaluating the data will have sufficient knowledge of the technical work to identify questionable values. All analyses requiring CLP protocols will be evaluated in accordance with the requirements of those protocols. Occasionally a result is found that does not meet the specified criteria for evaluation. The reporting of such a result and its associated samples is decided on a case by case basis by the laboratory manager, who is also responsible for providing a narrative documenting the event and the decision.

15.3 Data Review Process

The flow charts below depicts the analytical data reduction, evaluation and reporting process. Personnel who will handle data gathering and evaluation are shown in the Division Organization Chart (Figure 1.1).

Figure 15.1
GC and GC/MS Commercial Analysis Data Review

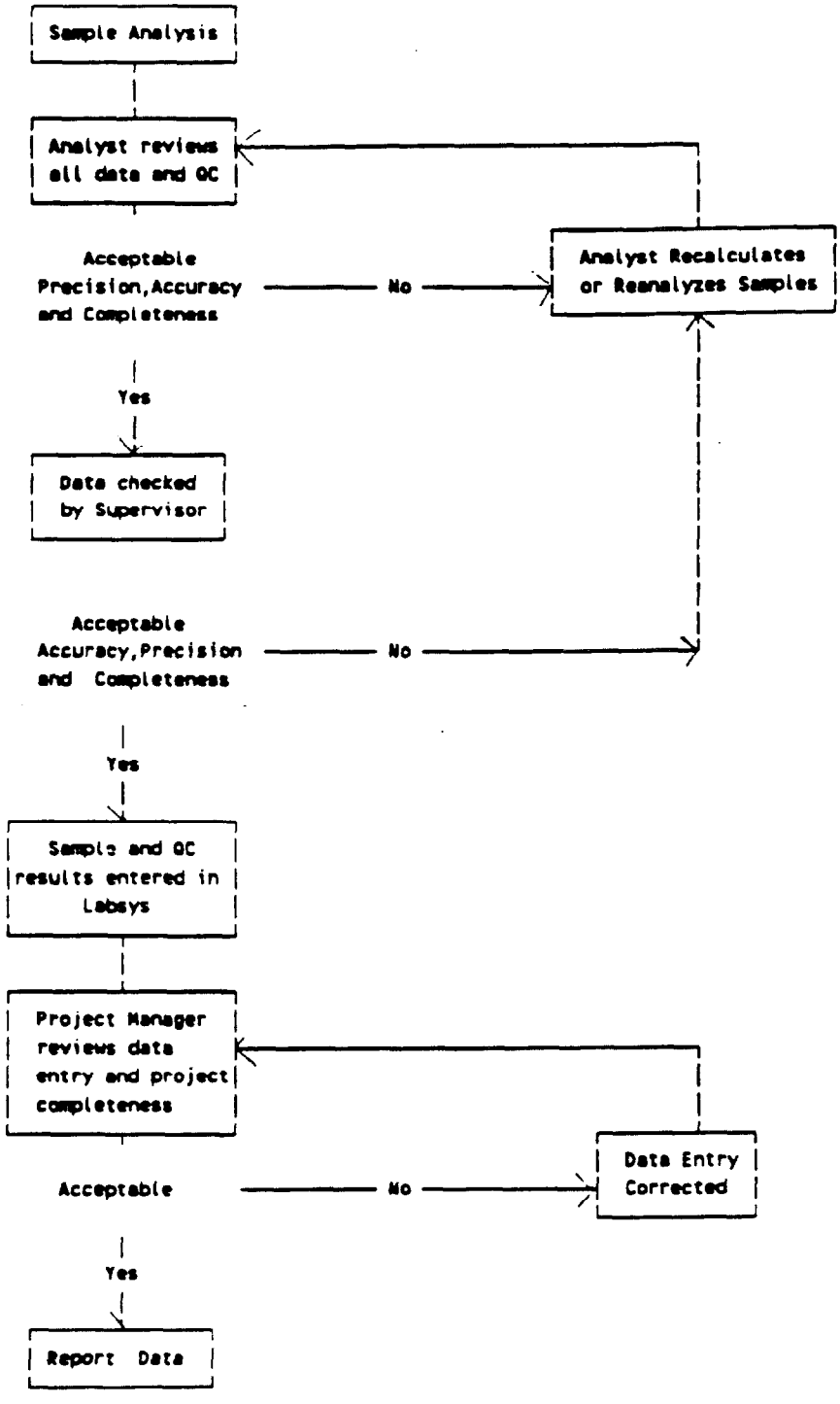


Figure 15.2
GC and GC/MS CLP Analyses Data Review

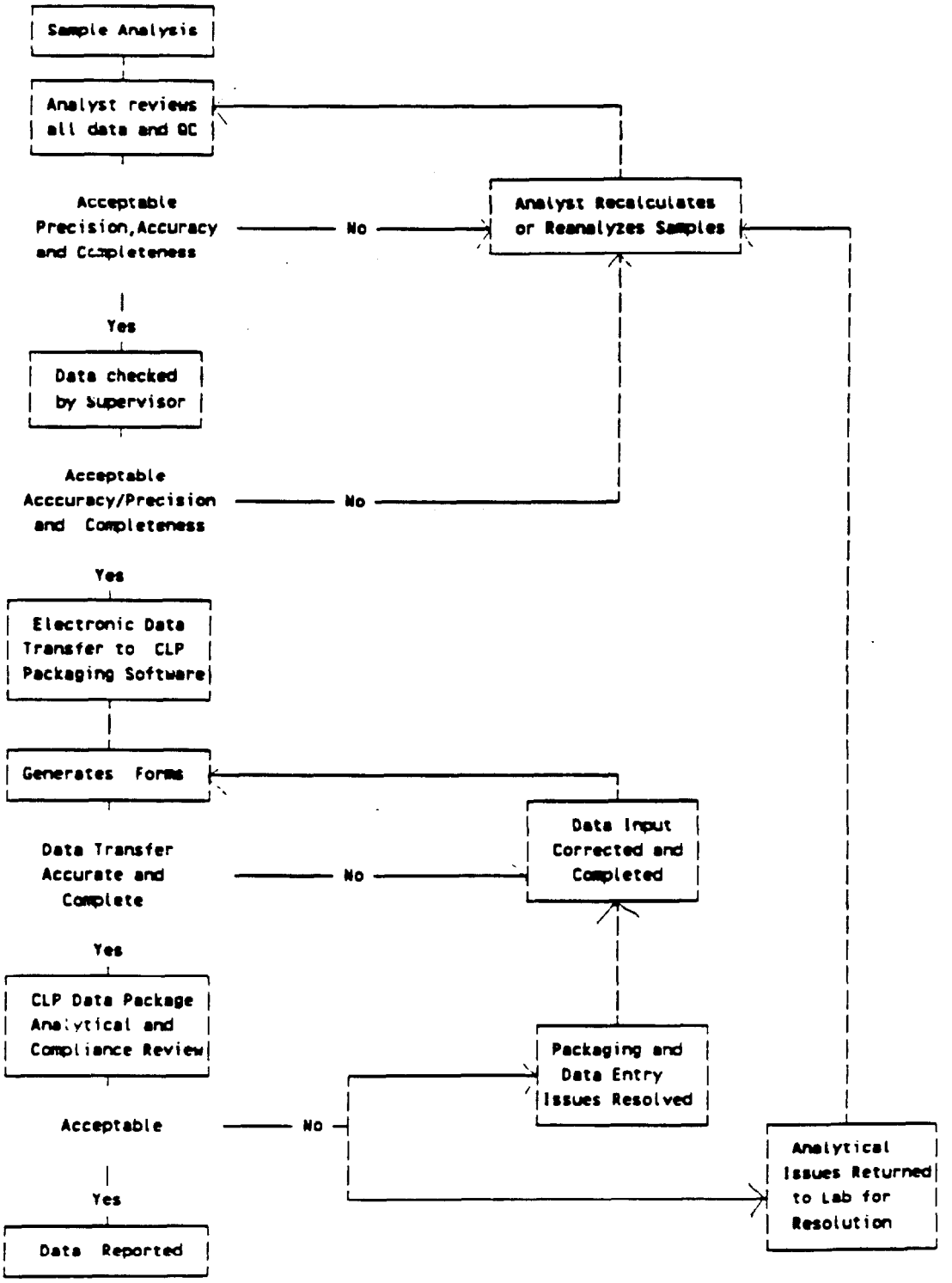


Figure 15.3
Metals CLP Data Review

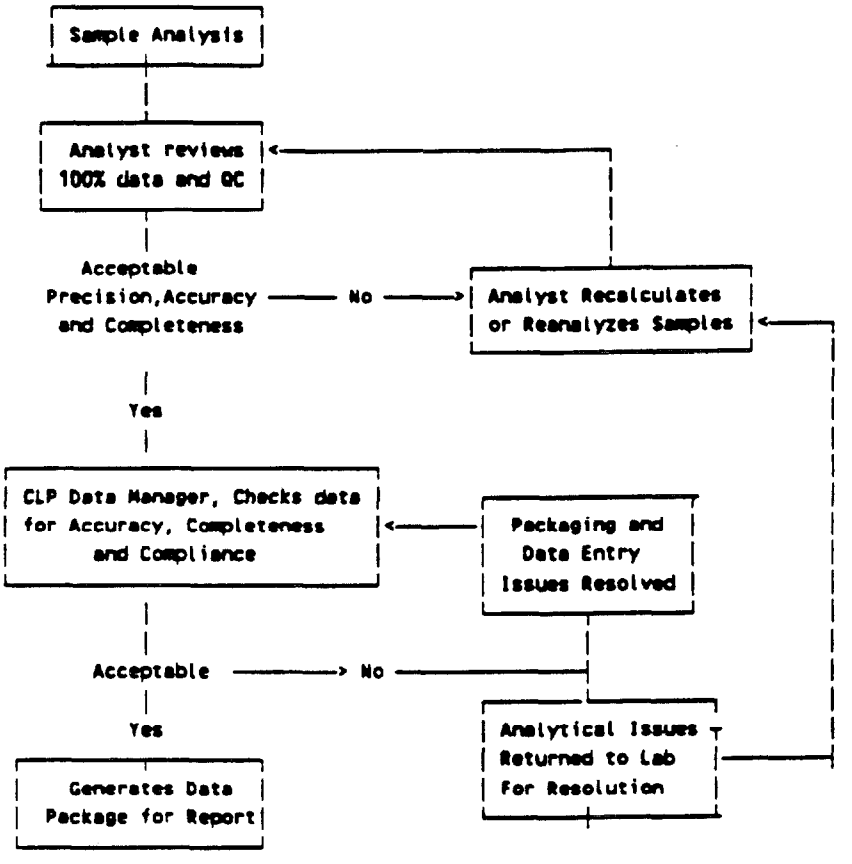


Figure 15.4
Conventional Chemistry Data Review

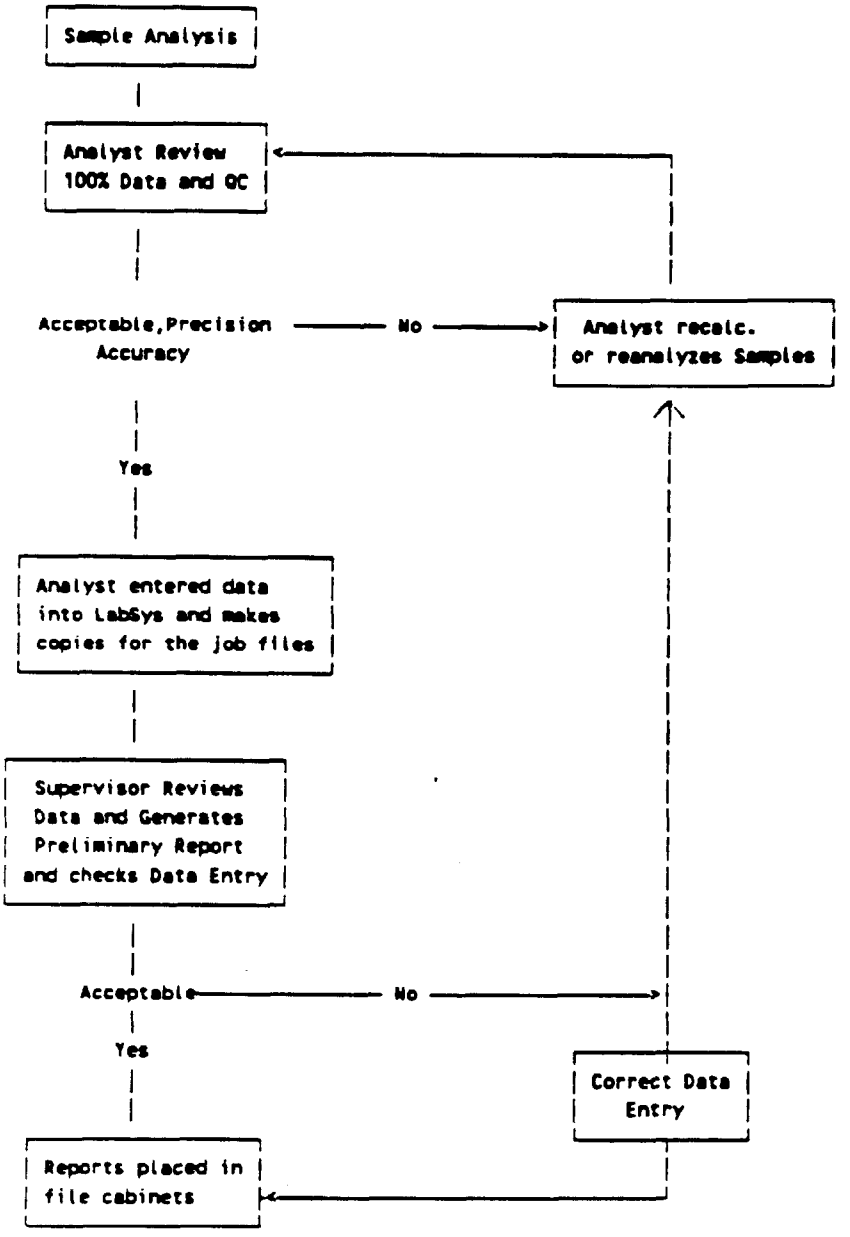
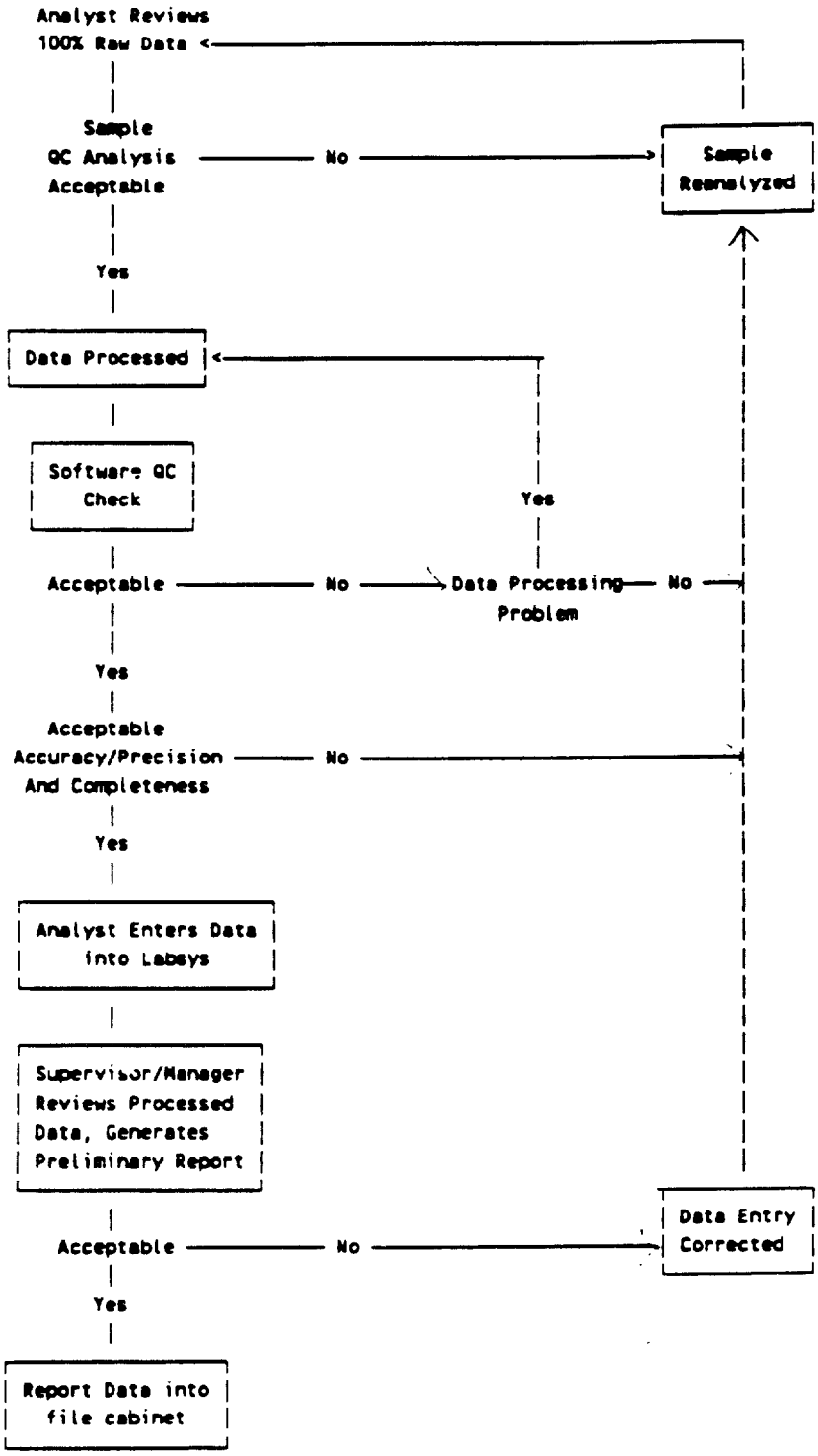


Figure 15.5
Metals Commercial Data Review



15.4 Data Reporting

NET uses a Laboratory Information Management System for tracking and reporting of analysis data.

A standard report includes:

- cover page;
- sample results;
- statement of methods for each parameter;
- date of sample receipt;
- initialed chain of custody form;
- minimum detection limits for each method;
- sample extraction and analysis dates; and
- case narrative summarizing any problems or corrective actions associated with the case.

CLP data are reported using CLP specified forms and in CLP protocol format. NET Cambridge uses a custom designed data management system for reporting CLP inorganics data. This system transfers data from dedicated microprocessors on each instrument to a central computer for storage and processing. CLP Organics data are screened for compliance by Finnigan's Q/A-Formaster II system which produces reports in CLP organics format.

16. AUDITS AND APPROVALS

16.1 System Audits

A system audit is an evaluation of the laboratory's quality assurance practices and operating procedures. This audit consists of an on-site review of the laboratory's quality assurance systems and its physical facilities. At least one department or operation is auditted each month by the Cambridge Quality Assurance Coordinator, and annual systems audits are conducted by the NET Director of Data Quality. External audits by government agencies and clients are performed as required. NET-Cambridge will cooperate with all requests for on-site audits performed by the client.

The audit may include several or all of the components listed below:

- Personnel, facilities and equipment;
- Chain-of-custody procedures;
- Instrument calibration and maintenance;
- Standards preparation and verification;
- Analytical procedures;
- Quality control procedures;
- Data handling procedures;
- Documentation control procedures.

16.2 Performance Audits

Performance audits provide a systematic check of laboratory data quality and measurement systems. For maximum usefulness two types of performance evaluation samples are employed, single blind and double blind.

