REMEDIAL DESIGN WORK PLAN

VOLUME I

ROWE INDUSTRIES GROUND-WATER CONTAMINATION SITE

SAG HARBOR, NEW YORK

MAY 1995

LBG ENGINEERING SERVICES, P.C.
PROFESSIONAL ENVIRONMENTAL AND CIVIL ENGINEERS
126 MONROE TURNPIKE
TRUMBULL, CONNECTICUT 06611
(203) 452-3110

TABLE OF CONTENTS

TABLE OF CONTENTS

(continued)

LIST OF TABLES
(at end of report)

Table

LIST OF FIGURES
(at end of report)

Figure

LIST OF PLATES
(in pocket)

Plate	
1	Site Vicinity Map
2	Boring Location Plan
3	Aquifer Pumping Test Schematics
4	Predesign Layout of Ground-Water Remediation System
5	Water Treatment Schematics
6	Soil Excavation Plan
7	Natural Features Map
A5-1	Project Schedule

LIST OF APPENDICES
(at end of report)

Appendix

I. Sampling and Analysis Monitoring Plan (SAMP) for Soils

- A. Soil Sampling Plan
- B. EPA Conditional Approval Letter for Soil Sampling

II. Field Activities Procedures

- A. Extraction Well Drilling & Construction Specifications
- B. Procedures for Running a Step-Rate Pumping Test
- C. Procedures for Running a Constant-Rate Pumping Test
- D. Plan for Evaluation of Greenbelt Pond System
- E. Procedure for Handling Well Development and Well Evacuation Water
- F. Procedure for Handling Drill Cuttings

III. Quality Assurance Project Plan for Ground-Water Predesign Activities

IV. Health and Safety Plan

V. Site Management Plan

- A. Organization Chart (Figure A5-1)
- B. Resumes
- C. Project Schedule (Plate A5-1)

VI. Aquifer Pumping Test

- A. Ground-Water Treatment Units - Manufacturers' Data Sheet
- B. Air Emission Calculations

VII Hagerman Access Agreement

ROWE INDUSTRIES GROUND-WATER CONTAMINATION SITE SAG HARBOR, NEW YORK

REMEDIAL DESIGN WORK PLAN

1.0 INTRODUCTION

The purpose of this Remedial Design Work Plan (RDWP) is to describe the tasks which will be completed during the design process for the Remedial Action (RA) selected by the United States Environmental Protection Agency (EPA) for the Rowe Industries Ground-Water Contamination Site (Rowe Site) in Sag Harbor, New York (plate 1). The remedy selection process was described in the Record of Decision (ROD) for the Rowe Site dated September 30, 1992. The major components of the selected remedy include:

- Excavation and disposal of approximately 365 cy (cubic yards) of soil at a Resource Conservation and Recovery Act (RCRA) permitted landfill. In order to comply with RCRA Land Disposal Restriction (LDR) regulations, it is possible that the excavated soils may have to be treated onsite prior to disposal. This will be verified during remedial design;

- Confirmatory sampling to ensure that soils with concentrations above the site-specific soil cleanup objectives have been excavated;

- Remediation of volatile organic compounds (VOCs) in the ground water by the installation of seven extraction wells which will pump the ground water to an airstripping treatment system with ultimate discharge of treated water to Sag Harbor Cove;

- Iron treatment, if required, based on analytical studies to be conducted during the pumping test;

- Implementation of a system monitoring program that includes the collection and analysis of samples of the influent and effluent from the treatment system and periodic collection of wellhead samples; and

- Implementation of a long-term monitoring program to track the progress of remediation and the concentrations of the contaminants of concern.

In addition to the major components of the remedy, there are a number of administrative and predesign tasks which must be completed prior to the design and/or implementation. These include the following:

- Delineate wetlands and conduct a wetlands evaluation;

- Assess floodplain (with delineation of the 100 and 500-year flood contours) at locations where excavation of soils is to take place;

- Complete a Stage 1A cultural resources survey to identify any known or potential historical, architectural, and/or archaeological resources at the Rowe Site at locations where excavation of soil is to take place;

- Conduct Toxicity Characteristic Leaching Procedure (TCLP) testing on the soils which will be excavated;

- Review Remedial Investigation (RI) hydrogeologic work to optimize the ground-water extraction design;

- Define areal extent of soil to be excavated and disposed of at a Resource Conservation and Recovery Act (RCRA) permitted landfill;

- Collect baseline data on existing local species of flora and fauna in Sag Harbor Cove over a period of one year prior to the start of the Remedial Action (RA) in order to determine the types of species in this area. Review information about species identified from existing literature to determine their salinity tolerance limits;

- Collect baseline data on salinity levels to determine salinity level changes, if any, in Sag Harbor Cove; and

- Collect baseline data on selected ponds of the Long Pond Greenbelt system. Specific ponds will be delineated. Collect data on a periodic basis, as necessary for at least one year prior to the start of the RA and during the RA, to establish water levels in, and ground-water elevations beneath, surrounding ponds, the normal seasonal fluctuations and any extreme hydrologic conditions. Select at least one control pond outside the hydrologic influence of the extraction wells.

The RDWP format follows the format of the Remedial Design/Remedial Action (RD/RA) Appendix B - Statement of Work, which is an integral part of the Consent Decree (dated April 20, 1994) that governs the RA at the Rowe Site. The RD/RA at the Rowe Site has been separated into two categories, soil and ground water. The soil RA can be completed in a relatively expeditious manner and, therefore, will be on a more accelerated schedule than the design and implementation of ground-water RA.

2.0 SAMPLING AND ANALYSIS MONITORING PLAN

The Sampling and Analysis Monitoring Plan (SAMP) covers all work which will be completed prior to RA implementation/construction. A revised SAMP will be included with the RD reports to cover activities which will occur during system construction, start-up and operational monitoring, as well as soil removal confirmation sampling. The SAMP for

confirmation sampling will provide a matrix table showing the number of samples to be collected, the sampling matrix, test methodology, decontamination procedures, reporting formats, sample designation procedure, containers, holding times, and preservatives. It will also show the type and frequency of Quality Assurance/Quality Control (QA/QC) samples, including method blanks, field blanks, duplicates and matrix spike samples and analytical protocols.

The following data is required to be obtained to complete the RD of the selected remedy and will be obtained during predesign activities.

2.1 Soils

Definition and characterization of soils on the Rowe Site slated for investigation and/or remediation has been completed and will be utilized for the final design report preparation. This portion of the SAMP was submitted to the EPA on July 8, 1993 and was conditionally approved in a letter from the EPA dated November 30, 1993. The plan, which included the boring locations shown on plate 2, and conditional approval letter are presented in Appendix IA. EPA's comments have been addressed in the SAMP.

Soil samples were analyzed for the parameters listed in table 1. Table 7a presents the parameters, analytical methods, holding times, container type and preservatives for the soil predesign sampling. Per 40 CFR Part 268.43, Table CCW, compliance with the Land Disposal Restrictions (LDRs) will be based on total concentration and not TCLP criteria.

2.2 Ground Water

Both hydrogeologic and water-quality data will be developed during the predesign activities for use in the RD. The tasks detailed in the following subsections will be completed in the predesign phase and will be addressed in the Ground-Water RD Report.

2.2.1 Ground-Water Extraction System Design Data

The objectives of the ground-water extraction system are to prevent any further migration of ground water containing volatile organic compounds (VOCs) beyond the Sag Harbor Industries

(SHI) property, to prevent further discharge of contaminated ground water to Sag Harbor Cove, and to extract and treat impacted ground water. Based on the ground-water flow model developed in the Feasibility Study (FS), it was determined that these objectives could be achieved using three offsite wells pumping at a combined rate of 500 gpm (gallons per minute) and four onsite wells pumping at a combined rate of 150 gpm. Preliminary well locations were developed using the model which, in turn, was based on assumed aquifer coefficients. The locations of these proposed recovery wells are shown on plates 2 and 4. The FS stated that actual pumping rates and well locations would be determined by field testing during the remedial design process. As a predesign activity, two test recovery wells will be installed and tested. RW-2 will be installed onsite and RW-6 will be installed offsite. The following elements will be completed as predesign tasks and the results will be used in the final design process:

2.2.1.1 Test Well Design

Based on water-quality and hydrogeologic data developed during the Remedial Investigation (RI), it is anticipated that the offsite test well (RW-6) will be approximately 80 feet deep, with the well screen extending from 10 feet below the water table to the completion depth. Blank sections of pipe will be used adjacent to clay layers. The presence and position of clay layers will be determined through the acquisition of split-spoon samples and through completing resistance and natural gamma geophysical logs. The onsite test well (RW-2) will be approximately 60 feet deep and will be screened from 5 feet below the water table to the completion depth.

Optimal well screen design is normally developed by conducting sieve analyses of representative sediment samples, and then designing the screen and associated gravel pack to retain a specific fraction of the formation. At this site, however, the wells are not necessarily being designed to provide the maximum available water; they need yield only the amount of water necessary to effect capture of the impacted ground water. However, the well screen will be designed to minimize operational difficulties and maintenance requirements.

As a predesign task, sediment samples obtained during installation of the test wells will be subjected to sieve analysis. The results will be used to modify the design specified in this Work

Plan if necessary. Well design specifications are presented in Appendix IIA. The test wells will be at the locations designated for RW-2 and RW-6, shown on figure 1 and plates 2 and 4, and their design and construction will allow their conversion to permanent recovery wells should design evaluations indicate the locations are acceptable.

For use during the RW-6 pumping test, two additional monitor wells (MW-53 and MW-54), completed with 10 feet of screen set from 40 to 50 ft bg (feet below grade), will be installed 50 feet north and 100 feet south (respectively) of the offsite test well (RW-6), as shown on figure 1.

2.2.1.2 Pumping Tests

Well RW-6 will be installed at the location shown on figure 1 and plate 4, per the drilling method and design described in Appendix IIA. After the well has been thoroughly developed to insure a clear discharge, a step-rate pumping test will be run on the well to determine its efficiency. Test specifications for the step-rate pumping test are presented in Appendix IIB. The wells which will be monitored during the pumping tests are shown on table 8.

Based on the results of the step-rate test, a pumping rate will be determined for a constant-rate test. The purpose of the constant-rate pumping test will be to assess the response of the aquifer to a pumping stress and to provide representative water-quality data. Test specifications for the constant-rate pumping test are presented in Appendix IIC. Results of the test analysis will be used to calculate the spacing of the remaining extraction wells such that their combined pumping influence will result in capture of the impacted ground water. The test data will be analyzed using distance-drawdown and time-drawdown relationships to arrive at site-specific aquifer coefficients, including transmissivity, storativity and, if appropriate, the leakage coefficient. These coefficients, in turn, will be incorporated into the model developed for the FS to refine its ability to predict zones of capture of various well configurations and pumping rates. A particle tracking routine will be used to illustrate and optimize the capture zones of the extraction wells. The model results will be presented in the Ground Water Preliminary Design Reports, as will a monitoring system to evaluate the system effectiveness.

The water extracted during the test will be treated using low-profile aerators, as specified in Section 2.2.1.3. The treated discharge will be routed above ground, using fire hose or irrigation pipe, to the point where Ligonee Brook flows under Noyack Road.

These procedures for step-rate and constant-rate pumping tests, followed by evaluation of the data, will be repeated for RW-2, shown on plate 2 with several minor differences. The pumping rate will be different, the test duration will be shorter and the discharge will be routed to the pond located in the southeast corner of the SHI property. Details for this test are in Appendix II.

Analytical results from aquifer-test influent samples will aid in developing final ground-water treatment system parameters. Table 2 presents a list of parameters to be analyzed. Table 7b presents the parameters, analytical methods, holding times, container types, preservatives, and QA/QC summary for ground-water predesign sampling. All of the parameters listed in table 2 will be sampled at the start of the pumping test and every 12 hours thereafter. Influent concentrations of VOCs will be used in the final design to determine the level of primary treatment (i.e., packed-tower airstripping) necessary to comply with New York's State Pollutant Discharge Elimination System (SPDES) permit. Effluent samples will concurrently be collected with influent sampling to determine compliance with discharge standards and evaluate low-profile airstrippers as an alternative treatment option. Other results from the parameters analyzed in table 2 will be used in the design to minimize the maintenance required for the primary treatment system. Samples collected during the pumping test and pilot study will be sent to IEA of Monroe, Connecticut for analysis. Only the final samples will be analyzed by Contract Laboratory Program (CLP) methodology. All other samples will be analyzed according to EPA SW-846 Methods 8010, 8020 and the 7000 series.

The Quality Assurance Project Plan for the pumping tests is presented in Appendix III.

2.2.1.3 Ground-Water Treatment for Pumping Tests

VOCs can be removed from the extracted ground water via airstripping prior to discharge. Treatment of the extracted ground water will be required to reduce the VOC concentrations to the

allowable effluent criteria shown in table 3. It should be noted that the allowable effluent criteria in table 3 is an estimate based on the most restrictive scenario (i.e., New York State Drinking Water Standards) and is subject to change based on the New York State Department of Environmental Conservation's (NYSDEC) review of a discharge application. Two Shallow Tray™ low-profile airstrippers, Model 3631, placed in parallel, with a combined capacity of 240 gpm, is considered appropriate for the pumping test. The low-profile airstripper would be provided by Northeast Environmental Products of West Lebanon, New Hampshire. Treatment schematics for each aquifer pump test are presented in plate 3 and specific design details for the water treatment equipment is contained in Appendix VI.

2.2.1.4 Air Monitoring During Pumping Test

Based on a review of the anticipated chemical concentrations in the influent, no exceedance of any NYSDEC Short-Term Guideline Concentrations (SGCs) is expected. These expected values are summarized in table 9 and Appendix VI.

Actual concentration in the stack during the pumping test will be calculated from water influent and effluent concentrations measured at the aerator(s) and measurement of air flow using a pilot tube placed inside the stack(s) at a point of average velocity.

2.2.1.5 Long Island Well Permit

Conversations with NYSDEC Region I indicate that a Long Island well permit will not be required for the discharge from the pumping test, based on the site being CERCLA regulated. However, should the United States Environmental Protection Agency (USEPA) direct so, a Long Island well permit application will be prepared and filed subsequent to final approval of the RDWP and prior to implementation of the pumping test.

2.2.2 Initial Testing Program

Prior to full-scale start-up of the extraction system, an initial testing program will be run to insure that the objectives of system operation will be met. The basic elements of the Initial Testing Program (ITP), described herein, will be expanded in the RD Report.

The ITP will consist of starting up the wells sequentially at 24-hour intervals and obtaining water-level measurements in the monitor well network on an hourly basis to determine zones of capture. It is expected that sufficient monitor wells exist to make this demonstration. If it is determined that additional monitoring points are required to make this demonstration, additional wells will be proposed. Pumping rates will be adjusted until drawdowns between the extraction wells are sufficient to demonstrate complete capture of water containing site-related VOCs. The demonstration of complete capture will be presented both graphically and in tabular format. The ITP report will show the observed drawdown in each well and the capture radius of each extraction well. Samples of water will be collected throughout the remedial system to document operation of the treatment units and confirm the quality of water being discharged from the system. The specific sample locations, analyses and frequencies will be determined after the design is completed.

2.2.3 Long-Term Monitoring Program

The RD Report will include a long-term water-level monitoring program to demonstrate continued capture of ground water. The plan will specify procedures to modify pumping rates based on specific target water levels in the well monitoring network. The monitoring program will be designed to insure overall capture during seasonal fluctuations. It can be expected that occasional excursions may occur during specific, short-term events involving heavy storms.

A water-quality monitoring program will also be developed to monitor improvements in water quality in the extraction wells and specified monitor wells. The data generated by this program will be used to make a demonstration for system modifications (i.e., pumping rate decrease or taking a well offline) or termination in the future.

The treatment system will ensure compliance with surface-water quality discharge standards by removing VOCs. Discharge standards will be verified on a monthly basis by sampling the outfall and analyzing the samples according to EPA Methods 8010 and 8020.

2.3 Salinity Study in Sag Harbor Cove

During the design and construction phase of ground-water remediation, a baseline study of salinity levels in Sag Harbor Cove will be completed. This study was initiated in October 1994. The purpose of the study is to document daily, monthly and seasonal variations in the salinity of the cove waters. The data will provide a baseline by which to evaluate potential changes in the salinity levels through the combined action of reducing inflow of fresh ground water by interdiction and reintroduction of the water through a diffuser. Two independent calculations completed by Leggette, Brashears & Graham, Inc. (LBG) and the Cornell Cooperative Extension have shown that salinity changes will be less than 1 percent. These calculations will be verified during the initial stages of ground-water remediation.

The monitoring plan consists of preset locations which are representative of the entire cove. Transects are located perpendicular to the flow of water in the cove. Individual locations across the transects are monitored, and salinity and temperature profiles at various depths are developed from the data.

To insure that the same stations are established during each monitoring event, land-based reference points such as homes, utility poles or docks are used to triangulate position. Sampling is completed using a boat having a negligible draft and high stability. A two-man crew is required, one person to hold the boat in position and one to take the measurements. A portable meter is used to measure salinity and temperature at one foot below the water surface and at 5-foot depth increments to the bottom, or at depth increments determined in the field. For each monitoring event at each location, readings are taken at, or close to, high and low tide. The locations of the transects are shown on figure 2.

All readings are recorded permanently in a field book and will be reported to the EPA in progress report(s). The Ground Water Remedial Design Report will contain all of the data

collected up to that point. The program will be initiated at least one year before and one year after discharge of treated water to the cove. Determination of change in percent salinity will be made on a monthly basis so that a determination can be made about the volume of discharge. Any observed salinity changes will be compared to the baseline study of salinity tolerance levels of the flora and fauna in and around the cove.

Contingency measures, should salinity changes be beyond the tolerance levels of most sensitive species, may include reduction in the discharge volume, addition of sea salt to the discharge, or lengthening of the diffuser pipe.

2.4 Flora and Fauna Baseline Study

The flora and fauna in Sag Harbor Cove and tidal wetlands will be inventoried over four seasons for a one-year duration. Specific surveys would be run in three locations: where Ligonee Creek enters the tidal wetlands, within the central portion of Sag Harbor Cove, and at the point where this portion of Sag Harbor Cove enters the main cove (at Long Point). The surveys would include an evaluation of marine algal and floral species, benthic grab samples and meter squares to determine benthic invertebrate populations using a 20-foot long seine to inventory fish and mobile invertebrate populations. Sampling events will be in June, September, December and March.

At the end of the year, after all indigenous and transient species have been identified, a literature search will be completed to determine the salinity tolerance of each species. The specie with the lowest salinity tolerance range will be used to establish performance standards for salinity monitoring.

2.5 Cultural Resources Survey

Disturbances to the land during the remedial action will be limited in extent. The following areas will be disturbed:

- Drum Storage Area: An area of approximately 20 feet by 20 feet will be excavated on land formerly disturbed by the construction of a concrete drum storage structure. No new areas will be subject to disturbance.

- Septic System and Dry Wells: These features, located on an industrial property, have already caused disturbance of the subsurface through their installation. No new areas will be subject to disturbance.

- Well Vaults and Piping: These features will be installed along Carroll Street, Noyack Road and across Sag Harbor Turnpike. Most of the route has already been disturbed by installation of the public water-supply main or for construction of the roads, and no significant cultural or archaeological features were reported.

Although very limited areas not previously disturbed may be subject to shallow trenching, a Phase IA Cultural Resources Survey will be completed for the project area. Under the National Historic Preservation Act, possible effects of the remedial activities on properties on, or eligible for inclusion in, the National Register of Historic Places (NRHP) must be evaluated. Potential Applicable or Relevant and Appropriate Requirements (ARARs) governing this aspect of the work are:

- Historic Sites Act of 1935 (HSA) (16 USC 461 et seq)
- National Historic Preservation Act of 1966 (NHPA), as amended, (16 USC 470)
- Executive Order 11593 - "Protection of and Enhancement of the Cultural Environment" - May 13, 1971
- Archaeological and Historic Preservation Act of 1974 (AHPA) (16 USC 469 et seq)
- Presidential Memorandum - "Environmental Quality and Water Resources Management" - July 12, 1978

- ACHP - Regulations for the Protection of Historic and Cultural Properties (36 CFR 800)
- Archaeological Resources Protection Act of 1970 (ARPA) (16 USC 470)
- Department of the Interior (DOI) - Criteria for Inclusion in the National Register of Historic Places (36 CFR 60.4)

The Phase IA Cultural Resources Survey will be completed in accordance with the Department of Interior guidelines for cultural resource survey reports. The primary sources for the information required will be the Sag Harbor Historical Society and the Southampton Town Trustees.

2.6 Delineation and Evaluation of Wetlands

Wetlands on the Rowe Site were delineated and evaluated during the Remedial Investigation phase of the project. The remedial actions will not take place in or near these wetlands. As part of the RD, wetlands delineation and evaluation will be completed for the environs of Sag Harbor Cove. The work will be completed in accordance with the "1987 Corps of Engineers Wetland Delineation Manual". The work will be completed in conjunction with the Flora and Fauna Evaluation Study of the cove. The results of the study will be used to support applications for activities to be completed in jurisdictional wetlands, which will consist of installation of a pipe to convey water from the treatment plant to the cove. The Ground Water Remedial Design Report will address the potential for wetland disturbance as well as restoration.

2.7 Evaluation of the Greenbelt Pond System

A study has been developed in conjunction with the Nature Conservancy to evaluate the water levels in the pond system to assess the impacts of ground-water withdrawals. The plan, presented in Appendix IID, has already been implemented. After at least one year of monitoring to determine the seasonal variations in pond levels, ground-water levels and their interdependence, performance standards will be determined, in conjunction with the Nature Conservancy.

2.8 Flood Plain Delineation

The 100- and 500-year flood plains in the vicinity of the Rowe Site have been established from Federal Emergency Management Agency (FEMA) flood maps published for the area. Base flood elevations were noted or inferred from the FEMA flood maps and then delineated on existing topographic surveys of the area. All inferred elevations were determined by comparing landmarks associated with the depicted flood plain boundaries on the FEMA maps and matching those landmarks to existing topographic surveys. The Natural Features Map showing the demarcated flood plains is presented on plate 7. Activities occurring within flood plains will be designed for minimal disturbance of the flood plain and include appropriate restoration, as required by law.

3.0 QUALITY ASSURANCE PROJECT PLAN

IEA Laboratory has been selected to perform analytical testing on the soil and water samples. They have prepared a Quality Assurance Project Plan (QAPP) based on EPA CLP SOW OLM01.9, and ILM 3.0 which is presented as Appendix III. The QAPP for the pumping test predesign activities is presented in Appendix III.

4.0 HEALTH AND SAFETY PLAN

The Health and Safety Plan (HASP) utilized for the RI covers most of the activities which will be conducted during the RD phase, including predesign drilling and sampling, pumping tests and pond monitoring.

Activities not covered relate to salinity monitoring in the Cove. This work will involve boating safety aspects, as described herein and in the amended HASP presented in Appendix IV.

4.1 Marine Sampling Safety Procedures

All activities involving offshore sampling will be subject to the following requirements to protect the safety of the sampling team:

- Any boat used for this purpose must be of a relatively low draft and have a high stability. The boat must be unsinkable, even when swamped;
- There must always be a two-man crew in the boat during offshore activities;
- Life jackets must be worn at all times (Type I or II) during offshore activities;
- If a motor is used for propulsion, a fire extinguisher appropriate for marine use must be on board at all times. The expiration date of the extinguisher must be checked on a weekly basis;
- All loose gear should be lashed securely to prevent movement in rough seas;
- This work consists of monitoring and can be postponed; do not go out in rough weather, in lightning conditions or in fog. Use prudence in selecting the sampling day ahead of time.

4.2 Remedial Action Implementation

The RD Reports for soil and ground water will contain updated Health and Safety Plans (HASPs) to cover aspects of the work that have not yet been addressed in the existing HASP. Such activities will consist of shoring and excavation, trenching and general construction.

5.0 SITE MANAGEMENT PLAN

The scope of the RD/RA necessitates the use of highly trained and skilled personnel. To this end, LBG has assembled a team with the qualifications to implement the RD/RA. This team will be comprised of personnel from LBG, LBG's subsidiary corporation (LBGES), and select subcontractors.

5.1 LBG and its Subsidiaries

All key, senior staff assigned to the project have graduated from accredited universities and hold or qualify for registration as Professional Engineers or are Licensed Geologists. Membership is held on an individual basis in technical organizations such as the American Society of Civil Engineers, the Association of Ground-Water Scientists and Engineers, the Society of

Environmental Toxicology and Chemistry and the National Society of Professional Engineers. All personnel assigned to the project are fully certified under the OSHA HAZWOPER regulations to conduct and/or supervise operations at hazardous waste sites. Resumes and copies of pertinent licenses for the key personnel are attached in Appendix V. The project organizational chart, which includes these personnel, is shown on figure A5-1.

As a Principal of LBG, Mr. Robert Lamonica is the Principal in Charge of the project. Mr. Lamonica has been with LBG since 1976 and has been a practicing geologist since 1976. Mr. Lamonica is a Professional Geologist in 3 states. It will be Mr. Lamonica's responsibility to ensure that all aspects of the project are completed in compliance the rules and regulations of the United States Environmental Protection Agency (EPA), to provide final Quality Assurance and Quality Control (QA/QC) review, to make general policy decisions, provide liaison between the client and agencies and to approve all working arrangements for the RD/RA.

As President of LBG Engineering Services, P.C. (LBGES), Mr. William K. Beckman will be the lead engineer for the RD/RA. Mr. Beckman has been with LBGES since its inception in 1992 and has been a practicing engineer since 1978. Mr. Beckman holds Professional Engineering licenses in 13 states, including the State of New York. It will be Mr. Beckman's responsibility to direct and oversee all engineering undertakings and provide final Quality Assurance and Quality Control (QA/QC) review for those undertakings, as specified in the Scope of Work, p2, paragraph B.

As a Senior Associate of LBG, Mr. Jeffrey Lennox will be the Project Manager for special projects associated with the RD/RA. Special projects currently include baseline flora and fauna studies, baseline water resources studies, aquifer testing and development of health and safety plans. Mr. Lennox has been with LBG since 1983. It will be Mr. Lennox's responsibility to oversee and direct all special projects associated with the RD/RA, to oversee and direct all geology staff and to provide QA/QC for all analytical work, geological work and special projects.

As Senior Environmental Engineer for LBGES, Mr. John J. Tacetta will be the Project Manager for the RD/RA. Mr. Tacetta has been with LBGES since 1993 and has been a practicing engineer since 1988. Mr. Tacetta holds an Intern Engineer Certificate and has the experience

required by the State of New York State Department of Education for engineering licensure. It will be Mr. Tacetta's task to arrange work schedules, coordinate subcontractors, direct design work, oversee report preparation, provide primary QA/QC review for engineering undertakings and to report progress to the Lead Engineer and Principal in Charge, as appropriate.

5.2 Subcontractors

Because LBG and it subsidiaries are geological and engineering consulting firms solely, the scope of the RD/RA will require LBG to retain the following services through subcontract:

- Drilling firms
- Analytical laboratories
- Construction and excavation firms
- Ecological and archaeological consultants

Because of the undeveloped nature of the RD/RA, a full list of subcontractors will not be available until all bids are awarded. However, predesign activities will require the use of several subcontractors.

Requests for Proposal/Quotation for installing and testing the onsite and offsite test wells and monitor wells will be sent to the following firms:

- D. L. Maher
- Aquifer Drilling and Testing
- Delta Well and Pump

Potential subcontractors for the soil and ground-water remediation will be presented in the Remedial Design reports.

6.0 ACCESS AGREEMENTS AND PERMITTING

6.1 Access Agreements

An access agreement with Richard Hagerman, owner of the property on which the former drum storage area is located, has been finalized (Appendix VII). Work on this property will include soil-vapor sampling, soil sampling and soil excavation and removal.

The only other anticipated access agreement requirement will be associated with running the discharge pipe to Sag Harbor Cove. After the location of the pipe has been finalized in the design, any required access agreements will be pursued.

6.2 Permits and Regulatory Requirements

The following subsections list tentatively-identified permits and notification requirements necessary to conduct remedial activities at the Rowe Site. The number of permits required for remedial activities proceed may increase or decrease based on information obtained during the remedial design process. It is noted that the RD/RA is a CERCLA action and, therefore, is not subject to permitting requirements of State and local jurisdictions. However, the EPA has directed that all design criteria meet established State and local regulations, and that such compliance shall be established through the filing of all required permit applications. Under the CERCLA framework, it is not necessary to obtain State and local permits to proceed with the RA. Because design changes are likely during USEPA review of RD documents, all permit applications will be prepared and filed subsequent to RD approvals and prior to implementation of those RDs. Accordingly, the following subsections detail the relevant State and local regulatory framework and specify which permit applications shall be filed with agencies which would otherwise have jurisdiction over the Rowe Site.

6.2.1 Federal Permits

New York State has a well developed State Implementation Program (SIP) for EPA-promulgated regulations. Accordingly, the only required Federal Permit application will be for an Army Corps of Engineer (ACE) permit for work being conducted (i.e., installation of diffuser) within the navigable waters of the United States. The ACE permit program is authorized by Section 10 of the River and Harbor Act of 1899, Section 404 of the Clean Water Act and Section 103 of the Marine Protection, Research and Sanctuaries Act.

6.2.2 State Permits

Under its SIP filed with the EPA, New York State regulates discharges to local and regional water and airsheds and oversees the construction and operation of treatment plants. Furthermore, New York requires permits for ground-water recovery wells constructed on Long Island. The following subsections detail the relevant environmental permitting requirements of the State of New York. All required NYSDEC permit applications shall be filed concurrently, under one cover, with the NYSDEC project manager for the Rowe Site.

6.2.2.1 Air Emissions

The construction and operation of an airstripping tower will require that a Permit Application to Construct and Operate a Process, Exhaust or Ventilation System be filed with the NYSDEC prior to construction. The above-referenced permit application will be filed in accordance with requirements specified in Title 6 NYCRR, Part 201, and guidelines presented in the NYSDEC's AIR GUIDE-1.

6.2.2.2 State Pollution Discharge Elimination System

Direct discharges of waste waters into surface-water bodies are regulated by the National Pollutant Discharge Elimination System (NPDES) program pursuant to the Clean Water Act (CWA) and the SPDES program as presented in Article 17 of New York's Environmental Conservation Law.

A SPDES permit is required to:

1) use any outlet or point source for the discharge of sewage, industrial waste or other wastes into the waters of the State;

2) construct or operate and use a disposal system for the discharge of sewage, industrial waste or other wastes into the waters of the State; or

3) increase or alter the content of wastes discharged through an outlet or point source into the waters of the State by a change in volume or characteristics.

SPDES permits include provisions requiring compliance with: 1) technology-based and water-quality based effluent limitations as required by the CWA; 2) standards of performance for new sources; 3) toxic and pretreatment effluent standards; 4) ocean discharge criteria adopted by the Federal government; and 5) any additional limitations necessary to ensure compliance with water-quality standards adopted pursuant to State law.

6.2.2.3 Tidal Wetlands

Because the proposed remedial system will require construction within a tidal wetland, a tidal wetland permit application must be completed. The Tidal Wetlands Permitting program is presented in Article 25 of New York's Environmental Conservation Law, Title 6 NYCRR Part 661.

6.2.2.4 Well Construction

The installation of recovery wells will require filing an application for a Long Island Well Construction Permit under Title 6 NYCRR Part 602.

