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LAGOON CLOSURE SAMPLING, ANALYSIS, AND QUALITY ASSURANCE PROJECT PLAN

BASF Rensselaer
Rensselaer, New York

August 3, 2004

Prepared for:

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Prepared by:

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August 2, 2004

Mr. Dan Lightsey
Environmental Engineer
New York State Department of Environmental Conservation
1150 North Westcott Road
Schenectady, New York 12306-2014

Re: Revised Lagoon Closure Sampling, Analysis
and Quality Assurance Project Plan

Dear Mr. Lightsey:

Enclosed is one copy of the Revised Lagoon Closure Sampling, Analysis and Quality Assurance Project Plan (LCSAQA Project Plan) for the post-remediation sampling program of the North and South Lagoons. The Revised LCSAQA incorporates comments from your e-mail dated July 26, 2004 to BASF Corporation (BASF) and was prepared by Roux Associates, Inc. (Roux Associates) on behalf of BASF. These comments have been addressed in the following sections:

- The sediment volumes for the North and South Lagoons were revised. These revisions are reflected in Section 1.1;
- References to the submission of a trip blank for laboratory analysis has been removed from Section 3.0.
- The rationale for ultraviolet lamp selection for field screening using the photoionization detector has been provided in Section 6.6.1; and
- The holding times for sampling collection/analysis presented in Table 2 were updated in accordance with the requirements presented in the NYSDEC's Analytical Services Protocol.

As always, if you have any questions, please do not hesitate to call.

Sincerely,

ROUX ASSOCIATES, INC.

Omar Ramotar (ns)

Omar Ramotar, P.E.
Senior Engineer

Attachments

cc: Alan Geisendorfer, NYSDEC
Michael Komoroske, NYSDEC
Daniel Geraghty, New York State Department of Health
J. Douglas Reid-Green, BASF Corporation
Hank Martin, Environmental Liability Management
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1.0 INTRODUCTION

This Lagoon Closure (LC) Sampling, Analysis and Quality Assurance Project Plan (SAQAPP) for the BASF Corporation (BASF) Rensselaer facility, Rensselaer, New York (Site) has been prepared by Remedial Engineering, P.C. (Remedial Engineering) and Roux Associates, Inc. (Roux Associates). This facility is located in an industrial area of Rensselaer County, New York (Figure 1). BASF owns approximately 80 acres of land that is separated into three areas that are commonly referred to as the Manufacturing Plant (including the wastewater treatment lagoons), Closed Landfill, and South 40 Parcel (Figure 2).

This LC SAQAPP outlines the measures that will be taken to verify that data generated from the analysis of the following samples are of quality sufficient to meet the project data quality objectives (DQOs):

- twelve post-excavation samples from the North Lagoon clay liner, as shown on Figure 3;
- thirteen post-excavation samples from the South Lagoon clay liner, as shown on Figure 3;
- eight surface soil samples below the combined staging area for the North and South Lagoons, as shown on Figure 4; and
- five surface soil samples in the vicinity of the combined staging area for the North and South Lagoons, as shown on Figure 4.

This LC SAQAPP does not address measures related to the collection and analysis of waste characterization samples. Waste characterization sampling will be performed in accordance with the requirements of the approved disposal facility and submitted to a laboratory currently certified by the NYSDOH Environmental Laboratory Approval Program (ELAP). Waste characterization may include analysis for RCRA characteristics (e.g., reactivity, and toxicity [excluding pesticides]), Total Petroleum Hydrocarbon (TPH), volatile organic compounds (VOCs) using the toxicity characteristic leaching procedure (TCLP), and/ or target analyte list (TAL) metals depending on the disposal facility requirements. For each sample, laboratory supplied bottles will be filled using a dedicated polyethylene scoop. Filled sample bottles will be placed into an ice cooler for subsequent transport to the laboratory under standard chain of custody procedures.

All LC field activities to be performed as part of the Rensselaer Remediation Project will be performed in accordance with the selected remedy outlined in Roux Associates October 16, 2003 Remedial Design/Remedial Action (RD/RA) Work Plan for the North Lagoon and Area 4C Remediation (Roux Associates 2003a) and the December 1, 2003 RD/RA Work Plan for the South Lagoon Remediation (Roux Associates, 2003b).

1.1 Summary of Selected Remedy

As described in the RD/RA Work Plans, the remedy addresses the removal of approximately 6,600 cubic yards of sediment from the North Lagoon, 1,670 cubic yards of soil from the northeast portion of the North Lagoon berm (referred to as Area 4C) and 3,990 cubic yards of sediment from the South Lagoon. Removal of sediment and soil will be performed using conventional excavation, dewatering and material handling equipment. Sediment will also be physically and chemically processed to maximize its' solid content. Once treated, excavated sediment and soil will be characterized for disposal purposes and sent off-site to an approved disposal facility. Treatment/handling/staging areas and other supporting facilities will be constructed prior to removal of sediments from the North and South Lagoons and soil from Area 4C. The sediments and soil, as necessary, will be de-watered to remove free liquids prior to transportation for off-site disposal. Additional excavation within the North and South Lagoons will be based on the results of the post-excavation sampling performed at each area of concern.

Area 4C will be excavated to 1 feet below the water table prior to backfilling with clean fill. It is estimated that approximately 1,670 cubic yards of soil will be removed from this area. Post excavation soil samples (bottom or sidewall) will not be collected as described in Section 7.9.2 of the RD/RA Work Plan for the North Lagoon and Area 4C Remediation.

1.2 North and South Lagoon Description

The North and South Lagoons are each approximately 400 feet long and 180 feet wide and 12 feet deep in their center. The estimated storage capacity of each lagoon is 6.25 million gallons. Each lagoon is lined with two feet of clay. The clay has a permeability of about 1×10^{-7} centimeters per second. The sediment thickness measured in the North Lagoon ranged from 2.25 feet to 6.5 with an average thickness of 4.0 feet. However, sediment thickness measurements in the South Lagoon were considerably lower and ranged from 1.5 feet to 3.0 feet with an average of only 2.25 feet.

The remainder of this LC SAQQAP is organized as follows:

- Section 2.0 discusses the content of the SAQQAP;
- Section 3.0 addresses quality control checks;
- Section 4.0 addresses project organization and responsibilities;
- Section 5.0 addresses quality assurance objectives for measuring data;
- Section 6.0 addresses sampling procedures;
- Section 7.0 addresses sample custody;
- Section 8.0 addresses calibration procedures and frequency; and
- Section 9.0 addresses data reduction, validation and reporting.

2.0 PLAN DESCRIPTION

This SAQAPP combines a field sampling plan (FSP) and a quality assurance project plan (QAPP) to streamline the project planning process. The FSP elements describe the sampling and data gathering methods to be used during the implementation of LC at the Site. This includes information relative to Site background, sampling objectives, sampling location and frequency, sample designation, sampling equipment and procedures, and sample handling and analysis.

The QAPP elements present the organization, objectives, functional activities and specific quality assurance (QA) and quality control (QC) activities associated with the investigation for this Site. The QAPP elements describe the specific protocols, which will be followed for sampling, chain of custody, and laboratory and field analysis. All QA/QC procedures were developed and will be implemented in accordance with applicable professional technical standards, NYSDEC requirements, and specific project goals and requirements.

This SAQAPP was prepared to provide procedures and guidelines to field and laboratory personnel so that the data obtained accurately reflects actual environmental conditions in the areas to be remediated. Any deviations from anticipated conditions will be noted, and acceptable corrective actions will be implemented to maintain appropriate quality in the sample collection and analysis program. The project objectives and scope of this SAQAPP are discussed as follows.

2.1 Project Objectives and Scope

The objective of the SAQAPP is to define the methods used for sample collection and analysis following the completion of sediment removal activities at the North and South Lagoons. Specifically, this SAQAPP will define the methods for the collection and analysis of the following:

- twelve post-excavation samples from the North Lagoon clay liner as shown on Figure 3;
- thirteen post-excavation samples from the South Lagoon clay liner as shown on Figure 3;
- eight surface soil samples below the combined staging area for the North and South Lagoons as shown on Figure 4; and
- five surface soil samples in the vicinity of the combined staging area for the North and South Lagoons as shown on Figure 4.

The sample locations, analytical parameters, and anticipated frequencies of field sample collection, including QA/QC samples, are summarized in Table 1. Table 2 presents a summary of sample collection, preservation and holding times. General procedures for the collection of each type of sample are presented in the following subsections.

2.1.1 Post-Excavation Samples

Post-excavation samples will be collected during the remediation of the North and South Lagoons, but not during the remediation of Area 4C as discussed previously. Post-excavation samples will be collected, as necessary, to confirm that the clay liners remaining within the North and South Lagoons meet site-specific cleanup objectives. Sampling will be performed in accordance with the appropriate New York State Department of Environmental Conservation (NYSDEC) regulations, criteria and guidance, as well as Roux Associates' Standard Operating Procedures (SOPs) (Appendix A). Post-excavation samples will be collected and analyzed in accordance with the requirements specified in Tables 1 through 5.

2.1.1.1 North and South Lagoons

Post-excavation sampling of the clay liners will be performed following removal of the North and South Lagoon sediments. Since the RD/RA Work Plans for the North and South Lagoons specify removal of all of the sediment, only the clay liner underlying these sediments will remain. Based on the analytical results generated from the sampling of the clay liner of each Lagoon, an appropriate work plan will be developed to address any contamination, if found.

32 samples will be collected from the clay liner underlying the North Lagoon and 33 samples will be collected from the South Lagoon clay liner. Sampling locations will be selected utilizing a 50-foot square grid. Approximate sampling locations are presented in Figure 3. Actual grid locations will be based on the field conditions encountered at the time of sampling. At the selected boring location, a hand auger will be used to collect a sample from the upper surface of the clay. A portion of each sample will be placed in a plastic Ziploc™ bag or glass jar and screened in the field for VOCs using a PID. Each of the 12 samples collected from the North Lagoon and 13 samples from the South Lagoon will be sent to a certified laboratory for VOC analysis. SVOC and TAL metals analysis will be performed on 25% of the post-excavation samples collected. It should be noted that all post-excavation samples would be collected and

analyzed in accordance with the Draft NYSDEC DER-10 Technical Guidance for Site Investigation and Remediation.

Once the North and South Lagoons have been completely remediated, the North Lagoon will be partially backfilled and the South Lagoon will be restored as a storm water retention basin.

2.1.1.2 Area 4C

Because Area 4C will be excavated to approximately 1 foot below the water table, post-excavation bottom samples will not be collected and analyzed upon the completion of the remediation at Area 4C. In addition, sidewall post-excavation samples will not be collected and analyzed because of the following reasons:

- The areas north and east of Area 4C have been previously excavated.
- The area south of Area 4C was previously determined to be clean based on post-excavation soil samples collected during the remediation of Area 4A.
- The area west of Area 4C is the sidewall of the North Lagoon.