<u>Single-blind</u> - a sample which is known by all concerned to be a PE and only the values are unknown. The results of these samples are useful in determining technical systemic problems within the operating group.

<u>Double-blind</u> - a sample that appears to be a client sample its identity and values are both unknown to the laboratory. Double blind samples are useful in identifying technical systemic problems, random analytical problems, and non-technical systemic problems.

NET-Cambridge routinely participates in single-blind laboratory performance evaluations for the U.S. EPA as part of the Water Supply (WS) and Water Pollution (WP) programs, and similar programs administered by the State of New York. NET-Cambridge participates in an Interlaboratory Testing Program (ITP) as part of its corporate quality assurance program. Additional performance evaluations are submitted on client, contract and project specific bases.

A schedule for NET's participation in these single-blind and double-blind performance audits is detailed in Table 16.1. The reports from these audits will be made available if requested by the client.

Table 16.1

Annual Laboratory Performance Evaluation Schedule

PE Set	1st quarter	2nd quarter	3rd quarter	4th
EPA WS		X		X
EPA WP	X		X	
NYDOH	Non-Potables	Potables	Non-Potables	
CLP *				
Organic	X	X	X	X
Inorganic	X	X	X	X
Organic ITP	X		X	
Inorganic ITP	X		X	

NYSDOH - New York State Department of Health

* CLP quarterly blind samples analyzed when made available through the EPA regional offices.

16.3 Approvals

NET Cambridge is certified to perform analyses on wastewater, drinking water and soil matrices in several states and for several government programs. Table 16.2 lists the certifications or approvals currently held by NET Cambridge. An NET Project manager will provide a list of certified parameters for states of interest upon request.

In addition to state certifications NET Cambridge has been approved to conduct analyses for the following government programs:

- US Army Corps of Engineers
  Defense Environmental Restoration Program
- Hazardous Waste Remedial Action Program - HAZWRAP
- Navy Energy & Environmental Support Activity - NEESA

Table 16.2
State Certifications

State	Potable Water	Non-Potable
Connecticut	Y	Y
Florida	N	Y
Maine	Y	N
Massachusetts	Y	Y
New Hampshire	Y	Y
New Jersey	Y	Y
New York	Y	Y
Pennsylvania	Y	N
Rhode Island	Y	Y
South Carolina	Y	Y
Virginia	Y	N

17. QUALITY ASSURANCE REPORT TO MANAGEMENT

In order to provide data and service of consistently high quality there must be frequent and timely communication of quality concerns to the operational groups and senior management. The Quality Assurance Coordinator also prepares a monthly report of quality issues for the Division Manager and the Corporate Director of Data Quality. These reports include:

- results of performance evaluation studies for ongoing or new contracts;
- Control charts of internal QC sample results analyzed each month
- Internal and external system audit reports and corrective action responses;
- updated information on state or program certifications
- status on the development and implementation of National and Division specific SOPs;
- significant quality assurance problems and recommended solutions.