6.2.2.5 Drywells

The drywells are Class V injection wells, as defined in 40 CFR Part 144.3. Under the Underground Injection Control (UIC) program, as implemented through the NYSDEC, certifications will have to be filed with the NYSDEC for closing or reconstruction of the drywells.

6.2.2.6 New York State Department of Transportation: State Highway Work Permit

Excavation for the piping systems will occur within New York State right-of-ways. Accordingly, a letter of intent and site plans must be supplied to the New York State Department of Transportation (NYSDOT) outlining the proposed activities.

6.2.2.7 Department of State: CMP Approval

Because work will be conducted within a coastal region, a Federal Consistency Assessment Form must be filed to assure that the proposed activities are consistent with New York State's Coastal Management Plan, as required by the United States Department of Commerce Regulations, 15 CFR Part 930.57.

6.2.3 County Permits - Suffolk

The Suffolk County Department of Health Services (SCDHS) regulates the construction of structures containing hazardous materials under Article 12 of the public health code. Suffolk County Department of Health Services notification and a SCDHS permit application may have to be filed with regards to the onsite treatment of soils.

6.2.4 Town of Southampton

6.2.4.1 Building Permit

Town of Southampton building permit applications will be filed for the treatment enclosure and the seven well vaults. The building permit applications must be completed and submitted prior to initiating construction on buildings and well vaults. The information provided on the application shall comply with all applicable zoning ordinances of the Town of Southampton.

6.2.4.2 Excavation

The Town of Southampton requires that a permit application be filed for the excavation of highways and dredging activities.

7.0 PERFORMANCE STANDARDS

The overall objective for the remedial action is the protection of human health and the environment. The EPA believes that the selected remedy will meet this objective while balancing effectiveness, implementability and cost. The specific remedial action objectives were developed based on the site conditions, the nature of the compounds detected in the ground water and the potential hazards to the public. The implementation of the designed remedial system is expected to achieve the stated objectives of the EPA.

The remedial action objectives were developed with the additional constraint that they meet ARARs. For any contaminant that will remain onsite (such as the local ground water), Section 121 of the Comprehensive Environmental Response, Compensation and Liability Act of 1980 (CERCLA), as amended by the Superfund Amendments and Reauthorization Act of 1986 (SARA), requires that remedial actions must satisfy ARARs identified for the Rowe Site, at both the Federal and State levels, unless a waiver for that ARAR can be invoked or Alternate Concentration Limits (ACLs) are established (EPA, 1988b). Furthermore, a State requirement can qualify as an ARAR only if it is more stringent than Federal requirements and is identified in a timely manner. It is

noted that New York State has a well developed SIP and, therefore, meets this last requirement. All ARARs are developed on a site-specific basis.

Maximum Contaminant Levels (MCLs) are enforceable standards that apply to specified contaminants which the EPA has determined have an adverse effect on human health above certain concentrations. In the absence of MCLs, Maximum Contamination Level Goals (MCLGs) and other non-enforceable health-based goals, such as EPA Drinking Water Health Advisories (DWHAs), Reference Dosages (RfDs), also called Acceptable Daily Intakes, and Ambient Water Quality Criteria (AWQC) may be used to develop ARARs. The following subsections detail the ARARs and performance standards developed by the EPA for the Rowe Site.

7.1 Ground Water

The potential New York State ARARs for establishing ground-water cleanup criteria at the Rowe Site are the State MCLs and quality standards promulgated pursuant to the New York State Surface Water and Groundwater Classifications and Standards (Title 6 NYCRR, Chapter X, Parts 700-705), the New York State Sanitary Codes for Drinking Water Supplies (Title 10 NYCRR, Chapter I, Subpart 5-1) and the New York State Standards for Raw Water Quality (Title 10 NYCRR, Chapter III, Part 170). The criteria for aquifer cleanup are summarized on table 4.

Waters in the State of New York are grouped into various classes for which different promulgated quality standards and effluent standards and limitations apply. The purpose of these classes, quality standards, effluent standards and limitations is to prevent pollution of ground water and to protect potable water supplies. Class GA waters are fresh ground waters found in the saturated zone of unconsolidated deposits and consolidated rock or bedrock. The best usage of Class GA waters is as a source of potable ground-water supply. The Rowe Site is underlain by sole source aquifers which are used for public drinking water supply and, therefore, ground water at the Rowe Site is classified as GA. As such, the provisions of Title 6 NYCRR, Chapter X, Parts 700-705, Title 10 NYCRR, Subpart 5-1 (Subpart 5-1) and Title 10 NYCRR, Part 170 (Part 170) are potential ARARs for establishing ground-water cleanup criteria. The New York

Department of Health has unspecified organic contaminant standards (Title 10 NYCRR, Part 5) for compounds for which there are no promulgated Federal or State Regulations. These standards also will be considered as clean-up criteria.

Subpart 5-1 Public Water Supplies specifically addresses drinking water supplies. Subpart 5-1 lists MCLs for drinking water quality, as well as regulations for protecting sources of ground water. However, the MCLs of Subpart 5-1 are defined as "the maximum permissible level of a contaminant in water which is delivered to the free-flowing outlet of the ultimate user of a public water system", not the maximum permissible level of a contaminant in water at the source of public water supplies. Therefore, the MCLs of Subpart 5-1 are not applicable. However, the MCLs of Subpart 5-1 are relevant and appropriate as aquifer cleanup standards because the ground water is a potential drinking water source. Therefore, the MCLs of Subpart 5-1 qualify as potential ARARs for establishing ground-water cleanup criteria at the Rowe Site.

Part 170 specifically addresses sources of water supply. The requirements of Part 170 are applicable for "any ground-water aquifer, surface-water body or water course from which by any means water is regularly taken either periodically or continuously for drinking, culinary or food processing purposes or which has been classified for present or future public beneficial use as a source for domestic or municipal purposes". Therefore, the requirements of Part 170, Water Supply, are applicable to the Rowe Site and are potential ARARs for establishing ground-water cleanup criteria.

In addition to the potential New York State ARARs described above, non-enforceable New York State guidelines are also available for some of the chemicals detected in the ground water at the Rowe Site. The DEC Division of Water has published a Technical and Operational Guidance Series (TOGS) which state desirable maximum contaminant concentrations. DEC has requested that these TOGS guidance values are to-be-considered (TBC) when establishing cleanup criteria for contaminants without Federal or State ARARs or for contaminants with TOGS values lower than Federal or State ARARs.

Specific treatment objectives for the parameters listed in table 3 will be identified or approximated during the preliminary design and the Preliminary Ground Water Remedial Design Report will demonstrate how these objectives will be met.

7.2 Soils

As required under CERCLA Section 121, the EPA has established clean-up criteria in its ROD for soils at the Rowe Site. These criteria are presented in table 5. Soils exhibiting chemical concentrations in excess of the clean-up criteria will be excavated for disposal.

The RCRA places restrictions on the chemical composition of materials requiring disposal. These restrictions are promulgated under the LDRs (40 CFR, Part 268). Recent changes to 40 CFR, Part 268 (August 31, 1993) have moved chemical constituents listed in the ROD from 40 CFR, Part 268.41, Table CCWE to 40 CFR, Part 268.43, Table CCW. This change in the RCRA regulations dictates the use of total concentrations for determining compliance with the LDRs as opposed to the TCLP criteria presented in the ROD. These (new) criteria for the disposal of excavated soils are presented in table 5. Materials exceeding any one of the criteria will require pre-treatment prior to disposal (to bring concentrations into compliance with the LDR criteria).

7.3 Water and Air Discharges

Because New York State has an approved State Implementation Plan (SIP) for the CWA and CAA, all discharges to air and water will be in compliance with Title 6 NYCRR, Part 703-705 and Title 6 NYCRR, Parts 200, 201 and 212, respectively. These State regulatory programs contain both broad rules regarding discharges into watersheds and airsheds and a permit system to control such discharges.

The primary condition attached to permitted water discharges covered under the SPDES program is that wastewater discharges may not violate the water-quality standards that have been assigned by NYSDEC to the particular body of water receiving the discharge. The general conditions, applicable to all water classifications, require that the discharge shall not cause impairment of the best usages of the receiving water as specified by the water classifications at the

location of discharge and at other locations that may be affected by the discharge. Sag Harbor Cove is classified as a SA water body, which represents a saline surface water. NYSDEC has determined the best usages for a SA water body to be primary and secondary contact recreation and fishing. SA waters should be suitable for fish propagation and survival.

The discharge criteria that would apply to the Rowe Site cannot be determined for certain until a SPDES permit application is submitted to the NYSDEC. However, it is possible to conjecture the anticipated discharge criteria based on the SA classification. Table 3 lists the ARAR-based discharge criteria for the projected treated water stream and the proposed receiving water body at the Rowe Site. Based on the assumptions discussed previously, these are the maximum chemical concentrations that may exist in the treated ground water to be discharged to Sag Harbor Cove.

7.4 Salinity Impacts

Performance standards must be developed to evaluate the amount of salinity change that will be considered acceptable in Sag Harbor Cove as a result of a diversion of fresh ground water and reintroduction through a diffuser pipe. The performance standards will be based on a year-long study of current salinity variations (Section 2.3) and a baseline study of existing flora and fauna (Section 2.4) in the vicinity of the cove.

Salinity in the cove will be monitored during the remedial action implementation to insure that any observable variations in salinity from those established during the baseline period are within the tolerance limits of the identified species.

A specific plan describing the monitoring strategy, location of monitoring points, description of equipment to be used, frequency of data collection and deliverables will be presented in the Ground Water Remedial Design Report.

7.5 Impacts on Greenbelt Pond System

Performance standards to minimize impacts on the flora and fauna in the Greenbelt system will be developed in conjunction with the Nature Conservancy based on the results of the ongoing monitoring plan (Section 2.7 and Appendix IID).

7.6 Disposal of Wastes

Implementation of the measures outlined in the SOW will lead to the generation of Investigation Derived Wastes (IDW), removal of soil in exceedance of cleanup criteria, spent carbon and possibly iron sludges. Under the provisions of the RCRA, none of these wastes are listed hazardous wastes. However, some or all of this waste may be characteristically hazardous as defined in the RCRA. All wastes generated by activities within the SOW will be strictly handled, contained, profiled, labeled and disposed as required by law under the provisions of the RCRA.

The firms and facilities below provide services for disposing of hazardous wastes generated from work conducted at the site. However, the presentation of these firms does not preclude the use of alternate facilities or the use of alternate treatment and disposal options (e.g., beneficial reuse of recovered soil) or disposing of non-hazardous waste at unsecured disposal facilities. These hazardous waste disposal firms are identified as follows:

Hazardous Waste Landfill:	CWM Chemical Services, Inc. 1550 Balmer Road Model City, NY 14107 (716) 754-8231
Licensed Disposal Contractor:	Chemical Pollution Control, Inc. 120 South Fourth Street Bayshore, NY 11706 (516) 586-0383

Approval of wastes for acceptance by any of the above contractors will be as required by law under the RCRA.

8.0 ADDITIONAL DESIGN TASKS

8.1 General Description of Ground-Water Remedial System

The overall ground-water treatment process is straightforward and is presented on plate 5, Water treatment schematic meters, sampling taps, level controls, and other control and instrumentation systems will be presented on the piping and instrumentation diagram presented in the Preliminary Ground Water Remedial Design Report. Water pumped from the designated recovery wells will pass into a packed-tower aeration system and then be pumped to Sag Harbor Cove for discharge. Iron treatment will be conducted, if required, based on analytical studies to be conducted during the pumping test. Standard flow controls (valves, meters, etc.) and process controls (air-flow and water-level sensors) will be included.

The preliminary design of the ground-water extraction system is based on the results of computer modeling completed during the RI and FS. Based on this modeling, seven recovery wells, four onsite and three offsite, will be required to contain the plume and extract contaminated ground water. The preliminary layout for the ground-water treatment system is presented on plate 4. The four onsite recovery wells (RW-1 through RW-4, inclusive) will intercept VOCs migrating off of the Rowe Site, while the other three recovery wells (RW-5 through RW-7, inclusive) will recover VOCs that have already migrated offsite. The contaminant plume will be contained by this array of recovery wells. Based on modeling investigations completed during the RI/FS, operation of the well array will not have an adverse impact on the aquifer because drawdown will be limited to the plume area. There are no ground-water users within the zone of influence of the wells. A submersible pump will be installed in each well and the necessary pipes and fittings will be used to make the connection with the below-grade pipe leading to the treatment system. The top of each well will be encased by a small vault. Below-grade electric power will run to each well vault.

Piping and trenching will be required for discharge to Sag Harbor Cove. Preliminary calculations indicate that the influent piping to the treatment system should be approximately 8 inches in diameter (on average) and the effluent piping to the cove should be approximately

10 inches in diameter. In addition to the influent/effluent water lines, a utility conduit will be run in the same trench.

All tanks used in the ground-water treatment system, including extraction, airstripping and carbon adsorption, will meet applicable RCRA requirements for tank systems containing hazardous waste, as required by law.

Packed-tower aeration consists of a contacting system that provides for mass transfer of VOCs from a dilute aqueous waste stream into an air (vapor) stream. Mass transfer takes place in a tower filled with a packing material having a large surface area. The packing is designed to allow for counterflow passage of water flowing down by gravity and of air flowing up through the packing under pressure supplied by a blower. The treated water is discharged and the air containing volatilized compounds are discharged through granular-activated carbon to the atmosphere.

The ease with which a given volatile contaminant can be stripped from the water phase is largely reflected by it's Henry's Law Constant. Henry's Law states that the partial pressure of a chemical compound in the air (evaporated from water) is directly proportional to its equilibrium concentration in water. A higher Henry's Law Constant indicates a higher affinity of the organic compound for the vapor phase. Henry's Law Constants are highly temperature dependent and influenced by vapor pressure, aqueous solubility and molecular weight. The primary contaminants at the Rowe Site have large Henry's Constant (i.e., 1,080 atmospheres for tetrachloroethylene (PCE) at the anticipated operating temperatures) and, therefore, can be easily stripped.

Preliminary design calculations, supplementary to those of the FS, have indicated that for a total flow rate of 650 gpm, the packed tower would be 6 feet in diameter and have 25 feet of packing. The overall height of the tower would be approximately 30 feet. A 7.5-hp blower would provide 6,500 scfm of air to the tower. Packed-tower aeration is a well documented and proven method of removing volatile constituents from ground water. For the 650-gpm wastestream, the tower is sized to remove 99.6 percent of PCE from a projected influent concentration of 1,230 ug/l (micrograms per liter) to the target 1 ug/l discharge criteria. Therefore, this technology will be effective in treating the recovered ground water to acceptable discharge quality. By using

PCE as the design contaminant, the other less concentrated VOCs will also be removed from the water to concentrations projected at less than 5 ug/l.

Sag Harbor Cove is located northwest of the proposed location for the treatment system (see plate 4, Water Treatment Schematic). Approximately 3,100 feet of piping will be needed to transport water from the seven recovery wells to the treatment system and about 3,700 feet of piping will run from the treatment system to Sag Harbor Cove. The total length of the trench is about 3,900 feet for this 650-gpm extraction configuration. The total trench lengths are less than the total pipe lengths because some sections of trench contain piping for both influent and effluent.

8.2 Soil Excavation and Disposal

Disposal at an offsite chemical waste landfill is the most viable remedial option for the contaminated soil. The soil will be excavated and prepared for transport and disposal according to the protocols of the receiving landfill. Prior to disposal, a Waste Material Profile Sheet will be submitted to the chemical waste landfill, accompanied with a Land Disposal Notification and Certification Form (LDNCF) and a representative sample. A waste profile sheet requests general information about the Rowe Site and necessary contacts, soil properties and composition, and shipping and sampling information. The LDNCF is designed to properly characterize the waste under the LDRs. Following review of the Waste Material Profile Sheet, the waste is either accepted or rejected by the landfill. If accepted, the generator will be required to submit documents, shipping papers or manifests as required for lawful transfer of waste products (i.e., Hazardous Materials Transportation Act, Toxic Substances Control Act, and the Resource Conservation and Recovery Act). An Entire Agreement between parties is then drafted defining transportation, storage, treatment, processing and disposal of waste products.

Once disturbed, the soil targeted for remediation will be considered a hazardous waste under the NCP. TCLP analyses will be conducted to determine the concentration of contaminants that may leach into the ground water and to compare these concentrations with LDRs. Pending proper LDR compliance and chemical waste landfill acceptance, the soil may either be directly transported to the landfill or require pretreatment prior to disposal. TCLP analyses will be

required in order to determine whether pretreatment (e.g., ex-situ vapor extraction) will be required prior to disposal.

The soil will be excavated in bulk and hauled by a hazardous waste transportation service. Transportation distance from the Rowe Site to a chemical waste landfill has been estimated to be 1,000 miles and should require 22 loads to remove affected soil associated with the former drum storage area, if necessary. Preliminary design calculations indicate a volume of 230 cy, weighing 350 tons, to be excavated from the former drum storage area. One hundred and thirty-five (135) cy of soil and debris associated with Dry Wells C, D and F, weighing 205 tons, also will be removed, if necessary. Approximately 365 tons of clean fill will be imported, backfilled and compacted in the former drum storage area. If necessary, clean fill and three new dry wells will be installed to replace Dry Wells C, D and F. All excavated soil will be placed on and covered with polyethylene sheeting prior to disposal to reduce the potential of exposure to contaminated material. The preliminary layout for the soil excavation activities is presented in plate 6, Soil Excavation Plan.

8.3 General Operation and Maintenance Requirements

The required operation and maintenance (O&M) will include electric power, servicing of pumps and motors, periodic well development, replacement of the tower packing and monitoring, water supply, heating instrument air, labor, and replacement of vapor granular-activated carbon (GAC). Monitoring will have two purposes: VOC tracking and system operation monitoring. Annual sampling of 19 monitoring wells will provide assessments of the extent and mobility of the VOCs. Eight of the monitor wells located on the Rowe Site, seven of the monitor wells located within the extent of the plume of VOCs and four of the monitor wells located downgradient of the extent of VOCs will be sampled. Samples will be collected annually and analyzed to determine the compounds present and their concentrations. Annual status reports will be filed with the EPA and NYSDEC. System monitoring includes collecting and analyzing monthly influent and effluent samples from the tower and periodically collecting well-head samples.

8.4 Effluent Diffuser

The effluent from the full-scale ground-water treatment system will be discharged into Sag Harbor Cove. As requested by the Southampton Trustees, the discharge into the cove will be diffused parallel with the southern shore, over the length of the ground-water recovery capture zone. This will be done in attempt to minimize adverse effects of a point source discharge of fresh water into the salt-water cove.

The design phase of the effluent diffuser system will include a literature search, the design of the diffuser system (e.g., piping and anchoring) and the identification of marine contractors. The literature search will include the review of current design practices (e.g., hydraulic analysis and case studies), underwater construction techniques (e.g., anchoring) and performance evaluation strategies. The design will include selection of the appropriate piping material and anchoring system based on the results of the literature search and professional experience. Design considerations will include structural integrity, geotechnical compatibility, navigational hazards, discharge distribution requirements, construction implementability and cost. A preliminary list of potential contractors experienced in marine work has been developed.

8.5 Pump Sizes

The ground-water recovery and transfer pumps will be sized based on the design flow rates, elevation differences and frictional losses from the pipes and fittings. The design flow rates are determined from interpreting the results of the aquifer pumping test. Results from the aquifer pumping tests will also be used to recalibrate the computer model. The recalibrated computer model will aid in developing final design flow rates that yield effective plume capture with minimal amounts of pumping. Frictional losses incurred by ground-water flow through the pipes and fittings are be determined either by using Darcy's equation or by the Hazen-Williams method described in Crane, 1988. The ground-water recovery and transfer pumps will be selected based on manufacturer's pump curves.

8.6 Pipe Sizes and Materials of Construction

Pipes will be sized based primarily on the final design flow rates. A secondary consideration will be frictional losses from the piping. Frictional losses will be determined using the same methods described Section 8.5. Decreasing frictional losses (corresponding to pipes with increasing pipe diameter) will be plotted against associated increases in cost for the purpose of optimizing the capital costs (pumps, pipe, etc.) with the operational costs (maintenance, power, etc.). Materials of piping will be selected subsequent to the establishment of line pressures throughout the proposed system. Pressure-testing procedures will be specified to check the below-grade pipes for leaks before the trenches are backfilled. To the extent possible, pipe routes will be oriented to minimize total pipe length and the amount of trenching.

8.7 Concrete Slab/Well Vaults

The treatment system will require the placement of concrete foundations, slabs and containment walls for the treatment building. All concrete design will be based on the American Concrete Institute's (ACI) Structural Code 301 for Buildings, and Building Code 318, Requirements for Reinforced Concrete. Geotechnical considerations, such as soil bearing capacity and settling, will be checked using the Meyerhof equations presented in "Foundation Analysis & Design", Bowles, 1988. Pre-cast vaults will be used to house the recovery wells below grade so there is no above-grade appurtenances that could impede traffic at the Rowe Site.

8.8 Ground-Water Treatment System Enclosure

The ground-water treatment building will be designed to comply with New York State's Building Code and with the applicable zoning ordinances in the Town of Southampton. The building will have access doors sized to accommodate operation and maintenance of the system and will be provided with ventilation and interior and exterior lighting.

8.9 Equalization Tanks

The design of the equalization tanks is straightforward. Design parameters for equalization tanks include the volumetric flow rate and retention time. Determination of the final design flow rate will be based upon aquifer characteristics established during the pumping test. The retention time for each of the equalization tanks will be determined based on analytical results of inorganic and physiochemical parameters obtained during the aquifer pumping test. Tank volumes and the design flow rate affect the amount of time that the transfer pumps will be required to operate (the pump cycles). This in turn affects the wear and tear and life expectancy of the pumps.

The Final Ground Water Remedial Design Report will present the numbered capacity of equalization tanks and how they will be controlled.

8.10 Packed-Tower Airstripper

Design parameters for a packed-tower airstripper include water and air flow rates, VOC influent concentrations, required removal efficiencies and tower dimensions. VOC influent concentrations will be revised from the analytical results obtained from samples collected during the aquifer pumping test. The required removal efficiencies will be calculated using the effluent quality criteria presented earlier. The tower diameter and height will be calculated using the final design flow rate and required removal efficiencies, respectively. Once design parameters are finalized, they will be presented to a vendor and an appropriately sized (i.e., diameter, height, packing type) tower and blower will be specified.

8.11 Excavation

Shoring requirements and volume calculations will be the primary design components for the excavation of the former drum storage area. Shoring requirements (i.e., sidewall stability) will be determined using the free-end method for anchored sheet pile walls, as presented in "Foundation Analysis & Design", Bowles, 1988. The design requirements identified in this analysis will be presented to a shoring subcontractor and an appropriate type and quantity will then

be specified. Volume calculations for the soil removed during the excavation will be determined using the method of equal depth contours, as presented in "Excavation Handbook", Church, 1981.

Dust shall be controlled during excavation by applying water through sprayers as required. An optimum moisture content of 6 percent in surface soils is desired. Ambient air monitoring stations will be specified in the remedial design plan to verify that dust and fugitive emissions from the site are in compliance with established ARARs.

8.12 Erosion Control

The design of any erosion controls exercised during the construction phase of the RA will comply with New York State's Guidelines for Urban Erosion and Sediment Controls, 1991.

8.13 Winterization

Any exterior pipes which contain water will need to be winterized to avoid freezing and breaking. The quantity of thermal protection (e.g., heat tape and pipe insulation) will be determined using the Design Guide for Insulated Pipes and Tubing, RayChem Corporation, 1991. The treatment building will be heated to provide reasonably constant temperature for the treatment process and to enable year-round operation.

8.14 Electrical

A number of electrical systems will be associated with the proposed system. These systems include control loops and power for the proposed system. The power supply will be independent of and metered separately from the Rowe Site. An emergency disconnect will be located on the exterior of the treatment building. Sensors will be installed to monitor the operation of the system and activate response controls should critical units operate outside of established allowable operating ranges. All electrical work and equipment will conform to the National Electrical Code, 1990 and IEEE standards, as appropriate.

8.15 Surveying

Land surveying will be required to establish existing grades, utility locations, well locations and elevations, and other nearby improvements for design and construction purposes. All predesign soil sampling locations will be surveyed and placed on a site plan to use in delineating the soil areas which will require excavation. A temporary benchmark will be established onsite for use during implementation, unless a benchmark already exists onsite or within a reasonable distance offsite. A Licensed Land Surveyor (L.L.S.) registered to practice in the State of New York will be retained to conduct all surveying activities. All surveying work will conform, at a minimum, to New York State's Code of Practice, 1986.

8.16 Air Emissions Control

Use of the Industrial Source Complex, Short Term (ISCST) has shown that initial air emission rates from the air stripper will cause ambient vapor concentrations of PCE in excess of the NYSDEC's Ambient Guideline Concentrations (AGCs) at offsite receptors. Accordingly, vapor-phase granular-activated carbon (GAC) will be used to control emissions of PCE from the air stripper. Because the emission rate is anticipated to decline with time, emission control may not be required during the entire duration of the remedial action. It is currently estimated that control of air emissions will only be required during the first five years of the RA. Information gained from predesign investigations will be used to establish anticipated GAC usage and to project the date at which control will no longer be required.

Control of air emissions will comply with Office of Solid Waste and Environmental Remediation (OSWER) directive 9355.0-28, "Control of Air Emissions from Superfund Air Strippers at Superfund Groundwater Sites". Control efficiency will be verified during system start-up through the collection of pre- and post-control air samples. Prior to this, ambient background concentrations will be measured to allow the determination of an emission rate which will attain compliance with NYSDEC AGCs.

8.17 System Failure, Shutdown and Start-up

In the event that air or water discharges are exceeded, the Lead Engineer shall, upon his review, order the system shutdown for repair. The United States Environmental Protection Agency (USEPA) shall be notified of such shutdown within 72 hours. Such notification shall detail the nature of the exceedance, its probable cause and the corrective action(s) to be undertaken or already performed. The Lead Engineer shall verify that all repairs have been completed and then authorize the system to be started up. Subsequent to start-up, the Lead Engineer shall review system performance and certify that the system is performing in accordance with design specifications.

9.0 REMEDIAL DESIGN SCHEDULE

An anticipated schedule for development of the RDWP is presented on plate A5-1. This schedule presents all activities associated with developing an EPA-approved RD. It is noted here that the schedule contains two distinct timelines: one for soil activities and one for ground-water activities.

10.0 DRAFT CONSTRUCTION SCHEDULE

A Draft Construction Schedule is presented on plate A5-1. This schedule presents the current estimates of the time required to conduct the soil remedial action and emplace an operable ground-water treatment system. As in the Remedial Design Schedule, the Draft Construction Schedule contains two distinct time lines: one for soil activities and one for construction of the ground-water treatment plant.

srf
May 1, 1995
nabdes.rpt/f:lbgrl

TABLES

TABLE 1

NABISCO BRANDS, INC.
ROWE INDUSTRIES SITE
SAG HARBOR, NEW YORK

Parameter List for Analysis of Soil

Organic
cis & trans 1,2-Dichloroethylene (1,2-DCE)
1,1-Dichloroethane (1,1-DCA)
1,1-Dichloroethylene (1,1-DCE)
Ethylbenzene
Freon 113
Methylene Chloride
Tetrachloroethylene (PCE)
Toluene
1,1,1-Trichloroethane (1,1,1-TCA)
Trichloroethylene (TCE)
Xylenes

nabsag.tbl/f:lbgrl

TABLE 2

NABISCO BRANDS, INC.
ROWE INDUSTRIES SITE
SAG HARBOR, NEW YORK

Parameter List for Analysis of Ground Water

Organics	Inorganic	Physiochemical
Chloroform	Antimony (Sb)	Biological Oxygen Demand (BOD)
cis & trans 1,2-Dichloroethylene (1,2-DCE)	Arsenic (As)	Chemical Oxygen Demand (COD)
1,1-Dichloroethane (1,1,-DCA)	Beryllium (Be)	Hardness
1,1-Dichloroethylene (1,1-DCE)	Calcium (Ca, Ca_{+2})	pH
Ethylbenzene	Cadmium (Cd)	
Freon 113	Iron (Fe)	Temperature
Methylene Chloride	Manganese (Mn)	Total Dissolved Solids (TDS)
Tetrachloroethylene (PCE)	Magnesium (Mg)	Total Suspended Solids (TSS)
Toluene	Selenium (Se)	Turbidity
1,1,1-Trichloroethane (1,1,1-TCA)	Sodium (Na)	
Trichloroethylene (TCE)	Carbonate	
Xylenes		

nabsag.tbl/f:lbgrl

TABLE 2A

NABISCO BRANDS, INC.
ROWE INDUSTRIES, INC.
SAG HARBOR, NEW YORK

Analytical Methods for Trace Metals

Parameter	Analytical method	Detection limit[1/] (mg/l)[2/]	Container type	Preservative
Antimony	7040	0.2 (0.06)	1 liter glass or polyethylene	pH $\leq$ 2; HNO_3
Arsenic	7060	0.002 (0.01)		
Beryllium	7090	0.005 (0.005)		
Calcium	7140	0.01 (5.0)		
Cadmium	7130	0.005 (0.005)		
Iron	7380	0.03 (0.1)		
Manganese	7460	0.01 (0.015)		
Magnesium	7450	0.001 (5.0)		
Selenium	7740	0.002 (0.005)		
Sodium	7770	0.002 (5.0)		

1/ Final sample to be analyzed using CLP SOW ILM 3.0; detection limit shown in parentheses.
2/ Milligrams per liter.

nabsag.tbl/f:lbgrl

TABLE 2B

NABISCO BRANDS, INC.
ROWE INDUSTRIES SITE
SAG HARBOR, NEW YORK

Analytical Methods for Physicochemical Parameters

Parameter	Analytical method[1/]	Sample container	Preservative	Holding time
pH	Field	NA	NA	NA
Temperature	Field	NA	NA	NA
Turbidity	Field	NA	NA	NA
COD	508	P,G 50 ml	4°C H_2SO_4 pH<2	28 days
BOD	507	P,G 1,000 ml	4°C	48 hours
TDS	209B	P,G 100 ml	4°C	7 days
TSS	209C	P,G 100 ml	4°C	7 days
Hardness	314	P,G 100 ml	HNO_3 pH <2	6 months

1/ Standard methods.
NA = Not applicable.
P,G = Plastic or glass.

nabsag.tbl/f:lbgrl

TABLE 3

NABISCO BRANDS, INC.
ROWE INDUSTRIES SITE
SAG HARBOR, NEW YORK

Performance Standards for Discharge to Marine Surface Water

Parameter	Allowable discharge (ug/l)
ORGANIC	
Chloroform	NL
cis & trans 1,2-Dichloroethylene (1,2-DCE)	NL
1,1-Dichloroethane (1,1-DCA)	NL
1,1-Dichloroethylene (1,1-DCE)	NL
Ethylbenzene	NL
Freon 113	NL
Methylene Chloride	NL
Tetrachloroethylene (PCE)	1 (ab)
Toluene	NL
1,1,1-Trichloroethane (1,1,1-TCA)	NL
Trichloroethylene (TCE)	11 (ab)
Xylenes	NL
Total Organic Compounds	
INORGANIC	
Antimony (Sb)	NL
Arsenic (As)	NL
Beryllium (Be)	NL
Calcium (Ca)	NL
Cadmium (Cd)	2.7 (ab)
Iron (Fe)	NL
Manganese (Mn)	NL
Magnesium (Mg)	NL