2.1.2 Surface Soil Samples

As requested by the NYSDEC, sampling of the surface soil at 8 locations within the lagoon sludge staging area shown on Figure 4 will be performed upon completion of the South Lagoon remediation. In addition, sampling of the surface at 5 locations east, west and south of this staging area (perimeter areas of concern) will also be performed, as requested by the NYSDEC. This sampling effort shall be performed after the staging areas have been demobilized. The surface soil will only be analyzed for VOCs, since SVOC and TAL Metals contamination is not present in the North and South lagoon sediments. All sampling will be performed in accordance with the Draft NYSDEC DER-10 Technical Guidance for Site Investigation and Remediation.

Based on the results of these samples, an appropriate work plan will be developed to address any contamination that may be found in soil at the surface of the lagoon staging area or in the perimeter areas of concern.

2.2 Data Usage

Post-excavation samples from the North and South Lagoons clay liners and surface soil samples within, and in the vicinity, of the lagoon staging areas will be collected and analyzed to confirm that proposed clean-up objectives for COCs have been met.

2.3 Data Quality Objectives

Data Quality Objectives (DQOs) are qualitative and quantitative statements used to develop a scientific and effective sampling design. A DQO Planning Process has been developed to assist in determining the amount and type of information required, including acceptable levels of error.

The DQO Planning Process helps the user determine the amount and quality of data, conserves resources by making data collection operations more efficient, and helps focus the objectives and narrows questions to essential issues.

Laboratory confirmation will be performed according to SW-846 analytical protocols, which are considered DQO Level 4. This provides a level of data quality that is used for purposes of evaluation of remedial alternatives. All laboratory analyses will be performed by Severn Trent Laboratories, Inc.'s (STL's) regional office located in Shelton, Connecticut.

3.0 QUALITY CONTROL CHECKS

Field duplicates, matrix spike/ matrix spike duplicates (MS/MSDs) and field blanks are analyzed to assess the quality of the data resulting from the field sampling program. This section describes the QC checks that will be used for this field investigation. QC samples serve as checks on both the sampling and measurement systems and assist in determining the overall data quality with regard to representativeness, accuracy, and precision. The frequency and type of field QC samples submitted are summarized below and presented in Table 3.

Field duplicate samples are individual portions of the same or essentially the same field sample. These samples can be used to estimate the overall precision of a data collection activity. Sampling error can be estimated by the comparison of duplicate sample results from the same sample. One duplicate sample will be collected for each 20 samples collected. If less than 20 samples are collected per matrix, a minimum of one duplicate sample will be analyzed.

MS/MSDs are used to evaluate analytical accuracy (MS), and precision (MSD). A MS and MSD sample will be collected for each 20 samples collected. If less than 20 samples are collected per matrix, a minimum of one MS and one MSD duplicate sample will be analyzed.

Field blanks (equipment blanks) are samples that are obtained by running analyte-free water through sample collection equipment after decontamination, and placing it in appropriate sample containers for analysis. These samples are used to determine if decontamination procedures are adequate. One field blank will be submitted per matrix per day of sample collection or at the discretion of the supervising field Engineer.

4.0 PROJECT ORGANIZATION AND RESPONSIBILITY

The overall management structure for field activities and a general summary of the responsibilities of the technical staff is provided below.

Project Manager

The Project Manager (PM) bears the primary responsibility for the successful completion of the work assignment within budget and schedule and the successful execution of the field program. The PM directs the activities of technical staff in the field and assists in the interpretation of all physical and chemical data, and report preparation. The PM is responsible for the management of technical staff including engineers, hydrogeologists and technicians, and subcontractors such as drillers and surveyors. In addition, the PM works closely with the Site Health and Safety Officer to assist in compliance with the Health and Safety Plan (HASP).

Field Technical Staff

Field technical staff consists of engineers, hydrogeologists and technicians who will perform activities such as water-level measurements, soil and ground-water sampling, and preparation of any field documentation, which may be necessary.

Site Health and Safety Officer

The Site Health and Safety Officer (SHSO) will be responsible for the implementation of the HASP. The SHSO will revise the HASP, if required, based upon the results of the Site investigation. Any necessary revision to the HASP will be submitted to the Project Manager for approval. The Field Technical Staff may be assigned as the on-site SHSO during remediation.

Project Quality Assurance Coordinator

The Project Quality Assurance Coordinator (PQAC) provides technical quality assurance assistance; prepares, reviews, and approves the SAP; oversees any contractor quality assurance activities to verify compliance with contract specifications; monitors field investigations and prepares QAPP reports, if necessary.

5.0 QUALITY ASSURANCE OBJECTIVES FOR MEASUREMENT DATA

The overall QA objective is to develop and implement procedures for field sampling, chain of custody, laboratory analysis, and reporting to provide results that maximize the likelihood that the data are collected, analyzed and documented in a defensible manner. Specific procedures for sampling, chain of custody, laboratory instruments calibration, laboratory analysis, data reporting, internal quality control, audits, preventive maintenance of field equipment, and corrective action are described in other sections of this SAP. The purpose of this section is to address the project-specific objectives for precision, accuracy, representativeness, completeness, and comparability, known as the "PARCC" parameters.

5.1 Accuracy, Precision, and Sensitivity of Analysis

The fundamental QA objective with respect to accuracy, precision, and sensitivity of laboratory analytical data is to achieve the QC acceptance criteria of the analytical protocols. Accuracy, precision and instrument sensitivity will be addressed for all the data generated. Accuracy, the ability to obtain a true value, is monitored through the use of field and method blanks, spikes, and standards, and is measured based on federal and state regulations and guidelines. The potential impact of matrix interferences on analytical results is determined by evaluating accuracy.

Precision, which is the ability to replicate a value, is evaluated through duplicate (replicate) samples for each matrix. The laboratory must perform corrective actions and documentation for substandard recoveries, or substandard precision. These parameters will be based on modified United States Environmental Protection Agency (USEPA) Contract Laboratory Program (CLP) criteria for non-CLP analyses.

Instrument sensitivity must be monitored to ensure high quality data through consistent instrument performance. Method detection limits depend on instrument sensitivity and matrix effects. Monitoring of instrument sensitivity is performed through the analysis of reagent blanks, near-detection limit standards and response factors.

Required field and laboratory QC samples and frequencies are summarized in Tables 3 and 4. Quality control criteria for laboratory and field analyses are provided in Table 5.

5.2 Completeness, Representativeness and Comparability

Completeness is a measure of the amount of valid data obtained from a measurement system compared to the amount that was expected to be obtained under normal conditions. It is expected that the laboratory will provide data meeting QC acceptance criteria for 90 percent or more for all samples tested using the non-CLP methods. Following completion of the analytical testing, the percent completeness will be calculated by the following equations:

$$\text{Completeness (percent)} = \frac{\text{(Valid Data Obtained)}}{\text{(Total Data Planned)}} \text{ X } 100$$

Representativeness expresses the degree to which data accurately and precisely represent a characteristic of a population, parameter variations at a sampling point, a process condition, or an environmental condition. Representativeness is a qualitative parameter that is dependent upon the proper design of the sampling program and proper laboratory protocol. Representativeness will be satisfied by ensuring that the SAP is followed, proper sampling techniques are used, proper analytical procedures are followed and holding times of the samples are not exceeded in the laboratory. Representativeness will be assessed in part by the analysis of field duplicate samples.

Comparability expresses the confidence with which one data set can be compared with another. The extent to which existing and planned analytical data will be comparable depends on the similarity of sampling and analytical methods.

6.0 SAMPLING PROCEDURES

The following sections describe the standard protocols to be used by Roux Associates' personnel during the course of sampling activities. The Roux Associates SOPs included in Appendix A will be referenced where applicable.

6.1 Sample Designation

Sample bottles (preserved, if necessary), labels, shipping containers, and field blank water will be provided by the laboratory. During collection of samples, the sample containers will be labeled with a site identifier, Roux Associates' project number, a sample identification code, analysis identifier, date and time of collection, and field handling information.

The sample identification code provided on each sample label will follow the sample number and coding system described below for post-excavation samples, surface soil samples and QA/QC samples.

1. As illustrated below, post-excavation sample locations will be designated in the following manner:

    PE – Lagoon X–Y/Q = Individual post-excavation sample from Lagoon X

    where X, Y and Q are defined as follows:

    X = North (N) or South (S).
    Y = Bottom sampling location (i.e., 1, 2, 3, etc.) within Lagoon X.
    Q = Quality Control identifier (if applicable) defined as follows:
        DUP = field duplicate
        MS = matrix spike
        MSD = matrix spike duplicate

2. As illustrated below, surface soil sample locations will be designated in the following manner:

    SS – Area X–Y/Q = Individual surface soil sample from Area X

    where X, Y and Q are defined as follows:

    X = Area (A, B, C, etc…).
    Y = Surface soil sampling location (1, 2, 3, etc.) within Area X.
    Q = Quality Control identifier (if applicable) defined as follows:
        DUP = field duplicate
        MS = matrix spike
        MSD = matrix spike duplicate

3. As illustrated below, QA/QC samples will be designated in the following manner:
    TB-Z = Individual Trip Blank (1, 2, 3, etc.)
    FB-Z = Individual Field Blank (1, 2, 3, etc.)

4. As illustrated below, analytical method designations will be as follows:
    VOCs = VOC
    SVOCs = SVOC
    TAL Metals = MET
    Total Petroleum Hydrocarbons = TPH
    Toxicity Characteristic Leaching Procedure Analysis = TCLP

6.2 Site Control

Site control procedures have been developed to minimize both the risk of exposure to contamination and the spread of contamination during field activities at the facility. In order to accomplish this objective, the following considerations have been addressed:

- decontamination of field equipment;
- proper handling of waste samples; and
- security procedures.

6.2.1 Decontamination

In an attempt to avoid the spread of contamination, all equipment (i.e., sampling equipment, etc.) must be decontaminated at a reasonable frequency in the decontamination area.

All sampling equipment will be decontaminated prior to sampling and between sampling locations according to the procedures outlined in the SOPs included in Appendix A. Sampling equipment will be decontaminated using non-phosphate, laboratory-grade detergent solution, and distilled or potable water in a clean bucket. Water sampling equipment will be decontaminated prior to sampling and between sampling locations in a similar manner.

The fieldwork will be performed in level D protection. Any decontamination of personnel required will be performed at a designated area of the facility and appropriate decontamination materials (e.g., eyewash) will be maintained for use in this area.

6.2.2 Site Security

The work zone is located on an industrial site that is surrounded by fencing and maintains 24-hour security at the front gate. At the completion of each working day, all loose equipment (e.g., sampling equipment, water-level measuring devices, etc.) will be secured. Heavy equipment, such as earth moving devices, will remain on the facility, within the current work zone.

6.3 Field Equipment

All measurement systems utilized in the field will be operated in accordance with the manufacturer's instructions and the applicable SOPs in Appendix A. Procedures for calibrating and maintaining the equipment are provided below.

6.3.1 Equipment Calibration

All measurement and health and safety equipment will be calibrated before use. Frequency of instrument calibration will be dictated by the type of measurement device, the frequency of use, and the manufacturer's recommendations. Records of all calibrations (both frequency and results) will be kept in the field or instrument logbook.