Quality Assurance Plan
Addendum 1

NET Inc. Cambridge Division
Personnel Qualifications Summary

me	Title	Academic Training	Present Specialty	Experience in Specialty	Total Exp.
ams, Elizabeth	Project Manager	BS Education/Zoology	project management	6 yr.	10 yr.
Belkas, Dan	Extraction Analyst	HS Diploma, Air Force Waste Water Program BS Engineering in process	organic extractions	1 month	4 yr.
Brierley, David	GC Analyst	BS Chemistry and Geology	Gas Chromatography analysis	1.5 yr	4.5 yr.
Bolton, Michele	GC Data Packager	BS Environmental Science	CLP Data Packaging and data entry review	1 month	1 yr.
Cattabriga, Kerry	GC/MS Data Packager	BE Engineering, AB Chemistry	VOA and Semivoa CLP Packaging	2 yr.	2 yr.
Clark, Sandra	Sample Bank Coordinator	Associates Biology	sample login and internal transfer	.5 yr	.5 yr
irrow, Dalison	Project Management Assistant	BA Communications	project management support	2 yr.	3.5 yr.
:laney, Michael	Director of Analytical Services	PhD Analytical Chemistry;BS Chemistry	analytical,chemistry	16 yr.	16 yr.
:rby, Fred	Facilities Manager	HS Diploma	facilities maintenance	24 yr.	24 yr.
uane, Earl	Waste Disposal Coordinator	Certificate Program	hazardous waste disposal	5 yr	26 yr
Dulac, Joseph	Extraction Analyst	BA chemistry	organic extractions	1.5 yr.	1.5 yr.
ındury, Diane	GC Analyst and Data Reviewer	BA Planetary and Space Science	GC Technical Review	2 yr.	4 yr.
ıwright, Christine	Metals Analyst	BA Chemistry	ICP analysis	2 yr.	2 yr.
pelman, Polina	Inorganic Laboratory Manager	MS Chemistry and Pharmaceutics senior chemist	inorganic lab management;	13 yr.	23 yr.

NET Inc. Cambridge Division
Personnel Qualifications Summary

Name	Title	Academic Training	Present Specialty	Experience in Specialty	Total Exp.
Raorikant, Natalya	GC Analyst	MS Environmental Science & Analytical Chemistry; BS chemistry	GC/ECD Analyses	1.5 yr.	16 yr.
Fiebranz, Sandy	Reports Production Assistant	HS Diploma, 2 years college	Reporting from LIM system	1 month	3 years
Frazier, Martha	Metals Analyst	BS Chemistry	metals analysis	4.5 yr.	22 yr.
Gomez, Charles	GC/MS Operator	BS Chemistry MAT Chemistry	volatile organic analysis	2 yr.	13 yr.
Grantz, Donna	Division Accounting Manager	BS Business Admin. and Accounting	accounting	8 yr.	8 yr.
Gray, Donald	GC/MS Operator	BA Chemistry	volatile organic	9 mo.	9 mo.
Haigh, Paul	Wet Chem Analyst	BA Chemistry	Wet Chem Analyses	1 mo.	6 mo.
Harley, Julian	Extraction Analyst	HS Diploma	organic extractions	1.5 yr.	1.5 yr.
Higgins, Kristin	Supervisor Reports	BS Chemistry	coordinating all reporting functions	1 mo.	6 yr.
Hidreth, George	GC Analyst	BS Clinical Laboratory Science	pest/PCB/PHC analyes	2.5 yr.	11 yr.
Jiang, Ping	Metals Prep Analyst	BS Chemistry	metals digestion	2 yr	2.5 yr.
Killeher, Christopher	Director of Business Development	BS Business Admin. and Marketing	marketing,business development	8 yr	11 yr.
Kelly, Joan	Wet Chem Analyst	candidate BS Env. Science	Wet Chem Analyses.	1 mo.	2 yr.
King, An-Shu	Extraction Laboratory Analyst	BS Mechanical Engineering	organic extraction	1.5 yr.	6 yr.

NET Inc. Cambridge Division
Personnel Qualifications Summary

ne	Title	Academic Training	Present Specialty	Experience in Specialty	Total Exp.
ba, Vladimir	Field Sampling Technician	MS Agricultural Engineering	Field Sampling & Testing	1 yr.	5.5 yr
Lambert, Mark	Manager, Mass Spectrometry Laboratory	BA Chemistry	semivolatile and volatile organic analysis	6 yr.	8 yr.
Lambert, Tara	Inorganics CLP Task Manager	BS Environmental Studies	inorganic analysis CLP protocols	1.5 yr.	4 yr.
Lapite, Constance	GC/MS Operator	BA Chemistry	semivolatile org. analysis	1 yr.	3.5 yr.
Lawler, Edward	Director of Project Management	BS Environmental Science	project management	7 yr.	14 yr.
Lawler, Sharyn	GCMS Data Reviewer	BS Botany	technical data review	6 yr.	8 yr.
Lee, Ashley	Courier	HS Diploma	courier delivery sample transportation	3 yr.	3 yr.
Livingston, Charlene	Supervisor Data Review GC/MS	BA Chemistry	CLP data review and packaging	7.5 yr.	7.5 yr.
Lorcel, Hermune	Glassware Washing	HS Diploma	cleaning/prepping glassware	2 yr.	2 yr.
McCarron, Ken	Extraction Analyst	HS Diploma	organic extraction	1 yr.	1 yr.
McCormack, Cindy	Reports Production Assistant	HS Equivalent	generating client reports from LIMS	1 month	3.5 yr.
McGrath, Deborah	Divison Manager	BS Chemistry	business devlopment and operations	11 yr.	21 yr.
Miller, D. Wesley	Project Manager	BS Environmental Science	project management	2 yr.	5 yr.

NET Inc. Cambridge Division
Personnel Qualifications Summary

me	Title	Academic Training	Present Specialty	Experience in Specialty	Total Exp.
Musanda, Jean Pierre	Group Leader GC/MS Data Review	BA Biochemistry	volatile organic data review	5 yr.	5 yr.
Najarian, Helen	Marketing Representative	BS Business and Finance	business development	2 yr.	7.5 yr.
Picano, Maureen	Sample Custodian		sample login and internal transfer		
Riviera, Ruth	GC/MS Analyst	BS Biology and Chemistry	volatile organic analysis	2 mo.	2.5 yr.
ode, Steven	Manager, GC and Organic Extractions	BS Biology and Chemistry; MS Environmental Chemistry;candidate	analytical chemistry	3 yr.	4 yr.
Robert, Nancy	Extraction Analyst	BS Env.Science in progress	organic extractions	1 mo.	1 mo.
ckcliffe, Dan	Mercury Analyst	BS Env.Science	CVA Hg Analysis	2 mo.	1 yr.
ssi, Dianne	Quality Assurance Coordinator	BS Biology	QA program management	1.5 yr.	5 yr.
npson, James	GC/MS Operator	BS Environmental Science	volatile organic analysis	4 yr.	5.5 yr.
hmidt, Leah	Extraction Analyst	BS Env. Management	organic extractions	1 mo.	1 mo.
irnova, Tamara	Inorganic analyst	MS Chemistry	inorganic analysis	1.5 yr.	9 yr.
omas, Michael	Supervisor, Extractions	AAS Chemical Technology	organic extractions	11 yr.	11 yr.
lencia, Aida	Receptionist	HS Diploma	Administrative support	7 yr.	7 yr.

NET Inc. Cambridge Division
Personnel Qualifications Summary

me	Title	Academic Training	Present Specialty	Experience in Specialty	Total Exp.
werren, Mark	GC-MS operator	BS Animal Science	volatile organic analysis	2 yr.	2 yr.
West, Ellen	Supervisor, Metals	BA Biology	metals analysis; CLP protocols	5 yr.	5 yr.
Yang, Hou-te	GC Analyst	BS Chemistry	gas chromatography	5.5 yr.	13 yr.
_rgeau, Douglas	Group Leader GC/MS Operations	BS Environmental	volatile organic analysis	4.5 yr.	4.5 yr.
¿ilitinkevitch, Larissa	Wet Chem Analyst	BS Pharmaceutical Chemistry	Wet Chem Analyses	1 mo.	12 yr.

Quality Assurance Plan
Addendum 2

ORIGINAL

Doc. No. 09.03.01
Method --
Rev. No. 0
Date: 04/18/91
Page 1 of 11

National Environmental Testing, Inc.

NET

STANDARD OPERATING PROCEDURES

ANALYTE OR SUITE: SOP for Waste Disposal

METHODOLOGY:

REFERENCE:

REGION: Atlantic DIVISION: Cambridge

REVISION # 0 DATE REVISED: 04/18/91

MAGNETIC REPOSITORY: FSDWASTE.SOP

APPROVALS:

Deborah F. McGrath
Division Manager

Douglas H. Green
Regional QA Manager

NET Atlantic, Inc.
Cambridge Division
Standard Operating Procedure

Director approval: _____

QA approval: _____

SOP for Waste Disposal

I. Scope/Summary/Application of Method

This SOP describes the procedures for temporary storage and disposal of the various waste streams generated in the Pesticide Studies Department.

II. Safety

Each employee is directly responsible for complete awareness of all health hazards associated with every chemical that he/she uses. Applicable MSDS information is available and should be reviewed prior to the initiation of any analysis. The SOP concerning General Laboratory Safety Information should be reviewed and available at all times. Additional detailed information is available from the Division Safety Officer, the employee's supervisor, and the NET Safety Manual.

III. Reagents and Materials

Black/white "CORROSIVE" decals
Orange "HAZARDOUS WASTE" labels
Red "FLAMMABLE LIQUID" decals
White "HAZARDOUS WASTE" labels
Glass bottles (4 liter capacity) with caps
Glass or polyethylene containers with lids
Nalgene carboys with caps and spigots
Red flammable waste can with spout
Waste glass boxes with liners and tops
Waste barrels with liners

IV. Interferences

Not Applicable

V. Procedure

V.1. SOLID WASTE - GLASS

V.1.1. Nature of waste: broken glassware, spent scintillation vials, pipettes, test tubes, etc. Also trace solvents and trace pesticides.

V.1.2. Modes of generation: breakage and single-use glassware.

V.1.3. Major potential hazards: cuts and abrasions.

V.1.4. At least two polymer-lined broken glass boxes are set up in the laboratory at all times, according to the instructions on the boxes.

V.1.5. Only discarded glassware is placed into these containers. Paper, plastic aluminum foil, etc. are to be placed into regular trash barrels. Whenever possible, labelling tape is removed from glass before being placed into box; the tape is placed in the regular trash barrels.