TABLE 3
(continued)

NABISCO BRANDS, INC.
ROWE INDUSTRIES SITE
SAG HARBOR, NEW YORK

Performance Standards for Discharge to Marine Surface Water

Parameter	Allowable discharge (ug/l)
Selenium (Se)	NL
Sodium (Na)	NL
PHYSIOCHEMICAL	
Biological Oxygen Demand (BOD)	NL
Chemical Oxygen Demand (COD)	NL
pH	NL
Temperature	NL
Total Dissolved Solids (TDS)	NL
Total Suspended Solids (TSS)	NL

NL: Not listed; however, NYSDEC Department of Water will assign values based on SPDES application.
(a) NYSDEC TOGS 85-W-38 (April 1, 1987).
(b) Applies to SC Water Classifications.

nabsag.tbl/f:lbgrl

TABLE 4

NABISCO BRANDS, INC.
ROWE INDUSTRIES SITE
SAG HARBOR, NEW YORK

Chemical-Specific ARARs Considered for Ground-Water Cleanup Criteria

Parameter	Aquifer Restoration (ug/l)[1/]
ORGANIC	
Chloroform	7 (d)
cis & trans 1,2-Dichloroethylene (1,2-DCE)	5 (a) (each isomer)
1,1-Dichloroethane (1,1-DCA)	5 (a)
1,1-Dichloroethylene (1,1-DCE)	5 (a)
Ethylbenzene	5 (a)
Freon 113	50 (a)
Methylene Chloride	5 (a)
Tetrachloroethylene (PCE)	5 (a)
1,1,1-Trichloroethane (1,1,1-TCA)	5 (a)
Trichloroethylene (TCE)	5 (a)
Toluene	5 (a)
Xylenes	5 (a) (each isomer)
INORGANIC[2/]	
Antimony (Sb)	6 (e)
Arsenic (As)	25 (b)
Beryllium (Be)	1 (e)
Cadmium (Cd)	5 (e)
Iron (Fe)	300 (ae)

TABLE 4
(continued)

NABISCO BRANDS, INC.
ROWE INDUSTRIES SITE
SAG HARBOR, NEW YORK

Chemical-Specific ARARs Considered for Ground-Water Cleanup Criteria

Parameter	Aquifer Restoration (ug/l)[1/]
Manganese (Mn)	300 (ae)
Selenium (Se)	10 (a)

1/ Micrograms per liter.
2/ Values for Inorganics represent criteria for filtered samples.
(a) 10NYCRR, Chapter I, Subpart 5-1, Drinking Water Standards.
(b) 6NYCRR, Chapter X, Part 703.5(2).
(c) 40 CFR Sections 141.11, 141.12, 141.61 and 141.62.
(d) Total trihalomethanes cannot exceed 100 ug/l per Federal MCL.
(e) Total of iron and manganese cannot exceed 500 ug/l.

nabsag.tbl/f:lbgrl

TABLE 5

NABISCO BRANDS, INC.
ROWE INDUSTRIES SITE
SAG HARBOR, NEW YORK

Performance Standards for Soil Remediation

Parameter	Soil Clean-up Criteria from the ROD (mg/kg, total)	Excavated Soil Disposal Criteria per the Land Disposal Restrictions[1/] (mg/kg, total)
Benzene	0.05	3.7
cis & trans 1,2-Dichloroethylene (1,2-DCE)[2/]	0.5	33[3/]
1,1-Dichloroethane (1,1-DCA)	0.2	7.2[3/]
1,1-Dichloroethylene (1,1-DCE)	0.5	33[3/]
Ethylbenzene	5.5	6
Freon 113	--	7.2[3/]
Methylene Chloride	--	33
Tetrachloroethylene (PCE)	1.5	5.6
Toluene	1.5	28
1,1,1-Trichloroethane (1,1,1-TCA)	1.0	5.6
Trichloroethylene (TCE)	1.0	5.6
Xylenes[2/]	1.2	28

1/ 40 CFR, Subpart 268.43, Table CCW.
2/ For each individual isomer.
3/ Derived from U Codes; not listed under F Codes.

nabsag.tbl/f:lbgrl

TABLE 6

NABISCO BRANDS, INC.
ROWE INDUSTRIES SITE
SAG HARBOR, NEW YORK

Air Guideline Concentrations on Property Line

Parameter	AGC[1/] (ug/m3)[2/]
Chloroform	23
cis & trans 1,2-Dichloroethylene (1,2-DCE)	1900 (cis), 360 (trans)
1,1-Dichloroethane (1,1-DCA)	500
1,1-Dichloroethylene (1,1-DCE)	1,900
Ethylbenzene	1,000
Freon 113	90,000
Methylene Chloride	NL
Tetrachloroethylene (PCE)	0.075
Toluene	2,000
1,1,1-Trichloroethane (1,1,1-TCA)	1,000
Trichloroethylene (TCE)	0.45
Xylenes	300

1/ AGC - Air Guideline Concentration; New York State Draft AIR GUIDE-1, at nearest offsite receptor.
2/ Micrograms per cubic meter.
NL Not Listed.

nabsag.tbl/f:lbgrl

TABLE 7A

NABISCO BRANDS, INC.
ROWE INDUSTRIES SITE
SAG HARBOR, NEW YORK

Parameter Table for Soil Predesign Sampling

Task	Number and purpose for samples	Matrix	Analyses[1/]	Analytical methods[2/]	Holding time	Container type	Preservative
Definition of soils requiring excavation in the Former Drum Storage Area	Minimum of 8 discrete samples having PID readings of less than 150 ppm. Maximum dependent on field responses.	Soil	VOAs	SW-846 Method 8010; 1 sample for TCL VOAs using CLP	14 days 10 days from receipt	40-mL vial	Store at 4°C
Characterization of soils in Former Drum Storage Area.	Two (2) composite samples to determine if pretreatment and/or incineration will be required prior to disposal in Subtitle C landfill.	Soil	TCL VOAs	TCLP CLP	14 days	40-mL vial	Store at 4°C
Determination if soils in the vicinity of Drywells C, D and F will require excavation	One (1) discrete sample having the highest PID reading in each boring; minimum of 3 samples with field decision on additional samples.	Soil	VOAs	SW-846 Method 8010	14 days	40-mL vial	pH $\leq$ 2 with HCL or H_2SO_4 Store at 4_oC
Quality Control	Field blank of soil sampling equipment (1 per day) Field blank of ground-water sampling equipment (1 per day)	Water Water	TCL VOAs TCL VOAs	CLP CLP	10 days from receipt	40-mL vial	Store at 4°C

1/ VOAs - Volatile Organic Chemicals
TCLP - Toxicity Characteristic Leaching Procedure
TCL - Target Compound List

2/ SW-846, EPA Test Methods for Evaluating Solid Waste
TCL VOAs - Target Compound List Volatile Organic Chemicals
CLP - Contract Laboratory Protocols
Standard Methods for the Examination of Water and Wastewater.

nabsag.tbl/f:lbgrl

TABLE 7B

NABISCO BRANDS, INC.
ROWE INDUSTRIES SITE
SAG HARBOR, NEW YORK

Parameter Table for Ground-Water Predesign Sampling

Task	Number and purpose for samples	Matrix	Analyses[1/]	Analytical methods[2/]	Holding time	Container type	Preservative
Pumping test of onsite and offsite extraction wells	Determine initial influent chemical concentrations for treatment design; 14 samples, obtained at start-up and every 12 hours, for the RW-6 test; 10 samples obtained during the RW-2 test.	Water	VOAs	SW-846 Methods 8010/8020 (final samples for TCL VOAs using CLP SOW)	14 days 10 days from receipt	40-mL vial (4 per sample)	Store at 4°C pH <2, HCL for CLP
			Metals	SW-846 7000 Series (final samples by CLP)	6 months 180 days from receipt	1 liter glass or polyethylene (one)	
			Physiochemical	Standard Methods			pH $\leq$ 2 with HNO_3
Quality Control	Trip blank (1 per day)	Water	TCL VOAs	CLP	10 days from receipt	40-mL vial (4 per sample)	Store at 4°C
	Field blank of ground-water sampling equipment (1 per day)	Water	TCL VOAs	CLP			
	Matrix spike and matrix Spike duplicate samples (1 per test)	Water	TCL VOAS	CLP			

1/ VOAs - Volatile Organic Chemicals
TCLP - Toxicity Characteristic Leaching Procedure
TCL - Target Compound List

2/ SW-846, EPA Test Methods for Evaluating Solid Waste
TCL VOAs - Target Compound List Volatile Organic Chemicals
CLP - Contract Laboratory Protocols
Standard Methods for the Examination of Water and Wastewater.

nabsag.tbl/f:lbgrl

TABLE 8

NABISCO BRANDS, INC.
ROWE INDUSTRIES SITE
SAG HARBOR, NEW YORK

Observation Wells to be Used
During the Pumping Tests

Location	Observation well	Distance from pumping well (feet)	Screen depth (feet below grade)
Offsite Test Well RW-6	MW-53	50	40 - 50
	MW-54	100	40 - 50
	MW-43A	200	14 - 29
	MW-43B	200	64 - 74
	MW-43C	200	97 - 107
	N-6	280	20 - 22
	N-11	260	19 - 21
	MW-42 Cluster	Background	
	MW-49 Cluster	Background/Tidal Flux	
Onsite Well RW-2	MW-44A	30	16 - 36
	MW-44B	30	39 - 49
	MW-44C	30	61 - 71
	N-24	35	34 - 36
	N-32	75	29 - 31
	N-28A	140	19 - 21
	MW-28B	140	38 - 48
	MW-45A	280	13 - 28
	MW-45B	280	40.5 - 50.5
	MW-48A	Background	19 - 34
	MW-48B	Background	59 - 59
	N-40	240	19 - 21
	N-36	320	29 - 31
	N-39	185	29 - 31
	MW-47A	215	4 - 14
	MW-47B	215	28 - 38

NOTE: All MW-series wells are 2-inch diameter PVC.
All N-series wells are 2-inch diameter mild steel.

nabsag.tbl/f:lbgrl

TABLE 9

NABISCO BRANDS, INC.
ROWE INDUSTRIES SITE
SAG HARBOR, NEW YORK

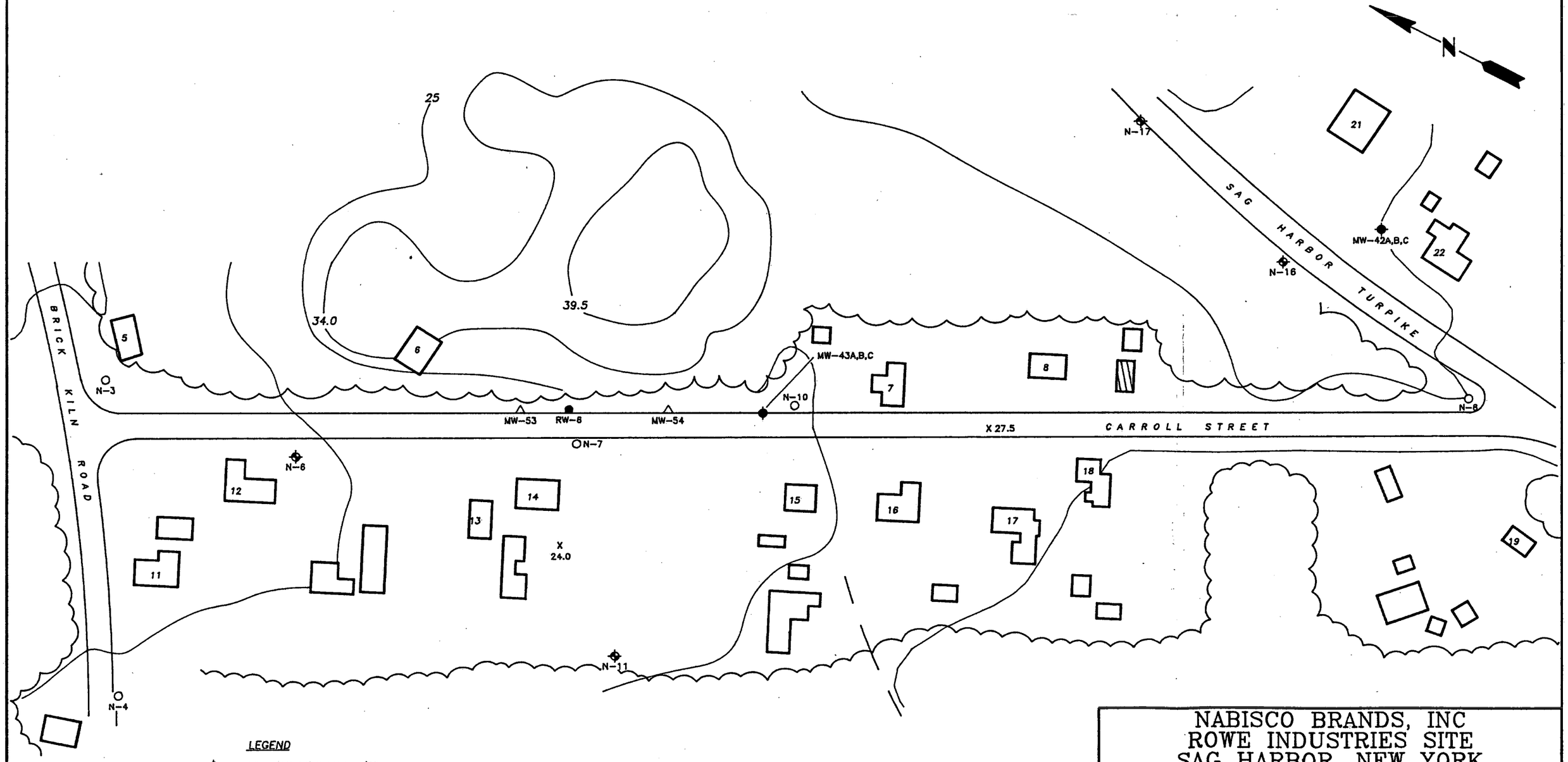
Anticipated Chemical Concentrations for Pumping Tests at RW-2 and RW-6[1/]

Chemical Parameter	Inlet Concentration (ug/l)[2/]		Combined Emission Rate (lbs/hr)[3/]		Stack Concentration (ug/m)[4/]		NYSDEC[5/] SGC[6/] (ug/m)[4/]
	RW-2	RW-6	RW-2	RW-6	RW-2	RW-6	
PCE	4,600	70	0.28	8.4×10^{-3}	35,147	1,063	81,000
TCE	32	15	19.2×10^{-4}	18×10^{-4}	248	248	33,000
1,1,1-TCA	--	27	--	3.2×10^{-3}	--	402	450,000
1,1-DCE	20	--	12×10^{-4}	--	146	--	2,000
trans-1,2-DCE	0.4	2	6×10^{-5}	2.4×10^{-4}	7.32	36	NL
1,1-DCA	0.7	--	6×10^{-5}	--	7.5	--	190,000
Methylene Chloride	22	--	12.6×10^{-4}	--	160	--	41,000

1/ Emission rates are combined from both low-profile aerators shown on plate 3.
2/ Micrograms per liter.
3/ Pounds per hour.
4/ Micrograms per cubic meter.
5/ New York State Department of Environmental Conservation.
6/ Short-term guideline concentrations
NL = Not listed.

nabsag.tbl/f:lbgrl

FIGURES



LEGEND

- MW-42A,B,C — WELL INSTALLED FOR RI/FS
- N-6 — LOCATED SCDHS MONITOR WELL
- N-3 — UNLOCATED SCDHS MONITOR WELL
- RW-6 — PROPOSED RECOVERY WELL
- MW-53 — PROPOSED MONITOR WELL

0 100
SCALE IN FEET

NABISCO BRANDS, INC
ROWE INDUSTRIES SITE
SAG HARBOR, NEW YORK

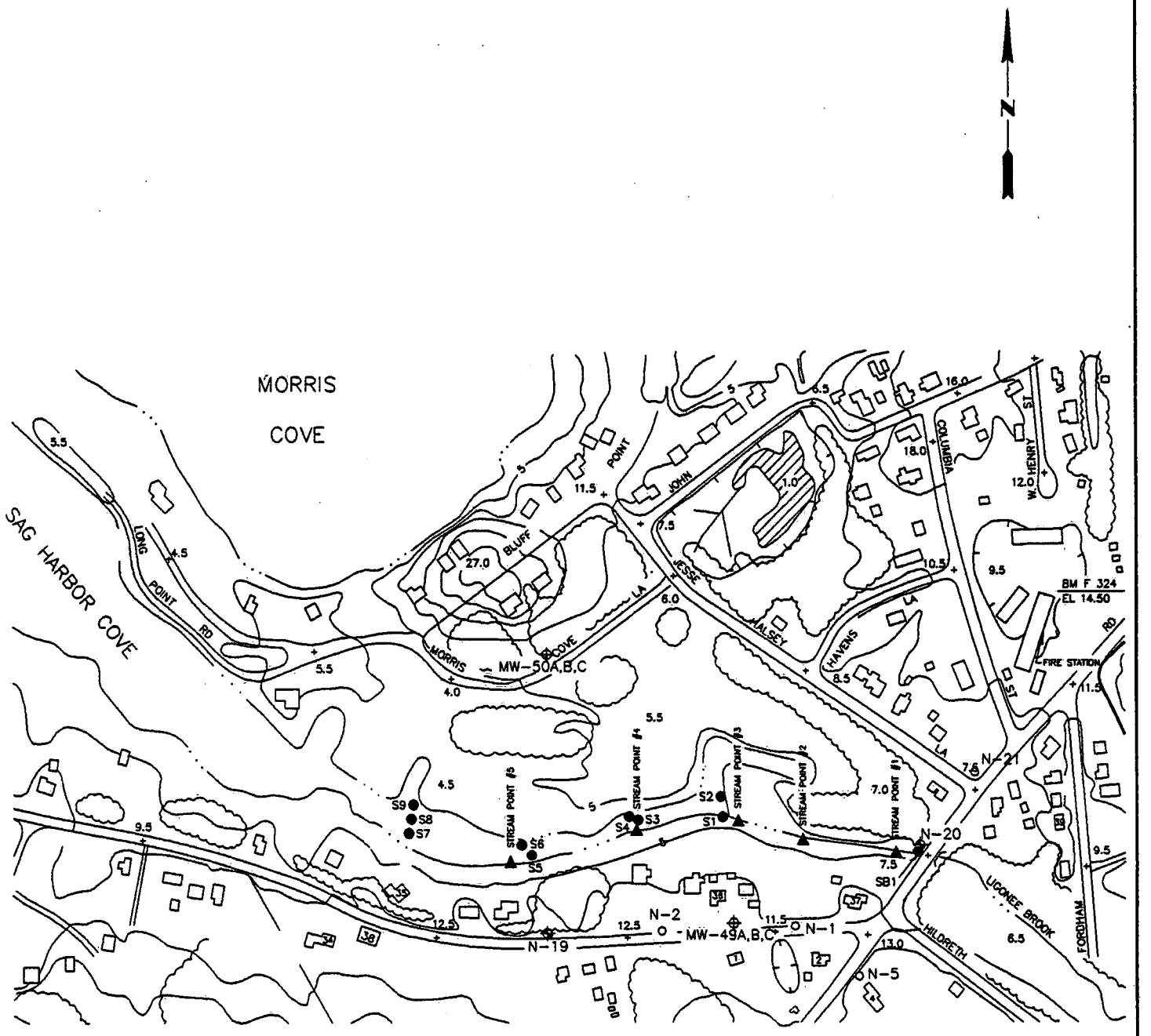
WELL LOCATIONS FOR RW-6 PUMPING TEST

DATE	REVISED

PREPARED BY:
LBG ENGINEERING SERVICES, P.C.
Professional Environmental and Civil Engineers
126 Monroe Turnpike
Trumbull, CT 06611
(203) 452-3110

DATE: 4/24/95 FIGURE: 1

D:\DWG\NABSAG\ESI\APR95\F1.DWG



LEGEND

● S1 SALINITY MONITORING LOCATION

NABISCO BRANDS, INC.
ROWE INDUSTRIES SITE
SAG HARBOR, NEW YORK

SALINITY MONITORING LOCATIONS

DATE	REVISED

PREPARED BY:

LBG ENGINEERING SERVICES, P.C.
Professional Environmental and Civil Engineers
126 Monroe Turnpike
Trumbull, CT 06611
(203) 452-3110

DATE: 4/26/95 FIGURE: 2

D:\DWG\NABSAG\ESI\APR95\FIG2.DWG

APPENDIX IA

REVISIONS TO THE SAMPLING ANALYSIS AND MONITORING PLAN FOR SOIL CHARACTERIZATION

The following Sampling Analysis and Monitoring Plan (SAMP) was conditionally approved by the United States Environmental Protection Agency, pending incorporation of the comments presented on the attached letter. The comments are addressed as follows:

a) At a minimum, at least one sample from each proposed boring will be submitted to the laboratory for analysis. This sample will be one which is expected to have volatile organic compound (VOC) concentrations lower than the remedial criteria and which exhibits less than 150 ppm (parts per million) VOCs on a photoionization detector (PID).

b) If peripheral borings encounter soils which exhibit headspace readings in excess of 150 ppm, an additional boring will be drilled 10 feet further from the center of the planned excavation. This process will be continued until readings of less than 150 ppm are encountered in all peripheral borings.

c) If the worst-case soil composite does not indicate the need for treatment of the soil prior to disposal, a second sample, chosen from soils exhibiting elevated headspace readings, will also be subjected to analysis for VOCs.

d) Additional soil-vapor sampling will be completed between the drum storage area and the Hagerman residence during the soil sampling program. Locations for the samples will be chosen in the field in conjunction with the regulatory agencies.

It should be noted that the Land Disposal Restrictions (LDRs) were revised in August of 1993. Previously, the criteria for disposal of Rowe Industries' related VOCs were based on TCLP analyses; now the criteria are based on totals. Therefore, the

soils SAMP is revised as follows: a second set of sample containers will not be utilized because TCLP analyses will not be performed. Samples will be collected from a boring near B-10, composited by the laboratory, and analyzed for total TCL VOAs. If LDR criteria are not met, additional samples will be selected as presented in the third paragraph of Page 3 of the soils SAMP, but analyzed for total TCL VOAs.

srf
May 1, 1995
nabdes.app/f:lbgrl

SAMPLING, ANALYSIS AND MONITORING PLAN FOR SOILS ROWE INDUSTRIES GROUND-WATER CONTAMINATION SITE SAG HARBOR, NEW YORK

Prepared For

Nabisco Brands, Inc.

July 1993

LEGGETTE, BRASHEARS & GRAHAM, INC.
Professional Ground-Water and Environmental Services
72 Danbury Road
Wilton, CT 06897

TABLE OF CONTENTS

LIST OF FIGURES
(at end of report)

Figure

SAMPLING, ANALYSIS AND MONITORING PLAN FOR SOILS ROWE INDUSTRIES GROUND-WATER CONTAMINATION SITE SAG HARBOR, NEW YORK

INTRODUCTION

The Record of Decision (ROD) for the Rowe Industries Site (Rowe Site) was issued by the United States Environmental Protection Agency (USEPA) on September 30, 1992. The specified remedy for the site includes excavation and offsite disposal of soils from the former drum storage area and from selected drywells, and ground-water remediation by the pump-and-treat method. The Remedial Investigation (RI) was sufficiently comprehensive to determine the probable and possible sources of volatile organic compounds (VOCs) to the ground water. However, the RI did not result in the density of data necessary to complete a detailed Remedial Design Work Plan (RDWP).

To accelerate the completion of the RDWP, a focused Sampling, Analysis and Monitoring Plan (SAMP) is being submitted to address additional soil samples that will be collected in and around the former drum storage area; adjacent to the drywells of concern (Drywells C, D and F); and in the vicinity of Well Cluster MW-28. The full RDWP will be submitted based on the normal schedule in the Consent Decree.

The additional borings will facilitate the delineation of the horizontal and vertical extent of the soil containing VOCs that will be excavated in the former drum storage area. The borings adjacent to the drywells of concern will quantify the soil quality to determine the extent, if any, of contamination outside the drywells. The borings near Well Cluster MW-28 will define the local geology in the area of the highest levels of VOCs in the ground water and will be used for a possible focused remedial design.

SAMPLING, ANALYSIS AND MONITORING WORK PLAN

I. Investigation of Unsaturated Soils in the Former Drum Storage Area

The primary goal of this investigation is to define the vertical and horizontal extent of VOCs in the soil to aid in planning the soil excavation in the former drum storage area.

Laboratory and screening results will delineate the area requiring excavation in order to meet the clean-up standards provided by the USEPA and specified in the ROD (see Appendix I). In addition to determining the extent of contamination, the laboratory analysis will determine if pre-treatment of the soil is necessary to meet the disposal requirements.

The approximate borehole locations are shown on figure 1. These locations were selected based on the soil-vapor survey and soil sample results from the RI. The RI results define a general area of unsaturated soil containing VOCs which will be more clearly defined from the proposed borings. Additional borings will be drilled as needed.

All boreholes will be drilled using 3 1/4-inch inside diameter hollow-stem augers. Soil samples will be collected continuously from grade to the top of the water table (approximately 18 ft bg (feet below grade)) utilizing 2-foot long by 3-inch diameter split-spoon samplers.

One set of sample containers will be filled for possible Target Compound List Volatile Organic Analysis (TCL VOA). These samples will be collected by opening the split spoon, splitting the sample in half longitudinally, and collecting the soil from the center of the split spoon using a stainless-steel spatula. The container will be filled completely to avoid any degassing of the VOCs into an open headspace. All containers holding samples for possible laboratory analysis will be stored on ice until a determination is made as to whether or not to analyze the samples (discussed below).

A second set of sample containers will be filled for possible Toxicity Characteristic Leaching Procedure (TCLP) analysis. These samples will be collected by completely filling the container with soil skimmed from the entire length of the sampler using a stainless-steel spatula. This will provide a representative composite sample for each 2-foot interval. All the samples for TCLP will be submitted to the laboratory and held for possible analysis.

A small portion of soil from each split spoon will be containerized in a clean glass jar and will be screened with a photoionization detector (PID) in the manner outlined in Appendix II. The PID will be calibrated daily in the manner described in Appendix II.

The criteria for submitting samples to the laboratory for TCL VOA analysis will be determined by the PID screening results. The goal is to avoid submitting samples that are clearly above the clean-up criteria. An analysis was performed to determine if there was a correlation between RI laboratory data and PID readings. In general, VOC concentrations exceed the EPA clean-up guidelines of 1.5 ppm (parts per million) for tetrachloroethylene at PID readings of 200 ppm and above. Therefore, to determine if the soil meets the clean-up objectives, samples that appear to be at the limit of the objective with a headspace reading of, or close to, 150 ppm will be submitted to the laboratory for TCL VOA analysis. These results will aid in planning the depth and horizontal extent of the excavation to meet the clean-up guidelines.

Based on the RI results, the unsaturated soil sample collected from the boring at B-10 had the highest concentrations of VOCs. A TCLP composite sample will be prepared from the samples collected from a boring near this location to provide the worst-case soil quality. The TCLP composite sample of the boring near B-10 will be prepared by the laboratory by obtaining a small amount of soil from the center of each VOA vial and placing it directly into the extraction process for TCLP analysis. A duplicate sample from this boring will be analyzed to verify the laboratory results.

If the results for the worst-case TCLP sample indicate the soil will require pre-treatment prior to disposal, additional samples will be analyzed by the TCLP method. These samples will originate from discrete intervals from individual borings, rather than composite samples of entire borings. Selection of additional samples for analysis will be based on the PID results and will be in sufficient number to define the areas most likely to need pretreatment. If results from the boring indicate pretreatment will not be necessary, it will be assumed that none of the excavated soils will require pretreatment, subject to final testing after excavation is complete.

A sample will be composited in the field from the borings near B-10, B-9 and B-12 for hazardous waste characterization, utilizing a portion of each split-spoon sample. The samples will provide additional data to assist with selection of a RCRA-permitted facility that will accept the soil.

All drilling and sampling equipment will be decontaminated before and between boreholes in the manner described in Appendix II. Each borehole will be backfilled with the cuttings upon drilling completion. The top foot of each borehole will be capped with a cement plug to minimize any vertical infiltration as a result of precipitation.

Throughout the drilling program, the ambient air quality will be monitored utilizing a PID. Levels of personal protection will be based upon these results, as outlined in the attached Health and Safety Plan (HSP).

II. Investigation of Unsaturated Soils Adjacent to Specified Dry Wells

Borings will be drilled adjacent to the drywells to determine the possible horizontal extent of contamination related to the activities of Drywells C, D and F. These borings will provide data to assist with the determination of the amount of soil which will require excavation.

One soil boring will be drilled adjacent to each of the drywells requiring remediation (Drywells C, D & F), as shown in figure 2. The borings will be advanced to the water table and continuous samples will be collected beginning at 5 ft bg, with the exception of the boring adjacent to Drywell C. This boring will be advanced to approximately 45 ft bg (further details are presented in Section III). All drilling and sample collection will follow the methods outlined in Section I. Based on PID readings, a minimum of one soil sample from each drywell will be submitted to the laboratory for TCL VOA analysis. If the field data indicate high concentrations of VOCs adjacent to the drywells, additional borings will be drilled and samples will be collected. Locations of the additional borings will be determined by the supervising hydrogeologist. Samples will not be analyzed for TCLP analysis because the RI data indicated that the depth of contamination is limited. However, if PID readings reveal unexpectedly high VOCs in the borings, TCLP samples will be considered.

After drilling has been completed, each borehole will be backfilled with the drill cuttings to approximately 1 ft bg and the remaining annular space will be filled with a cement seal.

All drilling and sampling equipment will be decontaminated prior and between uses as outlined in Appendix II.

III. Geologic and Ground-Water Investigation

Borings will be drilled to determine the local geology of the area around Wells N-26, N-27 and N-28. The highest concentrations of onsite solvents in the ground water have been detected in this area. In particular, the goal is to define the vertical and horizontal extent of clay layers observed during the RI in MW-28B between 23 and 29 ft bg and indicated at a similar depth in wells installed by the Suffolk County Department of Health Services (SCDHS). Geologic well logs from previous SCDHS studies indicate sandy clay layers at approximately 23 ft bg at Wells N-26 and N-28. Moving further downgradient, this clay was not observed in Wells N-24, N-25 or N-31 (Well Cluster MW-44).

Laboratory results of ground-water samples collected from the wells at various depths during the different studies indicate the highest VOC concentrations were detected where the well screen was placed above the 23-foot clay layer and the concentrations sharply decreased at a 45-foot sampling depth at the N-26, N-27 and N-28 area. Downgradient from this area at N-24 where the 23-foot clay is not evident, the contamination is evenly distributed between the 23-foot and 45-foot sampling zones, and is highest in the middle zone (39 ft to 49 ft bg) at Cluster MW-45. The clay, if it is locally extensive in the area of N-26, N-27 and N-28, could prevent natural flushing of the solvents and could keep the area somewhat isolated from the effects of a northern property line recovery well system. If this is the case, additional borings in the area will provide information to determine if focused ground-water remediation is required.