6.3.2 Equipment Maintenance

All field equipment will be stored in a clean, controlled environment (as necessary) to prevent damage due to heat, cold, moisture, etc. prior to use. Reusable equipment will be decontaminated as soon as reasonably possible after use and stored as described above. Decontamination procedures are provided in the SOPs (Appendix A). Maintenance for measurement and health and safety equipment will be in accordance with manufacturer's recommendations.

6.4 Field Documentation

The following sections provide guidance to field personnel in the areas of documentation and record keeping. The goal of field documentation is to provide a clear and complete record that can be used for reference and information retrieval at a later date. All field documentation will be recorded in bound logbooks or activity-specific forms using waterproof ink. Details of record keeping requirements are described in Appendix A. Samples of field forms are provided in Appendix B.

6.4.1 Field Logbooks

Field logbooks will be used for all record keeping to provide a permanent, bound record of all field related activities. Additional records may be kept on designated forms for sample tracking and other purposes. The types of information and level of detail required for logbook recording are described in the Field Record Keeping and Quality Assurance/Quality Control SOP in Appendix A.

6.4.2 Sampling Documentation

A complete record of how each sample was selected, aliquotted, packaged, and preserved for analysis will be maintained in the field logbooks. Specific procedures regarding the level and type of sampling documentation can be found in the activity-specific SOP in Appendix A. Sample designation and labeling are discussed in Section 6.0 of this SAP.

6.5 Custody Procedures and Documentation

The purpose of documenting sample custody is to verify that the integrity and handling of the samples is not subject to question. Sample custody will be maintained from the point of sampling through the analysis (and return of unused sample portion, if applicable). Specific procedures regarding sample tracking from the field to the laboratory are described in the SOP (Appendix A) and Section 6.0. Examples of a chain of a custody form and a custody seal can be found in Appendix B.

Each individual collecting samples is personally responsible for the care and custody of the samples. All sample labels should be pre-printed or filled out using waterproof ink. The technical staff will review all field activities with the Project Manager to determine whether proper custody procedures were followed during the fieldwork and to decide if additional QA/QC samples are required.

Samples must be accompanied by a properly completed chain of custody form (Appendix B). When transferring the possession of samples, individuals relinquishing and receiving will sign, date, and note the time on the record. This record documents transfer of custody of samples from the sampler to another person, to/from a secure storage area, and to the laboratory.

6.6 Sample Handling and Analysis

All samples will be collected and handled according to the appropriate protocols (Appendix A). The frequency of quality control samples is presented in Tables 3 and 4.

Sample packaging and shipment must be performed using the general outline described below. Additional information regarding sample handling is provided in the SOPs (Appendix A).

All samples will be shipped to the laboratory within 48 hours of collection and will be preserved appropriately at the time of sample collection. A description of the sample packing and shipping procedures is presented below.

1. Prepare cooler(s) for shipment.
   - Tape drain(s) of cooler shut;
   - Affix "This Side Up" arrow labels and "Fragile" labels on each cooler; and
   - Place mailing label with laboratory address on top of cooler(s).
2. Arrange sample containers in groups by sample number.
3. Ensure that all bottle labels are completed correctly. Place clear tape over bottle labels to prevent moisture accumulation from causing the label to peel off.
4. Seal sample containers within plastic Ziploc™ bags to prevent vermiculite from contacting samples, where appropriate.
5. Place approximately 2 inches of vermiculite or other packaging material at the bottom of the cooler to act as a cushion for the sample container(s).
6. Arrange containers in the cooler so that they are not in contact with the cooler walls or other samples.
7. Fill remaining spaces with vermiculite or other packaging material.
8. Ensure all containers are firmly packed in vermiculite or other packaging material.
9. If ice is required to preserve the samples, ice cubes should be repackaged in double Ziploc™ bags, and placed on top of the vermiculite or other packaging material.

10. Sign chain of custody form (or obtain signature) and indicate the time and date it was relinquished to Federal Express or other carrier, as appropriate.

11. Separate copies of chain of custody forms. Seal proper copies within a large Ziploc™ bag and tape to cooler. Retain copies of all forms.

12. Close lid and latch.

13. Secure each cooler using custody seals.

14. Tape cooler shut on both ends.

15. Relinquish to Federal Express or other courier service as appropriate. Retain airbill receipt for project records. (Note: All samples will be shipped for "next day delivery.")

16. Telephone laboratory contact and provide them with the following shipment information:
    - sampler's name;
    - project name;
    - number of samples sent according to matrix and concentration; and
    - airbill number.

6.6.1 Field Analysis

Portions of the samples will be screened in the field for VOCs using a photoionization detector (PID). Both 10.6 electron Volt (eV) ultraviolet (UV) and 11.7 eV UV lamps will be used in the PID. The 10.6 eV UV lamp emits energy at a wavelength of 120 nanometers, which is sufficient to ionize most aromatics and many other molecules whose ionization potential is below 10.6 eV. The 11.7 eV UV lamp is suitable for detecting chlorinated compounds (specifically 1,2-dichloroethane). The PID will be calibrated daily at a minimum. Each sample to be screened will be placed in a plastic Ziploc™-type bag and the probe-tip of the PID will be inserted into the bag to obtain the measurement. Field screening results will be recorded in the field logbook. A summary of the compounds detected above Universal Treatment Standards in the North Lagoon sediment samples, as described in Table 2 of the October 16, 2003 Remedial Design/Remedial

Action Work Plan for the Remediation of the North Lagoon and Area 4C, along with their respective ionization potential is provided below.

Analyte	**Ionization Potential (e.V)**
Volatile Organic Compounds (VOCs)	
Benzene	9.25
Chlorobenzene	9.07
1,2-Dichloroethane	11.04
Ethylbenzene	8.76
Toluene	8.82
Xylenes (total)	8.56
Semi-Volatile Organic Compounds (SVOCs)	
Benzo[a]anthracene	7.60
1,2-Dichlorobenzene	9.07
Fluoranthene	7.90
Naphthalene	8.10
4-Nitroaniline	8.85
Phenanthrene	8.10
Phenol	8.69

6.6.2 Laboratory Analysis

Analytical methods for the chemical analysis of constituents of concern have been chosen to provide the highest level of data quality in order to assess the effectiveness of the remedial measures. Applicable Quality Assurance/Quality Control procedures for these analyses are summarized in Table 4.

7.0 SAMPLE CUSTODY

The possession and proper transfer of samples and sample related information must be traceable from the time the samples are collected until the data have been accepted for analysis. The FSP describes the procedures for sample custody from the point where the sample is collected through the laboratory analysis. The following sections summarize the general aspects of custody and how they will be applied and managed during the course of the project.

A sample or sample related information (sample or evidence file) is under your custody if they:

- are in your possession;
- are in your view, after being in your possession;
- are in your possession and you place them in a secured location; or
- are in a secured, designated place.

7.1 Field Chain of Custody Procedures

The sample packaging and shipment procedures summarized below will ensure that the samples will arrive at the laboratory with the chain of custody intact. The protocols for specific sample numbering and other sample designation documentation are included in Section 5.

7.1.1 Field Procedures

A. The field sampler is responsible for the care and custody of the samples until they are transferred or properly dispatched. As few people as possible should handle the samples.

B. All bottles will be labeled with the appropriate sample numbers and locations.

C. Sample labels are to be completed for each sample using waterproof ink unless prohibited by weather conditions. For example, a logbook notation would explain that a pencil was used to fill out the sample tag because the ball-point pen would not function in freezing weather.

D. The Project Manager will review all field activities to determine whether proper custody procedures were followed during the fieldwork and decide if additional samples are required.

7.1.2 Field Logbooks/Documentation

Field logbooks will be used to document all data collecting activities performed in the field. As such, entries will be described in sufficient detail such that persons going to the Site could reconstruct a particular situation without reliance on memory. A summary of field documentation requirements is presented below.

Field logbooks will be bound field survey books or notebooks. Logbooks will be assigned to field personnel, but will be stored in the document control area when not in use. Each logbook will be dedicated and identified by the project-specific document number.

The title page of each logbook will contain the following:

- person to whom the logbook is assigned;
- logbook number;
- project name;
- project start date; and
- end date.

At the beginning of each entry, the date, start time, weather, names of all sampling team members present, level of personal protection being used, and the signature of the person making the entry will be entered into the field book. The names of visitors to the Site, field sampling or investigation team personnel and the purpose of their visit will also be recorded in the field logbook.

Measurements made and samples collected will be recorded. All entries will be made in ink and no erasures will be made. If an incorrect entry is made, the information will be crossed out with a single strike mark and initialed by the person making the correction. Whenever a sample is collected, or a measurement is made, a detailed description of the location of the station shall be recorded. The number of the photographs taken of the station, if any, will also be noted. All equipment used to make measurements will be identified, along with the date of calibration.

Samples will be collected following the sampling procedures documented in the FSP. The equipment used to collect samples will be noted, along with the time of sampling, sample description, depth at which the sample was collected, sample volume, and number of containers. Sample identification numbers will be assigned prior to sample collection. Field duplicate samples, which will receive an entirely separate sample identification number, will be noted under sample description (in the field logs but not the chain of custody).

7.1.3 Transfer of Custody and Shipment Procedures

A. Samples will be accompanied by a properly completed chain of custody form. The sample numbers and locations will be listed on the chain of custody form. When transferring the possession of samples, the individuals relinquishing and receiving will sign, date, and note the time on the record. This record documents transfer of custody of samples from the sampler to another person, to a mobile laboratory, to the permanent laboratory, or to/from a secure storage area.

B. Samples will be properly packaged for shipment and dispatched to the appropriate laboratory for analysis, with a separate, signed custody record enclosed in or on each sample box or cooler. Shipping containers will be locked and secured with strapping tape and Roux Associates custody seals for shipment to the laboratory. The preferred procedure includes use of a custody seal attached to the front right and back left of the cooler. The custody seals are covered with clear plastic tape. The cooler is strapped shut with strapping tape in at least two locations.

C. Whenever samples are split with another source (i.e., a government agency), a separate sample receipt is prepared for those samples and marked to indicate with whom the samples are being split. The person relinquishing the samples to the facility or agency should request the representative's signature acknowledging sample receipt. If the representative is unavailable or refuses, this is noted in the "Received By" space.

D. All shipments will be accompanied by the chain of custody record identifying the contents. The original record and yellow copy will accompany the shipment, and the pink copy will be retained by the sampler for returning to the sampling office. Photocopies of the original record should be made before shipment, if possible, to ensure that clean copies can be made later.

E. If the samples are sent by common carrier, a bill of lading (airbill) must be used. Receipts of bills of lading will be retained as part of the permanent documentation. If sent by mail, the package will be registered with return receipt requested. Commercial carriers are not required to sign off on the custody form as long as the custody forms are sealed inside or on the outside of the sample cooler and the custody seals remain intact.

7.2 Laboratory Chain of Custody Procedures

Laboratory custody procedures for sample receiving and log-in, sample storage, tracking during sample preparation and analysis, and storage of data are described in the laboratory QA plan. All laboratory handling and custody procedures must conform to the Test Methods of Evaluating Solid Waste (SW-846) requirements.