V.1.6. Care must be taken so that the box does not become too heavy; otherwise, the box is difficult to move and the bottom may fall out.

V.1.7. When a waste glass box is full the plastic bag is taped closed. The cardboard lid of the box is to be closed according to directions. The lid is then taped shut and taped to the sides of the box. The word "FULL" must be written on the lid, as well as the date. The box is placed near the waste cart to await collection by the division's Hazardous Waste Coordinator or Facilities Assistant. Filled boxes are replaced with empty ones.

V.1.8. Empty solvent bottles are allowed to vent in a hood for at least 15 minutes to reduce the amount of solvent remaining in the bottle. They are capped and placed under a designated lab bench to await collection by the division's Facilities Assistant.

V.2. SOLID WASTE - EXTRACTED SOLIDS

V.2.1. Nature of waste: vegetable matter, silica gel, florisil, glass wool, paper towels, Celite 545, filter paper, sodium sulfate, sodium chloride, etc. Minor quantities of solvents: hexane, methylene chloride, acetone, acetonitrile, 2-propanol (iso-propanol), water, acetone, miscellaneous ethers, 2,2,4-trimethylpentane (iso-octane), ethyl acetate, etc. Also trace pesticides.

V.2.2. Modes of generation: extraction of samples, filtration, cleanup of fume hoods, etc.

V.2.3. Major potential hazards: respiratory irritation, neurotoxicity, cancer.

V.2.4. A polyethylene or glass container, with screw cap, is placed in each fume hood. The container must have a small white "HAZARDOUS WASTE" label which contains a thorough list of the container's contents, including solvents used.

V.2.5. Waste is placed into the container and the container is immediately capped to minimize emission of fumes, per EPA requirements.

V.2.6. Containers are vented periodically in fume hood to release pressure buildup of vapors.

V.2.7. When a container is filled, the word "FULL" is written on it, as well as the date. The cap is secured firmly and the container is placed on the waste cart to await collection by the division's Hazardous Waste Coordinator.

V.3. SOLID WASTE - GC/HPLC VIALS

V.3.1. Nature of waste: GC/HPLC vials, aluminum/rubber caps, hexane, acetonitrile, water, methanol, acetone, 2,2,4-trimethylpentane (iso-octane), 2-propanol (iso-propanol), etc. Also trace pesticides.

V.3.2. Mode of generation: single-use vials.

V.3.3. Major potential hazards: cuts and abrasions, respiratory irritation.

V.3.4. At least one glass container is kept in the pesticides laboratory, in a fume hood, at all times. At least one glass container is also kept in the fume hood in the GC laboratory at all times. Each container must have a screw cap and a small white "HAZARDOUS WASTE" label, containing a list of contents.

V.3.5. Spent vials are placed into the containers, as needed, and caps are closed.

V.3.6. Containers are vented periodically in fume hood to release pressure buildup of solvents.

V.3.7. When a container is filled, the word "FULL" is written on it, as well as the date. The cap is secured firmly and the container is placed on the waste cart to await collection by the division's Hazardous Waste Coordinator.

V.4. SOLID WASTE - MISCELLANEOUS

V.4.1. Nature of waste: paper, spent plastic syringes, spent filter discs, labelling tape, packaging, etc.

V.4.2. Modes of generation: miscellaneous.

V.4.3. Major hazards: none to minimal.

V.4.4. Materials are placed into lined trash barrels, which are emptied, as needed, by the janitorial staff.

V.4.5. Uncontaminated recyclable materials (white paper, cardboard, styrofoam pellets, etc.) are placed in appropriate containers.

V.5. LIQUID WASTE - NON-CHLORINATED ORGANIC SOLVENTS

V.5.1. Nature of waste: hexane, toluene, ethyl acetate, methanol, ethanol, acetone, acetonitrile, miscellaneous ethers, 2,2,4-trimethylpentane (iso-octane), 2-propanol (iso-propanol), cyclohexane, water, trace pesticides, etc.

V.5.2. Modes of generation: mobile phases from HPLC and GPC, glassware rinsings, diluents, extraction of samples.

V.5.3. Major potential hazards: fire, respiratory irritation, neurotoxicity.

V.5.4. Wastes must meet these criteria:
- Content must be at least 5% organic solvent, by volume. Exception: dilute alcohols may go into appropriate aqueous waste stream, depending upon solution's pH.
- If solution is mostly aqueous and pH<5 or pH>9 then liquid must go into appropriate aqueous waste stream, regardless of solvent content.

V.5.5. A red specially-designed fire-resistant metal container is placed on the laboratory's waste cart at all times, to be emptied, as needed, by the division's Hazardous Waste Coordinator. The container has a red "FLAMMABLE LIQUID" decal and an orange "HAZARDOUS WASTE" label marked as follows:

Waste Flammable Liquid N.O.S.
UN 1993 (Methanol)
Flammable Material

V.5.6. Glass bottles are used for collection of waste mobile phases and are to have a red "FLAMMABLE LIQUID" decal and an orange "HAZARDOUS WASTE" label marked as follows:

Waste Flammable Liquid N.O.S.
UN 1993 (major constituent)
Flammable Material
date of accumulation

V.5.6.1. These glass bottles are emptied into the central flammable solvents can immediately upon becoming full.

V.5.6.2. Capillaries are inserted into holes of caps as long as a covering of aluminum foil is used to minimize the escape of vapors.

V.5.7. All containers are closed when not in use.

V.6. LIQUID WASTE - CHLORINATED SOLVENTS/MIXTURES

V.6.1. Nature of waste: methylene chloride, chloroform, carbon tetrachloride, water.

V.6.2. Modes of generation: extraction of samples, glassware rinses, diluents.

V.6.3. Major potential hazards: fire, respiratory irritation, neurotoxicity, cancer.

V.6.4. Any and all liquid waste containing any amount of chlorinated solvents must be placed into this waste stream. If waste has an aqueous layer with a pH<5 or pH>9 the aqueous layer (top) is to be decanted to the appropriate aqueous waste stream, with the organic layer (bottom) added to the chlorinated solvent waste stream.

V.6.5. A Nalgene carboy is placed on the laboratory's waste cart at all times, to be emptied, as needed, by the division's Hazardous Waste Coordinator. The container has a red "FLAMMABLE LIQUID" decal and an orange "HAZARDOUS WASTE" label marked as follows:

Waste Flammable Liquid N.O.S.
UN 1993 (Methylene Chloride)
Chlorinated Flammable Material

V.6.6. This container is closed when not in use.

V.6.7. Due to the volatility of the compounds in question, the container is vented in a fume hood from time to time.

V.7. LIQUID WASTE - ACIDIC/NEUTRAL AQUEOUS SOLUTIONS (SULFURIC)

V.7.1. Nature of waste: sulfuric acid, acetic acid, phosphoric acid, water, sodium chloride, 2-propanol (isopropanol), trace pesticides, etc.

V.7.2. Mode of generation: extraction of samples.

V.7.3. Major potential hazards: burns, skin irritation, respiratory irritation.

V.7.4. Wastes must meet these criteria:
- Aqueous solution.
- pH is 7 or less.
- Solution does not contain nitric acid.
- If pH of solution is between 5 and 7 (inclusively), it can be placed into this waste stream only if it has a minimal concentration (0%-5%) of dissolved organic solvents (with the exception of alcohols); otherwise, it belongs in the Non-chlorinated Organic Waste container or, if chlorinated, in the Chlorinated Organic Waste container.

V.7.5. A Nalgene carboy is placed on the laboratory's waste cart at all times, to be emptied, as needed by the division's Hazardous Waste Coordinator. The container has a black/white "CORROSIVE" decal and an orange "HAZARDOUS WASTE" label marked as follows:

Waste Corrosive Liquid N.O.S.
UN 1760 (Sulfuric Acid)
Corrosive Material

V.7.6. This container is closed when not in use.

V.8. LIQUID WASTE - ACIDIC AQUEOUS SOLUTIONS (NITRIC)

V.8.1. Nature of waste: nitric acid, water, trace pesticides, etc.

V.8.2. Mode of generation: extraction of samples.

V.8.3. Major potential hazards: burns, skin irritation, respiratory irritation.

V.8.4. Wastes must meet these criteria:
- Aqueous solution.
- pH is less than 7.
- Must contain nitric acid.

V.8.5. Whenever generated the waste shall be kept in a glass bottle on the laboratory's waste cart. The container shall have a black/white "CORROSIVE" decal and an orange "HAZARDOUS WASTE" label marked as follows:

Waste Corrosive Liquid N.O.S.
UN 1760 (Nitric Acid)
Corrosive Material

V.8.6. This container is closed when not in use.

V.9. LIQUID WASTE - BASIC AQUEOUS SOLUTIONS

V.9.1. Nature of waste: sodium hydroxide, potassium hydroxide, water, trace pesticides.

V.9.2. Mode of generation: extraction of samples.

V.9.3. Major potential hazards: burns, skin irritation.

V.9.4. Wastes must meet these criteria:
- Aqueous solution.
- pH is greater than 7.
- If pH of solution is between 7 and 9 (inclusively), it can be placed into this waste stream only if it has a minimal concentration (0%-5%) of dissolved organic solvents (with the exception of alcohols); otherwise, it belongs in the Non-chlorinated Organic Waste container or, if chlorinated, in the Chlorinated Organic Waste container.

V.9.5. At least two (2) glass bottles are placed in a designated fume hood in the laboratory. They are not placed on the waste cart in order to be kept separate from acidic wastes. Each bottle has a black/white "CORROSIVE" decal and an orange "HAZARDOUS WASTE" label marked as follows:

Waste Corrosive Liquid N.O.S.
UN 1760 (Sodium Hydroxide)
Corrosive Material

V.9.6. Bottles are closed when not in use.

V.9.7. When a bottle becomes full a note is attached to it with the word "FULL" written on it and the date it was filled. The bottle is kept in a designated fume hood to await collection by the division's Hazardous Waste Coordinator.

V.10. WASTE FROM GLASS CHROMATOGRAPHY COLUMNS

V.10.1. Nature of waste: florisil, silica gel, alumina, Bio-rad resins, glass wool, sand, sodium sulfate, misc. solvents, trace pesticides.

V.10.2. Mode of generation: cleanup of sample extracts.

V.10.3. Major potential hazards: respiratory irritation, cancer.

V.10.4. After use, columns must be emptied into a plastic beaker; glass wool can be removed with a coathanger. Each column must be rinsed at least once with a small volume (approximately 10 mL) of water; rinses are placed into the beaker as well. The beaker is placed in a fume hood for one half-hour to evaporate any remaining solvents. The liquid is then decanted into the Acidic Aqueous Waste drum. The solid is transferred to an Extracted Solid Waste container.

V.10.5. Filled columns must be kept in a fume hood at all times.

V.11. MISCELLANEOUS ITEMS

V.11.1. Whenever possible, the layers of a multilayered liquid are decanted into the respective waste streams. The exception is where a chlorinated solvent has an aqueous layer of moderate pH (between 5 and 9), in which case all layers go into the Chlorinated Organic Waste container.