Six soil borings will be drilled in the vicinity of Well Cluster MW-28 at the approximate locations shown on figure 2. Split-spoon samples will be collected continuously from grade. All borings will be advanced to approximately 45 ft bg following the drilling methods outlined in Section I.

A gamma-ray geophysical log will be run at the completion of each borehole to confirm the underlying stratigraphy observed during drilling. Each borehole will be grouted to grade with a bentonite-cement slurry through a tremie pipe. All drill cuttings will be containerized in 55-gallon drums until proper disposal method are determined. All drilling and sampling equipment will be decontaminated following the method described in Appendix II.

QUALITY ASSURANCE PROJECT PLAN

The SAMP will be conducted following the methodology of the approved Quality Assurance Project Plan (QAPP) in Section 4 of the 1989 Projects Operation Plan (POP). An updated laboratory QAPP reflecting the current analytical methods has been included as an attachment to this plan. TCL VOA samples will be analyzed utilizing CLP (Contract Laboratory Program) methodology. The data will not be formally validated because the samples are being obtained for planning purposes.

HEALTH AND SAFETY PLAN

The HSP has been included as an attachment to this Plan. The 1989 POP HSP has been revised to reflect only the work being performed during the SAMP. A more detailed HSP will be submitted with the RDWP.

SITE MANAGEMENT PLAN

Laboratory work will be performed by an EPA Contract Laboratory that is also certified by the New York State Department of Environmental Conservation. The EPA will be notified when a drilling contractor is selected.

Below is a list of personnel involved in this phase of the investigation:

Sampling Operations: Karen Billick/Eva Szigeti (LBG)
Sampling QC: Jeffrey Lennox (LBG)
Data Processing Activities: Karen Billick (LBG)
Data Processing QC: Jeffrey Lennox (LBG)
Data Quality Review: Robert Lamonica (LBG)
Overall QA: Robert Lamonica (LBG)
Overall Project Coordination: Jeffrey Lennox (LBG)

Telephone Numbers:

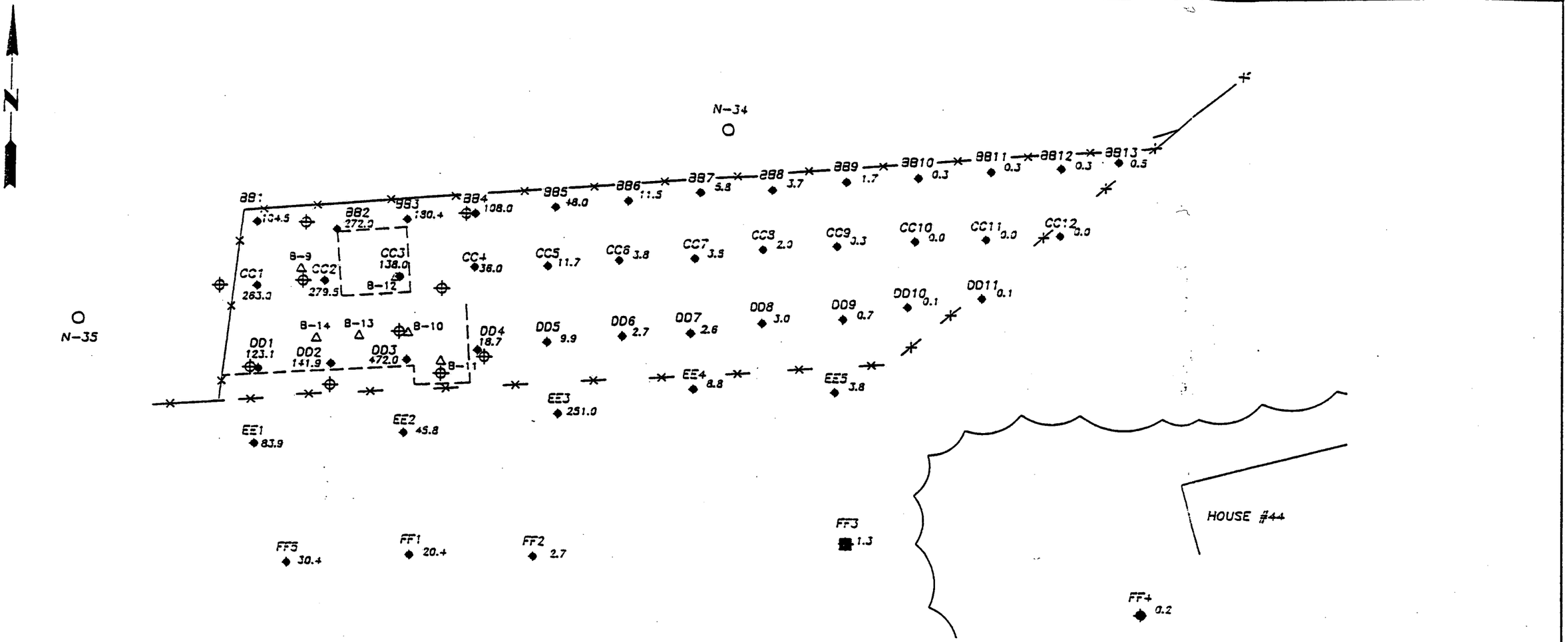
LBG: (203) 762-1207
EPA: (212) 264-8585

ACCESS AGREEMENTS AND ADMINISTRATIVE PERMITS

Prior to drilling in the former drum storage area, written permission from the owners of the property (Mr. and Mrs. Richard Hagerman, Jr. of Lily Pond Road) will be obtained. This access agreement will only pertain to SAMP activities covered in this plan. Any additional permission for remedial activities, including drilling and construction, will be obtained at the appropriate time. All other drilling covered in this SAMP will occur on the Sag Harbor Industries property.

skd
July 8, 1993
nabsag.pln/93-27

FIGURES



LEGEND

- EE2 ◆ — SOIL–VAPOR SAMPLING LOCATION
- FF3 ■ — APPROXIMATE SOIL–VAPOR SAMPLING LOCATION
- 30.4 — PID CONCENTRATION
- B-10 △ — RI BORING LOCATION
- ⊕ — PROPOSED BORING LOCATION
- N-35 ○ — APPROXIMATE LOCATION OF UNLOCATED SCDHS WELL
- ×—×—× — OLD FENCE LOCATION
- — — — CONCRETE WALL AND CONCRETE DRUM PAD LOCATION

ALL CONCENTRATIONS IN PARTS PER MILLION (ppm) EXPRESSED AS CALIBRATION GAS EQUIVALENTS

0 15
SCALE IN FEET

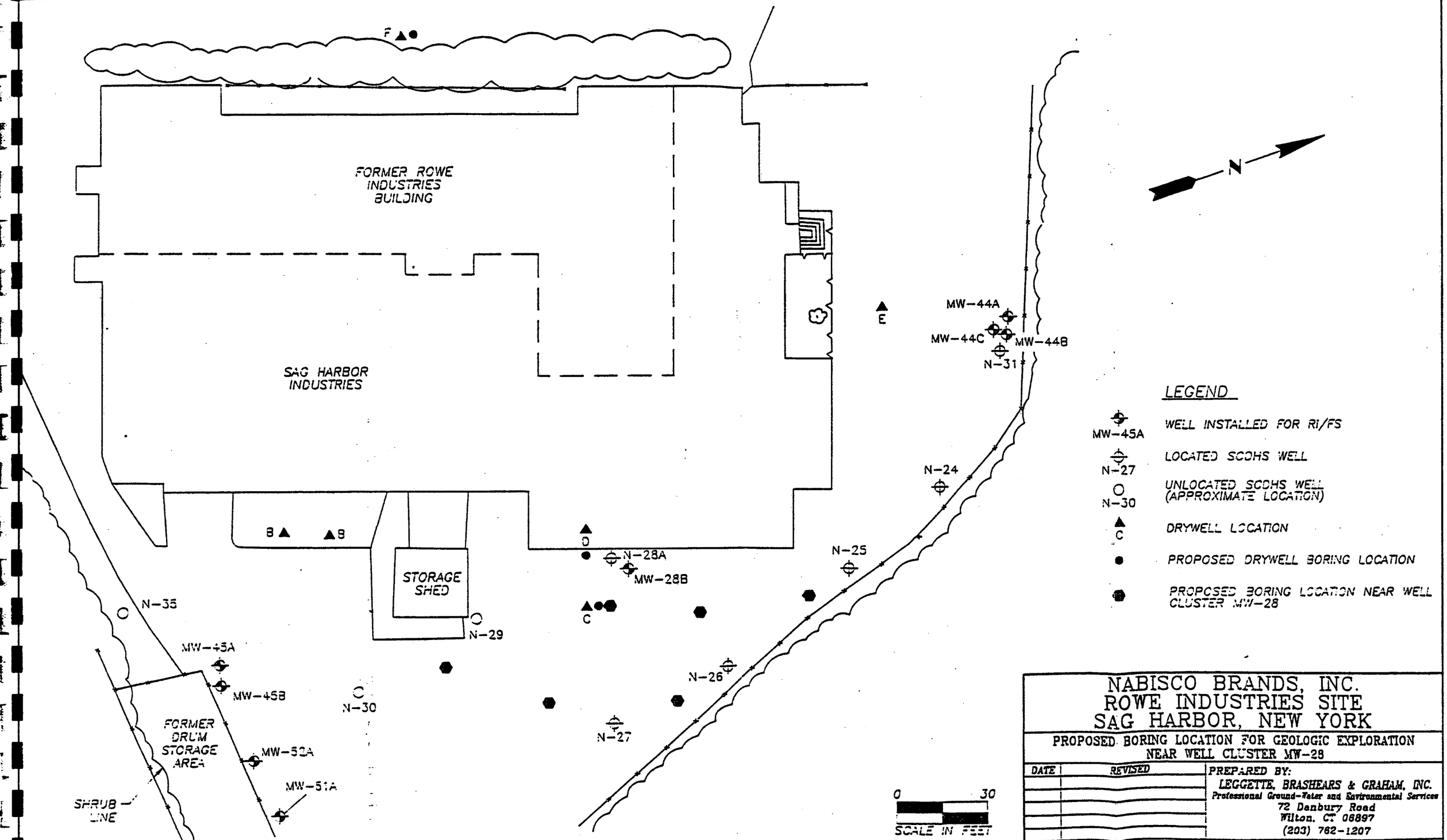
NABISCO BRANDS, INC.
ROWE INDUSTRIES SITE
SAG HARBOR, NEW YORK

PROPOSED BORING LOCATIONS AT THE FORMER DRUM STORAGE AREA

DATE	REVISED

PREPARED BY:
LEGGETTE, BRASHEARS & GRAHAM, INC.
Professional Ground-Water and Environmental Services
72 Danbury Road
Wilton, CT 06897
(203) 762-1207

DATE: 4/28/93 FIGURE: 1



NABISCO BRANDS, INC.
ROWE INDUSTRIES SITE
SAG HARBOR, NEW YORK

PROPOSED BORING LOCATION FOR GEOLOGIC EXPLORATION
NEAR WELL CLUSTER MW-28

DATE	REVISED

PREPARED BY:
LEGGETTE, BRASHEARS & GRAHAM, INC.
Professional Ground-Water and Environmental Services
72 Danbury Road
Wilton, CT 06897
(203) 762-1207

DATE: 4/28/93 | FIGURE: 2

APPENDIX I

SOIL CLEANUP OBJECTIVES

Table 13

Soil Cleanup Objectives

Contaminant	Cleanup Objective (in ppm)
Benzene	0.05
Xylenes	1.2
Ethylbenzene	5.5
Toluene	1.5
PCE	1.5
TCE	1.0
1,1-Dichloroethane	0.2
TCA	1.0
1,1-DCE	0.5
1,2-DCE	0.5

APPENDIX II

STANDARD OPERATING PROCEDURES

STANDARD OPERATING PROCEDURE

SCREENING SOIL SAMPLES FOR VOCs

Equipment:

PID

Sample jars with lids (approximately 250 milliliter)

Aluminum foil

Procedures:

1. Transfer a representative portion of the sample into the sample jar and fill it approximately halfway.
2. Seal the jar with a piece of aluminum foil.
3. Store the sample for at least one hour in a warm area.
4. In order to take a measurement, push the intake probe of the PID instrument through the foil, taking care not to allow soil or water to enter the intake.
5. Record the highest reading, which usually occurs within 5 seconds of puncturing the seal. Record measurement on log. Allow meter to return to background before next measurement.

skd
May 19, 1993
sops/93-25

STANDARD OPERATING PROCEDURE

DECONTAMINATION

Sampling Equipment

The decontamination procedure for all sampling equipment will be as follows:

a. wash and scrub with Alconox detergent (pH 9-9.5);

b. tap water rinse;

c. deionized water rinse (demonstrated analyte free);

d. air dry; and

e. wrap in aluminum foil, shiny side out, for transport or storage.

Drilling Equipment

All drilling equipment will be steam cleaned before use and between boreholes. Augers will be placed on wood planks prior to cleaning. Split-spoon samples will be decontaminated as follows:

a. brush off excess soil;

b. wash and scrub with Alconox detergent (ph 9-9.5);

c. tap water rinse;

d. deionized water rinse (demonstrated analyte free);

e. air dry; and

f. wrap in aluminum foil, shiny side out, for transport or storage.

Analyte-free deionized water used onsite will be provided by an LBG in-house system. The system is a Milli-Q Plus purification system by Millipore.

skd
May 19, 1993
sops/93-25

OVM 580B

Turn power on by inserting the power plug into the power port of the OVM. Turn pump and lamp on by pressing the ON/OFF switch.

Calibration Procedure

1. Be sure a flashing B symbol does not appear in the upper left corner of display. This indicate the batteries are low and need to be recharged before use.

2. Fill Tedlar bags 1/2-full with 100 ppm isobutylene span gas by attaching calibrant gas bottle to a regulator.

3. Press mode button, display will read "Log this value?"
   Depress the negative (-) button

4. Display will read "R/comm -/PARAM
   +/ACCESS 5/CLOCK"
   Depress the negative (-) button

5. Meter will display "Conc meter
   "Reset" to Chg"
   Depress the positive (+) button

6. Meter will display "Auto Logging
   Off"
   Depress the positive (+) button

7. Meter will display "Average = 0:01
   Reset to Charge"
   Depress the positive (+) button

8. Meter will display "ALM at 2000"
   Depress the positive (+) button

9. Meter will display "Lamp 10.0ev"
   (Serial # of Lamp)
   Depress the positive (+) button

10. Meter will display "RF = 1.00"
    Depress the positive (+) button

11. Display will read "Reset" to Calibrate"
    Press the reset button

12. Display will read "Restore Back-up"
    Press the negative (-) button

13. Display will read "zero gas"
    "Reset" when Ready"
    Hit "Reset" button

14. The 580B will then zero the instrument. The meter will display
    "MODEL 580B
    Zeroing"
    Once the 580B has zeroed the meter will display
    "SPAN PPM = 100"
    Hit the positive (+) button

15. The meter will display

"SPAN GAS

Reset when Ready"

Attach the Tedlar bag to the meter and press reset button.

The display will read

"MODEL 580B

Calibrating"

16. When the OVM displays

"Reset to Calibrate"

Press the Mode/Store button and it will display the calibration measurement in parts per million. The reading should be within 10 percent of the 100 ppm isobutylene span gas. If the value is off by more than 10 percent, recalibrate the OVM again.

17. The OVM is now ready for use. It is best to collect as many soil samples as practical for the job, turn the OVM on to test those samples and then turn it off. Do not unplug the OVM between uses or the instrument will lose the calibration.

18. Refer to instrument manual for trouble-shooting guide if machine is not responding to calibration procedures.

* The parameters (i.e., type of lamp, RF value, etc.) may be changed by hitting the reset button and entering the new parameter settings.

skd
May 19, 1993
OVM.sop/93-23

HNU HW-101

Attach the probe to the probe extension and then connect the probe to the key interface.

Turn the control knob to the battery position to be sure the instrument is charged. If this indicates that the batteries are low, the instrument should be recharged before use.

Calibration Procedure:

1. Set span dial to 9.8.
2. Turn control knob to the 0-20 scale and use the zero knob to zero the needle.
3. Turn knob to the 0-200 position.
4. Attach a regulator to a canister of 100 ppm isobutylene calibrant gas.
5. With a small piece of tubing attach the regulator to the probe extension tip and open the regulator valve.
6. The Hnu needle should display 56 ppm. The span may be changed to move the needle to the desired concentration level. The span should be recorded in a field log book. If the span is below 5.0, then the lamp should be cleaned following the manufacturers specifications and the instrument recalibrated.
7. The Hnu is now ready for use. It is best to collect as many soil samples as practical for the job, turn the HNu on to test those samples and then turn it off.
8. Refer to instrument manual for trouble-shooting, if the machine is not responding to the calibration procedures.

skd
May 19, 1993
sops./93-25

APPENDIX IB

EXPRESS MAIL--
RETURN RECEIPT REQUESTED

Mr. Jeffrey B. Lennox, CPG
Associate
Leggette, Brashears & Graham, Inc.
72 Danbury Road
Wilton, CT 06897

RE: Rowe Industries Site

Dear Mr. Lennox:

EPA conditionally approves the Sampling Analysis and Monitoring Plan dated July 1993. This approval is incumbant upon the incorporation of the following comments from EPA.

Investigation of Unsaturated Soils in the Drum Storage Area

a. The criteria for sending soil samples to the laboratory for analysis of using a head space reading of 150 ppm or greater must be revised. The plan must allow for a minimum percentage of samples to undergo laboratory analysis regardless of headspspace screening concentrations.

b. Define the criteria that will be used to determine if there is a need for additional borings.

c. A confirmatory sample must be required to be tested for TCLP analysis in the event that the worst-case TCLP sample indicates that pretreatment prior to disposal is not necessary.

d. The potential impacts of contaminated soil vapor to the residence directly behind former drum storage area has not been fully evaluated. Additional soil vapor samples need to be taken in this area. Specific sample locations should be selected under the direction of NYSDEC and NYSDOH personnel.

If you have any questions or comments, please contact Ms. Linda M. Wood of my staff at (212) 264-8585.

Sincerely yours,

Carole Peterson, Chief
New York/Caribbean Superfund Branch

APPENDIX IIA

APPENDIX IIA

EXTRACTION WELL DRILLING AND CONSTRUCTION SPECIFICATIONS

1. **Mobilization**

   A. Contractor will supply all equipment and materials sufficient to complete the extraction well installation in a timely manner and without undo delays. A staging area will be provided on the plantsite which will be used throughout the project. Contractor will be responsible for setting up decontamination equipment of sufficient size to accommodate the drill end of the rig, including the turntable, mast, platform and rear wheels, as well as drill rods and bits. Drill cuttings, development water and decon water will be segregated, analyzed and disposed according to the RCRA.

   B. A source of water will be designated for use throughout the project.

   C. Contractor will coordinate at all times with the client's representative to insure that there is minimal disruption to plant or neighborhood activities.

   D. Contractor will be familiar with the Health and Safety Plan and will have available for immediate use Level C personal protection equipment, and all personnel will have been properly trained in its use.

2. **Drilling Procedures**

   A. A 12-inch diameter borehole will be drilled to 80 feet in depth for offsite wells and 50 feet in depth for onsite wells using the mud-rotary method. The drilling fluid will be bentonite and water. All drill cuttings and drilling mud must be containerized and transported to a designated onsite staging area for storage prior to disposal.

B. Formation sampling for geologic characterization, using a split-spoon sampler, will be conducted at 10-foot intervals and at the discretion of the client's representative. Split-spoon contents will be disposed of in the same manner as the drill cuttings.

C. The client's representative will monitor the work space breathing zone using a photoionization detector. Based on organic vapor levels, as specified in the site Health and Safety Plan, the site safety officer may require that Level C personal protection be employed.

D. The client's representative may determine that certain drill cuttings and/or drilling fluids should be contained for analytical testing and possible offsite disposal. Contractor must be able to segregate these materials and store them in DOT 17E open-top drums upon request.

E. At the conclusion of the drilling, the client's representative will run a geophysical (resistance and gamma-ray) log for further geologic characterization.

F. Upon completion of the geophysical log, the contractor will be given the final screen setting.

3. <u>Well Construction</u>

A. The well will be constructed of 8-inch (pipe size) diameter, 20-slot, wire-wound stainless-steel screen, Johnson or equivalent. The screen will be 55 feet in length, set at the bottom of the borehole for the offsite well, and 30 feet in length for the onsite well.

B. The screen will be attached to 5 feet of 8-inch stainless-steel casing which in turn will be attached to 8-inch, standard-weight, low-carbon steel casing, sufficient in length to complete the well to 0.5 ft bg (feet below grade).

C. Centralizers will be affixed to the casing at 20-foot intervals to insure positioning of the well in the middle of the borehole and placement of a uniform thickness of gravel pack.

D. After the casing/screen assembly has been set in the borehole, the well will be flushed with potable water to thin the mud.

E. Morie No. 1 gravel pack (or equivalent) will be introduced around the well screen using a tremie pipe. A weighted steel tape will be used to periodically check the level of the gravel pack. The gravel pack will extend to 5 feet below the top of the casing.

F. Prior to surface completion, the well will be developed using a surge block and pumping. All development water must be containerized for storage at a designated location onsite to await disposal. Development will continue until the discharge is less than 5 NTUs (nephelometric turbidity units) or until terminated by the client's representative in the event that 5 NTUs cannot be achieved. After development, additional gravel pack will be added as needed to bring the gravel pack to 5 feet below the top of the casing.

G. A pitless adapter will be installed on the well casing at a depth of 3 ft bg. The top of the well casing will be ground smooth. The

wellhead will be covered with a standard steel cap with compression fittings to keep out surface water. A 2-foot square or 2-foot diameter round manhole and gate box will be cemented in place.

srf
May 1, 1995
nabdes.app/f:lbgrl

APPENDIX IIB

APPENDIX IIB

PROCEDURES FOR RUNNING A STEP-RATE PUMPING TEST

1. Purposes of the Test

A step-rate pumping test provides data which can be used for: 1) determination of well efficiency; and 2) determination of an appropriate rate of pumping for a constant-rate aquifer pumping test. Step tests are generally run at increments which range from far under the well's capacity to a rate in excess of the design yield. At the lowest rate the well should exhibit maximum efficiency, and at the highest rate the lowest efficiency, assuming the well is sufficiently stressed.

2. Setting up the Test

A) Obtain several static water levels in the well during the hour preceding the test. All measurements should be obtained with reference to a fixed point, generally at the top of the casing. The short duration of step-rate tests makes the collection of background measurements less crucial than for constant-rate tests. The purpose of the static readings is to determine if there are any radical changes in the water levels due to pumping at nearby locations, residual effects of pumping at the well being tested or extreme precipitation events.

B) If the well is not already equipped with a pump, install one with the full range of capacities required for the testing. The depth of the pump intake should be sufficient to insure that the anticipated drawdown will not dewater the pump. Reaction of the well during development should provide a good indication of expected drawdowns.

C) Install a flow measuring device which has an accuracy of at least 90 percent of the true flow. Use of an orifice plate and manometer is recommended, though not always possible. If the rates are low, a graduated container or 55-gallon drum is sufficiently accurate. If a flow

meter is to be used, it must be capable of providing rapid data, either through a volume/time measurement or through a totalizer which can be accurately read over a short period of time, such as one minute. For instance, if the desired pumping rate is 50 gpm (gallons per minute), a totalizer which totals by 100-gallon increments will not provide timely or accurate data.

All meters should be calibrated prior to running a test.

D) If an electric drop line is to be used for the test, make sure it is in good working order and that a backup unit is available. If the water levels will be obtained by transducers and the data stored on a logger, follow the standard operating procedure for the use of the equipment model. Make sure that the transducer has the right pressure range for the anticipated drawdowns.

E) Make sure provision has been made regarding the discharge, such as to a storm drain, stream, dry well, sump or overland, if there is sufficient water-carrying capacity in these conveyances. It is generally impractical to run a step-rate test into a water-supply line that has a lot of pressure.

3. <u>Test Procedures</u>

A) Four steps will be run for one hour each, without recovery periods between steps. The test rates will be 20, 40, 60 and 80 gpm for the onsite well (RW-2), and 60, 120, 180 and 240 gpm for the offsite well (RW-6). This will result in 12,000 gallons and 36,000 gallons of water requiring treatment prior to discharge, respectively. It is anticipated that treatment will be by shallow-tray aerators and that the discharge will be directed to the onsite pond or Ligonee Brook.

B) Immediately before start-up obtain a static water level. Turn the pump on at the desired rate and rapidly adjust it to correct flow. Obtain water levels (if being done manually) at 1-minute intervals for 10 minutes, and then at 5-minute intervals until the end of the step. If measurements are being made by a pressure transducer, set the datalogger to record measurement at 10-second intervals for the first 1 to 10 minutes, and at 5-minute intervals for the remainder of the step. Take several manual measurements during the test as a check of the equipment performance and accuracy. Repeat this procedure for each additional step. At the end of the last step shut the pump off and measure water-level recovery using the same frequency of measurements as described above.

4. Data Analysis

To calculate well efficiency, the step-test data will be graphed and the equation $S = BQ + CQ^2$ used to determine well losses and formation losses. A good explanation of the analytical method is presented in Ground Water and Wells by Driscoll. This analysis will aid in the determination about the sufficiency of well development and construction. It will also provide a basis for future comparisons of well efficiency to determine when the well should be redeveloped.

To determine the optimal rate for the constant-rate test, plot the data on semilogarithmic paper and project each trend to determine what pumping rate can be used without causing excessive drawdown, as determined by the pump setting or hydrogeologic conditions.

srf
May 1, 1995
nabdes.app/f:lbgrl

APPENDIX IIC

APPENDIX IIC

PROCEDURES FOR RUNNING A CONSTANT-RATE PUMPING TEST

1. Purpose of the Test

A constant-rate pumping test will be used to determine the transmissivity and storativity of the Upper Glacial aquifer. These parameters will be used to refine the flow component of the computer model generated in the FS process so that it will more accurately simulate aquifer responses to pumping.

The test will also be used to determine the zone-of-capture of the well so that a full-scale ground-water extraction system can be designed. Water samples collected during the test will be analyzed to provide representative water-quality data for use in designing the treatment system.

2. Setting up the Test

A) In order to establish antecedent trends in the levels of the potentiometric surface, water levels will be obtained for 48 hours prior to the test. For the RW-6 test, MW-54, MW-43A, MW-43B, MW-43C and MW-42A, MW-42B,MW-42C will be measured. For the RW-2 test, MW-44A, MW-44B, MW-44C, N-32, MW-48A, MW-48B and MW-48C will be measured. These wells will be measured with dataloggers with readings at least every 30 minutes. All other monitor wells being monitored during the test will be measured twice per day during the background period. All readings will be referenced from the same point throughout the test, usually a clearly marked point on the top of the casing.

B) A rain gage and barometer will be set up 48 hours prior to the test and readings will be taken hourly on both instruments. A determination will be made as to whether any corrections to the water-level data should be made due to atmospheric pressure changes.

C) Install a pump of sufficient capacity to pump to a rate of 20 percent more than the anticipated test rate. This will insure available capacity which may be needed as the water level in the well is lowered.

D) Install a flow measuring device which has an accuracy of at least 90 percent of the true flow. Use of an orifice plate and manometer is recommended, though not always possible. If the rates are low, a graduated container or 55-gallon drum is sufficiently accurate.

If a flow meter is to be used, it must capable of providing rapid data, either through a volume/time measurement or through a totalizer which can be accurately read over a short period of time, such as one minute. For instance, if the desired pumping rate is 50 gpm (gallons per minute), a totalizer which totals by the 100 gallons will not provide timely or accurate data.

All meters will be calibrated prior to running a test.

E) The attached table shows the monitor wells to be measured during testing. Monitor wells will be measured hourly during the first 24 hours and every four hours thereafter. If an electric dropline is to be used for the test, make sure it is in good working order and that a backup unit is available.

If the water levels will be obtained by transducers and the data stored on a logger, follow the standard operating procedure for the use of the equipment model. Make sure that the transducer has the right pressure range for the anticipated drawdowns. Take several manual measurements at each monitoring location during the test as a check of the equipment performance and accuracy.

F) The offsite well will be pumped at a rate of 200 gpm for 72 hours. The onsite well will be pumped at a rate of 100 gpm for 48 hours.

G) Discharge will be directed to Sag Harbor Cove or Ligonee Creek, after treatment with a shallow-tray aerator.

3. **Test Procedures**

A) Immediately before start-up, obtain a static water level. Turn the pump on at the desired rate and rapidly adjust it to the current flow. Obtain water levels (if being done manually) at 1-minute intervals for 10 minutes, and then a 5-minute intervals to the first hour. Hourly readings will be obtained thereafter until the test is completed. If measurements are being made by a pressure transducer, use the datalogger to record measurements at 10-second intervals for the first minute, 1-minute intervals from 1 to 10 minutes, and at 5-minute intervals for the first hour. Hourly measurements will be obtained until the end of the test. Take several manual measurements during the test as a check of the equipment performance and accuracy.

B) Obtain water-level measurements in all observation wells at the following frequency:

- every minute for the first 10 minutes;
- every 10 minutes for the remainder of the first hour; and
- hourly until the end of the test.

C) Samples from the pumping well for water-quality analyses will be obtained every 12 hours of the test and just before the well is turned off. Sampling and analytical protocols are presented in the Quality Assurance Project Plan.

D) At the end of the test, shut down the pump and obtain water levels during the recovery period at the same frequency as specified for start-up of the test. The length of the recovery monitoring period will be

determined in the field but should be continued until there has been at least 90-percent recovery of water levels in the observation wells.

4. Data Analysis

A) The data will be converted to drawdown readings by subtracting the depth to the static water level from the pumping water level. If necessary, the data will be adjusted for regional water-level trends, barometric efficiencies or tidal influences.

B) Drawdown data will be plotted on semilogarithmic format with time on the x-axis and drawdown on the y-axis for all wells. Use the Jacob Method to arrive at transmissivity and storage coefficient values. Other methods, appropriate to the aquifer response, will be employed to determine aquifer coefficients.

C) Plot final drawdowns from all wells on a semilogarithmic format with distance from the pumping well on the x-axis and drawdown on the y-axis. Use the Theim Method for determining transmissivity and storage coefficients.

srf
May 1, 1995
nabdes.app/f:lbgrl

NABISCO BRANDS, INC.
ROWE INDUSTRIES SITE
SAG HARBOR, NEW YORK

Observation Wells to be Used
During the Pumping Tests

Location	Observation well	Distance from pumping well (feet)	Screen depth (feet below grade)
Offsite Test Well RW-6	MW-53	50	40 - 50
	MW-54	100	40 - 50
	MW-43A	200	14 - 29
	MW-43B	200	64 - 74
	MW-43C	200	97 - 107
	N-6	280	20 - 22
	N-11	260	19 - 21
	MW-42 Cluster	Background	
	MW-49 Cluster	Background/Tidal Flux	
Onsite Well RW-2	MW-44A	30	16 - 36
	MW-44B	30	39 - 49
	MW-44C	30	61 - 71
	N-24	35	34 - 36
	N-32	75	29 - 31
	N-28A	140	19 - 21
	MW-28B	140	38 - 48
	MW-45A	280	13 - 28
	MW-45B	280	40.5 - 50.5
	MW-48A	Background	19 - 34
	MW-48B	Background	59 - 59
	N-40	240	19 - 21
	N-36	320	29 - 31
	N-39	185	29 - 31
	MW-47A	215	4 - 14
	MW-47B	215	28 - 38

NOTE: All MW-series wells are 2-inch diameter PVC.
All N-series wells are 2-inch diameter mild steel.

nabsag.tbl/f:lbgrl

APPENDIX IID

LEGGETTE, BRASHEARS & GRAHAM, INC.