The laboratory quality assurance officer will verify that chain of custody records are filled out upon receipt of the samples and will note questions or observations concerning sample integrity. The laboratory quality assurance officer will also verify that sample-tracking records are maintained. These records will follow each sample through all stages of laboratory processing. The sample tracking records must show the date of sample extraction or preparation and the date of instrument analysis. These records will be used, in part, to determine compliance with holding time requirements.

8.0 CALIBRATION PROCEDURES AND FREQUENCY

This section describes procedures for maintaining the accuracy of all measurements and measuring equipment, which are used for conducting field tests and laboratory analyses. All equipment must be calibrated prior to each use and on a periodic basis.

8.1 Field Instruments/Equipment

Field instruments and equipment used to gather, generate, or measure environmental data will be calibrated with sufficient frequency and in such a manner that accuracy and reproducibility of results are consistent with the manufacturer's specifications.

Equipment to be used during field sampling will be examined to certify that it is in operating condition. This includes checking the manufacturer's operating manual to verify that all maintenance requirements are being observed. Backup instrumentation will be sent into the field where possible. Preventive maintenance will be conducted for equipment and instruments to verify the accuracy of measurement systems, and to ensure the availability of spare parts and backup systems.

Calibration of field instruments is governed by the specific SOP for the applicable field analysis method, and such procedures take precedence over the following general discussion.

Calibration of field instruments will be performed at the intervals specified by the manufacturer or more frequently as conditions dictate. Field instrumentation may include an Organic Vapor Analyzer (OVA) or PID for air sampling. In the event that an internally calibrated field instrument fails to meet calibration/checkout procedures, it will be removed from service until the problem is resolved.

8.2 Laboratory Instruments

Calibration of laboratory equipment for non-CLP analyses will be based on approved written procedures. Records of calibration, repairs, or replacement will be filed and maintained by the designated laboratory personnel performing quality control activities. These records will be filed at the location where the work is performed and will be subject to QA audits. For all instruments, the laboratory will retain a factory-trained repair staff with in-house spare parts or will maintain service contracts with vendors.

The records of laboratory calibration will be kept as follows:

- If possible, each instrument will have a record of calibration permanently affixed with an assigned record number.
- A label will be affixed to each instrument showing description, manufacturer, model numbers, date of last calibration, by whom calibrated (signature), and due date of next calibration reports, and compensation or correction figures will be maintained with the instrument.
- A written stepwise calibration procedure will be available for each piece of test and measurement equipment.
- Any instrument that is not calibrated with the manufacturer's original specification will display a warning tag to alert the analyst that the device carries only a "Limited Calibration."

8.3 Standards/Calibration Solutions Preparation

The standards/calibration solutions preparation will be performed in accordance with the CLP SOWs, if applicable, and using good laboratory practice (GLP) in all cases.

9.0 DATA REDUCTION, VALIDATION AND REPORTING

Applicable methods/procedures will be required for the reduction, validation and reporting of data generated during all phases of this project in compliance with the USEPA Methods specified. Both the field and laboratory data will be examined to determine whether the particular requirements for the specific intended use are fulfilled.

9.1 Data Reduction

Data reduction involves the generation, interpretation and calculation of results from the field and laboratory analyses performed as part of the data gathering effort. In order to make the appropriate decisions, it is necessary to verify that the reported values are correct, both in the way they have been generated (instrument calibration, etc.) and the way they are calculated and reported. Due to the different quantities of documentation and the different quality levels of data generated in the field and the laboratory, somewhat different levels of effort are required for reduction verification for these different data sources.

9.1.1 Field Data Reduction

Raw data from field measurements and sample collection activities will be appropriately recorded in the field logbook. If the data are to be used in the project reports, they will be documented in the report. All measurement data recorded in field logbooks or field forms will be reviewed by the Project Manager for completeness and clarity. Any discrepancies noted shall be resolved by the Project Manager. All calculation equations shall also be verified by the Project Manager and individual calculations shall be verified at a minimum frequency of ten percent by the PQAO. Any field information input into data systems will be subject to the Roux Associates' QA/QC procedures (Appendix A).

9.1.2 Laboratory Data Reduction

The off-site laboratory will perform in-house analytical data reduction and validation under the direction of the Laboratory QA Officer. The Laboratory QA Officer is responsible for assessing data quality and advising of any data, which were rated "preliminary" or "unacceptable" or other notations, which would caution the data user of possible unreliability. Data reduction, validation, and reporting by the laboratory should be conducted as follows:

- Raw data produced by the analyst is turned over to the respective area supervisor.

- The area supervisor reviews the data for attainment of quality control criteria as outlined established USEPA methods and for overall reasonableness.

- Upon acceptance of the raw data by the area supervisor, a computerized report is generated and sent to the Laboratory QA Officer.

- The Laboratory QA Officer will complete a thorough audit of reports at a frequency of one in ten, and an audit of every report for consistency.

- The Laboratory QA Officer and area supervisors will decide whether any sample reanalysis is required.

- Upon acceptance of the preliminary reports by the Laboratory QA Officer, final reports will be generated and signed by the Laboratory Project Manager. The laboratory package shall be presented in the same order in which the samples were analyzed.

Laboratories will prepare and retain full analytical and QC documentation similar to that of non-CLP analyses as required by the Contract Laboratory Program.

The laboratory will report the data in chronological order along with all pertinent QC data. Laboratories will provide the following information in each analytical data package submitted.

1. Cover sheets listing the samples included in the report and narrative comments describing problems encountered in analysis.
2. Tabulated results of inorganic and organic compounds identified and quantified.
3. Method of analysis/method number.
4. Analytical results for QC samples, spikes, sample duplicates, initial and a continuing calibration verification standards and blanks, standard procedural (method) blanks, laboratory control samples, and ICP interference check samples.
5. Tabulation of instrument detection limits determined in pure water.
6. Dilution factors for all high concentration samples detected.

For organic analyses, the data packages must include matrix spikes, matrix spike duplicates, and surrogate spike recoveries, and acceptable criteria.

9.2 Field Data Validation

Field data assessment will be accomplished by the efforts of the Data Validation Service, PQAO and/or Project Manager. The data assessment by the Project Manager or his designee will be based on the criteria that the sample was properly collected and handled according to this SAP.

9.3 Laboratory Data Validation

Data Validation Services (DVS) of North Creek, New York (Appendix C), whose function will be to provide an independent review of the data package, will prepare a Data Usability Summary Report (DUSR) for the post-excavation analytical data generated by STL. The DUSR will be prepared in accordance with the NYSDEC Division of Environmental Remediation QA Guideline, "Guidance for the Development of Data Usability Summary Reports." DVS will conduct a systematic review of the data for compliance with the established QC criteria based on the spike, duplicate and blank results provided by the laboratory.

The data reviewer will identify any out-of-control data points and data omissions and interact with the laboratory to correct data deficiencies. Decisions to repeat sample collection and analyses may be made by the Project Manager based on the extent of the deficiencies and their importance in the overall context of the project.

9.4 Data Reporting

All laboratory analysis and generation of data reportables will be consistent with the current NYSDEC Analytical Services Protocol (ASP). Actual data deliverables will be NYSDEC ASP Category B. All data generated will be computerized in a database format organized to facilitate data review and evaluation. The computerized data set will include the data flags provided in accordance with the USEPA Contract Laboratory Program National Functional Guidelines for Organic Data Review (February 1994) and for Inorganic Data Review (February 1994) as well as additional comments. The data flags will include such items as: 1) concentration below required detection limit, 2) estimated concentration due to poor recovery below required detection limit, 3) estimated concentration due to poor spike recovery, and 4) concentration of chemical also found in laboratory blank. Selected data reviewer comments will also become part of the database in order to indicate whether the data are usable as a quantitative concentration, usable with caution as an estimated concentration, or unusable due to out-of-control QC results.

The Site data set(s) will be available for controlled access by the Project Manager, and authorized personnel using a site-specific code.

Respectfully submitted,

ROUX ASSOCIATES, INC.

Omar Ramotar rs

Omar Ramotar, P.E.
Senior Engineer

REMEDIAL ENGINEERING, P.C.

Charles J. McGuckin ars

Charles J. McGuckin, P.E.
Principal Engineer

Table 1. Sample Summary, BASF Corporation, Rensselaer, New York

Task	Parameter	Analytical Method[1]	Field Samples	Duplicates	Matrix Spike (MS)	Matrix Spike Duplicate (MSD)	Field Blank	Total Number of Samples
Post Excavation Sampling of Clay Liner for the North Lagoon	VOCs	8260	12	2	2	2	2	20
	SVOCs	8270	3	1	1	1	1	7
	TAL Metals	6010B	3	1	1	1	1	7
Post Excavation Sampling of Clay Liner for the South Lagoon	VOCs	8260	13	2	2	2	2	21
	SVOCs	8270	4	1	1	1	1	8
	TAL Metals	6010B	4	1	1	1	1	8
Confirmation Soil Sampling for Staging Area and Perimeter Areas of Concern	VOCs	8260	13	1	1	1	1	17

Notes:

(1) USEPA 1986, Test Methods for Evaluating Solid Wastes, SW-846, 3rd Ed.

VOCs - Volatile Organic Compounds

SVOCs - Semivolatile Organic Compounds

TAL - Target Analyte List

Table 2. Summary of Preservation, Holding Times and Sample Containers, BASF Corporation, Rensselaer, New York

Parameter	Preservation	Holding Time[(a)]	Containers
VOCs	4°C until extraction and analysis	14 days[(a/b)]	2 oz jar w/teflon lined lid
SVOCs	4°C until extraction and analysis	14 days until extraction[(a/c)]	8 oz jar w/teflon lined lid
TAL Metals	4°C until analysis	180 days[(a/d)]	8 oz jar w/teflon lined lid
TPH	4°C until extraction and analysis	28 days until extraction	8 oz jar w/teflon lined lid
TCLP VOCs	4°C until extraction and analysis	14 days	2 oz jar w/teflon lined lid
TCLP SVOCs	4°C until extraction and analysis	14 days	8 oz jar w/teflon lined lid
TCLP Metals	4°C until analysis	14 days	8 oz jar w/teflon lined lid

Notes:

(a) From time of sample collection

(b) 14 days from collection to TCLP extraction/14 days from extraction to analysis

(c) 14 days from field to TCLP extraction/7 days to extract

(d) 14 days from field to TCLP extraction/7 days to extract/180 days from extraction to analysis

VOCs - Volatile Organic Compounds
SVOCs - Semivolatile Organic Compounds
TAL - Target Analyte List
TPH - Total Petroleum Hydrocarbons
TCLP - Toxicity Characteristics Leaching Procedure

Table 3. Summary of Field Quality Control Sample Collection Frequency, BASF Corporation, Rensselaer, New York

Parameter	Media	Field Duplicate	Field Matrix Spike	Field Matrix Spike Duplicate	Field Blank[a]
Volatile Organic Compounds	Clay / Soil	1/20	1/20	1/20	1/day
Semivolatile Organic Compounds	Clay / Soil	1/20	1/20	1/20	1/day
TAL Metals	Clay / Soil	1/20	1/20	1/20	1/day

Notes:

(a) No field blank will be collected for toxicity characteristic

(b) TAL - Target Analyte List

Table 4. Summary of Laboratory Quality Control Sample Collection Frequency
BASF Corporation, Rensselaer, New York

Parameter	Media	Method Blank	MS/MSD[a]	Laboratory Replicate	Analytical Method[b]
Volatile Organic Compounds	Clay / Soil	1/20	1/20	NA	8260
Semivolatile Organic Compounds	Clay / Soil	1/20	1/20	NA	8270
TAL Metals	Clay / Soil	1/20	1/20	1/20	6010

Notes:

[a] Metals and TCLP require a matrix spike and lab duplicate

[b] USEPA 1986, Test Methods for Evaluating Solid Wastes, SW-846, 3rd Ed.