V.11.2. If an unknown liquid is to be discarded in limited quantity, the analyst must ask the other analysts in the laboratory if they know what the liquid is. If the liquid is still unknown, this procedure is followed:

- Add 2-4 mL water to a small culture tube. Add a few drops of the unknown liquid to the tube.
- If the liquid is soluble in water measure pH of waste. If pH is between 5 and 9, inclusively, then waste can be added to the Non-chlorinated Organic Waste container. If pH<5 then waste belongs in Acidic Aqueous Waste (Sulfuric) container. If pH>9 then waste is to be added to a Basic Aqueous Waste container.
- If the unknown liquid floats on water add waste to the Non-chlorinated Organic Waste container.

- If the unknown liquid sinks below water add waste to the Chlorinated Organic Waste container.

V.11.3. Filled containers are emptied by the division's Hazardous Waste Coordinator within three (3) days from the date of accumulation.

V.11.4. Paper towels used to wipe down fume hoods are placed in Extracted Solid Waste containers, due to their variable and uncertain concentrations of contaminants; they are not placed in the trash barrels.

V.11.5. Wastes not covered in this standard operating procedure are disposed according to the instructions of the division's Hazardous Waste Coordinator.

VI. Quality Control

Not Applicable.

VII. References

Keller & Associates, J.J. Driver's Pocket Guide to Hazardous Materials. 6th ed. Neenah: J.J. Keller & Assoc., 1989.

National Environmental Testing. Standard Operating Procedure for Handling and Disposal of Laboratory Wastes and Discarded Samples. 3rd rev. Bedford: National Environmental Testing, 1990.

Quality Assurance Plan
Addendum 3

Instrument Detection Limits

The concentration equivalent of the smallest signal which is distinguishable from background instrument noise. The determination of IDL's is done for metals quarterly per CLP protocols. The IDL is 3 times the average of 3 standard deviations each independently determined on non-consecutive days by 7 replicate analyses of a spiked reagent water standard under normal instrument operating conditions

Method Detection Limits

The Method Detection Limits is defined as the minimum concentration of a substance that can be measured and reported with a 99% confidence that the analyte concentration is greater than zero. This concentration is determined through multiple analyses (including all sample preparation steps) of a sample of a given matrix. The standard deviation of the results of these analyses is multiplied by 3, and the resulting value is considered the method detection limit. This procedure for determining the MDL is from 40 CFR Part 136 Appendix B Federal Register Vol. 49, No. 209 - 10/26/84). MDLs are done annually.

CLP 3/90 Volatiles
Aqueous MDLs ug/L
by Instrument

Analyte	CAS No.	K[1]	E[2]	H[3]	G[4]	L[5]
1. Chloromethane	74-87-3	3.09	1.20	1.76	1.43	1.4
2. Bromomethane	74-83-9	2.30	1.01	1.57	0.64	1.3
3. Vinyl Chloride	75-01-4	2.89	1.44	2.38	1.11	5.4
4. Chloroethane	75-00-3	1.65	1.19	2.33	1.23	1.2
5. Methylene Chloride	75-09-2	0.89	0.76	1.07	0.74	1.4
6. Acetone	67-64-1	4.02	7.11	1.77	4.69	7.1
7. Carbon Disulfide	75-15-0	1.92	1.36	1.81	0.85	0.4
8. 1,1-Dichloroethene	75-35-4	2.11	4.86	2.19	0.87	0.8
9. 1,1-Dichloroethane	75-34-3	1.97	1.77	1.49	0.56	0.9
10. 1,2-Dichloroethene (total)	540-59-0	3.39	NA	1.64	0.84	1.4
11. Chloroform	67-66-3	1.67	0.95	1.17	0.68	0.8
12. 1,2-Dichloroethane	107-06-2	1.74	1.29	0.78	0.74	0.7
13. 2-Butanone	78-93-3	1.49	6.84	NA	3.67	4.7
14. 1,1,1-Trichloroethane	71-55-6	2.55	1.22	1.41	0.81	0.5
15. Carbon Tetrachloride	56-23-5	2.71	1.23	1.69	0.74	0.5
16. Bromodichloromethane	75-27-4	1.71	0.63	0.61	0.52	0.4
17. 1,2-Dichloropropane	78-87-5	1.48	0.94	0.65	0.58	0.7
18. cis-1,3-Dichloropropene	10061-01-5	1.77	0.96	0.81	0.82	0.4
19. Trichloroethene	79-01-6	4.37	0.98	1.40	0.62	0.5
20. Dibromochloromethane	124-48-1	2.05	0.55	0.95	0.72	0.7
21. 1,1,2-Trichloroethane	79-00-5	1.47	1.00	1.33	0.81	1.2
22. Benzene	71-43-2	1.52	0.98	0.87	0.58	0.5
23. trans-1,3-Dichloropropene	10061-02-6	1.48	0.70	0.49	0.35	0.7
24. Bromoform	75-25-2	2.60	1.13	1.14	0.63	1.0
25. 4-Methyl-2-pentanone	108-10-1	1.32	3.27	1.11	3.11	2.7
26. 2-Hexanone	591-78-6	1.26	1.81	1.45	1.27	4.6
27. Tetrachloroethene	127-18-4	2.94	1.08	1.85	0.77	0.6
28. 1,1,2,2-Tetrachloroethane	79-34-5	1.08	1.35	1.00	1.02	1.8
29. Toluene	108-88-3	1.52	0.95	1.26	0.70	0.5
30. Chlorobenzene	108-90-7	1.62	0.85	0.90	0.59	0.4
31. Ethyl Benzene	100-41-4	2.01	1.67	NA	0.92	1.3
32. Styrene	100-42-5	1.51	0.86	0.73	0.40	0.6
33. Xylenes (total)	1330-20-7	4.19	4.17	NA	1.24	1.5

[1] MDL study on instrument K performed 6/20/92

[2] MDL study on instrument E performed 6/9/92

[3] MDL study on instrument H performed 1/30/91

[4] MDL study on instrument H performed 2/01/91

[5] MDL study on instrument L performed 8/31/91 using a heated purge

Analyte	CAS No.	Method 504 Volatiles MDLs (9/91) ug/L
1. 1,2-Dibromoethane (EDB)	106-93-4	0.0032
2. 1,2-Dibromo-3-Chloropropane (DBCP)	96-12-8	0.0030

Semivolatiles
Aqueous MDLs in ug/L

	Analyte	CAS No.	MDL
1.	Phenol	108-95-2	2.84
2.	bis(2-chloroethyl)ether	111-44-4	2.18
3.	2-Chlorophenol	95-57-8	1.58
4.	1,3-Dichlorobenzene	541-73-1	1.64
5.	1,4-Dichlorobenzene	106-46-7	2.32
6.	1,2-Dichlorobenzene	95-50-1	1.92
7.	2-Methylphenol	95-48-7	1.28
8.	2,2'-oxybis 1-Chloropropane	108-60-1	NA
9.	4-Methylphenol	106-44-5	3.93
10.	N-nitroso-di-n-dipropylamine	621-64-7	2.33
11.	Hexachloroethane	67-72-1	1.28
12.	Nitrobenzene	98-95-3	3.29
13.	Isophorone	78-59-1	NA
14.	2-Nitrophenol	88-75-5	1.52
15.	2,4-Dimethylphenol	105-67-9	1.33
16.	bis(2-chloroethoxy)methane	111-91-1	1.82
17.	2,4-Dichlorophenol	120-83-2	1.98
18.	1,2,4-Trichlorobenzene	120-82-1	2.36
19.	Naphthalene	91-20-3	3.06
20.	4-Chloroaniline	106-47-8	2.53
21.	Hexachlorobutadiene	87-68-3	2.24
22.	4-Chloro-3-methylphenol	59-50-7	1.52
23.	2-Methylnaphthalene	91-57-6	3.38
24.	Hexachlorocyclopentadien	77-47-4	NA
25.	2,4,6-Trichlorophenol	88-06-2	1.93
26.	2,4,5-Trichlorophenol	95-95-4	2.63
27.	2-Chloronaphthalene	91-58-7	2.52
28.	2-Nitroaniline	88-74-4	0.23
29.	Dimethylphthalate	131-11-3	0.27
30.	Acenaphthalene	208-96-8	2.41
31.	2,6-Dinitrotoluene	606-20-2	1.86
32.	3-Nitroaniline	99-09-2	1.92
33.	Acenaphthene	83-32-9	1.99
34.	2,4-Dinitrophenol	51-28-5	2.38
35.	4-Nitrophenol	100-02-7	3.90

Semivolatiles
Aqueous MDLs in ug/L

Analyte	CAS No.	MDL
36. Dibenzofuran	132-64-9	2.39
37. 2,4-Dinitrotoluene	121-14-2	1.11
38. Diethylphthalate	84-66-2	1.19
39. 4-Chlorophenyl-phenylether	7005-72-3	2.19
40. Fluorene	86-73-7	1.93
41. 4-Nitroaniline	100-01-6	6.39
42. 4,6-Dinitro-2-methylphenol	534-52-1	1.97
43. N-nitrosodiphenylamine	6-30-6	1.66
44. 4-Bromophenyl-phenylether	101-55-3	2.11
45. Hexachlorobenzene	118-74-1	2.92
46. Pentachlorophenol	87-86-5	2.92
47. Phenanthrene	85-01-8	2.37
48. Anthracene	120-12-7	2.15
49. Carbazole	86-74-8	NA
50. Di-n-butylphthalate	84-74-2	0.58
51. Fluoranthene	206-44-0	1.72
52. Pyrene	129-00-0	1.91
53. Butylbenzylphthalate	85-68-7	1.45
54. 3,3'-Dichlorobenzidine	91-94-1	NA
55. Benzo(a)anthracene	56-55-3	2.59
56. Chrysene	218-01-9	2.76
57. bis(2-Ethylhexyl)phthalate	117-81-7	8.83
58. Di-n-octylphthalate	117-84-0	2.92
59. Benzo(b)fluoranthene	205-99-2	2.96
60. Benzo(k)fluorathene	207-08-9	2.61
61. Benzo(a)pyrene	50-32-8	2.94
62. Indeno(1,2,3-cd)pyrene	193-39-5	3.11
63. Dibenz(a,h)anthrace	53-70-3	2.90
64. Benzo(g,h,i)perylene	191-24-2	3.31

Pesticides
Aqueous MDLs (ug/L)