PROFESSIONAL GROUND-WATER
AND ENVIRONMENTAL SERVICES

R. G. SLAYBACK
FRANK H. CRUM
MICHAEL R. BURKE
ROBERT LAMONICA
WILLIAM K. BECKMAN
DAN C. BUZEA
J. KEVIN POWERS
JOHN NASO, JR.

G. SIDNEY FOX
WILLIAM F. GUYTON
MERVIN L. KLUG

126 MONROE TURNPIKE
TRUMBULL, CT 06611
203-452-3100
FAX 203-452-3111

W. JOHN SEIFERT, JR.
FRANK J. GETCHELL
CHARLES W. KREITLER
JEFFREY B. LENNOX

DAVID A. WILEY
TERRANCE P. BRENNAN
DAVID M. SCHANTZ
W. THOMAS WEST
CARY G. PIETERICK
DAVID B. TERRY
WILLIAM B. KLEMT
THOMAS P. CUSACK
JOHN M. BENVEGNA
KENNETH D. VOGEL

50
Years of Excellence

July 19, 1993

Ms. Linda Wood
Emergency and Remedial Response Division
United States Environmental Protection Agency
Region II
26 Federal Plaza, Room 747
New York, NY 10278

RE: Rowe Industries Site
Monitoring Plan for Greenbelt Ponds

Dear Ms. Wood:

To address community concerns about the potential impacts that the ground-water remediation system would have on the nearby pond system, we propose establishing a monitoring system. As we have stated previously, the pumping rates and well locations contained in the Feasibility Study were preliminary and will be "fine tuned" after pumping test data are available. Significant drawdown beneath the primary portion of the Greenbelt would be an indication that the wells are being pumped at too high a rate.

The Nature Conservancy has stated they have very little data on the ponds. Therefore, we propose collecting a variety of data that will allow for a proper analysis to be made. The plan follows:

1. **Establish piezometers in "Whaler's Road" Pond, Round Pond, Lily Pond and Crooked Pond** - The piezometers will be installed (by hand) and measured to provide pond water levels and potentiometric heads in the underlying aquifer. With this data, the magnitude and direction of the head drive between the pond and aquifer can be determined. The data from Crooked Pond will be utilized for control (background) purposes, because it is well beyond the zone of influence of the remediation system and is adjacent to a Suffolk County observation well. Locations are shown on the attached map.

2. **Measure depths of ponds listed in 1., above** - Pond depths are currently unknown but are vital for determining if some of the ponds ever dry up seasonally (as the Nature Conservancy assumes) or, if any drawdown is predicted at a pond, to determine how the drawdown compares to the available summer water depth.

3. **Establish a monitor well between "Whaler's Road" and Round Pond** - This well, in the heart of the Greenbelt system and adjacent to the pumping center, will be utilized during the remedial design pumping tests and for the general monitoring plan.

4. **Monitoring Schedule** - All piezometers, the new monitor well, the Suffolk County well adjacent to Crooked Pond (if permission can be obtained), Wells MW-48A and B (on Lily Pond Drive), Wells MW-47A and B (adjacent to the onsite pond), and Wells MW-28A and B (adjacent to the Sag Harbor Industries building) will be measured on a monthly basis.

5. **Analysis** - The water-level data will be graphed on a monthly basis and analyzed to determine normal seasonal water-level trends. At the end of the 1993 summer season, the available water in the ponds during the seasonal low will be evaluated. Final analysis of potential drawdown at the ponds cannot be made until the pumping tests are complete and the model is rerun to determine the final well locations and pumping rates. The monthly monitoring will continue through the design phase and, assuming the EPA does not change the selected remedy for the site, will be utilized to document the water levels during remediation to assist with changes in pumping rates, if necessary. The Nature Conservancy will be provided with copies of the monitoring data.

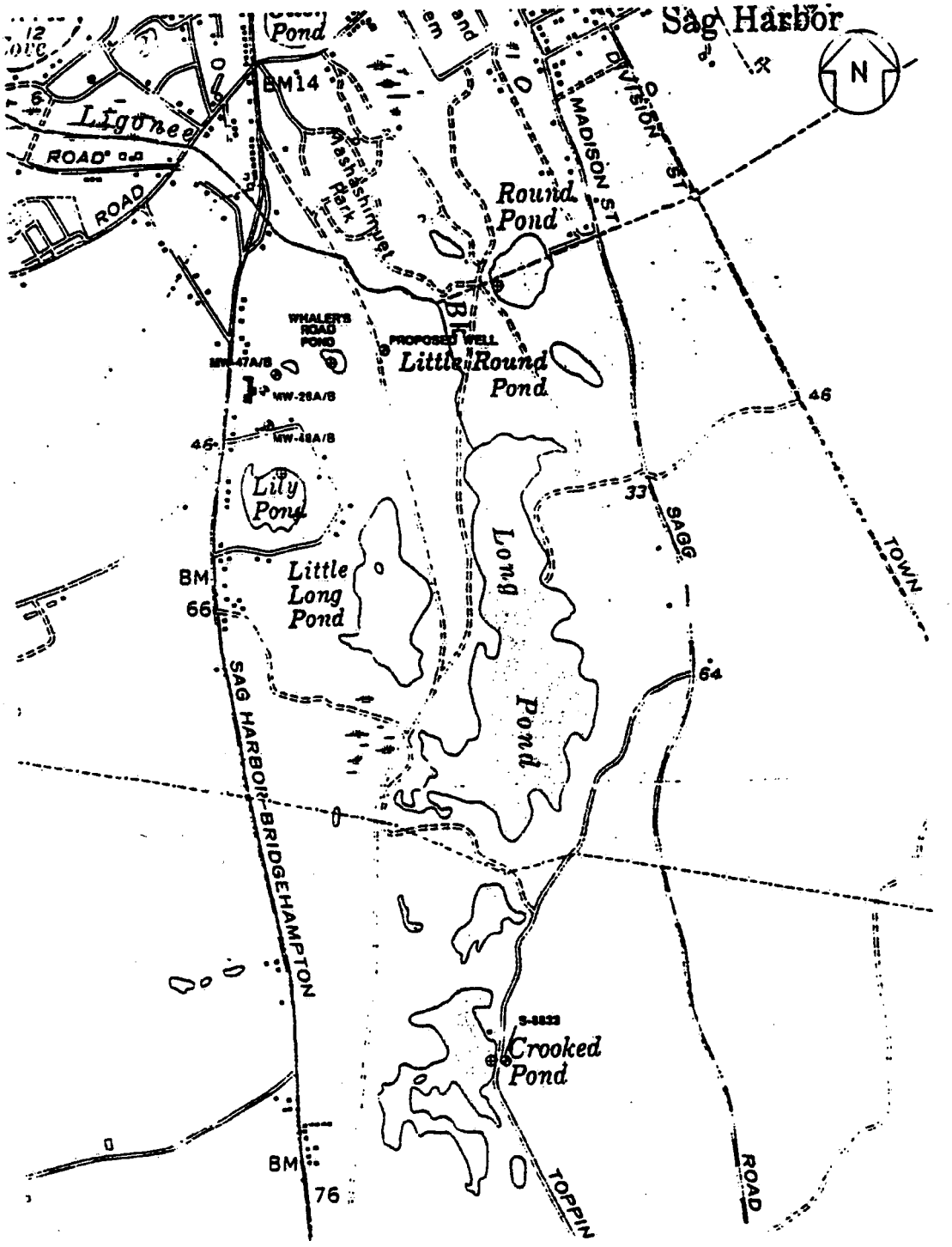
We would like to establish the monitoring points as soon as possible. We will be coordinating with the Nature Conservancy to obtain proper permission to work in the ponds.

Very truly yours,

LEGGETTE, BRASHEARS & GRAHAM, INC.

Jeffrey B. Lennox, CPG
Associate

JBL:srf
cc: C. Bennett
I. Karpf
M. Jordan
rowepond.ltr/93-38



LEGEND

- PIEZOMETER
- MONITOR WELL

0 1000

SCALE IN FEET

NABISCO, INC.

ROWE INDUSTRIES SITE

POND MONITORING LOCATIONS

DATE	REVISED

PREPARED BY: LEGGETTE, BRASHEARS & GRAHAM, INC.
Professional Ground-Water Consultants
72 Danbury Road
Wilton, CT 06897
(203) 762-1207

DATE 7/15/93 FIGURE

APPENDIX IIE

APPENDIX IIE

PROCEDURE FOR HANDLING WELL DEVELOPMENT AND WELL EVACUATION WATER

Pre-design activities will include the drilling and installation of two test extraction wells and two water-level monitoring wells. These wells will require development prior to the planned pumping tests. This water may contain volatile organic chemicals and cannot be discharged without treatment. It will, therefore, be the responsibility of the drilling contractor to supply a settling tank for the drilling mud and sediments generated during development, followed by carbon treatment.

For the offsite well, the development water will be passed through carbon beds and then discharged to the nearest storm drain. The storm drains discharge to ground water within the existing plume.

The onsite well development water will be passed through carbon and be discharged to the undeveloped portion of the Sag Harbor Industries property.

srf
May 1, 1995
nabdes.app/f:lbgrl

APPENDIX IIF

APPENDIX IIF

PROCEDURE FOR HANDLING DRILL CUTTINGS AND DRILLING MUD

Pre-design activities include the drilling of several wells and test borings, all of which will generate drill cuttings. These drill cuttings may contain volatile organic chemicals and should be property handled. Therefore, the following procedure will be used to store, test and dispose of these materials.

- All drill cuttings will be containerized in 55-gallon drums, which will be temporarily stored on the Sag Harbor Industries property.

- Split-spoon samples, whether or not they will be subject to later analyses, will be subjected to headspace screening using a photoionization detector (PID). Any cuttings which exceed 5 ppm (parts per million) on the PID should be segregated into separate drums.

- Cuttings which have less than 5 ppm PID response will be disposed of in the rear of the Sag Harbor Industries property.

- Cuttings which exceed the 5-ppm PID cutoff will be stored in the 55-gallon drums for disposal with the soils to be excavated during the remedial activity.

- Drilling fluids will be containerized and tested for volatile organic chemicals and will be retained for proper disposal.

srf
May 1, 1995
nabdes.app/f:lbgrl

APPENDIX III

APPENDIX III

QUALITY ASSURANCE PROJECT PLAN (QAPP) FOR GROUND-WATER PREDESIGN ACTIVITIES

The following Quality Assurance Project Plan (QAPP) has been developed for insuring that data collected for the Ground-Water Remedial Design meets United States Environmental Protection Agency (USEPA) standards. The QAPP for soil predesign activities was previously submitted and approved. A QAPP for the soil remedy will be included in the Soil Remedial Design Report and a QAPP for implementation and monitoring of the ground-water remedy will be included in the first submittal of the Ground Water Remedial Design Report.

Project Description

Two pumping tests will be conducted at the Rowe Industries Site to facilitate the ground-water remedial design. The test procedures are presented in Appendix IIC. The offsite recovery well test will be run for 72 hours and the onsite recovery well test will be run for 48 hours. Samples for analysis will be obtained at the start of the test and every 12 hours during the test, with the final sample obtained just before the test is terminated. Samples will be obtained before and after treatment. This will result in 14 samples from offsite Well RW-6 and 10 samples from onsite Well RW-2.

Data Objectives

The analytical results of these samples will be used for design of the ground-water treatment system, including any necessary pretreatment, and to determine the potential frequency of well or system maintenance caused by inorganic parameters such as iron or manganese. The purpose of obtaining samples during the test will be to determine if there are any significant changes in the water quality with time. The results will also be used to verify the effectiveness of the temporary treatment system.

The analytical data generated during this program will not be used for risk assessments, cost recovery actions or remedy selection; therefore, full CLP deliverables

and data validation are unnecessary. The final sample obtained from each test will be done using CLP methods and will be validated.

Parameter Table

Table 1 is the parameter table for the sampling which will take place during the pumping tests.

Project Organization and Responsibility

Samples will be collected in the field by the supervising hydrogeologist. Full chain-of-custody documentation will be completed and the samples shipped by overnight courier to IEA Laboratories in Monroe, Connecticut. The laboratory organizational structure is presented in their QAPP.

The sample validation will be performed by DAT, Inc. of Columbus, Ohio.

Review of the data results and incorporation of the data into the design work will be responsibility of William Beckman, P.E.

Data Quality Requirements and Assessments

The precision and accuracy of the data will be assessed by the data validator, DAT, Inc. Data representativeness, completeness and comparability will be assessed by comparison of the data with historical water-quality data developed during the RI and by comparing the data sets with the individual analyses. Fourteen (14) samples will be collected during the RW-6 pumping test. The volatile organic compound results should fall within an expected range of variability. Outliers will be tagged for inquiry to the laboratory. The same procedure will be used for the RW-2 test data.

QA/QC samples will consist of one trip blank per day and one duplicate, matrix spike and matrix spike duplicate for each of the two pumping tests. There will be no sampling equipment, so no field blanks will be obtained.

Sampling Procedures

The raw water samples will be obtained from a sampling port installed in the discharge line before treatment and the treated water will be sampled from a sampling port installed after the treatment unit. The water will be allowed to drain for several seconds to establish a steady flow and then the samples will be obtained in laboratory-supplied VOA vials. Samples will be kept on ice and transported to the laboratory each day.

Sample Custody

Samples will remain in the custody of the field hydrogeologist or technician until transference to an overnight courier service. The laboratory custody procedures are presented in the IEA QAPP presented herein.

Field Measurements and Equipment Calibration

Prior to obtaining the water samples during the pumping tests, measurements will be made of temperature, pH and conductivity. Standard operating procedures for the equipment are attached to this QAPP and kept with the calibration field book. All instruments will be calibrated daily. The laboratory calibration procedures are presented in their QAPP.

Preventative Maintenance

Preventative maintenance for field and laboratory equipment will consist of equipment checks during calibration. Data reproducibility will be the parameter used to judge equipment performance. Corrective action will consist of equipment replacement, rather than repair, because of the short duration of the project.

IEA's calibration procedures and preventative maintenance plan is in their attached QAPP.

Data Reporting

The results of the pumping tests will be presented in the 30-percent Ground Water Remedial Design Report. The data will be presented in tabular form with a discussion in the text. Quality Assurance discussions will be completed by the data validator and will be supported by the validation summary reports which will be presented in the appendix of the report.

Documentation and Data Reduction

The data will be validated (the final samples from the tests and the QA/QC samples) by DAT, Inc. using the most recent revisions of EPA Region II data validation standard operating procedures.

Performance and System Audits

The IEA self-auditing program is included in the QAPP. The CLP program also provides for audits. Leggette, Brashears & Graham, Inc. has already audited the laboratory to insure that sample receipt, custody, analysis and reporting procedures are in keeping with the QAPP.

Corrective Action

The most senior field person will be in charge of readily remedied impediments to sample collection or obtaining field measurements. If corrective action requires test termination, the field supervisor will call the project manager and the EPA RPM to discuss the need for the action.

QA Reports

The Ground Water Remedial Design Report will contain a QA discussion which will address data accuracy, completeness, comparability, validation results and overall data acceptance or rejection.

srf
May 1, 1995
nabdes.app/f:lbgrl

TABLE 1

NABISCO BRANDS, INC.
ROWE INDUSTRIES SITE
SAG HARBOR, NEW YORK

Parameter Table for Ground-Water Predesign Sampling

Task	Number and purpose for samples	Matrix	Analyses[1/]	Analytical methods[2/]	Holding time	Container type	Preservative
Pumping test of onsite and offsite extraction wells	Determine initial influent chemical concentrations for treatment design; 14 samples, obtained at start-up and every 12 hours, for the RW-6 test; 10 samples obtained during the RW-2 test.	Water	VOAs	SW-846 Methods 8010/8020 (final samples for TCL VOAs using CLP SOW)	14 days 10 days from receipt	40-mL vial (4 per sample)	Store at 4°C pH <2, HCL for CLP
			Metals	SW-846 7000 Series (final samples by CLP)	6 months 180 days from receipt	1 liter glass or polyethylene (one)	pH $\leq$ 2 with HNO_3
			Physiochemical	Standard Methods			
Quality Control	Trip blank (1 per day)	Water	TCL VOAs	CLP	10 days from receipt	40-mL vial (4 per sample)	Store at 4°C
	Field blank of ground-water sampling equipment (1 per day)	Water	TCL VOAs	CLP			
	Matrix spike and matrix Spike duplicate samples (1 per test)	Water	TCL VOAS	CLP			

1/ VOAs - Volatile Organic Chemicals
TCLP - Toxicity Characteristic Leaching Procedure
TCL - Target Compound List

2/ SW-846, EPA Test Methods for Evaluating Solid Waste
TCL VOAs - Target Compound List Volatile Organic Chemicals
CLP - Contract Laboratory Protocols
Standard Methods for the Examination of Water and Wastewater.

nabsag.tbl/f:lbgrl

STANDARD OPERATING PROCEDURE

Corning M90 pH/Conductivity Meter (readings are automatically temperature compensated to 25°C

pH Mode

Calibration

1. Attach pH sensor to meter by locating the sensor's pins in the meter and pushing into the meter.
2. Remove wetting cap from tip of sensor and slide the vent sleeve to expose the fill hole.
3. Make sure that the fill solution is not more than one inch below the fill hole. Add KCl solution if necessary.
4. Gently tap the sensor to remove any air bubbles at the ceramic junction.
5. Rinse the pH probe with distilled water, and insert in pH 7 buffer.
6. Press [CAL] - CAL 1 is displayed. After endpointing, the display automatically updates to the calibrated volume shown, or the temperature compensated value.
7. Rinse probe with distilled water and insert in pH 4 buffer.
8. Press [CAL] - CAL 2 is displayed. After endpointing, the display automatically updates to the calibrated value shown, or the temperature compensated value.

Measurements

1. Rinse the probe with distilled water and place in solution.
2. Press [READ] - automatic endpoint detection freezes the display when plateau is reached.
3. Thoroughly rinse probe with distilled water between measurements.
4. Store pH probe with the wetting cap, containing pH 7 buffer, on and the fill hole covered with the vent sleeve.
5. The pH sensor is separated from the meter by squeezing down the catch at the rear and pulling the sensor away from the meter.

Conductivity Mode

Calibration

1. Attach conductivity sensor to meter by locating the sensor's pins in the meter and pushing into the meter.
2. With its clear plastic shield in place, hold the clean, dry probe in free air.
3. Press [CAL] - CAL 1 is displayed. After endpointing, the display automatically updates to the calibrated value shown, or the temperature compensated value.
4. Place the sensor in the 1413 umho's conductivity standard.
5. Press [CAL] - CAL 2 is displayed. After endpointing, the display automatically updates to the calibrated value shown, or to the temperature compensated value.

Measurements

1. Rinse probe and shield with distilled water.
2. With shield in place, immerse probe in solution. Make sure that the solution is above the cell chamber rings and below the vent hole. Also make sure the cell chamber is bubble free.
3. Press [READ] - automatic endpoint detection freezes the display when plateau is reached.
4. Thoroughly rinse probe and shield with distilled water between measurements.
5. Dry probe and shield before storing.
6. The sensor is separated from meter by squeezing down the catch at the rear and pulling the sensor away from the meter.

sop
April 26, 1995
ph/MAIL

STANDARD OPERATING PROCEDURE

Y.S.I. Model 33 Conductivity/Salinity/Temperature Meter

Setup

1. Adjust meter zero (if necessary) by turning the bakelite screw on the meter face so that the meter needle coincides with the zero on the conductivity scale.

2. Calibrate the meter by turning the MODE control to REDLINE and adjusting the REDLINE control s the meter needle lines up with the redline on the meter face. If this cannot be accomplished, replace the batteries.

3. Plug the probe into the probe jack on the side of the instrument.

4. Put the probe in the solution to be measured. (See Probe Use.)

Temperature

Set the MODE control to TEMPERATURE. Allow time for the probe temperature to come to equilibrium with that of the water before reading. Read the temperature on the bottom scale of the meter in degrees Celsius.

Conductivity

1. To check calibration, immerse probe in 25°C conductivity standard solution in 1,413 umhos or 12,000 umhos, depending on the expected conductivities of the samples. If the reading is inaccurate, clean probe. If still in accurate, preplatinize probe.

2. Switch to X100. If the reading is below 50 on the 0-500 range (5.0 on the 0-50 mS/m range), switch to X10. If the reading is still below 50 (5.0 mS/m), switch to the X1 scale. Read the meter scale and multiply the reading appropriately. The answer is expressed in micromhos/cm (mS/m). Measurements are not temperature compensated.

3. When measuring on the X100 and X10 scale, depress the CELL TEST button. The meter reading should fall less than 2 percent; if greater, the probe is fouled and the measurement is in error. Clean the probe and remeasure.

NOTE: The CELL TEST does not function on the X1 scale.

Salinity

1. Determine the sample temperature and adjust the temperature dial to that value.

2. Switch to X100. If the reading is above 500 micromhos/cm (50 mS/m), the salinity value is beyond the measurement range.

3. If the reading is in range, switch to SALINITY and read salinity on the red 0-40 ppt meter scale.

4. Depress the CELL TEST button. The fall in meter reading should be less than 2 percent; if it is greater, the probe is fouled and the measurement is in error. Clean the probe and remeasure.

skd
April 26, 1995
ph/MAIL

IEA-CT LABORATORY

QUALITY ASSURANCE PLAN

Prepared by:

Marsha K. Culik

200 Monroe Turnpike
Monroe, CT 06468

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

APPENDIX

A) Equipment List

B) Professional Profiles

C) Chain of Custody

1.0 QUALITY ASSURANCE PROGRAM -IDENTIFICATION FORM

Document Title: **IEA-CT QUALITY ASSURANCE PROGRAM PLAN**

Company Address: IEA,Inc.-CT
200 Monroe Turnpike
Monroe, CT 06468

Telephone: (203) 261-4458

Company Official: Michael V. Bonomo
Title: Director of Operations

Company Official: Jeffrey C. Curran
Title: Laboratory Manager

Company Official: Marsha K. Culik
Title: Quality Assurance Manager

Plan Coverage: IEA Connecticut laboratory including the following:

Functions:

- Sample Receipt
- GC Laboratory
- GC/MS Laboratories
- Quality Assurance
- Report Production
- Computer Systems
- Inorganics Laboratory
- Organic Extractions
- Data Entry
- Facilities and Safety

Concurrences:

Name:	Michael Bonomo	Signature:
Title:	Director of Operations	Date: 8/3/93
Name:	Jeffrey Curran	Signature:
Title:	Laboratory Manager	Date: July 31, 1993
Name:	Marsha Culik	Signature:
Title:	Quality Assurance Manager	Date: Aug. 3, 1993
Name:	Larry Lewis	Signature:
Title:	Organics Manager	Date: Aug. 3, 1993
Name:	Jack Bennett	Signature:
Title:	Extractions Group Leader	Date: Aug 5, 1993
Name:	Larry Decker	Signature:
Title:	GC/MS Volatiles Group Leader	Date: Aug. 4, 1993
Name:	Kristen Madden	Signature: Kristen Madden
Title:	GC/MS Semi-volatiles Group Leader	Date: August 3, 1993
Name:	Kim Maturo	Signature:
Title:	GC Group Leader	Date: Aug. 3, 1993
Name:	Peter Frick	Signature:
Title:	Classical Chemistry Group Leader	Date: August 3, 1993
Name:	Dan Helfirch	Signature:
Title:	Metals Group Leader	Date: Aug. 3, 1993

2.0 INTRODUCTION

2.1 Background

The Connecticut facility of IEA Corporation (Industrial & Environmental Analysts, Inc.) located at 200 Monroe Turnpike, Monroe, Connecticut. is a full service environmental testing laboratory specializing in analysis of air, water, soil, and sediments.

IEA is a wholly-owned subsidiary of the AQUARION Company, headquartered in Bridgeport, Connecticut.

2.2 Purpose

This Quality Assurance Program Plan (QAPmP) covers laboratory operation at IEA, Inc.-CT. The purpose of this QAPmP is to provide information on laboratory operations as required for specific Quality Assurance Project Plans (QAPjPs), and to provide the basis for the Quality Assurance Program at IEA, Inc.-CT. This program is based on the IEA Corporate Quality Assurance Program Plan document# QAQ00101.NET.

This QAPmP is based upon USEPA guidelines are specified in the following EPA document:

> QAMS-004/80, Guidelines and Specifications for Preparing Quality Assurance Program Plans. Quality Assurance Management Staff (QAMS), USEPA, 1979.

2.3 Scope

This QA program applies to the generation of analytical data utilized for environmental monitoring and assessment programs. The major types of laboratory support for government regulations are as follows:

- Analysis and characterization of environmental (soil, sediment, water and air) and waste samples per the Resource Conservation and Recovery Act (RCRA) for either compliance, disposal or delisting purposes.
- Analysis of drinking water samples in support of the Safe Drinking Water Act (SDWA).
- Analysis of environmental samples in accordance with contracts with the USEPA CLP program and various state agencies (CERCLA and NYSDEC).
- Analysis of environmental samples (soil, sediment, water and air) for contaminants such as those compounds found on the EPA priority pollutant list, target compound list, etc. for site assessment purposes.
- Analysis of waste stream samples in accordance with NPDES requirements.

3.0 QUALITY ASSURANCE POLICY STATEMENT

It is the policy of IEA, Inc.-CT that the Quality Assurance (QA) Program be appropriate to assure that all data collected and reported will be of known and documented value.

The objective of the QA Program (QAPmP) is to ensure, assess and document that all data collected, stored and reported are scientifically valid, defensible and of the precision and accuracy required to meet the objectives of our clients.

It is the goal of IEA, Inc.-CT to provide the best laboratory services to our clients. To accomplish this, the product which we produce, analytical measurement data, must be of defined quality and at the same time conform to government regulations and requirements.

IEA Quality Policy

> *"Management and staff are committed to maintaining a carefully controlled analytical environment in order to ensure the consistent generation of accurate data which meets or exceeds the data quality objectives of our clientele"*

3.1 ETHICS POLICY

IEA - CT recognizes that maintaining a proper ethical standard is an important element of an effective Quality Assurance program. In order to ensure that all personnel understand the importance the company places on maintaining high ethical standards at all times, the company has established an "Ethics Policy" (attached as Figure 1.0). All existing and new employees are required to review and sign an acknowledgment that they will adhere to the policy. A copy is maintained in personnel files.

4.0 QUALITY ASSURANCE MANAGEMENT

4.1 Introduction

The management of IEA-CT is committed to the execution of the quality assurance program described in this document. All managers and employees are required to comply with the program's goals, requirements and responsibilities.

4.2 Assignment of Responsibilities

Quality Assurance at IEA - CT is monitored at both the corporate and laboratory levels. IEA's Network Quality Assurance program is led by the Corporate Director of Quality Assurance, who reports directly to the Chief Executive Officer of IEA. The QA program at each network lab is directed by the QA Manager at that facility, who reports directly to the Laboratory Director and indirectly to the Corporate QA Director.

The following provides a listing of responsibilities and authority of key managerial personnel:

Director of Operations:

Responsibility:

To comply with the quality assurance program and require similar compliance by all staff personnel.

Ensure that all laboratory operations under control are active participants in attaining the network quality assurance objectives.

Ensure compliance with methods and procedures as written.

Timely compliance with any corrective action requirements.

Authority:

Maintain the authority to suspend or terminate employees for dishonesty, or non-compliance with established QA policies and procedures.

Authority is granted from the vice president of IEA, to whom they report.

Laboratory Manager:

Responsibility:

Ensure compliance with methods and procedures as written.

Ensure that analytical procedures are performed in accordance with the requested method and SOPs.

Oversee preparation of analytical reports and data review.

Authority:

Maintain the authority to suspend or terminate employees for dishonesty, or non-compliance with established QA policies and procedures.

Authority is granted from the Director of Operations, to whom they report.

Laboratory Quality Assurance Staff

Responsibility:

Responsible for monitoring and assessing compliance of the laboratory with the requirements contained in the corporate QA program.

Function as a liaison between the corporate QA director and laboratory staff at their facility.

Maintain a document control system containing correct policies and procedures utilized by the laboratory.

Maintain laboratory certification programs.

Oversee corrective action process with regards to data quality issues.

Conduct internal system and performance audits.

Authority:

The QA staff has the authority to stop or change any analytical procedure in order to assure that data quality is maintained.

The authority of the QA staff is granted by the director of the facility.

4.3 Communications

The quality assurance department communicates internally and externally through various means. Weekly conference calls are held by the network QA department for all QA Managers to discuss various issues and exchange information. Monthly quality assurance reports are generated and submitted to laboratory management and the corporate QA department.

4.4 Document Control

A document control system is set up both at the corporate level as well as the laboratory level. Procedures for Corporate Document Control are detailed in corporate SOP DOC# QAS00100.NET. The Quality Assurance Manager is responsible for ensuring that the document control system is properly managed. Any new or revised document must be submitted to the QA Manager for review and distribution.

It is the responsibility of all members of the laboratory to maintain complete records of all operations

performed. All records shall be neat and organized. All laboratory records are the property of the laboratory and shall not be removed from the premises without permission from supervisors. All records are considered confidential and must be safeguarded. Unauthorized changes, loss or destruction of records can be grounds for dismissal from the laboratory. Consult the IEA, Inc. Ethics Policy regarding integrity of data and employee conduct.

Measurement records must be recorded in pre-printed record logs or pre-printed measurement logs. This policy will facilitate the organization and archival of all laboratory data for future reference.

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

All measurement data is recorded in logbooks or on pre-printed log sheets in permanent ink. Transcriptions will be avoided whenever possible. The record will reflect the measurement performed and all appropriate details for conclusions related to the measurement. The record must be initialed and dated by the individual performing the measurement on the day the measurement is performed. Corrections shall be made by drawing a single line through the error, initialing and dating the error. All forms will be reviewed by the QA Manager annually. If it is found that the document does not meet the requirements of the SOP, the discrepancy is forwarded to the group/section leader through the corrective action process (reference SOP on Corrective Action Reports -QAS00501.CT). Further detail on laboratory document control is found in the SOP on Document Control - QAS00300.CT.

4.5 QA Program Assessment

On a semi-annual basis the QA Manager will perform laboratory audits. The purpose of this is to determine if the laboratory staff is following the SOPs or if the SOPs need revising. The QA Manager will also ensure that proper documentation through corrective action reports and case narratives is utilized and that there is conformance to identified critical control points.

The Corporate QA Director semi-annually audits the facility for conformance to corporate QA directives. The SOP for Corporate Audit checklist, Doc# QAS00300.NET, is used for all internal audits. Other performance audit checklists may be used to ensure adherence to specific protocols.

The QA Manager shall submit an audit report to the Laboratory Manager. A written response must be submitted back to the QA Manager within 30 days with a corrective action response to all findings. The audit report shall be included in the monthly progress report to management.

Quality Assurance reports are generated by the QA Manager on a monthly basis summarizing all QA/QC activities. The QA report to the corporate QA director may include a summary of PE results, data audits, external audits, changes in certification status, significant QA concerns and recommendations for resolution and a summary of the internal audit if performed. A copy of this is distributed to laboratory management and to the Corporate QA Director.