NA - Not Applicable

TAL - Target Analyte List

MS/MSD - Matrix Spike/ Matrix Spike Duplicate

Table 5. Summary of Project Quality Control Summary, BASF Corporation, Rensselaer, New York

Parameter	Matrix	Quantitation Limit[a]	Estimated Accuracy	Estimated Precision	Completeness	Analysis Method[b]
Volatile Organic Compounds	Clay / Soil	0.1 to 4 µg/kg	75-125%	50 RPD	90%	8260
Semivolatile Organic Compounds	Clay / Soil	100 to 2,000 µg/kg	11-142%	50 RPD	90%	8270
TAL Metals	Clay / Soil	0.2 to 1,000 mg/kg	65-135%	50 RPD	90%	6010

Notes:

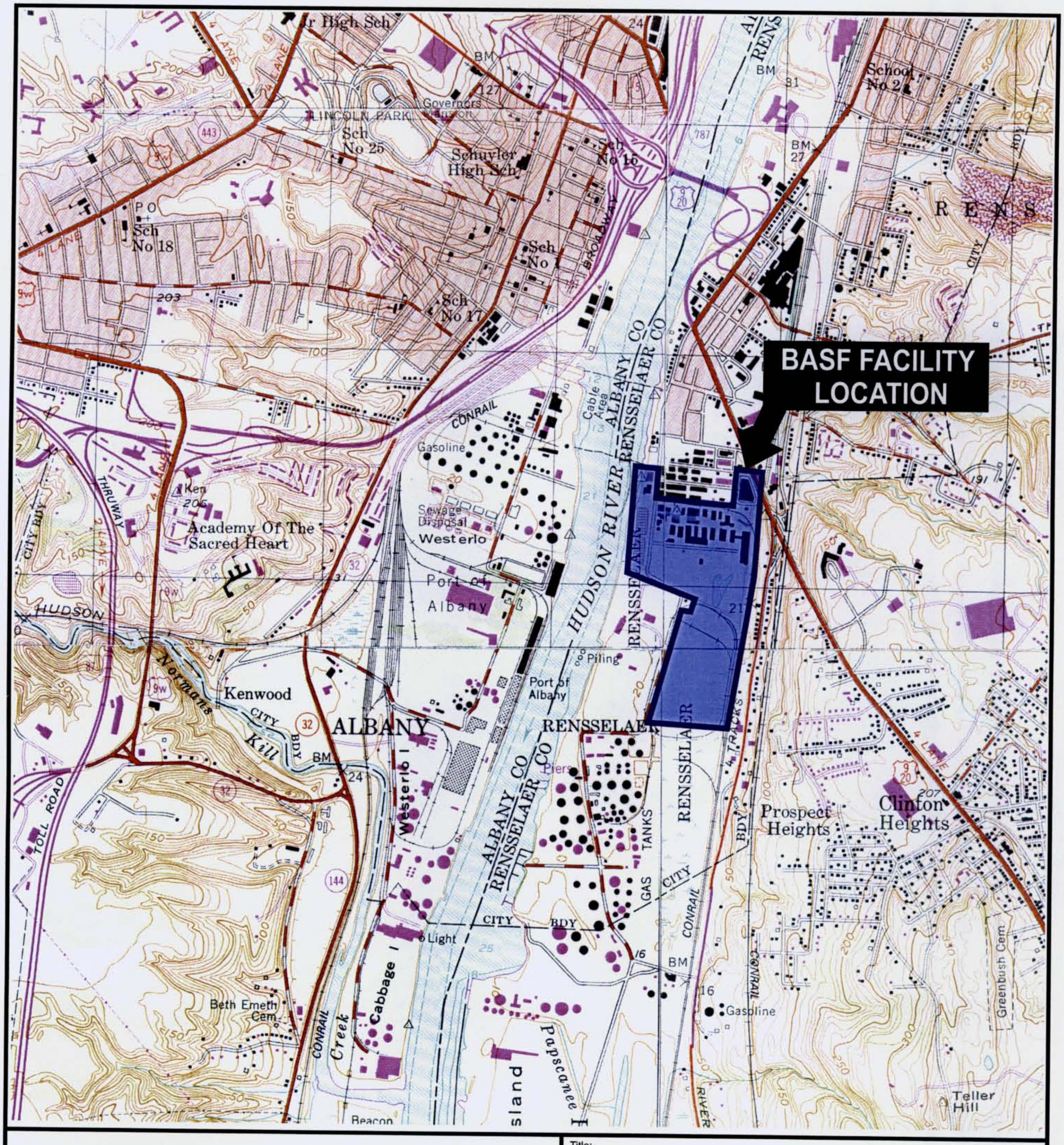
(a) Limits are based on nominal wet weight of sample. Dry weight limits will be higher.

(b) USEPA 1986, Test Methods for Evaluating Solid Wastes, SW-846, 3rd Ed.

TAL - Target Analyte List

µg/kg - micrograms per kilogram

RPD - Relative Percent Difference



BASF FACILITY LOCATION

QUADRANGLE LOCATION

SOURCE:
USGS; 1980. Albany, New York;
USGS; 1980. Troy South, New York
USGS; 1980. Delmar, New York
USGS; 1980. East Greenbush, New York
7.5 Minute Topographic Quadrangles

0 2000'

N

Title:

SITE LOCATION MAP

Prepared for:

BASF CORPORATION
MOUNT OLIVE, NEW JERSEY

ROUX ROUX ASSOCIATES, INC. *Environmental Consulting & Management*	Compiled by: O.R.	Date: 03OCT03	FIGURE
	Prepared by: R.K.	Scale: AS SHOWN	1
	Project Mgr.: O.R.	Office: NY	
	File No.: BF1133101.CDR	Project No.: 25111Y23	

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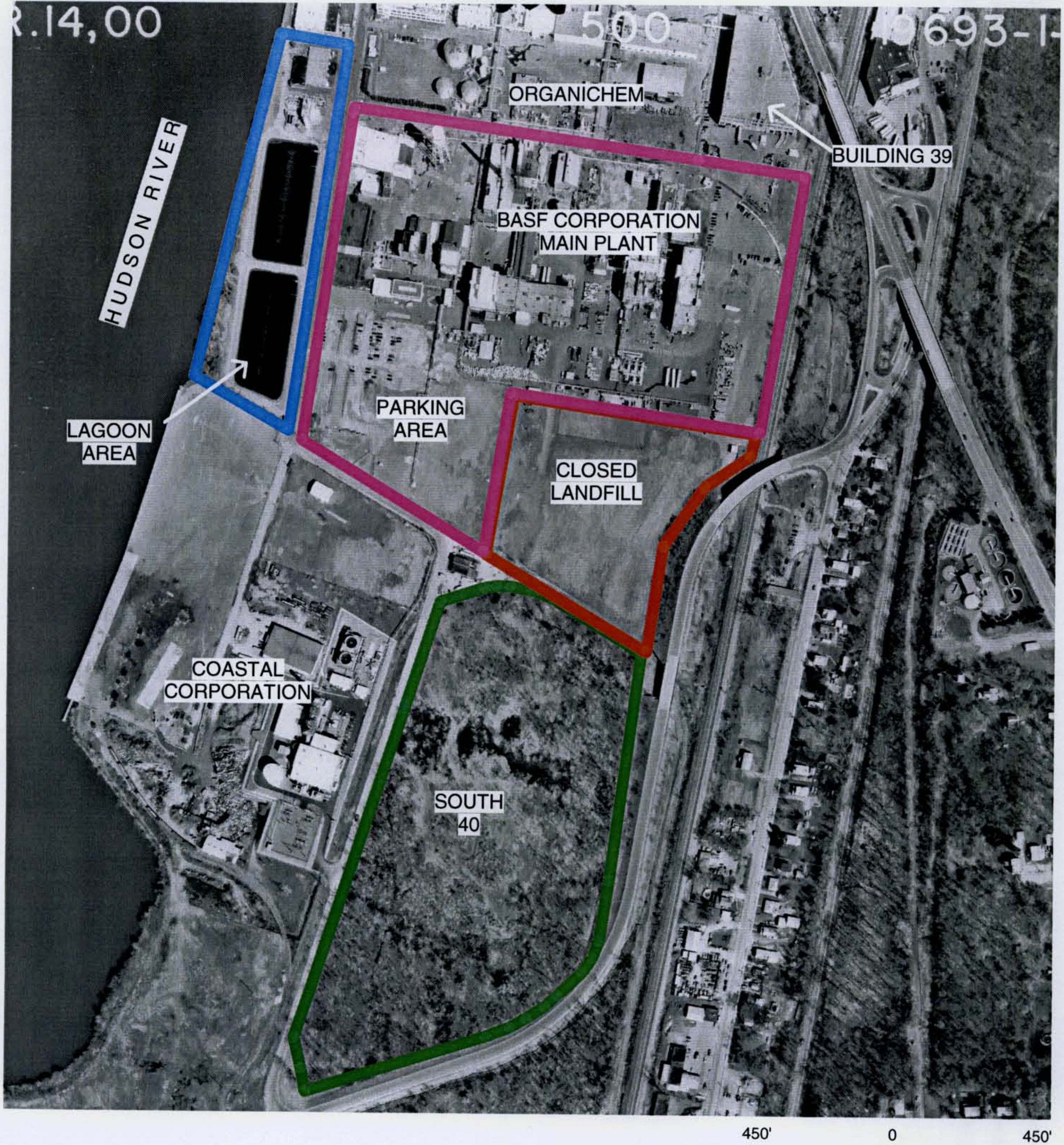


N

AERIAL PHOTOGRAPH DATE : APRIL 14, 2000

Title:

SITE AREAS

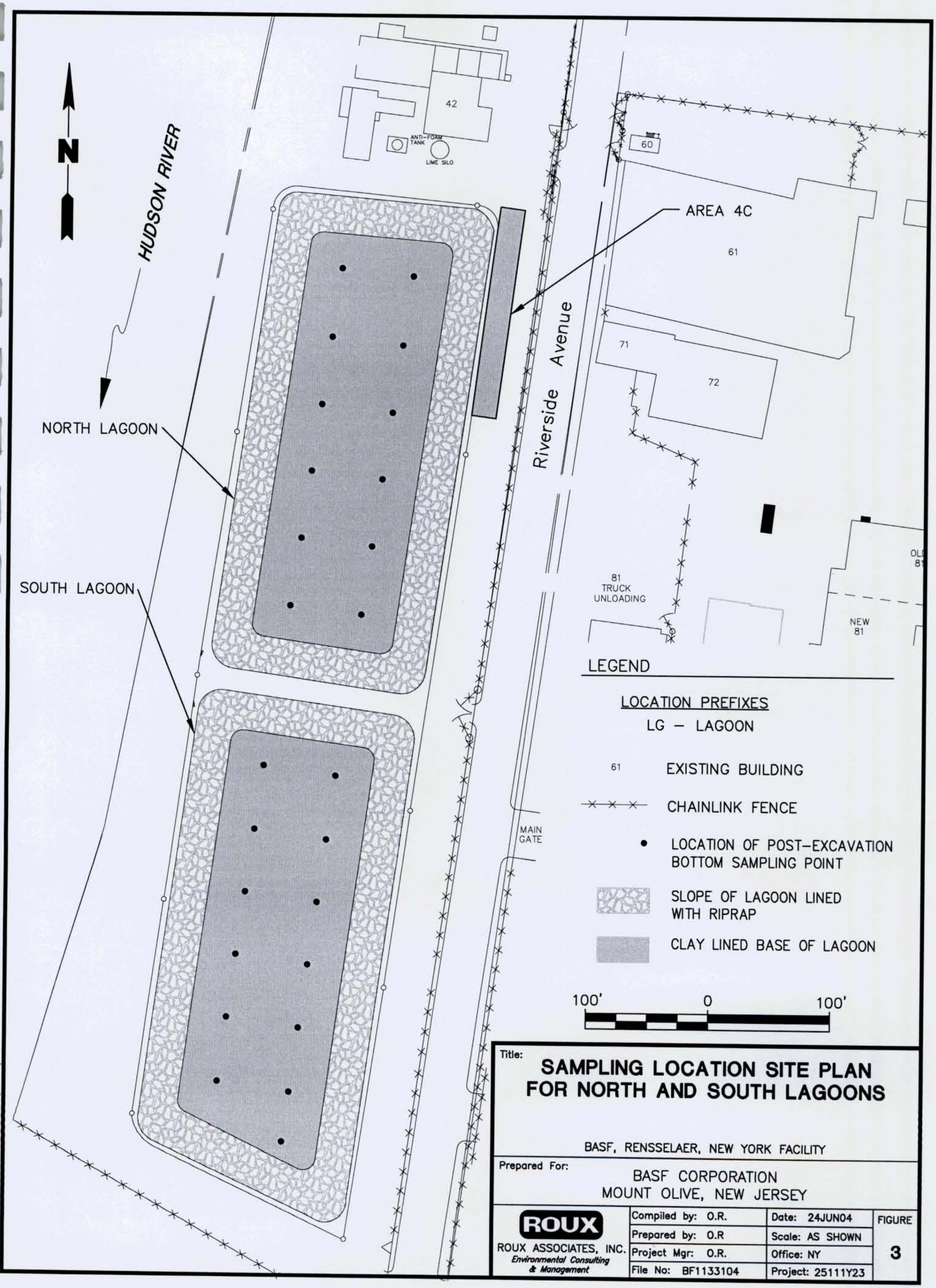
RENSSELAER, NEW YORK FACILITY

Prepared For:

BASF CORPORATION
MOUNT OLIVE, NEW JERSEY

ROUX
ROUX ASSOCIATES INC
Environmental Consulting & Management

Compiled by: S.S.	Date: 7/11/02	FIGURE
Prepared by: S.S.	Scale: AS SHOWN	2
Project Mgr: C.M.	Office: NY	
File No: BF1124201.WOR	Project: BF25111Y11	



Title:

SAMPLING LOCATION SITE PLAN FOR NORTH AND SOUTH LAGOONS

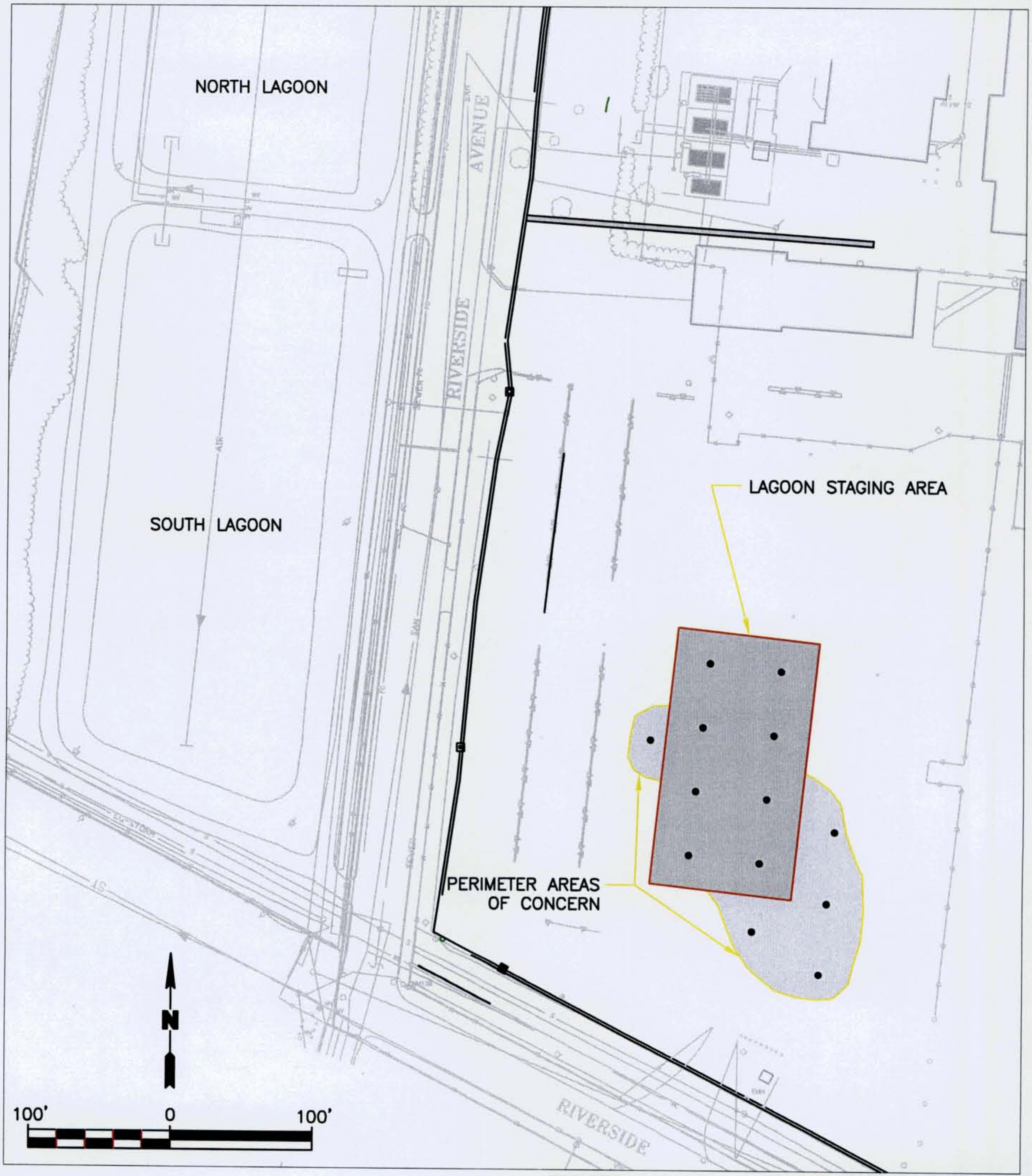
BASF, RENSSELAER, NEW YORK FACILITY

Prepared For:

BASF CORPORATION
MOUNT OLIVE, NEW JERSEY

ROUX
ROUX ASSOCIATES, INC.
Environmental Consulting & Management

Compiled by: O.R.	Date: 24JUN04	FIGURE
Prepared by: O.R	Scale: AS SHOWN	3
Project Mgr: O.R.	Office: NY	
File No: BF1133104	Project: 25111Y23	



LEGEND

● LOCATION OF SOIL SAMPLING POINT

Title:

SAMPLING LOCATION SITE PLAN FOR STAGING AREAS AND PERIMETER AREAS OF CONCERNS

BASF, RENSSELAER, NEW YORK FACILITY

Prepared For:

BASF CORPORATION
MOUNT OLIVE, NEW JERSEY

ROUX ROUX ASSOCIATES, INC. *Environmental Consulting & Management*	Compiled by: O.R.	Date: 24JUN04	FIGURE
	Prepared by: O.R.	Scale: AS SHOWN	4
	Project Mgr: O.R.	Office: NY	
	File No: BF1133105	Project: 25111Y23	

APPENDIX A

Roux Associates, Inc.
Standard Operating Procedures

STANDARD OPERATING PROCEDURE 3.2
FOR FIELD RECORD KEEPING AND
QUALITY ASSURANCE/QUALITY CONTROL

Date: May 5, 2000

1.0 PURPOSE

The purpose of this standard operating procedure (SOP) is to provide procedures and standards for record keeping and maintenance, for all field activities conducted by Roux Associates, Inc. (Roux Associates).

Strict quality assurance/quality control (QA/QC) is necessary to properly and accurately document and preserve all project-related information. Quality assurance is implemented to corroborate that quality control procedures are followed. Quality control provides a means to monitor investigation activities (e.g., sampling and laboratory performance) as a check on the quality of the data.

Valid data and information are integral to all aspects of Roux Associates' field activities. These aspects include, but are not necessarily limited to, activities that involve: drilling; sediment, sludge, and soil sampling (lithologic, and soil-quality and analysis); well construction and development; aquifer testing and analysis; water-quality sampling and analysis (surface water and ground water); free-product sampling and analysis; air-quality sampling and analysis; geophysical testing; demolition activities; waste removal operations; engineering installations; etc. The data will be confirmed by QA/QC methods established and set forth in the work plan/scope of work. Without checks on the field and analytical procedures, the potential exists for contradictory results, and associated incomplete or incorrect results from the interpretation of potentially questionable data.

Documentation will be entered in the field notebook and must be transcribed with extreme care, in a clear and concise manner, as the information recorded will become part of the permanent legal record. Because field notes are the legal record of site activities, they must be taken in a standard and consistent manner. If abbreviations are used, then they must first be spelled out for clarity (i.e., to avoid ambiguity and misunderstanding). All entries must be dated and initialed, and the time (military time) of the entry included. Field notebooks and forms must be assigned to an individual project and properly identified (i.e., client name, project number, location and name of site, individual recording information, dates, times, etc.). Change of possession of field notebooks or forms must be documented with the date and time, and initialed by both individuals. Following each day's entries, the field notebook or form must be photocopied in the event that the original documentation is lost or stolen. All field notebooks must have the company name and address legibly printed in indelible ink along with the message "If found, then please forward to Roux Associates, Inc. at the above address - REWARD OFFERED."