	Analyte	CAS No.	MDL
1.	alpha-BHC	319-84-6	0.018
2.	beta-BHC	319-86-8	0.012
3.	delta-BHC	319-86-8	0.017
4.	gamma-BHC (lindane)	58-89-9	0.013
5.	Heptachlor	76-44-8	0.015
6.	Aldrin	309-00-2	0.014
7.	Heptachlor epoxide	1024-57-3	0.024
8.	Endosulfan I	959-98-8	0.009
9.	Dieldrin	60-57-1	0.021
10.	4,4'DDE	72-55-9	0.015
11.	Endrin	72-20-8	0.008
12.	Endosulfan II	33213-65-9	0.013
13.	4,4'DDD	72-54-8	0.005
14.	Endosulfan Sulfate	1031-07-8	0.023
15.	4,4'-DDT	50-29-3	0.015
16.	Methoxychlor	72-43-5	0.089
17.	Endrin ketone	53494-70-5	0.010
18.	Endrin aldehyde	7421-36-3	0.013
19.	alpha-Chlordane	5103-71-9	NA
20.	gamma-Chlordane	5103-74-2	NA
21.	Toxaphene	8001-35-2	NA
22.	Aroclor-1016	12674-11-2	NA
23.	Aroclor-1221	11104-28-2	NA
24.	Aroclor-1232	11141-16-5	NA
25.	Aroclor-1242	53469-21-9	NA
26.	Aroclor-1248	12672-29-6	NA
27.	Aroclor-1254	11097-69-1	NA
28.	Aroclor-1260	11096-82-5	NA

Analyte	Metals IDLs ug/L
1. Aluminum	20
2. Antimony	30
3. Arsenic	3.0
4. Barium	5.0
5. Beryllium	1.0
6. Cadmium	3.0
7. Calcium	20
8. Chromium	3.0
9. Cobalt	5.0
10. Copper	3.0
11. Iron	25
12. Lead	2.0
13. Magnesium	20
14. Manganese	1.0
15. Mercury (HGCVA)	0.2
16. Nickel	6.0
17. Potassium	300
18. Selenium	2.0
19. Silver	3.0
20. Sodium	80
21. Thallium	2.0
22. Vanadium	8.0
23. Zinc	2.0

Analyte	Method	Wetchem Analyses MDLs ug/L
1. Ammonia	350.1	0.1
2. COD	410.4	15
3. Chloride	300.1	0.040
4. Cyanide, Total	335.2	0.008
5. Fluoride	300.1	0.012
6. TKN	351.2	0.5
7. Nitrate	300.0	0.011
8. TOC	415.2	0.54
9. Phenols	420.2	0.005
10. Phosphorus, Total	365.3	0.15
11. Total Dissolved Solids	160.1	7.3
12. Sulfate	300.0	0.070
13. TOC	415.2	0.54

Quality Assurance Plan
Addendum 4

ADDENDUM 4
QUALITY ASSURANCE PLAN

The analytical laboratory will provide sampling bottles and preservatives to Atlantic. The sampling bottles will be purchased from lots which have been precleaned and checked for contamination by the vendor. Certificates verifying that the bottles are free of contaminants down to appropriate detection levels will be maintained by the laboratory and copies provided upon request.

ADDENDUM 4
PRESERVATION AND HOLDING TIME REQUIREMENTS

Parameter	Required Volume & Containers	Preservation	Holding[1] Time (days)
Volatile Organic Compounds	3 40 ml VOA vial (water) 1 125 ml glass (soil)	4°C (±2°C) HCL; pH < 2[2]	10 days
Semi-Volatile Organic Compounds	2 L (water) 1 125 ml glass (soil)	4°C (±2°C)	5 to extract (waters) 10 to extract (soils) 40 from start of extraction to analysis
Pesticides/Aroclors	2 L (water) 125 ml glass (soil)	4°C (±2°C)	5 to extract (waters) 10 to extract (soils) 40 from start of extraction to analysis
TAL Metals plus Boron Hg	50 ml glass (water) 10 g	HNO_3, pH < 2[2], 4°C	180 days 26 days
Total Cyanide	1000 ml glass (water) 40 g	NaOH, pH > 12[2], 4°C	12 days
Grain Size	100 g	4°C	NA
Chloride	10 ml	4°C	26 days
Total Petroleum Hydrocarbons	1000 ml amber glass 30 g	H_2SO_4, pH < 2[2], 4°C	26 days
Dioxins	soil - 30 grams water - 1 liter	protect from light	soil - extract within 10 days of sample receipt water - extract within 5 days of sample receipt extracts - analyze within 40 days of extraction
Gross Alpha/Beta and Gamma Spectrum Analysis	2 liters plastic	HNO_3, pH < 2	6 months
Biochemical Oxygen Demand	500 ml polyethylene or glass	4°C	48 hours
Chemical Oxygen Demand	250 ml polyethylene or glass	H_2SO_4, pH < 2, 4°C	28 days
Total Organic Carbon	100 ml polyethylene or glass	H_2SO_4, pH < 2, 4°C	28 days
Oil and Grease	1500 ml glass	H_2SO_4, pH < 2, 4°C	28 days
Total Suspended Solids	100 ml polyethylene or glass	4°C	7 days
Ammonia as Nitrogen	500 ml polyethylene or glass	H_2SO_4, pH < 2, 4°C	28 days
Phosphorous, total	100 ml polyethylene or glass	H_2SO_4, pH < 2, 4°C	28 days

Please Note: All sample containers should be filled to maximum capacity.

1. Holding time begins at time of sample collection.
2. To verify pH, a sample that will not be sent to the lab will be analyzed for pH as increasing larger amounts of preservatives are added until the sample pH < 2 or > 12. This amount plus 25 percent will be used to preserve all other similar samples.

APPENDIX B

SUMMARY OF SAMPLES TO BE COLLECTED AT EACH SITE

APPENDIX B
SUMMARY OF SAMPLES TO BE COLLECTED AT EACH SITE

Site	Analysis	Number Sampled			Field Duplicate			Trip Blank		Equip. Rinse	Field Blank Source Water	Matrix Spike		Matrix Spike Duplicate	
		Water	Soil	Air	Water	Soil	Air	Water	Air	Water	Water	Water	Soil	Water	Soil
Rubble Fill															
Soil	VOC, SVOC, inorganic, pesticide, PCB, TCLP, engineering		16			2		5		5	4		2		2
Water	VOC, SVOC, inorganic, pesticide, PCB engineering	12			2			5		5		2		2	
Torpedo Shops															
Soil	VOC, SVOC, inorganic, pesticide, PCB, TCLP, TPH, engineering		24			3		10		10			3		3
Water	VOC, SVOC, inorganic, pesticide, PCB, TPH, engineering	27			3			10		10		3		3	
Goss Cove															
Soil	VOC, SVOC, inorganic, pesticide, PCB, TCLP, dioxin, engineering		30			3		13		13			3		3
Water	VOC, SVOC, inorganic, pesticide, PCB, RAD, engineering	27			3			10		10		3		3	
Air	VOC			6			2		4*						
Spent Acid															
Soil	VOC, SVOC, inorganic, pesticide, PCB, TCLP, engineering		16			2		3		3			2		2
Water	VOC, SVOC, inorganic, pesticide, PCB, engineering	8			1			3		3		1		1	
Area A															
Soil	VOC, SVOC, inorganic, pesticide, PCB, TCLP, dioxin, engineering		78			8		15		15			8		8
Water	VOC, SVOC, inorganic, pesticide, PCB, RAD, engineering	151			15			15		15		15		15	
BIOTA	Pesticide		43			4		10		10			4		4
DRMO															
Soil	VOC, SVOC, inorganic, pesticide, PCB, TCLP, dioxin, engineering		32			4		8		8			4		4
Water	VOC, SVOC, inorganic, RAD, engineering	20			2			8		8		2		2	
Lower Base															
Soil	TCLP, TPH, engineering, PCB		22			3		5		5			3		3
Water	VOC, SVOC, inorganic, TPH, engineering	52			6			5		5		6		6	
Thames River															
Soil	SVOC, inorganic, pesticide, PCB, engineering		16			2		5		5			2		2
Water	VOC, SVOC, inorganic, pesticide	16			2			5		5		2		2	
BIOTA	VOC, SVOC, inorganics pesticide, PCB		19			2		8		8			2		2

APPENDIX B (continued)
SUMMARY OF SAMPLES TO BE COLLECTED AT EACH SITE

Site	Analysis	Number Sampled			Field Duplicate			Trip Blank		Equip. Rinse	Field Blank Source Water	Matrix Spike		Matrix Spike Duplicate	
		Water	Soil	Air	Water	Soil	Air	Water	Air	Water	Water	Water	Soil	Water	Soil
CBU															
Soil	VOC, SVOC, inorganics, pesticides, PCBs, TCLP (metals only)		6			1		2		2			1		1
Water	VOC, SVOC, inorganics, pesticides, PCBs, TCLP	2			1			2		2		1		1	
OBDANE															
Soil	VOC, SVOC, inorganics, TCLP (metals only)		7			1		2		2			1		1
Water	VOC	2			1			2		2		1		1	
Total Soil	334		247			29							29		29
Total Water (2 Rounds)	695	317			36			133		133	4	36		36	
Total Air (2 Rounds)	12			6			2		4*						
Total Biota	116		62			6		18		18			6		6

* includes two trip blanks and two backup cartridges

APPENDIX C

SPECIAL ANALYTICAL PROCEDURES

ATTACHMENT I
(Special Technical Instructions)

Total Recoverable Petroleum Hydrocarbons in Soil/Sediment

1. Decant and discard any water layer covering a sediment sample.

2. The soil or sediment sample must be mixed thoroughly. Any foreign objects such as sticks, leaves and rocks are discarded.

3. A portion of the sample should be weighed out for moisture determination, to be carried out by drying overnight at 105°C. Method 3540, Part 7.2.1. If the sample contains more then 50% water (less than 50% solids) then more sample must be taken in order to reach the 20 gm of solid sample needed for analysis.

4. Blend 20g. of the solid soil sample with 20g. of anhydrous sodium sulfate and place in an extraction thimble. If the sediment sample is a sludge use the preparation described in Method 9071 7.2-7.6 using $Mg_2SO_4 \cdot 2H_2O$.

5. Extract samples according to Method 3540, Extraction of Nonvolatile and Semi-Volatile Organic Compounds from Solids.

6. Soxhlet extraction should be performed using 250 ml. of Freon 113. Extract the sample for four hours.

7. The 250 ml of Freon extract must be concentrated to 10.0 ml using a Kuderna Danish (K-D) concentrator equipped with a three ball Snyder Column. The freon is concentrated to approximately 10.0 ml or to a low volume capable of transfer to the silica gel column. To avoid loss of low molecular weight hydrocarbons, do not bring the concentrate to dryness.

8. A silica gel column as described in SW846 method 3630, Section 7.1.2, is prepared by loading activated silica gel onto the column using freon 113 solvent. The activated silica gel will remove polar compounds while allowing hydrocarbons to pass through.

9. The 10 ml of concentrated extract is loaded onto the column and allowed to elute at a rate of 2 ml/min. The rate can be measured using a volumetric cylinder and stop watch. When the level of sample solution reaches the upper surface of the sodium sulfate covering the silica gel, the 25 ml of freon 113 is loaded onto the column. The first 35 ml of freon is collected and should contain the petroleum hydrocarbons. The column must be eluted with only enough solvent to elute the petroleum distillates and not elute any polar or aromatic compounds. The 35 ml of solution is collected in a 50 ml volumetric flask. The eluate is then brought to mark with Freon 113.