A written status report is also generated and distributed to the laboratory staff. In addition to the

information addressed on the corporate QA report, this report includes a summary of corrective action reports for the month, status of SOPs, external audit comments, data review comments, and communications from the corporate QA department.

4.6 Additional Lab Policies to Achieve QA Objectives

QA objectives are accomplished by having analytical data be of defined quality and at the same time conform to EPA regulations and requirements. There are numerous policies and standard procedures which have been implemented to ensure that data of known quality is continually generated by the IEA - CT laboratory. The following are examples of additional policies performed at the IEA-CT laboratory:

4.6.1 External Proficiency Program

Bi-annually, the laboratory participates in the USEPA Water Supply (WS) and Water Pollution (WP) proficiency programs. IEA - CT also participates in the NYSDOH proficiency testing program for Potable Water, Hazardous Waste and CLP. The lab currently analyzes quarterly organic PE samples from EPA for the CLP program.

4.6.2 Internal Proficiency Program

On a quarterly basis the QA Manager will submit QC samples supplied from an external source to the laboratory. The purpose of this is to check the accuracy of results, assess data quality, documentation and completeness of data reporting.

4.6.3 Routine Use of QC Check Samples

In order to access the quality of analytical data on a day-to-day QC check samples, a QC check sample/LCS is included in every inorganic batch which includes metals and wet chemistries. For organic analyses, these are included in analytical batches as required by the particular method. The check sample contains the analytes of interest and must be of an independent source or lot number. For organic Appendix 9 analyses the TAL sub-set shall be used for the QC check standard. Inorganic acceptance criteria is listed in figure 5.1. Organic acceptance criteria is method dependant. Examples are listed in figure 5.0.

4.6.4 Solvent Monitoring Program

All solvents are assayed prior to use. Solvents purchased in bulk are assayed by the IEA-NC laboratory for the IEA network of laboratories according to corporate SOP on Solvent Assay - QAS00400.NET. Assay results are on file at that facility. A list of approved solvents is distributed to all other facilities. Any solvents purchased independently of the corporate solvent program must be assayed according to the corporate SOP on Solvent Assays - QAS00400.NET. All cases of solvent received are coded and stored in a secured stock room. Solvent is used on first-in first-out basis. Method blank data is reviewed to access possible solvent contamination.

4.6.5 Quality Assurance Final Report Review

The QA Manager is responsible for reviewing 5 percent of the final data reports issued for each month.

4.6.6 Monitoring Lateness of Data Reports

One of the key aspects of the quality of laboratory services to IEA-CT is the timeliness of report generation. This information is monitored on a monthly basis through the use of the LIMS computer system and reported to IEA corporate through the QA department.

4.6.7 Method Detection Limit Verification

Method detection limit (MDL) studies are required during initial setup of the particular method. MDLs must be performed in the event of a major change in technique or instrumentation. Certain state certifications require that all MDLs be performed annually. This shall be performed for the standard target compound list for organics and all other certified parameters. Miscellaneous parameters will be done upon initial set-up. All MDLs are available for review upon request.

4.6.8 IEA Good Laboratory Practices

Below are listed examples of Good Laboratory Practices established to enhance the quality of data reported:

A. Standardized logbook requirements (Doc# QAS01201.NET)

Measurement records must be recorded in pre-printed record logs or pre-printed permanently bound measurement logs. This policy will facilitate the organization and archival of all laboratory data for future reference.

All measurement data is recorded in logbooks or on pre-printed log sheets in black permanent ink. Transcriptions will be avoided whenever possible. The record will reflect the measurement performed and all appropriate details for conclusions related to the measurement. The record must be initialed and dated by the individual performing the measurement on the day the measurement is performed. Corrections shall be made by drawing a single line through the error, initialing and dating the error.

B. Balance calibration (Doc# QAS01000.NET)

There must be a unique identifier for each balance. All balances are checked daily with use and documented. Acceptance ranges are established for each balance. Each balance must be checked in the weight range normally used. All balances are

professionally serviced and calibrated semi-annually.

C. Temperature monitoring requirements for lab apparatus (Doc# QAS00801.NET)

Refrigerators, freezers and lab ovens are checked each working day. A unique identifier is assigned for each unit. Acceptance ranges are established for each unit. Thermometers used in monitoring must be calibrated to a NBS traceable thermometer annually, at a minimum. State certification requirements may require more frequent calibration. All thermometers are immersed in appropriate media to avoid temperature fluctuations during measurement.

D. Correcting data and general laboratory records (Doc# QAS01300.NET)

All entries must be entered in black ink. "White Out" is not to be used at any time within the laboratory for alteration or correction of lab documents. Corrections are made using a one-line strikeout. All corrections are initialed and dated by the data editor.

E. Handling reagents and analytical standards

Full and complete documentation is provided on the use and composition of all standards used for preservation or measurement, or spiking of all environmental samples. This includes lot numbers of solvents, reagents, and standards used and the date and initials of the analyst who prepared the standard. These items must be recorded in the standards preparation logbook. IEA preparation code numbers must be assigned to each and every standard prepared including dilutions of standards. Further information on standards preparation can be found in the analytical SOPs.

F. Cleaning procedures for laboratory glassware

All glassware is cleaned according to procedures outlined in the laboratory SOPs. Glassware is washed with soap and water then either rinsed with a solvent or an acid wash depending on the type of analyses being performed. Glassware used for organic extractions are placed in a muffle furnace for further cleaning.

G. Requirements for general lab calibration curves including the following:

In cases where the referenced analytical method does not provide specific guidance or requirements for development of initial or continuing calibration curves, the following procedure is to be utilized by the laboratory.

All standard calibration curves must consist of a minimum of three points. Any deviation from this must be approved in writing by the facility QA Manager.

The curve must yield a correlation coefficient greater than 0.995, or alternatively all

calibration points must be within 10 percent of the expected value for the curve to be considered acceptable.

Concentration of compounds or analytes must fall within the calibration range of the curve to be acceptable for quantitation for inorganic and organic methodology.

H. Method blank subtraction

Subtraction of method blanks from sample results is not permitted unless specifically authorized by the laboratory QA Manager unless stated in the method.

4.6.9 Quality Control Charts

Control charts are to be generated for parameters for which QC data is available. Both precision (RPD) and accuracy (percent recovery) are to be charted. All control charts are to be updated on a quarterly basis. Control charts are generated using a computer program. Procedures are outlined in the SOP.

5.0 PERSONNEL QUALIFICATIONS

5.1 Introduction

The IEA-CT staff consists of over 60 professionals and support personnel which include:

Analytical Chemists
Quality Assurance Specialists
Computer Systems Analysts
Environmental Technicians
Customer service Staff
Account Executives

5.2 Education and Experience

The personnel who are responsible for operations of sample analyses and data validation are outlined in Figure 2. Figure 2 also illustrates the reporting relationships. Professional profiles of key employees are presented in the appendix of the QAP.

IEA-CT has many years of experience in the environmental testing field. Examples of relevant experiences are available upon request.

5.3 Training

All laboratory personnel must have adequate education, training, and experience to carry out their responsibilities. The QA Manager and the Laboratory Management will periodically review the training needs of the staff and make recommendations for any additional training. Each department within the laboratory is responsible for personnel training. Training sessions are scheduled on a monthly basis. Each training session, whether it be individual or group training must be documented utilizing the forms attached to the corporate SOP for Employee Training QAS01600.NET. The completed forms must be submitted to the Human Resource department for placement into the employee training files. Included in the training process is analyst proficiency testing. A successful QC check sample must be analyzed and documented for each analyst. This information is on file with the QA Manager.

5.4 Certifications

Table 5.4.1 presents the state certifications held by the IEA-CT laboratory. Many states certify laboratories for specific parameters or tests within a category (i.e. method 325.2 for wastewater). The information in the following table indicates the lab is certified in a general category of testing such as drinking water or wastewater analysis. The laboratory should be contacted directly if parameter-specific certification information is required.

IEA-CT currently participates in the USEPA Superfund Contract Laboratory Program (CLP). The lab is also approved to perform work for the Army Corps of Engineers which validates laboratories on a project-by-project basis.

TABLE 5.4.1

STATE CERTIFICATIONS

In some instances it may be necessary for environmental data to be reported to a regulatory authority with reference to a certified laboratory. For your convenience, the laboratory identification numbers for the IEA-Connecticut laboratory are provided in the following table. Many states certify laboratories for specific parameters or tests within a category (i.e. method 325.2 for wastewater). The information in the following table indicates the lab is certified in a general category of testing such as drinking water or wastewater analysis. The laboratory should be contacted directly if parameter-specific certification information is required.

IEA-Connecticut
Certification Summary (as of June 1993)

State	Responsible Agency	Certification	Lab Number
Connecticut	Department of Health Services	Drinking Water, Wastewater	PH-0497
Kansas	Department of Health and Environmental Services	Drinking Water, Wastewater/Solid, Hazardous Waste	E-210/E-1185
Massachusetts	Department of Environmental Protection	Potable/Non-Potable Water	CT023
New Hampshire	Department of Environmental Services	Drinking Water, Wastewater	252891
New Jersey	Department of Environmental Protection	Drinking Water, Wastewater	46410
New York	Department of Health	CLP, Drinking Water, Wastewater, Solid/ Hazardous Waste	10602
North Carolina	Division of Environmental Management	Wastewater	388
Rhode Island	Department of Health	Chemistry...Non-Potable Water and Wastewater	A43
California	Department of Health Services	Hazardous Waste	1778

6.0 FACILITIES, EQUIPMENT AND SERVICEES

6.1 Introduction

The following describes the physical facility of the IEA-CT laboratory.

6.2 Facilities

IEA-CT is located at 200 Monroe Turnpike, Monroe, Connecticut. The laboratory currently maintains a staff of approximately 60 environmental professionals and occupies a facility of approximately 13,000 sq. ft. Separate laboratory areas are dedicated to GC instrumentation, GC/MS instrumentation, extractions for organic parameters, sample preparation for metals analysis, metals analysis and wet chemistries.

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

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

The floor plan of the analytical laboratory is attached as Figure 3.

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

The sample receipt and storage area is under the responsibility of the sample custodian. This area is a locked, secure area opened by the sample control department each day. A walk-in refrigeration unit and 14 locked commercial refrigerator units are used to house samples waiting for analysis. Samples for volatile analysis are stored in separate units. Locked laboratory refrigerators, located throughout the laboratory, are used to maintain sample extracts or laboratory reagents. Each laboratory refrigerator is dedicated to sample, sample extract, or reagent storage.

6.3 Equipment

A complete list of equipment utilized at the IEA-CT facility is listed in the Appendix. The following outlines major equipment used by the laboratory:

Gas Chromatography/Mass Spectrometers	7
Gas Chromatographs	6
Inductively Coupled Plasma Spectrophotometer	2
Graphite Furnace/AA	3

Automated Analyzer for Wet Chemistry	1	
Total Organic Halide (TOX) Analyzer	1	
Total Organic Carbon Analyzer	1	
LIMS (Laboratory Information System)	1	
Automated Data Acquisition Management System (ADAM)		1

6.4 Instrument Maintenance

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

Each analytical measurement SOP lists the preventive maintenance schedule for each instrument which is to be followed by in-house and extramural repair contractors. In addition, each measurement group must maintain a log of all in-house and extramural preventive maintenance activities. The following represent examples of general measures which are performed throughout the laboratory.

GC/MS SYSTEMS

1.0 Hewlett-Packard 5995 GC/MS

Routine and Preventive Maintenance	Frequency
*Check oil level in mechanical pumps	Weekly
*Check water level and operating condition in the Neslab cooling units	Weekly
*Check compressed air gas supply	Daily
*Check helium gas supply	Daily
*Check carbon dioxide gas supply	Daily
*Change the oil in the mechanical pumps	Every 6 months
*Inspect the pump hoses and replace if required	Every 6 months
*Change oil in the diffusion pump	Every 6 months
*Change foreline and exhaust trap absorbent	Every 6 months
*Inspect and refill the calibration sample vial with PFTBA	Every 6 months
*Vacuum fan grills and filters	Every 6 months
*Check fore and separator pump pressures	Weekly
*Ion source cleaning and filament replacement	As needed
*Column replacement and conditioning	As needed
*Column cutting and reinstallation	As needed
*Manual tuning	As needed
*Change compressed air gas supply	As needed
*Change helium gas supply	As needed
*Change carbon dioxide gas supply	As needed
*Recharge Neslab cooling units	As needed

*Replace electron multiplier	As needed
*Remove and clean or replace jet separator	As needed

2.0 Hewlett-Packard 5970 MSD / 5971 MSD

Routine and Preventive Maintenance	Frequency
*Check oil level in mechanical pumps	Weekly
*Change the oil in the mechanical pumps	Every 6 months
*Inspect the pump hoses and replace if required	Every 6 months
*Change oil in the turbo pump	Every 6 months
*Change exhaust trap absorbent	Every 6 months
*Inspect and refill the calibration sample vial with PFTBA	Every 6 months
*Vacuum fan grills and filters	Every 6 months
*Ion source cleaning and filament replacement	As needed
*Manual tuning	As needed
*Replace electron multiplier	As needed
*Clean out transfer line to GC	After every column removal

3.0 Hewlett-Packard 5890 GC

Routine and Preventive Maintenance	Frequency
*Check helium gas supply	Daily
*Change split vent trap	Every 3 months
*Column replacement and conditioning	As needed
*Column cutting and reinstallation	Daily or as needed
*Change helium gas cylinder	As needed
*Change liner and septum	Daily or as needed
*Clean injection port	As needed

4.0 Hewlett-Packard 7672A Autosampler

Routine and Preventive Maintenance	Frequency
*Inspect and correct injector alignment	After reseating
*Inspect syringe	Daily
*Check compressed air gas supply	Daily
*Inspect and adjust tension on sample tray	Daily
*Change rinse vials	Daily
*Change waste vials	Weekly
*Replace syringe	As needed
*Sand injector post	As needed
*Realign autosampler on brackets	As needed
*Change compressed air cylinder	As needed

5.0 Hewlett-Packard 7673A Autosampler

Routine and Preventive Maintenance	Frequency
*Inspect syringe	Daily
*Inspect seating of injector	Daily
*Change rinse vials	Daily
*Change waste vials	Weekly
*Replace syringe	As needed
*Reset control box	As needed

6.0 Tekmar Purge and Trap Sample Concentrators and Autosamplers

Routine and Preventive Maintenance	Frequency
*Inspect spargers and fittings	Daily
*Check purge flow	Daily
*Inspect line and valve temperatures	Daily
*Change and condition trap	As needed
*Adjust purge flow	As needed
*Rinse or clean sparging vessels	As needed
*Rinse sample lines	As needed
*Bake out trap	After each analysis extend as needed
*Replace lines and fittings	As needed
*Adjust line and valve temperatures	As needed

7.0 Envirochem Air Sample Concentrator and Autosampler

Routine and Preventive Maintenance	Frequency
*Inspect fittings	Daily
*Check flows	Daily
*Inspect line and valve temperatures	Daily
*Change and condition internal traps	As needed
*Adjust flow	As needed
*Bake out trap	After each analysis extend as needed
*Replace lines and fittings	As needed
*Adjust line and valve temperatures	As needed

GC SYSTEMS

1.0 Hewlett-Packard 5890A GC (GC-4 Dual ECD)

Routine and Preventive Maintenance	Frequency
*Check gas supply	Daily
*Check breakdown criteria	As required by run sequence
*Vacuum filters and grills	Quarterly
*Column replacement and conditioning	As needed
*Column cutting and reinstallation	As needed
*Change gas cylinders	As needed
*Change liner and septum	As needed
*Replace guard column	As needed
*Clean injection port	As needed
*Recondition ECD	As needed
*Change ECD vent absorbent traps	Quarterly

2.0 Hewlett-Packard 5890A GC (GC-3 FID/NPD)

Routine and Preventive Maintenance	Frequency
*Check gas supply	Daily
*Vacuum filters and grills	Quarterly
*Column replacement and conditioning	As needed
*Column cutting and reinstallation	As needed
*Change gas cylinders	As needed
*Change liner and septum	As needed
*Clean injection port	As needed
*Replace or reactivate the NPD collector	As needed

3.0 Perkin-Elmer Sigma 3B GC (GC-2 ECD)

Routine and Preventive Maintenance	Frequency
*Check gas supply	Daily
*Vacuum filters and grills	Quarterly
*Column replacement and conditioning	As needed
*Change gas cylinders	As needed
*Change injection port septum	As needed
*Clean or replace ECD anode	As needed
*Change glass wool	As needed
*Replace partial packing	As needed
*Change ECD vent absorbent trap	Quarterly

6.0 Hewlett-Packard 7673A Autosampler

Routine and Preventive Maintenance	Frequency
*Inspect syringe	Daily
*Inspect seating of injector	Daily
*Inspect rinse and waste vials	Daily
*Vacuum filters and grills	Quarterly
*Replace syringe	As needed
*Change rinse and waste vials	As needed

7.0 Perkin-Elmer AS-100B Autosampler

Routine and Preventive Maintenance	Frequency
*Inspect syringe	Daily
*Inspect rinse and waste vials	Daily
*Check flushing efficiency	Daily
*Clean or replace syringe	As needed
*Change rinse and waste vials	As needed
*Change diverter valve septum	As needed

METALS SYSTEMS

1.0 Graphite Furnace

Routine and Preventive Maintenance	Frequency
*Clean contact rings, furnace housing and quartz windows	Daily
*Inspect, clean or replace graphite tubes	As needed
*Replenish matrix modifiers	Daily
*Check lamp alignments and energies	Daily
*Clean mirrors for the optical sensors	Weekly
*Clean windows on furnace housing	Weekly
*Inspect contact rings for excessive wear	Monthly

2.0 Inductively Coupled Plasma

Routine and Preventive Maintenance	Frequency
*Change capillary and pump tubing	Twice weekly
*Replace liquid argon tank	As required
*Reprofile via slit micrometer	Per manual
*Replace and realign plasma torch	As needed
*Clean nebulizer and spray chamber	As needed

*Check primary imaging mirror	Weekly

3.0 Mercury Analyzer

Routine and Preventive Maintenance	Frequency
*Clean sample cell and tubing	Monthly
*Check sparger condition	Daily
*Check level of mercury scrubber solution	Daily
*Replace lamps	As required

WET CHEMISTRY SYSTEMS

1.0 pH Meters

Routine and Preventive Maintenance	Frequency
*Clean electrode if calibration has deteriorated	As needed
*Store pH electrodes in pH 7.0 buffer	Daily
*Check ISE electrodes and meter	Per manual

2.0 Analytical Balances

Routine and Preventive Maintenance	Frequency
*Surfaces cleaned and covered	Daily
*Calibrated and cleaned by manufacturer	Semi-annually
*Accuracy checked by class "S" weights	Prior to use

3.0 Conductivity Meters

Routine and Preventive Maintenance	Frequency
*Instrument surfaces inspected and cleaned	Daily
*Calibrated using 0.01M potassium chloride	Daily
*Spare cells on inventory	As needed

4.0 Spectrophotometers

Routine and Preventive Maintenance	Frequency
*Instrument cleaned	Daily use

5.0 Total Organic Halogen Analyzer (TOX)

Routine and Preventive Maintenance	Frequency
*Instrument cleaned	Daily use
*Perform cell performance checks	Daily
*Flush cells and check heated tapes	Daily
*Inspect sample boats, inlet and exit tubes, o-rings and seals	Daily

6.0 Autoanalyzer Systems

Routine and Preventive Maintenance	Frequency
*Clean all components and flush system	Daily use
*Inspect all pump tubes and sample lines	Daily use
*Inspect line coils, heating baths and filters	Weekly
*Inspect all colorimeter filters	Weekly
*Inspect and clean chemical manifolds	Monthly

7.0 DATA GENERATION

7.1 Introduction

There are numerous policies and standard procedures which have been implemented to ensure that data of known quality is continually generated by the IEA-CT laboratory. The IEA Corporate and Laboratory Facility Quality Assurance Plans are examples of documents which are generated. Guidelines for the facility QA plans are detailed in section 7.2.1 of the Corporate Quality Assurance Program Plan Doc#QAQ00101.NET.

7.2 Quality Assurance Project Plans

Quality Assurance Project Plans (QAPjP) are developed to meet contract and agency requirements on a project specific basis. These plans discuss specific terms, policies, objectives and QA activities designed to achieve the data quality objectives of the project.

All QA project plans are written in accordance with the following USEPA Document: USEPA Guidelines and Specification for Preparing Quality Assurance Project Plans, QAMS-005/80, Washington DC: USEPA, Quality Assurance Management Staff, October 17, 1980.

Guidelines for preparing QA project plans are also detailed in the Corporate Quality Assurance Program Plan Doc#QAQ00101.NET.

7.3 Methods

IEA-CT utilizes a wide variety of analytical methods. A listing of general analytical capabilities is presented in Table 7.3.1.

Each department is required to have a written standard operating procedure (SOP) in use which describes how the requirements of the method are met. All SOPs must be prepared in accordance with IEA Doc.#QAS00200.NET.

Analytical methodologies and quality assurance protocols in use are based on the following guidelines:

"Methods of Organic Chemical Analysis of Municipal and Industrial Wastewater", Federal Register Vol. 49, No. 209, October 26, 1984;

"Test Methods for Evaluating Solid Wastes", SW-846 Third Edition, September 1986, USEPA;

"Standard Methods for the Examination of Water and Wastewater" 1985, 14th, 15th, 16th and 17th Editions;

"Methods for Chemical Analysis of Water and Wastes" March 1983 EMSL, EPA;

Organic Analysis: Multi-media, Multi-concentration-IFB-CLP, January 1991, Document Number OLM01.9 (plus revisions);

Inorganic Analysis: Multi-media, Multi-concentration-IFB-CLP, Document Number ILM03.0;

New York State Department of Environmental Conservation - Analytical Services Protocol, September 1989, 12/91 Revisions;

"Methods for the Determination of Organic Compounds in Drinking Water" December 1988 (revised July, 1991), EPA-600/4-88/039;

"Handbook for Analytical Quality Control in Waste and Wastewater Laboratories", EPA-600/4-79-019, March 1979.

Organic Analysis: Multi-media, Multi-concentration-IFB-CLP, January 1991, Document Number OLM01.8 (plus revisions);

Inorganic Analysis: Multi-media, Multi-concentration-IFB-CLP, Document Numbers ILM01.0 and ILM02.0;

New York State Department of Environmental Conservation - Analytical Services Protocol, September 1989, 12/91 Revisions;

"Methods for the Determination of Organic Compounds in Drinking Water" December 1988 (revised July, 1991), EPA-600/4-88/039;

"Handbook for Analytical Quality Control in Waste and Wastewater Laboratories", EPA-600/4-79-019, March 1979.

TABLE 7.3.1

IEA-CT ANALYTICAL CAPABILITIES

I. ORGANICS-GC/MS

Volatile Organics-524
Volatile Organics-8240
Volatile Organics-CLP
Volatile Organics-T01/T02
Volatile Organics-Appendix IX
Acid & Base/Neutrals-8270
Acid & Base/Neutrals-CLP
Acid & Base/Neutrals-Appendix IX

II. ORGANICS-GC

Organohalide Pesticides & PCBs-608
Organohalide Pesticides & PCBs-8080
Organohalide Pesticides & PCBs-CLP
Organophosphate Pesticides-8140
Organohalide Pesticides & PCBs-Appendix IX
Chlorinated Herbicides-8150
Chlorinated Herbicides-Appendix IX

III. INORGANIC METALS

ICP Metals
Furnace Metals
CLP Metals

IV. BIOLOGICAL ANALYSES

Total Coliform
Fecal Coliform
Standard Plate Count
Enterococci
Fecal Streptococcus

V. INORGANIC WET CHEMISTRY*

Acidity
Alkalinity
Ammonia
Bicarbonate
Biochemical Oxygen Demand (BOD)
Bromide
Chloride
Chlorine Demand
Chlorine Residual
Chemical Oxygen Demand
Color
Conductivity
Chromium (VI)
Cyanide - Amenable
Cyanide - Total
Cyanide (CLP)
Dissolved Oxygen
Flashpoint
Fluoride
Grain Size
Hydrocarbon analysis
MBAS
Nitrate
Nitrite
Odor
Oil and Grease
Paint Filter Test
pH
Phenols
Phosphate
Phosphorus
Settleable Solids
Silica
Specific Gravity
Sulfate
Sulfide
Sulfite
Sludge Volume Index
Tannins and Lignins
Total Dissolved Solids
Total Kjeldahl Nitrogen
Total Organic Carbon
Total Organic Halides
Total Solids
Total Suspended Solids
Turbidity
Volatile Solids
Corrosivity Characteristics
Ignitability Characteristics
EPTOX
TCLP

* Figures 6.0 - 6.1 list actual analytical methods utilized

7.4 Standard Operating Procedures

All laboratory activities, from sample receipt to analysis to final report generation, must adhere to the laboratory Standard Operating Procedures (SOPs) which have been developed to provide quality environmental data with adequate documentation to be of known quality and hence of maximum use to our clients. All SOPs provide complete documentation as to how each sample is measured for each parameter. Reference corporate document QAS00200.NET for the IEA corporate format for generating SOPs. Each SOP shall have a unique code in accordance with the IEA corporate document control procedure as outlined in the corporate SOP on document control.

On a regular basis the QA Manager will review data to check for compliance to SOPs. Additionally the QA Manager will review SOPs to ensure they meet the requirements of the methodologies and applicable regulations. If it is found that the document does not meet the requirements, the discrepancy is forwarded to the group/section leader through the corrective action process. (reference SOP on Corrective Action Reports -QAS00501.CT).

In addition to method SOPs, at minimum the laboratory is required to have on file SOPs for the following operations. Many of these SOPs have been generated by the IEA corporate QA department.

Sample Receipt and Log-in
Chain-of-Custody Procedures
Sample Storage
Security of Samples and Laboratory Facility
Preventing Sample Contamination
Purity of Standards and Standards Preparation Documentation
Maintaining Laboratory Records and Logbooks
Sample Analysis and Data Control Systems
Sample Bottle and Glassware Cleaning Procedures
Monitoring of Refrigerators, Freezers, and Ovens
Monitoring of Laboratory Reagent Water Quality
Technical Review of Data and Reports
Sample Analysis, Data Handling and Reporting
Instrument Preventive Maintenance
Document Control System
Corrective Action Process

A complete list of the laboratory SOPs is available upon reuqest.

7.5 Chain-of Custody

Chain of custody procedures are designed to document the physical flow of samples throughout the laboratory. The National Enforcement Investigations Center (NEIC) of EPA defines custody of evidence in the following ways:

It is in your actual possession; or

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

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

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

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

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

All documentation received with samples is reviewed by the sample custodian at the time of receipt. The project manager then reviews the paperwork again at the time of log-in to the LIMS computer system. If there are any discrepancies noted by the sample custodian, a corrective action report is filled out and submitted to the project manager. The client is then contacted for resolution.

The specific procedures and requirements for receiving samples are specified in the SOP for sample control - "Sample Processing Methods Performed at Sample Arrival".

8.0 DATA PROCESSING

8.1 Introduction

Data processing is defined as the mechanisms employed for collecting, reviewing, transcribing, reporting and storing of analytical data and related information.

Because of the critical relationship between instrument calibration, the accuracy of the analytical data generated, and specific method protocols that determine data quality, IEA maintains strict controls on the calibration procedures for the various types of analytical equipment. Each type of instrumentation is calibrated prior to sample analysis according to method criteria. Specific criteria for the instrument calibrations must be met before samples may be processed. Corrective action must be taken to remedy any out of control situations.

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

8.2 Collection

Gas Chromatography

Data from the Gas Chromatographs is collected through interfaces and processed by a Hewlett Packard computer system (HP-1000) with RTE-A operating system and 3550A LAS software. Data is reviewed at the bench level by the analyst. If all required QC is met then the data is reviewed for chromatographic scaling and dilutions. If necessary reintegrations and rescalings are done using the LAS system. The binary result files are then converted to ASCII report files for transfer to alternate computer systems for data report forms generation.

GC/Mass Spectrometry

GC/MS data is collected utilizing Hewlett Packard 1000 RTE, RTA or DOS chemstation computer systems with Aquarius or Environquant software. This software allows for the comparison of sample non-target spectrum against reference library spectra. The most recent NIST/EPA mass spectral library supported by the system must be used. Data is reviewed by the analyst. If the data meets QC requirements, then binary data files are sent to a HP 9000 computer with HP-UX operating system and Thru-put Systems, Inc Envision software for CLP deliverables and diskette preparation, or to an alternate PC for other types of deliverable packages.

Atomic Absorption

ICAP metals are analyzed by a Thermo-Jarrel Ash 61. Data is collected on a Dell computer and is directly transferred to a floppy disk. This data is then taken to a Compaq PC with software to generate metals data reporting forms. Furnace data analyzed by the Perkin

Elmer 5100s are collected on PCs, transfered to floppy and moved to the Compaq for forms generation. Mercury raw data results are manually entered into the LIMS computer where the data is processed and recorded. This data requires manual entry to the compaq for forms generation.

Classical Chemistry

Routine wet chemistry analyses have pre-printed logbooks, such as distillation logs and digestion logs. The less frequent analyses are recorded in analysts' notebooks. Raw data is then entered into the LIMS computer for data calculation. This includes the calibration curve data which may have been previously entered. Semi-automated analyses performed on the Lachat produce calculated final results. These results are then entered into LIMS. Any raw data produced is stored in a central file. Quality control data is manually calculated. Results data is reported off LIMS in the required format.

8.3 Validation/Review

There are numerous policies and standard procedures which have been implemented to ensure that data of known quality is continually generated by the IEA-CT laboratory.

Each analytical SOP details the type and frequency of quality control checks. This includes such items as analysis of client reference standards, matrix spikes, blanks, the use of internal standards and surrogate spikes, etc. All calibrations are checked before sample analysis can begin. If the analytical system does not pass the initial QC limits, then the system is determined to be "out of control", and the cause of the problem must be determined and corrected before measurements can continue. Once the problem is corrected, QC measurements are repeated to verify the calibration. If the system is still out of control, the system is re-examined until the problem is corrected. General requirements are listed below:

Organics

- A minimum of one method blank is analyzed per 20 samples (or batch) per matrix, per concentration level or extraction procedure. A method blank is required every 12 hours for volatile analysis. Blanks and samples are analyzed on the same instrumentation. Pesticides/PCB's also require instrument blanks.
- Holding blanks are placed in volatile refrigerators on a weekly basis. For EPA CLP SOW volatile analysis, holding blanks are analyzed once per SDG.
- A matrix spike/matrix spike duplicate is analyzed at a frequency of one per 20 samples per matrix, per concentration level or per SDG, whichever is more frequent.
- Prior to sample processing, surrogates are added to all samples and method blanks. GC/MS analyses also require the use of internal standards.
- Multi-level initial calibration curves are performed with continuing calibration standards analyzed every 12 hours. Recalibration is required if criteria cannot be met.
- GC/MS system tuning is verified every 12 hours.

Inorganics

- Multi-level calibration is performed on required instrumentation and verified as required.
- Calibration and prep blanks are analyzed at required frequencies.
- A matrix spike and sample duplicate are analyzed every 20 samples/SDG per matrix type.
- A Laboratory Control Sample is analyzed every 20 samples or per batch.
- Multi-level calibrations are performed for all manual and semi-automated wet chemistry methods and verified as required (if applicable).
- Method blanks are analyzed at required frequencies.