Information must be recorded while onsite because it may be difficult to recall details at a later date. Furthermore, information must be documented immediately as it provides unbiased information which will be used for writing the report when the field activities are completed. Project-related documentation is an irreplaceable, important record for other individuals who may become involved in the project, and provides the project manager with a complete history of project-related activities. Written information must be accompanied by maps, sketches, and photographs where appropriate, especially if these supplemental sources of information assist in the documentation process. A new page must be used in the field notebook for each new day's entries (i.e., unused portions of a previous page must have an "X" placed through it). The end of the day's records must be initialed and dated.

As part of record keeping and QA/QC activities, state and federal regulatory agencies should be contacted to check if special or different protocols are required and/or if particular or unconventional methods are required for the given field activity. Thus, the record keeping and QA/QC activities implemented by Roux Associates are based on technically sound standard practices and incorporate Roux Associates own, extensive experience in conducting hydrogeologic field activities.

2.0 MATERIALS

In order to track investigation activities, specific materials are required. These materials include the following:

a. A bound, waterproof field notebook.

b. Appropriate Roux Associates' forms (e.g., daily log, geologic log, monitoring well construction log, well sampling data form, location sketch, chain of custody, telephone conversation record, meeting notes, etc.).

c. Appropriate labels (e.g., sample, Roux Associates' Custody Seal, etc.)

d. Work plan/scope of work.

e. Health and safety plan (HASP).

f. Appropriate Roux Associates' SOPs.

g. Black pens, and indelible markers.

h. Camera and film.

3.0 DOCUMENTATION

3.1 Before the Roux Associates personnel leave the field, they must ensure that their field notes include comprehensive descriptions of the hydrogeologic conditions, and all investigation-related activities and results (onsite and offsite). This will safeguard against the inability to reconstruct and comprehend all aspects of the field investigation after its completion, and will serve to facilitate the writing of an accurate report. Properly documented information provides the QA/QC tracking (back-up) required for all Roux Associates' projects. General types of information that must be recorded (where pertinent to the investigation being conducted) include, but may not necessarily be limited to, the following:

a. List of Roux Associates personnel on site.

b. Name, date, and time of arrival on site by Roux Associates personnel, including temporary departures from, and returns to, the site during the work day.

c. Client and project number.

d. Name and location of study area.

e. Date and time of arrival on site by non-Roux Associates personnel (names and affiliation) and equipment (e.g., subcontractors and facility personnel, and drilling equipment, respectively, etc.), including temporary departures from, and returns to, the site during the work day, and departure at the end of the work day.

f. List of non-Roux Associates personnel on site.

g. Weather conditions at the beginning of the day as well as any changes in weather that occur during the working day.

h. Health and safety procedures including level of protection, monitoring of vital signs, frequency of air monitoring, and any change (i.e., downgrade or upgrade) in the level of protection for Roux Associates and other on-site personnel (e.g., subcontractors, facility personnel, etc.).

i. Health and safety procedures not in compliance with the HASP (for all on-site personnel).

j. Site reconnaissance information (e.g., topographic features, geologic features, surface-water bodies, seeps, areas of apparent contamination, facility/plant structures, etc.).

k. Air monitoring results (i.e., photoionization detector [PID], etc. measurements).

l. Task designation and work progress.

m. Work-related and site-related discussions with subcontractors, regulatory agency personnel, plant personnel, the general public, and Roux Associates personnel.

n. Delays, unusual situations, problems and accidents.

o. Field work not conducted in accordance with the work plan/scope of work, and rationale and justification for any change(s) in field procedures including discussions with personnel regarding the change(s) and who authorized the change(s).

p. QA/QC procedures not conducted in accordance with the QA/QC procedures established in the work plan/scope of work and rationale and justification for any change(s) in QA/QC procedures including discussions with personnel regarding the change(s) and who authorized the change(s).

q. Equipment and instrument problems.

r. Decontamination and calibration procedures.

s. Activities in and around the site and work area by any and all on-site personnel which may impact field activities.

t. Sketches, maps, and/or photographs (with dates and times) of the site, structures, equipment, etc. that would facilitate explanations of site conditions.

u. Contamination evidenced as a result of work-related activities (e.g., visible contaminants [sheen] in drilling fluids or on drilling equipment; sheen on, or staining of, sediments; color of, or separate [nonaqueous] phase on, water from borehole or well; vapors or odors emanating from a borehole or well; etc.); make all observations as objectively as possible (e.g., grey-blue, oil-like sheen; black and orange, rust-like stain; fuel-like odor; etc.) and avoid using nontechnical or negative-sounding terms (e.g., slimy, goopy, foul-smelling).

v. Date and time of final departure from the site of all personnel at the end of the work day.

3.2 In addition to the general types of information that must be recorded (as presented in Section 3.1), task-specific information must also be properly documented. Task-specific information which is required is provided in each respective task-oriented SOP, and the documentation procedures outlined in each SOP must be followed.

END OF PROCEDURE

Date: May 5, 2000

1.0 PURPOSE

The purpose of this standard operating procedure (SOP) is to establish guidelines for sample handling which will allow consistent and accurate results. Valid chemistry data are integral to investigations that characterize media-quality conditions. Thus, this SOP is designed to ensure that once samples are collected, they are preserved, packed and delivered in a manner which will maintain sample integrity to as great an extent as possible. The procedures outlined are applicable to most sampling events and any required modifications must be clearly described in the work plan.

2.0 CONSIDERATIONS

Sample containers, sampling equipment decontamination, quality assurance/quality control (QA/QC), sample preservation, and sample handling are all components of this SOP.

2.1 Sample Containers

Prior to collection of a sample, considerations must be given to the type of container that will be used to store and transport the sample. The type and number of containers selected is usually based on factors such as sample matrix, potential contaminants to be encountered, analytical methods requested, and the laboratory's internal quality assurance requirements. In most cases, the overriding considerations will be the analytical methodology, or the state or federal regulatory requirements because these regulations generally encompass the other factors. The sample container selected is usually based on some combination of the following criteria:

a. Reactivity of Container Material with Sample

Choosing the proper composition of sample containers will help to ensure that the chemical and physical integrity of the sample is maintained. For sampling potentially hazardous material, glass is the recommended container type because it is chemically inert to most substances. Plastic containers are not recommended for most hazardous wastes because the potential exists for contaminants to adsorb to the surface of the plastic or for the plasticizer to leach into the sample.

In some instances, however, the sample characteristics or analytes of interest may dictate that plastic containers be used instead of glass. Because some metals species will adhere to the sides of the glass containers in an aqueous matrix, plastic bottles (e.g., nalgene) must be used for samples collected for metals analysis. A separate, plastic container should accompany glass containers if metals analysis is to be performed along with other analyses. Likewise, other sample characteristics may dictate that glass cannot be used. For example, in the case of a strong alkali waste or hydrofluoric solution, plastic containers may be more suitable because glass containers may be etched by these compounds and create adsorptive sites on the container's surface.

b. Volume of the Container

The volume of sample to be collected will be dictated by the analysis being performed and the sample matrix. The laboratory must supply bottles of sufficient volume to perform the required analysis. In most cases, the methodology dictates the volume of sample material required to complete the analysis. However, individual laboratories may provide larger volume containers for various analytes to ensure sufficient quantities for duplicates or other QC checks.

To facilitate transfer of the sample from the sampler into the container and to minimize spillage and sample disturbance, wide-mouth containers are recommended. Aqueous volatile organic samples must be placed into 40-milliliter (ml) glass vials with polytetrafluoroethylene (PTFE) (e.g., TeflonTM) septums. Non-aqueous volatile organic samples should be collected in the same type of vials or in 4-ounce (oz) wide-mouth jars provided by the laboratory. These jars should have PTFE-lined screw caps.

c. Color of Container

Whenever possible, amber glass containers should be used to prevent photodegradation of the sample, except when samples are being collected for metals analysis. If amber containers are not available, then containers holding samples should be protected from light (i.e., place in cooler with ice immediately after filling).

d. Container Closures

Container closures must screw on and off the containers and form a leak-proof seal. Container caps must not be removed until the container is ready to be filled with the sample, and the container cap must be replaced (securely) immediately after filling it. Closures should be constructed of a material which is inert with respect to the sampled material, such as PTFE (e.g., TeflonTM). Alternately, the closure may be separated from the sample by a closure liner that is inert to the sample material such as PTFE sheeting. If soil or sediment samples are being collected, the threads of the container must be wiped clean with a dedicated paper towel or cloth so the cap can be threaded properly.

e. Decontamination of Sample Containers

Sample containers must be laboratory cleaned by the laboratory performing the analysis. The cleaning procedure is dictated by the specific analysis to be performed on the sample. Sample containers must be carefully examined to ensure that all containers appear clean. Do not mistake the preservative as unwanted residue. The bottles should not be field cleaned. If there is any question regarding the integrity of the bottle, then the laboratory must be contacted immediately and the bottle(s) replaced.

f. Sample Bottle Storage and Transport

No matter where the sample bottles are, whether at the laboratory waiting to be packed for shipment or in the field waiting to be filled with sample, care must be taken to avoid contamination. Sample shuttles or coolers, and sample bottles must be stored and transported in clean environments. Sample bottles and clean sampling equipment must never be stored near solvents, gasoline, or other equipment that is a potential source of cross-contamination. When under chain of custody, sample bottles must be secured in locked vehicles, and custody sealed in shuttles or in the presence of authorized personnel. Information which documents that proper storage and transport procedures have been followed must be included in the field notebook and on appropriate field forms.

2.2 Decontamination of Sampling Equipment

Proper decontamination of all re-usable sampling equipment is critical for all sampling episodes. The SOP for Decontamination of Field Equipment and SOPs for method-specific or instrument-specific tasks must also be referred to for guidance for decontamination of various types of equipment.

2.3 Quality Assurance/Quality Control Samples

QA/QC samples are intended to provide control over the proper collection and tracking of environmental measurements, and subsequent review, interpretation and validation of generated analytical data. The SOPs for Collection of Quality Control Samples, for Evaluation and Validation of Data, and for Field Record Keeping and Quality Assurance/Quality Control must be referred to for detailed guidance regarding these respective procedures. SOPs for method-specific or instrument-specific tasks must also be referred to for guidance for QA/QC procedures.

2.4 Sample Preservation Requirements

Certain analytical methodologies for specific analytes require chemical additives in order to stabilize and maintain sample integrity. Generally, this is accomplished under the following two scenarios:

a. Sample bottles are preserved at the laboratory prior to shipment into the field.

b. Preservatives are added in the field immediately after the samples are collected.