10. The Standard reference oil is made as per Method 418.1 as follows:

15.0 ml Hexadecane
15.0 ml isooctane
10.0 ml Chlorobenzene
40 ml stored in a stopped bottle

1 ml of reference oil is weighed into a tared 200 ml volumetric flask, stoppered quickly and reweighed. The oil is diluted to 200 ml with Freon 113 and stoppered. This is the stock standard from which working standards are made. The concentration of this standard is calculated in mg/l.

11. A 1.0 gm solid sample of Lauramide (lauric acid amide) is weighed into a tared 200 ml volumetric flask and dissolved in 100 ml Freon 113. After dissolution the volumetric is brought to mark. This Lauramide solution will be mixed with the reference oil solution in a 0.5 mg/50 ml/0.5 mg/50 ml ratio to give a 0.25 mg/50 ml concentration of both. The equal mixture will be used to measure the separation efficiency of the silica gel column. Ten milliliters of the mixed reference and Lauramide solution will be passed through the silica gel column identically as a sample is passed through the column as in Paragraph 9.0. The concentration of the reference oil will be subsequently measured to determine the recovery. If the Lauramide remains in the solution after silica column separation, then the measurement of the reference oil at 2930 cm^{-1} will exceed the expected concentration of .25 mg/50 ml. The presence of Lauramide will create a high absorbance when the scan is started from 3200 cm^{-1} through 2700 cm^{-1}.

12. Calibrate the infrared spectrophotometer with the appropriate cell path using a series of five standards including a blank equivalent to .01 mg/50 ml to 1.0 mg/50 ml petroleum distillate. The standards are prepared as per Method 418.1 and Step 10.0. Prepare a calibration plot of absorbance vs. milligrams/50 ml petroleum hydrocarbons measured at 2930 cm^{-1}. Each sample and standard should be scanned from 3200 cm^{-1} to 2700 cm^{-1} and the maximum checked at 2930 cm^{-1}. Calculate the correlation coefficient for the plot using the least squares fit method. The correlation coefficient must be >0.995.

13. Fill the infrared cell from the 50 ml sample flask and scan the range from 3200 cm^{-1} to 2700 cm^{-1}. Measure the absorbance at 2930 cm^{-1} and record the reading.

14. The concentration of petroleum hydrocarbons in the samples should be calculated on a dry weight basis.

ATTACHMENT II
DELIVERABLES

1. Narrative explaining all anomalies and corrective actions taken. Included in the narrative should be a tabulation of the sample numbers with the corresponding laboratory sample numbers.

2. Daily instrument calibration plot of styrene thin film.

3. Tabulated sample results; positive results and detection limits for non-detects.

4. Laboratory analysis notebook pages or bench sheets; all sample raw data including sample weight, dilutions, and concentration factors.

5. Tabulated results of duplicate and matrix spike analyses; tabulations of standard results and calibration verification results.

6. Calibration curve raw data.

7. Examples of sample results calculations.

8. Sample preparation logs.

9. Copies of request, packing lists, chain-of-custody, sample tags and shipping airbills.

10. Raw data for percent solids determination must be included.

11. Scans of Lauramide/reference oil check plots from 3200 cm^{-1} to 2700 cm^{-1}.

ATTACHMENT III

QC Requirements

Audits Required	Frequency Audits	Limits	Corrective Actions
1. Calibrate Spectrophotometer (wavelength) using styrene film	Daily	Must meet manufacturer's specification for wavelength	Call for help from manufacturer's representative.
2. Prepare a calibration plot of absorbance vs. mg petroleum hydrocarbons per 50 ml solution (.01 mg/50 ml to 1.0 mg/50 ml	Daily	Correlation Coefficient >.995	Make new working standards and prepare new calibration plot.
3. Method Blank	1 per 10 analytical samples	≤2 times DL	If >2 times DL, determine source of contamination and reanalyze blank. Limits must be met prior to analysis.
4. Laboratory Duplicate (Separate preparation of sample)	1 per 10 analytical samples	±20%	If not ±20%, rerun duplicate. If out of limit, proceed.
5. Matrix spike 0.20 mg/50 ml reference oil solution	1 per 10 analytical samples	80%-120% recovery	If not within limits repeat if not again proceed
6. Continuing Check Standard 0.20 mg/ 50 ml std reference oil solution	1 per 10 samples and at the end of analysis	±10%	If outside limits, recalibrate and rerun all samples run since last acceptable calibration check.
7. Separation check sample (Lauramide/ Ref oil mixture)	1 per 20 samples	No ore than +10% of reference oil concentration	If outside limit reseparate all related samples with new SiO_2 column since last compliant check.

SAS - Dioxin-002
Revised August, 1992

U.S. Environmental Protection Age
CLP Sample Management Office
P.O. Box 818 - Alexandria, Virgin
Phone: 703/557-2490 - FTS/557-249

_____ Region I, CLP-TPO, SAS Approval _____ Date

SPECIAL ANALYTICAL SERVICES

Client Request

_____ Regional Transmittal _____ Telephone Request

A. EPA Region/Client: Region I/

B. RSCC Representative: Heidi Horahan

C. Telephone Number: (617) 573-5798

D. Date Of Request: _____

E. Site Name: _____

Please provide below description of your request for Special Analytical Services under the Contract Laboratory Program. In order to most efficiently obtain laboratory capability for your request, please address the following considerations, if applicable. Incomplete or erroneous information may result in a delay in the processing of your request. Please continue response on additional sheets, or attach supplementary information as needed.

1. General description of analytical services requested:

Analysis of water, soil, fly ash and/or chemical wastes (stillbottom, fuel oil and sludge matrices) using a modified version of the DFLM01.0 Statement Of Work (SOW) for analysis of Polychlorinated Dibenzo-P-Dioxins (PCDD) and Polychlorinated Dibenzofurans (PCDF). Modifications are as per Section 8 (Special Technical Instructions)

Note: High Resolution Mass Spectrometry (HRMS) may be utilized as long as all QC requirements stated in this analytical request are met or exceeded. $M-COCL^+$ ions need not be monitored when employing HRMS.

2. Definition and number of work units involved (specify whether whole samples or fraction; whether organics or inorganics; whether aqueous or soil and sediments; and whether low, medium or high concentration):

3. Purpose of analysis (specify whether Superfund (enforcement or remedial action), RCRA, NPDES, etc.):

4. Estimated date(s) of collection:

5. Estimated date(s) and method of shipment

6. Number of days analysis and data required after laboratory receipt of samples:

Analysis must be completed and data package must be received by the Region within 15 days of laboratory receipt of last sample in the SDG.

Deliver data to:

Overnight Delivery	US Mail
Heidi Horahan US EPA Region I 90 Canal Street Boston, MA 02114	Heidi Horahan US EPA Region I JFK Federal Building HPC-CAN 7 Boston, MA 02203-2211

7. Analytical protocol required (attach copy if other than a protocol currently used in this program):

DFLM01.0, Statement Of Work (SOW) for Analysis of Polychlorinated Dibenzo-P-Dioxins (PCDD) and Polychlorinated Dibenzofurans (PCDF), with SAS modifications. Any deviations from this request must be approved by Region I prior to bid award.

8. Special Technical Instructions (if outside protocol requirements, specify compound names, CAS numbers, detection limits, etc):

a) ALL EMPC values are to be included in the TEF calculations.

b) Second column confirmation is required for all samples which exceed the action level of 7 ppt for water, 0.7 ppb for solids (soil, sediment and fly ash; dry weight) or 7 ppb for chemical wastes.

c) Dry weights must be performed on all solid (soil, sediment and fly ash) samples. Immediately after weighing the sample for extraction, weigh 5-10 grams of the sample into a tared crucible. Determine the percent moisture by drying overnight at 105°C. Allow to cool in a desiccator before weighing. Concentrations of individual analytes in each sample must be reported relative to the dry weight of the sample.

d) The S/N ratio of the continuing calibration standard (CC3) must be greater than 10 to 1 for all unlabeled PCDD/PCDF ions and for all labeled internal, recovery and clean-up standards.

e) Window defining mix must be analyzed every day prior to the continuing calibration standard (CC3).

f) The laboratory must provide an example of an EDL and EMPC calculation.

9. Analytical results required (if known, specify format for data sheets, QA/QC reports, Chain-of-Custody documentation, etc.). If not completed, format of results will be left to program discretion.

As per deliverables stated in Exhibit B of the CLP DFLM01.0 SOW including the following clarification:

a) SICPs must be presented so the two molecular ions, M^+ and $(M+2)^+$, the $(M-COCL)^+$ ion, and any relevant internal/recovery standards or diphenyl ether interferents are to be presented on one page. The SICP must show the full time window scanned for each ion.

b) The complete data system report shall include all of the information listed below. For laboratories which do not use automated data system procedures, a laboratory "raw data sheet", containing the following information, must be included in the sample data package in addition to the chromatogram and SICPs:

- EPA sample number,
- Date and time of analysis,
- RT (and scan number if available) of identified compounds,
- Ions used for quantitation with measured area,
- Copy of area table from data system,
- GC/MS instrument ID,
- Lab file ID.

c) Report Form I values corrected for the dry weight.

10. Other (use additional sheets or attach supplementary information, as needed):

None

11. Name of sampling/shipping contact:

	Name	Phone
Primary		
Secondary		

12. Data Requirements

Parameter	Method Detection Limit

Refer to Section C in the CLP SOW DFLM01.0.

13. QC Requirements

Audits Required	Frequency of Audit	Limits	Corrective Action

As per the CLP SOW DFLM01.0.

Note: Blind QC samples must meet EPA's 99% Confidence Limits.

14. Action Required if Limits are Exceeded

If limits are exceeded, contact the Sample Management Office, then _____

_____

_____

Please return this request to the Sample Management Office as soon as possible to expedite processing of your request for Special Analytical Services. Should you have any questions or need any assistance, please contact your Regional representative at the Sample Management Office.

APPENDIX D

QUALITY ASSURANCE OBJECTIVES FOR VOC ANALYSIS OF LIQUIDS

3.0 QUALITY ASSURANCE OBJECTIVES

Quality assurance is defined as the ability to assure that all of the activities are performed correctly and the data can be confidently used to make decisions.

In order to achieve the data requirements that are consistent with the objectives of each task, there must be an assessment of the performance of five data quality parameters. These data quality parameters are precision, accuracy, representativeness, completeness, and comparability. Definitions of these data quality parameters are presented below:

Precision - A measure of the reproducibility of measurements under a given set of conditions.

Accuracy - A measure of how close a result is to the true value.

Representativeness - The degree to which a single measurement is indicative of the characteristics of a larger sample or area or the degree to which the data gathered by the project represents the field conditions.

Completeness - A measure of the amount of valid data obtained from the measurement system compared to the amount that is planned, e.g.,

$$\% \text{ Completeness} = \frac{\text{\# of Valid Results}}{\text{Total \# of Results}} \times 100$$

Valid results will be defined for each task by addressing accuracy, precision, and representativeness parameters quantitatively.

Comparability - A measure of the confidence with which one data set can be described as similar to another.

3.1 Data Quality Parameters

Target compound list volatiles (waters)

1. Accuracy

- All blanks must be less than the reporting limits.