The precision and accuracy control limits employed by IEA are based primarily on limits contained in the published methods or required by the U.S. Environmental Protection Agency's Contract Laboratory Program (CLP). When warranted by IEA's historical data, more restrictive control limits are set than those cited by the method or the CLP.

When the CLP protocol is not applicable to analysis of samples, the precision and accuracy requirements for each analytical method are included in the individual laboratory Standard Operating Procedure (SOPs). Examples of data acceptance criteria is detailed in figures 5.0 - 5.1.

At a minimum, all data will be subject to supervisory review. Sensitive data requires higher level review and release. All releases must be in writing. Oral or Faxed preliminary releases are prohibited unless prior permission of the appropriate supervisor(s) is granted.

Each analytical group in the laboratory is responsible for generating the data for all analyses the group performs. In general the data must first meet all the specific QA/QC associated with the SOP that was used for the analysis prior to any release of the data. The analytical group leader (supervisor) is responsible for the final verification of the data from the analysis.

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

The laboratory Quality Assurance Manager periodically examines data packages at random to ensure that all QCAR's are present and to ascertain that the data package meets the requirements as stated in the SOP. These findings are transmitted to laboratory management via progress reports.

8.4 Data and Report Storage

Reports for the current year are filed in the data management area in filing cabinets. If the report has a larger data package, such as "CLP like" deliverables, it is then stored in numbered boxes. The number of the box is recorded into the cross reference logs and then stored in the locked storage area in the basement. All jobs must be signed out if being taken from the data management area.

8.5 Transcription

Whenever possible, manual transcription is avoided through the use of electronic data transfer. Where manual transcription is used, information is checked and verified by the department manager or designee within the department.

8.6 Data Reduction

Data reduction includes all processes that change either the form of expression (i.e., the units of measure) or the quantity of data values (rounding). It often involves statistical and mathematical analysis of data and usually results in a reduced subset of the original data set. Data reduction is performed either manually by the analyst or by computer systems interfaced to the analytical instruments. Whenever such procedures are employed within the laboratory network, mathematical procedures have been verified for accuracy of computation.

An example of this would be for CLP data packages, the data is transfered directly onto the HP 9000 computer from the GC and GC/MS systems. The data is further processed and stored in the database. Other data is entered at this point such as TIC data, client ID's, etc. All calculations and final results are performed by the Envision software. Many of these calculations are also done at the instrumentation level as a secondary review. Data in the database is sorted be client delivery group for easy retrieval. CLP forms are generated after all data is entered and reviewed. The forms and raw data are compiled into a data package.

The data associated with each analysis is hardcopied for permanent storage either through the printing of computer files or through hand entry into bound laboratory notebooks. All notebook entries are dated and signed by the analyst.

Job packages which include 20 samples or samples received by the laboratory during a one week time frame will comprise an "SDG". All organic parameter results will be reported in ug/L for aqueous samples and ug/Kg dry weight for soil/sediment samples. Inorganic result units vary according to the methodology.

It is laboratory policy that any and all problems related to client samples and the measurement of client samples be documented in the SDG narrative of the final laboratory report which goes to the client. The mechanism for documenting problems which shall be included in the SDG narrative is described in Section 10.0. It is the responsibility of the data management group to see that information on CAR's is included in the final SDG narrative.

After final review by the department manager, the data is placed in sample control for tracking on the project status sheet. If possible the data is placed into the job folder. When all parameters are complete the folder is removed by the data management department. It is the responsibility of the data management group to make sure that all the data is present and deliverable requirements are complete. This may include chain of custody forms, special instructions, and case narratives. The data is then compiled and sent to the report production group for word processing.

9.0 DATA QUALITY ASSESSMENT

Data quality is measured through comparison of resulting data with established acceptable limits for data precision, sensitivity, accuracy, representativeness, comparability and completeness (PSARCC) as described in EPA documentation. In order to routinely assess the precision and accuracy of the data generated, the laboratory performs monthly statistical analysis of the spike and spike duplicate data as part of our QA program. These results are used to generate control charts.

9.1 Precision

Precision is defined as a measure of agreement among individual measurements for samples of the same type. The objective of IEA - CT concerning precision, is to equal or exceed the precision demonstrated in the analytical methods on samples of similar matrix. Relative Percent Difference (RPD) is used as the measure of precision. The laboratory will analyze matrix spikes/matrix spike duplicates for organics and sample/sample duplicate for inorganics, on a one per 20 frequency, per matrix, per concentration level.

$$RPD = \frac{\text{absolute (MSR - MSDR)}}{(1/2)(MSR+MSDR)} \times 100$$

where,

MSR = matrix spike recovery

MSDR = matrix spike duplicate recovery

The absolute value of the recovery difference is used in the above equation.

9.2 Sensitivity

Sensitivity is defined as the achievement of method detection limits dependent on instrumental achievablity and matrix effects. Quantitation limits for routine analyses performed are specified in the laboratory SOPs with examples listed in figures 6.0 - 8.0. Quantitation limits may be affected by matrix interferences, such as highly-contaminated samples. Sample/extract cleanups are performed on samples to achieve the detection limits. Instrument detection limits are performed on a quarterly basis for metals analysis and semi-annually for organic analyses.

9.3 Accuracy

Accuracy is defined as the degree of agreement of a measurement with an accepted reference or true value. It is the measurement of the bias in a system and is usually reported as percent recovery of the true value. IEA-CT will access system accuracy by the analysis of matrix spikes. Surrogate spiking will be used for organic parameters. These procedures are outlined in the laboratory SOPs. Examples of specific criteria is listed in figures 5.0 - 5.1.

$$\% \text{ Recovery} = \frac{SSR - SR}{SA} \times 100$$

where,

SSR = spiked sample result

SR = sample result

SA = spike added

9.4 Representativeness

Representativeness of the analytical data is primarily a function of the sampling procedures and techniques employed in the field. As such, the sampling plan must be designed to provide representative samples to the laboratory. Once received at the laboratory, samples are homogenized as much as possible to yield representative data.

9.5 Comparability

Comparability is a measure of the confidence with which one data set can be compared to another. Comparability relies upon precision and accuracy to be within appropriate QC limits. IEA-CT accomplishes this through the use of standardized and approved methods, standardized QC acceptance criteria and laboratory SOPs.

9.6 Completeness

Completeness is the measure of the amount of valid data obtained from a measurement system compared to the amount that was expected to be obtained under routine conditions. It is IEA-CT's goal to strive for 100 percent completeness.

10.0 CORRECTIVE ACTION

10.1 Introduction

The Corrective action form provides a routine written communication vehicle to describe most types of problems which may occur throughout the laboratory or as a result of a client inquiry. Problems described in SDG narratives should be supported by a CAF.

Corrective actions can be initiated at several operational levels; however they must always involve the QA Manager. Corrective actions are reviewed, documented and distributed to the appropriate personnel through the QA department. Responses are returned to QA for review and redistributed in a specified time frame.

Examples of three types of corrective actions which may be initiated are as follows:

Sample problems

Individual samples or matrix problems may cause documented corrective actions such as re-extraction, reanalysis, cleanups or dilutions.

QC problems

Corrective action may occur on entire batches of samples when QC criteria cannot be achieved.

Systematic problems

Specific project issues and procedural issues may require corrective actions. These are handled by laboratory management and the QA department.

The QA Manager will monitor and log the progress of CAF's and will report in the QA Progress Report the status of major corrective actions taken in the past month. It is the QA Manager's responsibility to see that laboratory problems are documented and solved in a timely manner. This system is outlined in the SOP for Corrective Action Reports - QAS00501.CT.

10.2 System Audit

On a semi-annual basis the QA Manager will perform system audits of the laboratory. The purpose of this is to determine if the laboratory staff is in compliance with the QA program and analytical SOPs. The QA Manager will also ensure that proper documentation through corrective action reports and case narratives is utilized and that there is conformance to identified critical control points.

The Corporate QA Director semi-annually audits the facility for conformance to corporate QA directives. The audits are scheduled so that the laboratory is audited once per quarter.

The SOP for Corporate Audit checklist, Doc# QAS00300.NET, is used for all internal audits. Other performance audit checklists may be used to ensure adherence to specific protocols. The QA Manager shall submit an audit report to the Laboratory Manager. A written response must be submitted back to the QA Manager within 30 days with a corrective action response to all findings. The audit report shall be included in the monthly progress report to management.

10.3 Performance Audits

A performance audit is a quantitative check of the accuracy and/or precision of analytical data.

IEA-CT participates in a number of contracts and certification programs. Many of these programs employ performance evaluations which take the form of proficiency samples submitted to the laboratory on a regular basis.

Bi-annually, the laboratory participates in the USEPA Water Supply (WS) and Water Pollution (WP) proficiency programs. IEA-CT also participates in the NYSDOH proficiency testing program for Potable Water, Hazardous Waste and CLP. The lab currently analyzes quarterly organic PE samples from EPA for the CLP program.

On a quarterly basis the QA Manager will submit QC samples supplied from an external source to the laboratory. The purpose of this is to check the accuracy of results, assess data quality, documentation and completeness of data reporting. The QA Manager shall submit an data review report to the laboratory. A written response must be submitted to QA within two weeks addressing the unacceptable findings Corrective actions shall be put in place and monitored.

10.4 Independent Audits

The laboratory is routinely audited by state and federal agencies for compliance with government regulations. In addition many clients conduct system and performance audits of the laboratory.

10.5 Subcontracted Services

Selected analyses, not performed by the IEA-CT laboratory may be subcontracted within the IEA network or to other facilities outside the network. All subcontract laboratories require approval of the QA department and client prior to use. This includes, at a minimum, review of the facility's Quality Assurance plan. Subcontract laboratories may receive an on-site audit if deemed appropriate. All subcontractors must hold the required certifications necessary for the project.

All clients are notified whenever a subcontracted lab is to be used. This is documented in all laboratory reports.

11.0 IMPLEMENTATION

The date presented in the document header represents the official document date.

The IEA Corporate Quality Assurance Program Plan outlines the specific schedule of implementation required by the network laboratories.

FIGURES

IEA, INC.

ETHICS POLICY

The management of IEA corporation recognizes our responsibility to clients and fellow employees to ensure that fair and ethical business practices are followed at all facilities.

Our clients have placed their trust in our organization to continually provide high quality data which is reliable and represents sound professional judgement at all times. In order to meet this responsibility it is imperative that high ethical standards be maintained at all times by all employees.

The management and staff are committed to maintaining a carefully controlled analytical environment which assures the consistent generation of accurate data which meets the data quality objectives of our clientele.

The following represents the IEA ethics policy which has been adopted to clearly identify the corporate position on ethical practices. Failure to comply with this policy cannot and will not be tolerated.

The Company and All its Employees will:

- Fully comply with all applicable federal, state, and local laws and regulations.
- Produce analytical products that are accurate, defensible and which represent sound professional judgement at all times.
- Provide employees with guidance and an understanding of the ethical and quality standards required in the environmental industry. In this regard, all employees should feel free to identify any ethical misconduct without fear of retribution. Any employee involved in any form of ethical misconduct will be subject to immediate disciplinary action including potential termination of employment.
- Present services to clients in a confidential, honest and forthright manner and strive to deliver quality products at a fair price.

IEA, INC.

ETHICS POLICY -Continued...

- Treat employees equitably by compensating them fairly, acknowledging their scientific contributions, and providing them opportunities for professional growth and development.

- Offer employment opportunities to qualified candidates regardless of their race, creed, color, sex or age.

- Be a responsible corporate citizen of the community by operating in an environmentally sound manner at all times.

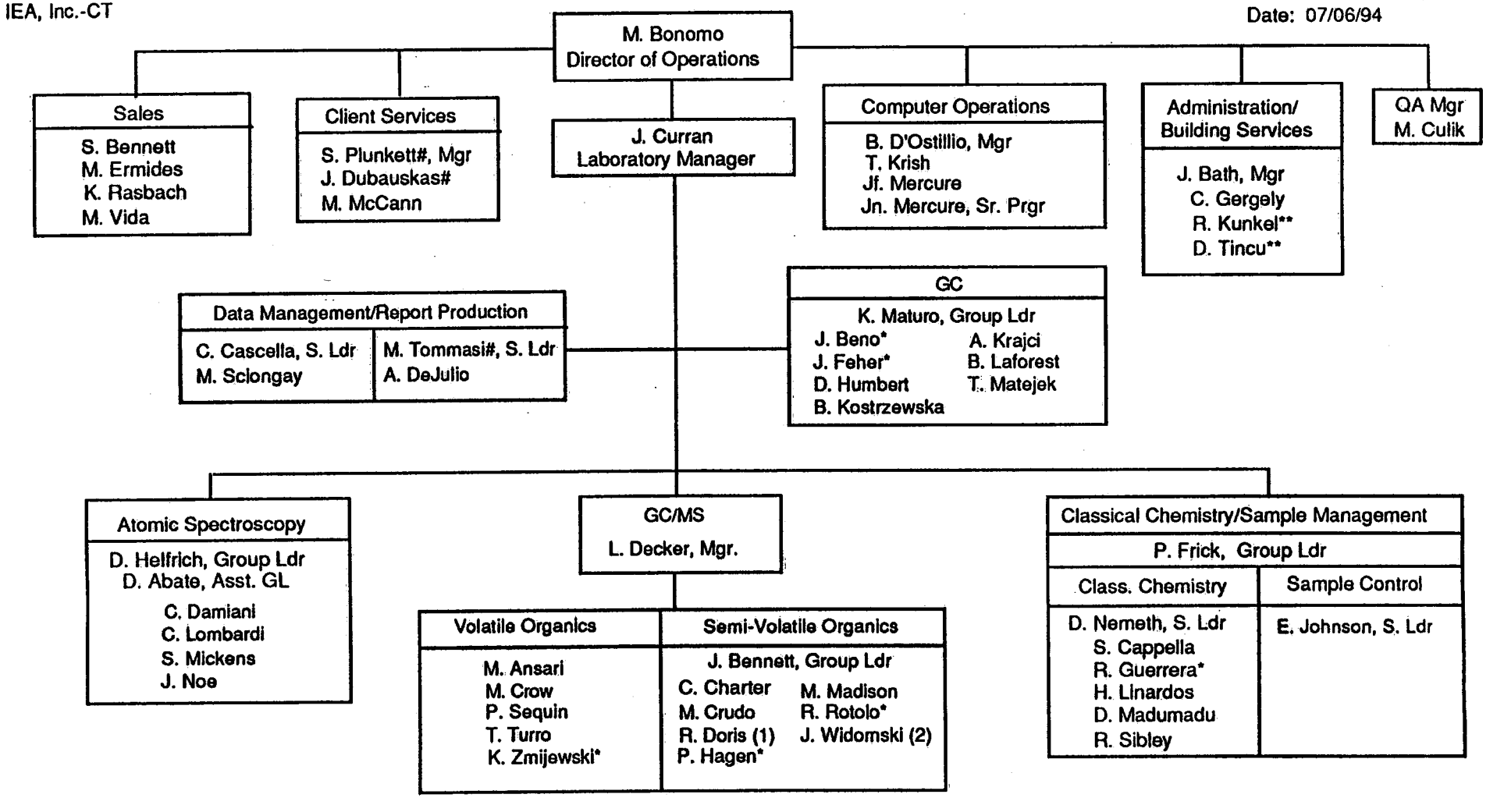
- Maintain all facilities in a safe and professional manner through maintenance of a safety awareness program and provide the necessary safety equipment and training to protect all employees from preventable injury and chemical exposure.

Attached is an "Ethics and Data Integrity Agreement" which is utilized to ensure communication of the company's position on this important issue. Upon completion, a copy of the agreement is maintained in the employee's personnel folder.

If an employee is concerned about potential ramifications of reporting an incident, it is suggested that a notice (anonymous, if desired) be provided to the local QA Manager or Corporate QA Director. The QA department will investigate the allegation and ensure that appropriate action is taken.

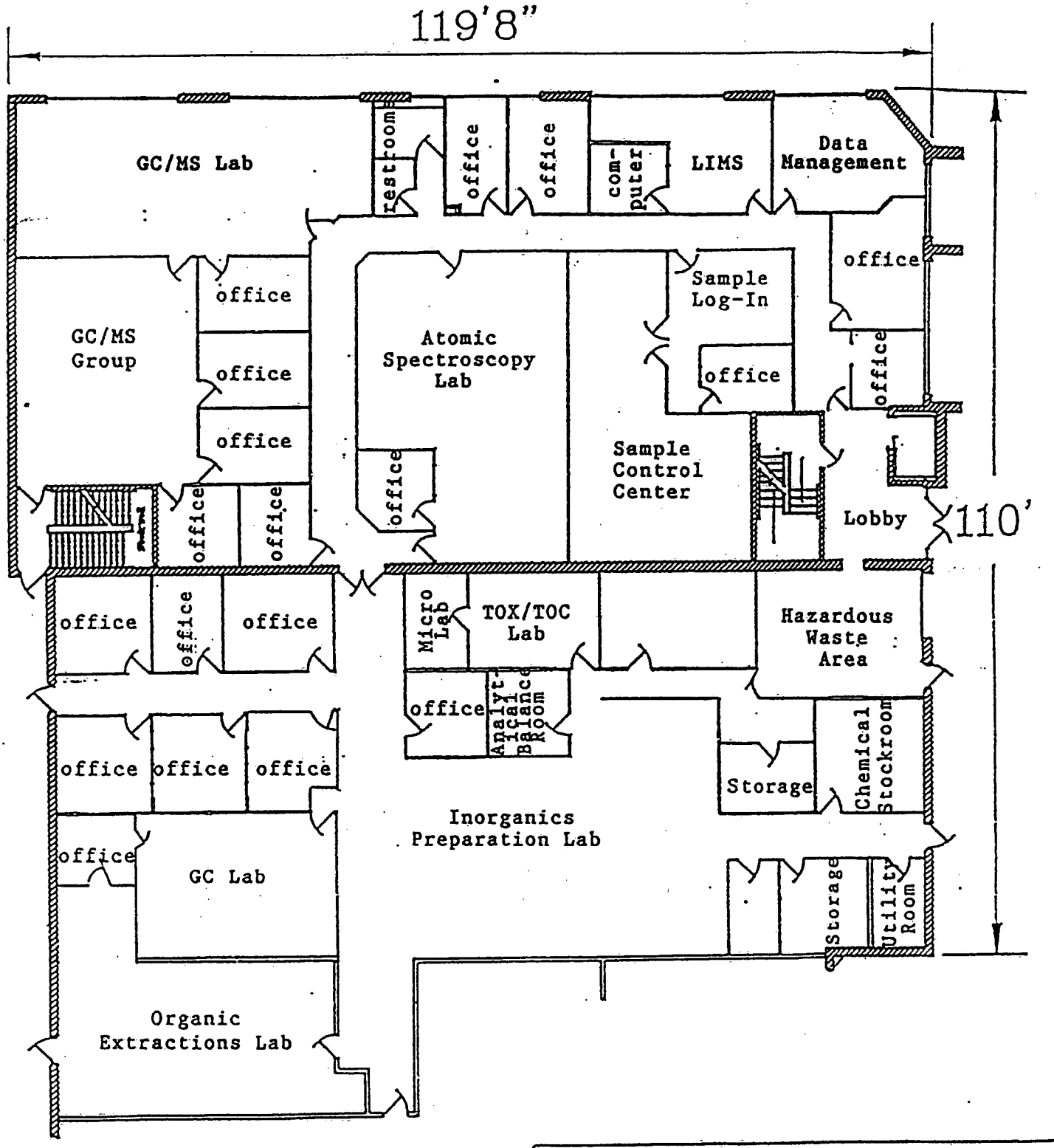
IEA, Inc.-CT

Doc #QAQ00103.CT
Date: 07/06/94



*Part Time/Temp
**25% charged to AMS
#30 hour work week
(1) Splitting time VOA/SVOA PRN
(2) Splitting time SVOA/DM/SC PRN

Fig. 3.0



IEA, INC.-CONNECTICUT
200 MONROE TURNPIKE MONROE, CONNECTICUT 0646
FLOOR PLAN 5/9

IEA
An Aquarion Company

Fig. 4.0
CORRECTIVE ACTION FORM

A. Originator Information Client Inquiry_____

Client:_____ Job/Case:_____

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

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

Detailed Description of Potential Problem:_____

B. Quality Assurance Information Corrective Action ID# _____

Recommended Corrective Action:_____

Groups Involved: __Sample Control __ Wet Chemistry __ Metals
__Gas Chromatography __ Mass Spectrometry __ Report Generation
__Client Service __ Sample Preparation

C. Final Resolution

Describe What Happened and Long Term Corrective Action Taken:_____

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

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

Corrective Action Approved: _____
Date Finalized: _____
Was a problem identified? Yes / No

Fig. 5.0
IEA-CT Precision and Accuracy Data Quality Objectives

ORGANICS

Parameter	QC	Compounds	Aqueous Control Limits	Solid Control Limits
VOA Components	Lab Blank, Trip Blank, Holding Blank	All TCL Compounds	<5 x RQL Methylene Chloride, Acetone, Toluenrd 2-Butanone ≤RDL All Other Compounds	<5 X RQL Methylene Chloride, Acetone, Toluene and 2-Butanone ≤RQL All Other Compounds
	Surrogate Spike Recovery	1,2-dichloroethane-d_4	76-114%	70-121%
		toluene-d_8	88-110%	81-117%
		bromofluorobenzene	86-115%	74-121%
	Matrix Spike Recovery and Matrix Spike Duplicate Precision	1,1-dichloroethene	61-145% (14% RPD)	59-172% (22% RPD)
		trichloroethene	71-120% (14% RPD)	62-137% (24% RPD)
		benzene	76-127% (11% RPD)	66-142% (21% RPD)
		toluene	76-125% (13% RPD)	59-139% (21% RPD)
		chlorobenzene	75-130% (13% RPD)	60-133% (21% RPD)
BNA Components	Lab Blank	All Parameters	<5 x RQL Phthalate Esters, <RDL All Other Compounds	<5 x RQL Phthalate Esters <RDL All Other Compounds
	Matrix Spike Recovery and Matrix Spike Duplicate Precision	phenol	12-110% (42% RPD)	26-90% (35% RPD)
		2-chlorophenol	27-123% (40% RPD)	25-102% (50% RPD)
		1,4-dichlorobenzene	36-97% (28% RPD)	28-104% (27% RPD)
		N-nitroso-di-n-propylamine	41-116% (38% RPD)	41-126% (38% RPD)
			39-98% (28% RPD)	38-107% (23% RPD)
		1,2,4-trichlorobenzene	23-97% (42% RPD)	26-103% (33% RPD)
		p-chloro-m-cresol	46-118% (31% RPD)	31-137% (19% RPD)
		acenaphthene	10-80% (50% RPD)	11-114% (50% RPD)
		4-nitrophenol	24-96% (38% RPD)	28-89% (47% RPD)
		2,4-dinitrotoluene	9-103% (50% RPD)	17-109% (47% RPD)
		pentachlorophenol	26-127% (31% RPD)	35-142% (36% RPD)
		pyrene		
	Surrogate Spike Recovery	nitrobenzene-d_4	35-114%	23-123%
		2-fluorobiphenyl	43-116%	30-115%
		terphenyl-d_{14}	33-141%	18-137%
		phenol-d_8	10-110%	24-113%
		2-fluorophenol	21-110%	25-121%
		2,4,6-tribromophenol	10-123%	19-122%
Pesticide/PCB's	Lab Blank	All TCL pesticides/PCB's	<RQL - all Compounds	<RQL - all Compounds
	Matrix Spike Recovery and Matrix Spike Duplicate Precision	lindane	56-123% (15% RPD)	46-127% (50% RPD)
		heptachlor	40-131% (20% RPD)	35-130% (31% RPD)
		aldrin	40-120% (22% RPD)	34-132% (43% RPD)
		dieldrin	52-126% (18% RPD)	31-134% (38% RPD)
		endrin	56-121% (21% RPD)	42-139% (45% RPD)
		4,4'DDT	38-127% (27% RPD)	23-134% (50% RPD)
	Surrogate Spike Recovery	dibutylchlorendate	24-154% (advisory)	24-150% (advisory)
Herbicides	Lab Blank	All Herbicides	<RQL - all Compounds	<RQL - all Compounds
	Compound Spike Recovery and Precision	2,4-D	10-80% (30%RPD)	20-110% (30%RPD)
		Silvex	10-80% (30%RPD)	20-110% (30%RPD)

For acceptance, the majority of % recoveries and RPDs obtained for the duplicate spike pair must meet the % recoveries and RPDs listed above.

Metals Quality Control Limits

Quality Control Sample	Control Limit	Failure Action
Initial Cal. Verification	± 10 %	Recalibrate
Initial Cal. Blank	± 0.20 ug/L	Recalibrate
CRA	± 20 %	None
Cont. Cal. Verification	± 20 %	Rerun Samples
Cont. Cal. Blank	± 0.20 ug/L	Rerun Samples
Duplicate	± 20 % RPD	Flag Sample
Sample Spike	± 25 % Recovery	Flag Sample
Prep Blank	± 0.20 ug/L	Reprep Samples
Lab Control Sample	± 20 %, 95 % Confid Win	Reprep Samples

Classical Chemistry Quality Control Limits

Quality Control Sample	Control Limit	Failure Action
Initial Cal. Verification	± 15 %	Recalibrate
Initial Cal. Blank	Method Dependent	Recalibrate
Cont. Cal. Verification	± 15 %	Rerun Samples
Cont. Cal. Blank	Method Dependent	Rerun Samples
Duplicate	± 20 % RPD	Rerun & Flag Sample
Sample Spike	± 25 % Recovery	Rerun & Flag Sample
Prep Blank	N/A	Method Dependent
Lab Control Sample	± 20 %, 95 % Confid Win	Rerun

Parameter	Method*	Reference	PQL
Acidity	305.1	600	1.0 mg/L
Alkalinity	310.1	600	1.0 mg/L
Ammonia-Nitrogen	350.1	600	0.04 mg/L
Bicarbonate	406C	SM	1.0 mg/L
Biochemical Oxygen Demand	405.1	600	2.0 mg/L
Bromide	405	SM	0.2 mg/L
Chloride	325.1	600	3.0 mg/L
Chlorine Demand	3-364	ACE	1.0 mg/L
Chlorine (Res.)	330.4	600	0.1 mg/L
Chemical Oxygen Demand	410.4	600	10.0 mg/L
Coliform Fecal	909C	SM	1 cfu/100 mL
Coliform Total	909A	SM	1 cfu/100 mL
Color	110.2	600	5 Pt-Co units
Conductivity	120.1	600	N/A
Chromium (VI)	7196	SW846	0.01 mg/L
Cyanide Amenable	335.1	600	10.0 ug/L
Cyanide Total	335.3	600	10.0 ug/L
Cyanide (CLP)	ILM01.2	EPA CLP	10.0 ug/L
Dissolved Oxygen	360.1	600	0.1 mg/L
Flashpoint	1010	SW846	
Fluoride	340.2	600	0.10 mg/L
Grain Size	D422-63	ASTM	N/A
Hardness	130.2	600	1.0 mg/L
Hydrocarbons (Grav.)	503E	SM	1.0 mg/L
Hydrocarbons (IR)	418.1	600	1.0 mg/L
MBAS	425.1	600	0.04 mg/L
Nitrate/Nitrite-Nitrogen	353.2	600	0.10 mg/L
Nitrite-Nitrogen	354.1	600	0.005 mg/L
Odor	140.1	600	
Oil & Grease (Grav.)	413.1	600	1.0 mg/L
Oil & Grease (IR)	413.2	600	1.0 mg/L
Paint Filter Test	9095	SW846	N/A
pH	150.1	600	N/A
Phenols	420.2	600	0.005 mg/L
Phosphorus	365.2	600	0.10 mg/L
Phosphate (Ortho)	365.2	600	0.10 mg/L
Settleable Solids	160.5	600	1.0 mL/L
Silica	370.1	600	1.0 mg/L

Parameter	Method*	Reference	PQL
Specific Gravity	3-61	ACE	N/A
Sulfate	375.3	600	10.0 mg/L
Sulfide	376.1	600	1.0 mg/L
Sulfite	377.1	600	1.0 mg/L
Sludge Volume Index	213C	SM	1.0 mL/mg
Tannin & Lignin	513	SM	0.5 mg/L
Total Dissolved Solids	160.1	600	5.0 mg/L
Total Kjeldahl Nitrogen	351.2	600	0.04 mg/L
Total Organic Carbon	415.2	600	0.5 mg/L
Total Organic Halides	9020	SW846	10.0 ug/L
Total Solids	160.3	600	1.0 mg/L
Total Suspended Solids	160.2	600	5.0 mg/L
Turbidity	180.1	600	0.10 NTU
Volatile Solids	160.4	600	1.0 mg/L
Corrosivity Characteristics	9045	SW846	N/A
Ignitability Characteristics	D93-79	ASTM	
TCLP	1311	SW846	NA

600 - Methods for Chemical Analysis of Water and Wastes, USEPA 600/4-79-020.
SM - Standard Methods for the Examination of Water and Wastewater, 16th Edition.
ACE - Army Corps of Engineers Procedures for Handling and Chemical Analysis of Sediment and Water Samples, May 1981.
SW846 - Test Methods for Evaluating Solid Wastes, Physical/Chemical Methods, SW846 3rd Edition.

* - Laboratory capablities may include alternate methods

Volatiles	Quantitation Limits [a,b] Water (ug/L)	Low Soil (ug/Kg)	Medium Soil (ug/Kg)
Chloromethane	10	10	1200
Bromomethane	10	10	1200
Vinyl Chloride	10	10	1200
Chloroethane	10	10	1200
Methylene Chloride	5	5	600
Acetone	10	10	1200
Carbon Disulfide	5	5	600
1,1-Dichloroethene	5	5	600
1,1-Dichloroethane	5	5	600
1,2-Dichloroethene (total)	5	5	600
Chloroform	5	5	600
1,2-Dichloroethane	5	5	600
2-Butanone	10	10	1200
1,1,1-Trichloroethane	5	5	600
Carbon Tetrachloride	5	5	600
Vinyl Acetate	10	10	1200
Bromodichloromethane	5	5	600
1,2-Dichloropropane	5	5	600
cis-1,3-Dichloropropene	5	5	600
Trichloroethene	5	5	600
Dibromochloromethane	5	5	600
1,1,2-Trichloroethane	5	5	600
Benzene	5	5	600
trans-1,3-Dichloropropene	5	5	600
Bromoform	5	5	600
4-Methyl-2-pentanone	10	10	1200
2-Hexanone	10	10	1200
Tetrachloroethene	5	5	600
Toluene	5	5	600
1,1,2,2-Tetrachloroethane	5	5	600
Chlorobenzene	5	5	600
Ethylbenzene	5	5	600
Styrene	5	5	600
Xylene (total)	5	5	600

[a] Quantitation limits listed for soil/sediment are based on wet weight. The quantitation limits calculated by the laboratory for soil/sediment, calculated on dry weight bases as required by the contract, will be higher.

[b] Specific quantitation limits are highly matrix-dependent. The quantitation limits listed herein are provided for guidance and many not always be achievable.

Semi-Volatiles	Quantitation Limits [a,b] Water (ug/L)	Low Soil (ug/Kg)	Medium Soil (ug/Kg)
Phenol	10	330	10000
bis(2-Chloroethyl)ether	10	330	10000
2-Chlorophenol	10	330	10000
1,3-Dichlorobenzene	10	330	10000
1,4-Dichlorobenzene	10	330	10000
Benzyl alcohol	10	330	10000
1,2-Dichlorobenzene	10	330	10000
2-Methylphenol	10	330	10000
2,2'-oxybis(1-Chloropropane)#	10	330	10000
4-Methylphenol	10	330	10000
N-Nitroso-di-n-propylamine	10	330	10000
Hexachloroethane	10	330	10000
Nitrobenzene	10	330	10000
Isophorone	10	330	10000
2-Nitrophenol	10	330	10000
2,4-Dimethylphenol	10	330	10000
Benzoic acid	50	1600	50000
bis(2-Chloroethoxy)methane	10	330	10000
2,4-Dichlorophenol	10	330	10000
1,2,4-Trichlorobenzene	10	330	10000
Naphthalene	10	330	10000
4-Chloroaniline	10	330	10000
Hexachlorobutadiene	10	330	10000
4-Chloro-3-methylphenol	10	330	10000
2-Methylnaphthalene	10	330	10000
Hexachlorocyclopentadiene	10	330	10000
2,4,6-Trichlorophenol	10	330	10000
2,4,5-Trichlorophenol	50	1600	50000
2-Chloronaphthalene	10	330	10000
2-Nitroaniline	50	1600	50000
Dimethylphthalate	10	330	10000
Acenaphthylene	10	330	10000
2,6-Dinitrotoluene	10	330	10000
3-Nitroaniline	50	1600	50000

Previously known by the name bis(2-Chloroisopropyl)ether

[a] Quantitation limits listed for soil/sediment are based on wet weight. The quantitation limits calculated by the laboratory for soil/sediment, calculated on dry weight bases as required by the contract, will be higher.

[b] Specific quantitation limits are highly matrix-dependent. The quantitation limits listed herein are provided for guidance and many not always be achievable.

Semi-Volatiles (cont.)	Quantitation Limits [a,b] Water (ug/L)	Low Soil (ug/Kg)	Medium Soil (ug/Kg)
Acenaphthene	10	330	10000
2,4-Dinitrophenol	50	1600	50000
4-Nitrophenol	50	1600	50000
Dibenzofuran	10	330	10000
2,4-Dinitrotoluene	10	330	10000
Diethylphthalate	10	330	10000
4-Chlorophenyl-phenylether	10	330	10000
Fluorene	10	330	10000
4-Nitroaniline	50	1600	50000
4,6-Dinitro-2-methylphenol	50	1600	50000
N-Nitrosodiphenylamine (1)	10	330	10000
4-Bromophenyl-phenylether	10	330	10000
Hexachlorobenzene	10	330	10000
Pentachlorophenol	50	1600	50000
Phenanthrene	10	330	10000
Anthracene	10	330	10000
Di-n-butylphthalate	10	330	10000
Fluoranthene	10	330	10000
Pyrene	10	330	10000
Butylbenzylphthalate	10	330	10000
3,3'-Dichlorobenzidine	20	660	20000
Benzo(a)anthracene	10	330	10000
Chrysene	10	330	10000
bis(2-Ethylhexyl)phthalate	10	330	10000
Di-n-octylphthalate	10	330	10000
Benzo(b)fluoranthene	10	330	10000
Benzo(k)fluoranthene	10	330	10000
Benzo(a)pyrene	10	330	10000
Indeno(1,2,3-cd)pyrene	10	330	10000
Dibenzo(a,h)anthracene	10	330	10000
Benzo(g,h,i)perylene	10	330	10000

[a] Quantitation limits listed for soil/sediment are based on wet weight. The quantitation limits calculated by the laboratory for soil/sediment, calculated on dry weight bases as required by the contract, will be higher.

[b] Specific quantitation limits are highly matrix-dependent. The quantitation limits listed herein are provided for guidance and many not always be achievable.

Pesticides/Aroclors	Quantitation Limits[a,b] Water (ug/L)	Soil (ug/Kg)
alpha-BHC	0.05	8.0
beta-BHC	0.05	8.0
delta-BHC	0.05	8.0
gamma-BHC (Lindane)	0.05	8.0
Heptachlor	0.05	8.0
Aldrin	0.05	8.0
Heptachlor Epoxide	0.05	8.0
Endosulfan I	0.05	8.0
Dieldrin	0.10	16.0
4,4'-DDE	0.10	16.0
Endrin	0.10	16.0
Endosulfan II	0.10	16.0
4,4'-DDD	0.10	16.0
Endosulfan Sulfate	0.10	16.0
4,4'-DDT	0.10	16.0
Methoxychlor	0.50	80.0
Endrin-Ketone	0.10	16.0
alpha-Chlordane	0.50	80.0
gamma-Chlordane	0.50	80.0
Toxaphene	1.0	160.0
Aroclor - 1016	0.5	80.0
Aroclor - 1221	0.5	80.0
Aroclor - 1232	0.5	80.0
Aroclor - 1242	0.5	80.0
Aroclor - 1248	0.5	80.0
Aroclor - 1254	1.0	160.0
Aroclor - 1260	1.0	160.0

[a] Quantitation limits listed for soil/sediment are based on wet weight. The quantitation limits calculated by the laboratory for soil/sediment, calculated on dry weight basis as required by the contract, will be higher.

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

[b] Specific quantitation limits are highly matrix-dependent. The quantitation limits listed herein are provided for guidance and many not always be achievable.

Fig. 8.0

IEA Corporation **Routine Metal Method Detection Limits**

Date: 07/28/93

Parameter	Soil (mg/Kg)	Water (ug/L)
Aluminum	40	200
Antimony	12	60
Arsenic	2	10
Barium	40	200
Beryllium	1	5
Boron	200	100
Cadmium	2	10
Calcium	200	1,000
Chromium	2	10
Cobalt	10	50
Copper	5	25
Iron	20	100
Lead	0.6	3
Magnesium	200	1,000
Manganese	3	15
Mercury	0.1	0.2
Molybdenum	4	10
Nickel	8	40
Potassium	200	1,000
Selenium	1	5
Silicon		100
Silver	2	10
Sodium	200	1,000
Thallium	2	10
Tin	10	50
Titanium	4	4
Vanadium	10	50
Zinc	4	20

APPENDIX A

CLASSICAL CHEMISTRY

Equipment Name	Manufacturer	Model Number	Serial Number
Spectrophotometer, UV-VIS	Perkin-Elmer	Hitachi 200	522-5
Spectrophotometer, UV-VIS	Perkin-Elmer	35	34630
IR-Spectrophotometer	Perkin-Elmer	1310	134423
Turbidimeter	Hach Company	2100A	851017142
TOC Analyzer	Xertex-Dohrmann	DC-80	HF2029
TOX Analyzer	Xertex-Dohrmann	MC3 A,B	MF 2106
Fluorometer	Sequoia-Turner Corp.	112-003	D 01491
pH/ISE Meter	Orion	SA 720	SR45A
pH/ISE Meter	Beckman	12	0232578
Conductivity Meter	Cole-Parmer Instrument	1484-20	1421
Flash Point Apparatus	Precision Scientific	Pensky-Martin	10 Au-12
Oven	Fisher Scientific	55G	291
Oven	VWR	1320	0701090
Incubator	Blue M Electric	100 A	IN1-1362
Bio Refrigerator	Frost Queen	R20/L	00029
Centrifuge	Garver Manufacturing	549	10883
Centrifuge	DYNAC	0101	16846
Water Bath	Blue M Electric	MW-1220	MX-2520
D.O. Meter	YSI	51A	0241
Autoclave	Market Forge	STM-E	034200
COD Reactor	HACH	45600	920300006892
Muffle Furnace	Thermolyne	-	-
TKN block digestor	Scientific Instruments	AD-4020	-
Digital Hot Plate/Stirrer	PMC	730	-
Digital Hot Plate/Stirrer	PMC	730	-
Semiautomated Analyzer	LACHAT	Quikchem	-

METALS

Mercury Analyzer	Spectro-Products	HG4	4708
ICP-Sequential	Perkin-Elmer	6500	128238
ICP-Semiultaneous	Jarrell-Ash	JA61	67782
Furnace AA	Perkin-Elmer	Z3030	3131
Furnace AA	Perkin-Elmer	Z5100	130911
Furnace AA	Perkin-Elmer	Z5100 PC	135141

ORGANIC EXTRACTIONS

Gas Chromatograph	Perkin-Elmer	8320	83N546502
Gel Permeation Chromato-tograph	ABC	1002B	7323
Gel Permeation Chromato-tograph	ABC	AP1000	9228
Refrigerator	WW	4EF	F3978U
Oven	ASP	D 1142	144011
Oven	ASP	D 1162	149010
Sonicator	Sonics & Materials	SM500	6892
Sonicator	Tekmer	TM500	7264
Auto Sampler	Perkin-Elmer	AS100	95234
Integrator/Plotter	Perkin-Elmer	LCI-100	N431931C
GC	Perkin-Elmer	Sigma 3	093317002180

GC/MS-VOLATILES

Purge & Trap	Tekmar	LSC 2000	91318021
Purge & Trap	Tekmar	ALS 2016	91322002
Purge & Trap	Tekmar	LSC 2000	91203019
Purge & Trap	Tekmar	ALS 2016	91232007
Tube Desorber	Envirochem	810TD	268153
Tube ALS	Envirochem	MTD	MT-1005
Purge & Trap	Tekmar	LSC 4000	254
Purge & Trap	Tekmar	ALS	372
Purge & Trap	Tekmar	LSC-2	1824
Computer/Data System	Hewlett Packard	425T	3048T147545
SCSI Tape Drive	Hewlett Packard	1300S	313E03914
Terminal	Hewlett Packard	X-window	3048T18725
Terminal	Hewlett Packard	X-window	3048T18726
Disc Drive	Hewlett Packard	7914	---
Disc Drive	Hewlett Packard	7914	---
P&T	Tekmar	LSC-2	227
P&T	Tekmar	4000	192
P&T	Tekmar	4000	398
P&T	Tekmar	14-2000-000	88068001
P&T	Tekmar	LSC-2	1324
P&T	Tekmar	ALS	679
P&T	Tekmar	14-2962-200	88061015

GC/MS-VOLATILES (cont.)

P&T	Tekmar	ALS	494
P&T	Tekmar	ALS	1068
GC/MS	Hewlett Packard	5995B	2217A00358
GC/MS	Hewlett Packard	5995C	2413A00659
GC/MS	Hewlett Packard	5995C	2413A00430
Terminal	Hewlett Packard	45849A	2530A13541
Terminal	Hewlett Packard	35751	2643A07666
CRT	Hewlett Packard	35731A	8633K26810
Printers (partial list)	Hewlett Packard	2934A	2635A32940
Printers	Hewlett Packard	2934A	2715A43948
Printers	Hewlett Packard	2225A	2512S30379
Printers	Hewlett Packard	2225A	2510S32359
Terminal	Hewlett Packard	35751	2630A06622
CRT	Hewlett Packard	35731A	8610K20516
Magnetic Tape Unit	Hewlett Packard	7970E	N/A
Scanning Interface	Hewlett Packard	59824A	N/A
Scanning Interface	Hewlett Packard	59824A	N/A
Cart. Tape Unit	Hewlett Packard	7914	N/A
5010 Auto Desorber	Tekmar	14-2150-000	133-GT
Cart. Tape Unit	Hewlett Packard	7914	N/A

GC-MS-SEMIVOLATILES

Gas Chromatograph	Hewlett Packard	5890	7518A05422
Gas Chromatograph	Hewlett Packard	5890	2728A14615
Auto Sampler	Hewlett Packard	76732A	2441A03468
Mass Selective Detector	Hewlett Packard	5970	2513A00923
Mass Selective Detector	Hewlett Packard	5970	2716A10638
Computer Terminal	Hewlett Packard	150 II	2720Y05798
Computer Terminal	Hewlett Packard	150 II	2720Y03266
Computer Terminal	Hewlett Packard	150 II	2530A13540
Scanning Interface	Hewlett Packard	59824A	---
Scanning Interface	Hewlett Packard	59824A	---
Tape Drive	Hewlett Packard	9144	---
Disc Drive	Hewlett Packard	7958	---
9 Track Magnetic Tape	Hewlett Packard	7970E	---
9 Track Magnetic Tape	Hewlett Packard	7970E	---

GC-MS-SEMIVOLATILES (cont.)

Computer	Hewlett Packard	HP1000A	---
Computer	Hewlett Packard	HP1000	---
Printer	Hewlett Packard	2934A	2524A19296
Printer	Hewlett Packard	2235A	2814A11816
Printer	Hewlett Packard	2225A	2618S30681
Printer	Hewlett Packard	2934A	2643A35608
Autosampler	Hewlett-Packard	7673A	2546A01489
GC	Hewlett-Packard	5890A	---
MSD	Hewlett-Packard	5971A	3040A01426
Autosampler	Hewlett-Packard	7673	3120A28431
Computer	Gateway	386/25 DX	365201578025
Terminal	Hewlett Packard	36731A	8635K28238

GAS CHROMATOGRAPHY

GC	Hewlett-Packard	5890	2541A06301
GC	Hewlett-Packard	5890	2750A14840
Autosampler	Hewlett-Packard	7673A	2546A00709
Autosampler	Hewlett-Packard	7673A	3123A25128
Autosampler	Hewlett-Packard	7673A	2718A0653A
Integrator	Hewlett-Packard	3396A	2804A01106
Integrator	Hewlett-Packard	3393A	2332A00D80
GC	Hewlett-Packard	5890 Series II	3121A35826
GC	Hewlett-Packard	5890 Series II	3235A44989
Data System	Hewlett-Packard	HP1000A	3020A05230
Terminals (3)	Hewlett-Packard	35741A	---
Printers (2)	Hewlett-Packard	35741A	---
Tape Drive	Hewlett Packard	9144	2724E13732

APPENDIX B

IEA
An Aquarion Company

200 Monroe Turnpike
Monroe, Connecticut 06468

Phone 203·261·4458
Fax 203·268·5346

Key Professional Profiles

IEA, INC. - CONNECTICUT

July 15, 1993

Sunrise, Florida 305·846·1730

Schaumburg, Illinois 708·705·0740

N. Billerica, Massachusetts 617·272·5212

Whippany, New Jersey 201·428·8181

Research Triangle Park, North Carolina 919·677·0090

Essex Junction, Vermont 802·878·5138

PROFESSIONAL PROFILE
Michael V. Bonomo

TITLE: Director of Operations-Connecticut

ACADEMIC ACCOMPLISHMENTS:

Fordham University - Bronx, New York
B.S. Biology

Pace University - White Plains, New York
M.B.A Marketing

MAJOR AREA OF EXPERTISE:

Environmental Regulations
(RCRA, CERCLA, CWA, SDWA, ECRA)

Sampling and Analysis Plan Design

Data Management

SUMMARY OF EXPERIENCE:

Mr. Bonomo has over 14 years experience in environmental monitoring programs. He has functioned in numerous roles including director, co-director, sales manager, project manager, field and laboratory scientist, consultant, and seminar instructor. He has assisted many Fortune 500 companies and consultant/engineers in the design and implementation of sampling and analysis project plans. He has been involved in a wide spectrum of environmental programs for groundwater, soil, and sludge testing to monitoring various aquatic biota. Mr. Bonomo is also experienced in data management requirements for large analytical projects. He was instrumental in developing and implementing a system that was successfully utilized on many projects. He has also served as a seminar instructor for groundwater monitoring sampling and data tracking for a major waste management company.

PROFESSIONAL EXPERIENCE:

1992 to Present IEA-Connecticut, Inc.

Position Director of Operations

Responsibility

Responsible for overall operations and profitability.

1991 to 1992 IEA-Connecticut, Inc.

Position Co-Director

Responsibilities

Co-responsibility for the profitability and management. Duties included business development, marketing, financial and budget management, sales management, strategic planning and monitoring operations.

1990 to 1991 IEA-Connecticut, Inc.

Position Sales and Marketing Manager

Responsibilities

Responsible for the sales staff, corporate strategic planning, sales management and marketing in the New Jersey, Connecticut, Massachusetts and Vermont laboratories.

1989 to 1990 York Wastewater Consultants (YWC)
Monroe, Connecticut

Position Executive Director

Responsibilities

Assisted in the growth of an unknown Connecticut based company to one that covered all of the Eastern United States. Participated in a 6-month strategic planning process that provided insight into the tools needed to run a successful company. In spite of severe banking problems, a 2-year Federal EPA investigation, and a downturn in the market, saw YWC through successful acquisition by Aquarion.

1987 to 1989 York Wastewater Consultants (YWC)
Monroe, Connecticut

Position Sales and Marketing Manager

Responsibilities

Managed three York Laboratories division of YWC, Inc. Responsible for the Northeast, Mid-Atlantic and Midwest United States. Built sales and marketing program where non had existed before. Helped to assimilate five disjointed businesses into a single working division with resource sharing, cross training, budget management, and team building.

1982 - 1987 ETC

Position National Account Executive

Responsibilities

Developed and managed new business for analytical and data management services. Responsible for marketing to many Fortune 500 chemical, petrochemical, waste, and electronics firms. Efforts included major projects throughout the United States. Worked with clients in regulatory compliance, project design, and data use and interpretation. Developed a client base that was involved in RCRA groundwater monitoring, CERCLA site Remedial Investigation Feasibility Studies, New Jersey ECRA investigations, and Clean Water Act compliance. Involved in one of the first petroleum refinery land treatment demonstrations in the United States. Served as the Chairman of the ETC Technical Product Development Committee.

1980 - 1982 Lawler, Matusky and Skelly Engineers

Position Project Manager

Responsibilities

Project Manager for environmental monitoring programs related to the electric utility industry. Responsible for proposal writing, program design, management of staff scientists and technicians for his projects, budget control, report writing and technical presentations. These projects included water chemistry, fish population studies, lower trophic level monitoring, and mitigation of the impact of power plants on the river environment. Designed and implemented groundwater sampling programs with customized equipment for a major site in New York State.

1978 - 1980 Lawler, Matusky and Skelly Engineers

Position Project Scientist

Responsibilities

Crew Chief for field survey including sampling of biota, water, soil and sludge. Responsible for maintaining field control of samples, including documentation, custody, and proper sampling techniques. Performed laboratory analysis including wet chemistry procedures, fish taxonomy and other biological studies. Responsible for writing Standard Operating Procedures for laboratory operations.

Doc# HRR02100.NET

PROFESSIONAL PROFILE
Jeffrey C. Curran

TITLE: Laboratory Manager

ACADEMIC ACCOMPLISHMENTS:

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

MAJOR AREA OF EXPERTISE:

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

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

SUMMARY OF EXPERIENCE:

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

PROFESSIONAL EXPERIENCE:

Present

IEA, Inc. - Connecticut

Position Laboratory Manager

Responsibilities

For the past 15 years Mr. Curran has directed and participated in a variety of projects. Some highlights are listed below:

Hazardous Waste Site, East Windsor, CT

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

Ethylene Oxide Emissions Testing, Sherburn, New York

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

Canadian Tariff Board Hearings

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

Worker Exposure Study, Lynchburg, Virginia

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

Food Processing Plant, Rochester, New York

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

Hazardous Breakdown Product Study

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

PROFESSIONAL AFFILIATIONS:

Member of the American Chemical Society

PROFESSIONAL PROFILE
Marsha Culik

TITLE: QA Manager

ACADEMIC ACCOMPLISHMENTS:

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

MAJOR AREA OF EXPERTISE:

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

SUMMARY OF EXPERIENCE:

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

PROFESSIONAL EXPERIENCE:

1/91 to Present

IEA, Inc. - Connecticut

Position QA Manager

Responsibilities

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

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

1986 to 1991

Position GC Group Leader

Responsibilities

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

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

1984 to 1986

Position Chemist

Responsibilities

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

1981 to 1984

Position Laboratory Analyst - American Waterworks Service Company

Responsibilities

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

1978 to 1981

Position Lab Technician - Suffolk County Water Authority

Responsibilities

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

Marsha Culik

1976-1978

Position Lab Technician - Hooker Chemicals & Plastics

Responsibilities

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

SPECIALIZED TRAINING:

1984 Certified Grade 3 Water Treatment Plant Operator

1977 ASCP Registered MLT

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

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

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

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

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

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

ASQC Course
Auditing of Quality Systems

ASQC Course
Introduction to SPC

PROFESSIONAL PROFILE
John Bennett, Jr.

TITLE: Sample Preparation Laboratory Supervisor

ACADEMIC ACCOMPLISHMENTS:

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

MAJOR AREA OF EXPERTISE:

Classical Chemistry
Atomic Spectroscopy
Organic Extractions
Gas Chromatography
Microbiology

SUMMARY OF EXPERIENCE:

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

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

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

PROFESSIONAL EXPERIENCE:

1988 to Present

IEA, Inc. - Connecticut

Position Sample Preparation Laboratory Supervisor

Responsibilities

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

1987 to 1989

Position Laboratory Director - Chemrox, Inc.

Responsibilities

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

1985 to 1987

Position Senior Chemist

Responsibilities

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

1980 to 1985

Position Senior Microbiologist/Associate Chemist - YWC, Inc.

Responsibilities

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

1978 to 1980

Position Senior Chemist - Nutmeg Chemical Company

Responsibilities

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

1978 to 1979

Position Laboratory Technician

Responsibilities

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

SPECIALIZED TRAINING:

Basic Atomic Spectroscopy
Perkin Elmer
Norwalk, Connecticut 1979

ICP Spectroscopy
Spectra Inc.
Pompton Lakes, New Jersey 1988

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

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

PROFESSIONAL PROFILE
Peter P. Frick

TITLE: Group Leader

ACADEMIC ACCOMPLISHMENTS:

University of Connecticut - Storrs, CT
B.S. Chemistry 1984
University of Bridgeport - Bridgeport, CT
M.B.A. Finance 1993

MAJOR AREA OF EXPERTISE:

Environmental Analytical Chemistry
Atomic Absorption Spectroscopy
Ion Chromatography
Point-of-Use Water Treatment
Environmental Field Services

SUMMARY OF EXPERIENCE

Mr. Frick has over eight years experience in environmental laboratories and pilot plant operation. He has performed a wide variety of analytical testing in the wet chemistry, gas chromatography, and atomic absorption areas. Mr. Frick has functioned in a supervisory role for over six years. He is familiar with hazardous waste management and the OSHA lab standard. Mr. Frick is 40 hour OSHA trained and has field sampling, as well as field PCB screening experience.

Mr. Frick has completed 40 hours of Radiation Safety Officer training and has experience in performing swipe tests, as well as, working with nickel 63 sealed sources.

PROFESSIONAL EXPERIENCE:

6/88 to Present

IEA, Inc. - Connecticut

Position Group Leader

Responsibilities

Mr. Frick has managed the Classical Chemistry Group since June 1988; responsibilities include scheduling and training, as well as chemical and technical support. He has been charged with implementing and maintaining rigorous QA/QC programs. The Classical Chemistry Group performs tests in the areas of inorganic wet chemistry, bulk organics (oil & grease, hydrocarbons, TOX, TOC, phenols, etc.) and microbiology. Mr. Frick is familiar with both EPA and NYSDEC protocols and SW846 Methods relating to inorganic wet chemistry analyses.

5/86 to 6/88

Position Manager - Water Lab Systems

Responsibilities

Responsible for the marketing, engineering and installation of Point-of-Use water treatment systems. Water treatment systems used included commercial/industrial ion exchange, chlorination, water softeners, liquid and solid neutralizers, carbon and reverse osmosis. Routinely analyzed potable waters for water quality parameters. Participated in seminars to educate various groups about environmental issues.

3/85 to 5/86

Environmental Analysis Corporation

Position Senior Chemist

Responsibilities

Responsible for performing chemical and bacterial analyses, water sampling of various sources, and supervision of the lab technicians.

American Cyanamid

Position Pilot Plant Engineering Assistant

Responsibilities

Activities included formulating herbicides and pesticides, maintaining area safety, pipe fitting, product sampling, and packaging.

PROFESSIONAL AFFILIATIONS:

American Chemical Society
Water Quality Association

PROFESSIONAL PROFILE
Lawrence H. Decker

TITLE: GC/MS Volatiles Group Leader

ACADEMIC ACCOMPLISHMENTS:

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

MAJOR AREA OF EXPERTISE:

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

SUMMARY OF EXPERIENCE:

Lawrence Decker has eight years of GC/MS experience. He has been responsible for operations of the GC/MS group for five years. Presently functioning as the Volatile Group Leader.

PROFESSIONAL EXPERIENCE:

5/92 to Present

IEA, Inc. - Connecticut

Position GC/MS Volatile Group Leader

Responsibilities

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

10/91 to 5/92

Position GC/MS Section Leader

Responsibilities

Responsibilities included: Sample analysis for both semi-volatile and volatile samples, tracking and scheduling sample analysis, troubleshooting instrumentation, final data package preparation and review. Unknown compound determination (TIC's). Assisting Group Leader with selected tasks. Responsible for tracking and prioritizing sample analysis, reviewing both initial sample batches and final reports, troubleshooting instruments and monitoring of GC/MS operations.

4/86 to 9/90

Position GC/MS Operator

Responsibilities

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

SPECIALIZED TRAINING:

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

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

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

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

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

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

Introduction to Analytical Separations

Introduction to Chemical Analysis

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

Analytical Separation

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

Chromatography (General Principles)

Chromatographic behavior of solutes; column efficiency and resolution.

Gas Chromatography

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

PROFESSIONAL PROFILE
Daniel W. Helfrich

TITLE: Group Leader

ACADEMIC ACCOMPLISHMENTS:

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

MAJOR AREA OF EXPERTISE

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

SUMMARY OF EXPERIENCE:

Mr. Helfrich has over 4 years experience in environmental analysis. He has functioned in numerous analytical roles including: Sample prep, Furnace analysis, ICP analysis and hazardous waste coordinator. Experienced in data review, and familiar with EPA and NYSDEC protocols. OSHA trained and experienced.

PROFESSIONAL EXPERIENCE:

1992 to Present

IEA, Inc. - Connecticut

Position Group Leader

Responsibilities

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

1989 to 1992

Position Senior Chemist - IEA,Inc. CT

Responsibilities

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

1987 to 1989

Position Lab Manager - PGP Industries

Responsibilities

ICP Operator and Health & Safety Manager

1984 to 1987

Position Senior Chemist - Handy & Harmon

Responsibilities

ICP Operator

SPECIALIZED TRAINING:

OSHA Seminar - 40 hour training + 28 hour update

Clean Harbours - Hazardous Waste Seminar

PROFESSIONAL PROFILE
Kimberly A. Maturo

TITLE: GC Group Leader

ACADEMIC ACCOMPLISHMENTS:

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

SUMMARY OF EXPERIENCE:

Ms. Maturo has over 7 years experience in the environmental field. She started in the organic extractions department as a lab technician and worked her way up to supervisor. From there, she transferred to the Gas Chromatography Department in order to expand her knowledge by learning more about the analysis of environmental samples. She is now Group Leader of the GC Department and is experienced in Pesticide and PCB residue analysis.

PROFESSIONAL EXPERIENCE:

3/91 to Present

IEA, Inc. - Connecticut

Position GC Group Leader

Responsibilities

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

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

10/88 to 3/91

Position GC- Senior Lab Technician

Responsibilities

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

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

10/85 to 10/87

Position Extractions Group

Responsibilities

Over this time period Ms. Maturo was a member of the extractions group and supervised the operations and staff for the last year. Her duties were primarily extraction of environmental samples for semi-volatile organics, pesticides/PCB's and herbicides. She also was responsible for screening of organic extracts via gas chromatography.

PROFESSIONAL PROFILE
Bruno D'Ostilio

TITLE: Systems Manager

ACADEMIC ACCOMPLISHMENTS:

Western Connecticut State University - Danbury, CT
Computer Science and Business Program
September 1978 , 1989 - Present

MAJOR AREA OF EXPERTISE:

Various types of computer hardware.
Unix and DOS operating systems.
Networks.
Programming.

SUMMARY OF EXPERIENCE:

Mr. D'Ostilio has over 10 years experience in the computer industry. He has a broad knowledge of computers ranging from mainframes to P.C.'s. He has extensive knowledge of UNIX, XWINDOWS, TCP/IP, DOS and various types of hardware.

PROFESSIONAL EXPERIENCE:

10/92 to Present

IEA, Inc. - Connecticut

Position Systems Manager

Responsibilities

Systems Manager reintegration, rescaling, checking standards. Mr. D'Ostilio has over 10 years computer related experience on systems ranging from mainframes to personal computers. His is responsible for all systems hardware and software for our CLP 390 system. This system includes a HP9000 workstation with a UNIX Operating System, Envision application software, Ingres RDMS, XWindows and a network of X Terminals and P.C.'s using Advanlink and TCP/IP. His is also responsible for ensuring diskette deliverables meet the requirements specified by the EPA.

10/86 to 10/92

Position Senior Customer Engineer - Concurrent Computer Corp., Wallingford, CT

Responsibilities

Install, service and maintain Concurrent mini and microcomputers, as well as many other types and manufacturers of disk drives, tape drives, printers, modems, multiplexers, networks and personal computers. Also responsible for the installation, troubleshooting and upgrading of systems software which involves shell and C programming. System software includes UNIX SYSTEM V, XWINDOWS, MOTIF, TCP/IP, LABWORKBENCH, DOS and many other packages.

1984 to 1986

Position Customer Engineer - Memorex Corporation, Darien, CT

Responsibilities

Install, service and maintain magnetic tapes drives, disk drives, display stations and printers within local Connecticut & New York territories.

SPECIALIZED TRAINING:

IBM compatible mainframe peripherals, include:

High performance disk drives, tape drives, Impact & Laser printers.
Concurrent computer corp. mini computer hardware.
UNIX Systems Manager.
UNIX based Workstation Hardware.
Novell networks.
RDMS.

APPENDIX C

IE
An Aquarion Company

[redacted] Monroe Turnpike
Monroe, CT 06468
203-261-4458

CHAIN OF [redacted] STODY RECORD

PAGE [redacted] OF [redacted]

NO. [redacted]

IEA JOB #:

CLIENT:

PROJECT ID:

IEA PROJECT MGR:

RUSH ☐ YES ☐ NO DUE DATE

BOTTLE SET #	CLIENT SAMPLE ID	DATE / TIME SAMPLED	MATRIX	LAB ID	QC Y / N	TESTS								GENERAL REMARKS
						BOTTLE TYPE AND PRESERVATIVE								
						FIELD FILTERED - CIRCLE Y or N								SAMPLE REMARKS
						Y / N	Y / N	Y / N	Y / N	Y / N	Y / N	Y / N	Y / N	

MATRIX CODES

A - AIR
AQ - AQUEOUS
C - COMPLEX
D - DRUM WASTE
OI - OIL
S - SOIL
SL - SLUDGE
W - WIPE
O - OTHER
FB - FIELD BLANK
TB - TRIP BLANK

BOTTLES PREPPED BY	DATE / TIME
SIGNATURE	
SAMPLES COLLECTED BY	DATE / TIME
SIGNATURE	

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

REMARKS ON SAMPLE RECEIPT

☐ BOTTLES INTACT ☐ CUSTODY SEALS
☐ PRESERVED ☐ SEALS INTACT
☐ CHILLED ☐ SEE REMARKS

LABORATORY COPY