- The Laboratory Control Sample percent recoveries must be and Matrix Spike recovery advisory limits are:

	water
1,1-Dichloroethene	61-145%
Trichloroethene	71-120%

Benzene	76-127%
Toluene	76-125%
Chlorobenzene	75-100%

- The Relative Response Factor (RRF) for initial calibration must be greater than 0.300 for the five System Performance Check Compounds (0.250 for Bromoform). The System Performance Check Compounds are: chloromethane; 1,1-dichloroethane; bromoform; 1,1,2,2-tetrachloroethane; and chlorobenzene.

- The Percent Relative Standard Deviation (%RSD) for the initial calibration must be less than 30% for Calibration Check Compounds (CCCs) 1,1-Dichloroethene, Chloroform, 1,2-Dichloropropane, Toluene, Ethylbenzene, and Vinyl chloride.

- The percent difference (%D) for the continuing calibration (CCCs) must be less than 25%.

- The detection limit must be equal to or less than the reporting limits listed below.

Water
µg/l

1. Chloromethane	2
2. Bromomethane	2
3. Vinyl Chloride	2
4. Chloroethane	2
5. Methylene Chloride	2
6. Acetone	5
7. Carbon Disulfide	1
8. 1,1-Dichloroethene	1
9. 1,2-Dichloroethane	1
10. 1,2-Dichloroethene (total)	1
11. Chloroform	1
12. 1,2-Dichloroethane	1
13. 2-Butanone	5
14. 1,1,1-Trichloroethane	1
15. Carbon Tetrachloride	1
17. Bromodichloromethane	1
18. 1,2-Dichloropropane	1
19. cis-1,3-Dichloropropene	1
20. Trichloroethene	1
21. Dibromochloromethane	1
22. 1,1,2-Trichloroethane	1
23. Benzene	1
24. trans-1,3-Dichloropropene	1

25. Bromoform	1
26. 4-Methyl-2-pentanone	5
27. 2-Hexanone	5
28. Tetrachloroethene	1
29. Toluene	1
30. 1,1,2,2-Tetrachloroethane	1
31. Chlorobenzene	1
32. Ethyl Benzene	1
33. Styrene	1
34. Xylenes (Total)	1

2. Precision

- All laboratory duplicates and matrix spike duplicates should have a relative percent difference (RPD) as follows:

	water
1,1 Dichloroethene	14%
Trichloroethane	14%
Benzene	11%
Toluene	13%
Chlorobenzene	13%

If the results for the duplicate pair are positive and greater than five (5) times the PQL then the %D criteria are used. However, if the results for the duplicate pair are less than 5 times the PQL then the acceptance criteria will be +/- PQL or the %D criteria, whichever is greater. This criteria will be used for duplicate results that have a "ND" and a positive value. Of course, a duplicate that gives two ND values does not give any precision information and thus precision will not be used to judge the date's validity.

3. Representativeness

To insure that analyses reflect actual field conditions the laboratory will strive to maintain the integrity of the samples prior to and during analysis and to minimize the effects of the laboratory environment on the samples. To monitor effects of the laboratory environment, two types of blanks are used.

The first type is a trip blank which will consist of a volatile organic analysis vial filled by Pace with deionized, analyte-free water that will remain capped and accompany the sample VOA vials at all times. A trip blank may accompany all water VOA samples shipped to the laboratory. The trip blank indicates the effects of sample bottle preparation, shipment to the site, site storage and handling, return shipment, and sample holding at the laboratory on sample integrity.

The second type is a laboratory holding blank which consists of a volatile organics sample vial filled with analyte-free water and randomly placed with samples as received for storage prior to analysis. The holding blank serves to monitor the effects of sample bottle preparation and sample storage at the lab prior to and during analysis.

Target Compound List Volatiles (soil)

1. Accuracy

- The presence of any analyte in the method blank is undesirable, although trace amounts of methylene chloride periodically occur, because of their use in other parts of the lab. Up to 5 times the reporting limit is allowed for this analyte. For all others, no compounds shall be present above the reporting limit.

- The Matrix Spike percent recoveries must be:

Compound Name	soil % recv
1,1-Dichloroethene	59-172

APPENDIX E

NSB-NLON PROJECT FILES

FILING REQUEST FORM
U.S. NAVAL BASE
GROTON, CT

UPDATED 12/28/92

CONTRACTS

____ CONTRACT
____ CONTRACT ADDENDUM #4/PIER 33 & BERTH 16 WORK PLANS
____ CONTRACT ADDENDUM #5/RES. WELL SAMPLING
____ CONTRACT ADDENDUM#6/WELL SAMPLING
____ AMEND. #7/COMMUNITY RELATIONS PLAN
____ CONTRACT #10/TRC MEETING
____ CONTRACT MOD #11/RES. WELL SAMPLING
____ CONTRACT MOD #12/H.W. STORAGE AREA SAMPLING
____ CONTRACT MOD#13 SUPPLEMENTAL & PHASE II WORK PLANS
____ CONTRACT AMENDMENT #14
____ CONTRACT AMENDMENT #15 SUPPLEMENTAL STEP I,MISC, GOSS COVE
____ CONTRACT AMENDMENT #16 PIER 33/BERTH 16
____ CONTRACT NEGOTIATION FILE (IR STUDY)
____ SUBCONTRACTOR CONTRACT CORRESPONDENCE
____ CONTRACT OFFSITE POND SAMPLING
____ CONTRACT MOD-FS STUDY
____ CONTRACT MOD-OFFSITE POND SAMPLING
____ PROPOSAL FEASIBLITY STUDY
____ TRC MEETING CONTRACT AMENDMENT
____ AMENDMENT #17 COST PROPOSAL

CORRESPONDENCE/MISC.

____ ATSDR
____ CORRESPONDENCE
____ CTDEP/EPA/NAVY COMMENTS
____ FINANCIAL (FILE MY MONTH)
____ INTERNAL MEMO'S
____ MISC. MEETING NOTES
____ FIELD SUPPLIES COST ESTIMATE BACKUP
____ NEWSPAPER ARTICLES
____ PROGRESS REPORTS
____ HOMEOWNER MEETING 3/12/1991
____ PUBLIC MEETING 7/26/90
____ PUBLIC MEETING 1/22/91
____ PUBLIC MEETING 3/12/91
____ PUBLIC MEETING TRC 4/11/91
____ PUBLIC MEETING TRC 9/19/91
____ PUBLIC MEETING TRC 12/2/92
____ PURCHASE ORDERS
____ SCHEDULE
____ TIME SHEETS
____ TRC COMMENTS
____ TRC MEETING MEETING NOTES
____ TRC MEETING NOTES 1/9/91
____ TRC MEETING 3/31/92
____ TRC MEETING CONTRACT AMENDMENTS
____ TRC MEMBER LIST

SUBCONTRACTORS

____ ASSOCIATED SURVEYS
____ MENZIE-CURA & ASSOCIATES
____ EMPIRE SOILS
____ META ENVIRONMENTAL
____ NET ATLANTIC
____ RADIATION SAFETY
____ WESTON GEOPHYSICAL

PROJECT FILES

____ HAZARDOUS WASTE STORAGE FIELD SAMPLING (TSDF)
____ PIER 16 & BERTH 33 WORK PLAN
____ OFF SITE POND SAMPLING FIELD
____ COMMUNITY RELATIONS
____ TSDF SAMPLING 1256-12-01
____ NAVY PROPOSAL FEASIBILITY STUDY
____ RESIDENTIAL WELL SAMPLING 1256-13
____ NAVY DESCRIPTION OF CURRENT SITUATION 1256-14-01
____ NAVY FS DEVELOPMENT OF

ALTERNATIVE REMEDIAL ACTION 1256-14-02
____ NAVY INITIAL SCREENING OF ALTERNATIVE 1256-14-03
____ NAVY EVALUATION OF ALTERNATIVES 1256-14-04
____ FS REPORT PREPARATION 1256-14-05
____ NAVY FS MENZIE 1256-14-06
____ NAVY/SUPPLEMENTAL WELL SAMPLING, ISTOPIC ANALYSIS 1256-17-01
____ COMUNITY RELATIONS FACT SHEETS 1256-18-08
____ PHASE II WORK PLAN, FSP, QA/QC AND HASP 1256-18
____ BORON/BACKGROUND PLAN OF ACTION
____ BORON LITERATURE SEARCH

NAVY REMEDIAL INVESTIGATION (STEP I/II)

____ FS FINAL
____ FSP 1ST DRAFT
____ FSP 2ND DRAFT
____ HASP FINAL
____ HASP 1ST DRAFT
____ HASP 2ND DRAFT
____ QA/QC GENERAL
____ QA/QC FINAL
____ QA/QC 1ST DRAFT
____ QA/QC 2ND DRAFT
____ FEASIBILITY STUDY WORKING DRAFT 9/92
____ PHASE II WORK PLAN

NAVY PLANS & BACKGROUND INFORMATION

____ 200 SCALE UTILITIES
____ AREA A
____ AERIAL PHOTOS
____ BATTERY ACID AREA
____ DPDO AREA
____ GOSS COVE
____ FORMER GAS STATION
____ LOWER BASE BLD. #79
____ MAPS PLANS
____ SUBMARINE BASE
____ TECHNICAL REFERENCES/PAST REPORTS
____ TORPEDO SHOP
____ EXISTING CONDITIONS/PHOTO REDUCTION
____ RAW MATERIAL INFO.
____ AERIAL PHOTOS
____ NEW SITE INFORMATION
____ RADIOLOGICAL TEST RESULTS 12/91

____ DRAFT EIS THAMES RIVER DREDGING PROJECT
____ BORING LOGS PIER 33/ BERTH 16

NAVY FIELD & LAB DATA

____ BORING LOGS
____ MONITORING WELL CONSTRUCTION
____ GROUNDWATER ELEVATION DATA
____ GEOLOGIC INFORMATION
____ HYDROLOGIC INFORMATION
____ GEOPHYSICAL DATA
____ SOIL GAS DATA
____ FIELD NOTEBOOKS
____ MASTER SAMPLE LOG BOOKS
____ CHAIN OF CUSTODY
____ NET/ATLANTIC MONTHLY QA REPORTS
____ MONTHLY LAB DATA FOR PROGRESS REPORTS
____ LAB RESULTS SURFACE SOIL
____ LAB RESULTS GROUNDWATER
____ LAB RESULTS SURFACE WATER
____ LAB RESULTS SEDIMENT
____ LAB RESULTS BORING
____ LAB RESULTS RESIDENTIAL WELLS
____ QA/QC SURFACE SOIL DATA
____ QA/QC DATA VALIDATION
____ QA/QC GROUNDWATER DATA
____ QA/QC SEDIMENT DATA
____ QA/QC BORING DATA
____ QA/QC AUDITS
____ UTILITY MANHOLE INSPECTION
____ FIELD NOTES (PRELIMINARY SITE INSPECTION)
____ INTERNAL LAB
____ ANALYSIS TRACKING
____ PHOTOS/SLIDES/VIDEO