Many laboratories provide pre-preserved bottles as a matter of convenience and to help ensure that samples will be preserved immediately upon collection. A problem associated with this method arises if not enough sample could be collected, resulting in too much preservative in the sample. More commonly encountered problems with this method include the possibility of insufficient preservative provided to achieve the desired pH level or the need for additional preservation due to chemical reactions caused by the addition of sample liquids to pre-preserved bottles. The use of pre-preserved bottles is acceptable; however, field sampling teams must always be prepared to add additional preservatives to samples if the aforementioned situations occur. Furthermore, care must be exercised not to overfill sample bottles containing preservatives to prevent the sample and preservative from spilling and therefore diluting the preservative (i.e., not having enough preservative for the volume of sample).

When samples are preserved after collection, special care must be taken. The transportation and handling of concentrated acids in the field requires additional preparation and adherence to appropriate preservation procedures. All preservation acids used in the field should be trace-metal or higher-grade.

2.5 Sample Handling

After the proper sample bottles have been received under chain-of-custody, properly decontaminated equipment has been used to collect the sample, and appropriate preservatives have been added to maintain sample integrity, the final step for the field personnel is checking the sample bottles prior to proper packing and delivery of the samples to the laboratory.

All samples should be organized and the labels checked for accuracy. The caps should be checked for tightness and any 40-ml volatile organic compound (VOC) bottles must be checked for bubbles. Each sample bottle must be placed in an individual "zip-lock" bag to protect the label, and placed on ice. The bottles must be carefully packed to prevent breakage during transport. When several bottles have been collected for an individual sample, they should not be placed adjacent to each other in the cooler to prevent possible breakage of all bottles for a given sample. If there are any samples which are known or suspected to be highly contaminated, these should be placed in an individual cooler under separate chain-of-custody to prevent possible cross contamination. Sufficient ice (wet or blue packs) should be placed in the cooler to maintain the temperature at 4 degrees Celsius (°C) until delivery at the laboratory. Consult the work plan to determine if a particular ice is specified as the preservation for transportation (e.g., the United States Environmental Protection Agency does not like the use of blue packs because they claim that the samples will not hold at 4°C). If additional coolers are required, then they should be purchased. The chain-of-custody form should be properly completed, placed in a "zip-lock" bag, and placed in the cooler. One copy must be maintained for the project files. The cooler should be sealed with packing tape and a custody seal. The custody seal number should be noted in the field book. Samples collected from Monday through Friday will be delivered to the laboratory within 24 hours of collection. If Saturday delivery is not available, samples collected on Friday must be delivered by Monday morning. Check the work plan to determine if certain analytes require a shorter delivery time. If overnight mail is utilized, then the shipping bill must be maintained for the files and the laboratory must be called the following day to confirm receipt.

3.0 EQUIPMENT AND MATERIALS

3.1 General equipment and materials may include, but not necessarily be limited to, the following:

a. Sample bottles of proper size and type with labels.

b. Cooler with ice (wet or blue pack).

c. Field notebook, appropriate field form(s), chain-of-custody form(s), custody seals.

d. Black pen and indelible marker.

e. Packing tape, "bubble wrap", and "zip-lock" bags.

f. Overnight (express) mail forms and laboratory address.

g. Health and safety plan (HASP).

h. Work plan/scope of work.

i. Pertinent SOPs for specified tasks and their respective equipment and materials.

3.2 Preservatives for specific samples/analytes as specified by the laboratory. Preservatives must be stored in secure, spillproof glass containers with their content, concentration, and date of preparation and expiration clearly labeled.

3.3 Miscellaneous equipment and materials including, but not necessarily limited to, the following:

a. Graduated pipettes.

b. Pipette bulbs.

c. Litmus paper.

d. Glass stirring rods.

e. Protective goggles.

f. Disposable gloves.

g. Lab apron.

h. First aid kit.

i. Portable eye wash station.

j. Water supply for immediate flushing of spillage, if appropriate.

k. Shovel and container for immediate containerization of spillage-impacted soils, if appropriate.

4.0 PROCEDURE

4.1 Examine all bottles and verify that they are clean and of the proper type, number, and volume for the sampling to be conducted.

4.2 Label bottles carefully and clearly with project name and number, site location, sample identification, date, time, and the sampler's initials using an indelible marker.

4.3 Collect samples in the proper manner (refer to specific sampling SOPs).

4.4 Conduct preservation activities as required after each sample has been collected. Field preservation must be done immediately and must not be done later than 30 minutes after sample collection.

4.5 Conduct QC sampling, as required.

4.6 Seal each container carefully and place in an individual "zip lock" bag.

4.7 Organize and carefully pack all samples in the cooler immediately after collection (e.g., bubble wrap). Insulate samples so that breakage will not occur.

4.8 Complete and place the chain-of-custody form in the cooler after all samples have been collected. Maintain one copy for the project file. If the cooler is to be transferred several times prior to shipment or delivery to the laboratory, it may be easier to tape the chain-of-custody to the exterior of the sealed cooler. When exceptionally hazardous samples are known or suspected to be present, this should be identified on the chain-of-custody as a courtesy to the laboratory personnel.

4.9 Add additional ice as necessary to ensure that it will last until receipt by the laboratory.

4.10 Seal the cooler with packing tape and a custody seal. Record the number of the custody seal in the field notebook and on the field form. If there are any exceptionally hazardous samples, then shipping regulations should be examined to ensure that the sample containers and coolers are in compliance and properly labeled.

4.11 Samples collected from Monday through Friday will be delivered to the laboratory within 24 hours of collection. If Saturday delivery is not available, samples collected on Friday must be delivered by Monday morning. Check the work plan to determine if certain analytes require a shorter delivery time.

4.12 Maintain the shipping bill for the project files if overnight mail is utilized and call the laboratory the following day to confirm receipt.

END OF PROCEDURE

Date: May 5, 2000

1.0 PURPOSE

The purpose of this standard operating procedure (SOP) is to establish the criteria to be followed for the evaluation of data quality and for data validation. Because valid media-quality data are integral to environmental investigations that characterize site conditions, the quality of the data generated by a laboratory is extremely important to the successful completion of a project. The level of data evaluation and validation required is determined by the project data quality objectives and must be outlined in the work plan/scope of work. Data collected to establish qualitative trends, for example, do not require the same level of validation as data generated to support litigation.

The data evaluation procedure described in Section 2.0 of this SOP is designed to provide a measure of comparability regarding quality control (QC) samples, i.e., between duplicate or replicate samples and to detect any contamination or bias in analyses of blanks. They may be used for both intra-laboratory and inter-laboratory comparisons.

The data validation procedure described in Section 3.0 of this SOP is designed to provide a stringent review of analytical chemical data with respect to sample receipt and handling, analytical methods used, and data reporting and deliverables.

Prior to performing any data evaluation or validation, it is crucial that all appropriate regulatory agencies be contacted and their data validation requirements be determined, as these requirements vary from agency to agency and may vary among different Regions of the United States Environmental Protection Agency (USEPA).

2.0 PROCEDURE FOR EVALUATION OF DATA

2.1 Not all analytical data packages will require a full data validation procedure as described in Section 3.0. The procedures described in this section provide an initial screening to help decide if full data validation is warranted. These data evaluation procedures are used as a quality assurance (QA) check for water-quality data, and are not generally applicable to soil-quality data. They are to be used when a full data validation procedure (described in Section 3.0) is not required.

2.2 Primary/Replicate, Primary Split and Primary/Laboratory Duplicate Comparisons

X = primary sample concentration

Y = replicate/split/laboratory duplicate sample concentration

Z = $\{(X-Y)/[(X+Y)/2]\} \times 100$

IDC = initial concentration requiring dilution, if samples have been diluted. If samples did not require dilution, then use the first range (i.e., QL-10[QL]).

QL = Quantitation Limit(1)

Organic Constituents

Range	Quantitative	Qualitative	Unusable
QL - 10(QL)	$Z \leq 60\%$	$100\% > Z > 60\%$	$Z \geq 100\%$
10(QL) - IDC	$Z \leq 40\%$	$100\% > Z > 40\%$	$Z \geq 100\%$
X or Y > IDC	$Z \leq 60\%$	$100\% > Z > 60\%$	$Z \geq 100\%$

Inorganic Constituents

Analytical Method	Quantitative	Qualitative	Unusable
Wet Chemistry testing	$Z \leq 60\%$	$100\% > Z > 60\%$	$Z \geq 100\%$
Atomic Absorption (AA)	$Z \leq 40\%$	$100\% > Z > 40\%$	$Z \geq 100\%$
Inductively Coupled Plasma (ICP)	$Z \leq 40\%$	$100\% > Z > 40\%$	$Z \geq 100\%$

2.3 Comparison of Blanks

X = primary sample concentration(2)

D = highest concentration in associated blank(s)

Y = X/dilution factor

	Quantitative	Qualitative	Unusable
Field Blank	$D \leq 0.1X$	$0.5X > D > 0.1X$	$D \geq 0.5X$
Trip Blank	$D \leq 0.1X$	$0.5X > D > 0.1X$	$D \geq 0.5X$
Lab Blank	$D \leq 0.1Y$	$0.5Y > D > 0.1Y$	$D \geq 0.5Y$

(1)The quantitation limit will be dependent upon the specific methodology and the matrix, and will be either the minimum detection limit (MDL) or the practical quantitation limit (PQL).

(2)Results reported as BDL (below the detection limit) will be considered Quantitative because the primary samples have not been affected by the bias(es) which resulted in concentrations reported in the blank sample(s).

3.0 PROCEDURE FOR DATA VALIDATION

3.1 Determine study-specific data quality needs and pertinent regulatory agency data validation requirements.

3.2 Contact the appropriate regulatory agency(ies) to obtain their data validation procedure manual. This manual will indicate acceptable ranges for QC parameters to be investigated and procedures to follow for data which do not meet these requirements.

3.3 For inorganic compounds, the requirements that will be examined during the validation process are:

a. Holding times.

b. Instrument calibration, including initial and continuing calibration verification.

c. Blank(s).

d. Laboratory control sample(s).

e. Inductively Coupled Plasma (ICP) interference check samples.

f. Duplicate sample(s).

g. Matrix spike sample(s).

h. Furnace atomic absorption QC.

i. ICP serial dilution(s).

j. Sample result verifications.

k. Field duplicates.

l. General data assessment.

3.4 For organic compounds, the requirements that will be examined during the validation process are:

a. Holding times.

b. Gas Chromatograph/Mass Spectrometer (GC/MS) tuning.

c. GC calibration, initial and continuing.

d. Blanks.

e. Surrogate recoveries.

f. Matrix spike/matrix spike duplicates.

g. Internal standards performances.

h. Target Compounds List (TCL) compound identifications.

i. Reported detection limits.

j. Tentatively identified compounds (TICs).

k. Overall system performance.

l. General data assessment.

3.5 The parameters which do not conform to requirements are then listed and the data are qualified according to the guidelines provided in the appropriate regulatory agency's data validation procedure manual. The qualified data package is then reviewed and the project data reviewer, the project geochemist and/or the project manager makes a professional judgement concerning the validity of the data package, and its usability for the project.

END OF PROCEDURE

STANDARD OPERATING PROCEDURE 5.1
FOR COLLECTION OF SOIL SAMPLES
FOR LABORATORY ANALYSIS

Date: May 5, 2000

1.0 PURPOSE

The purpose of this Standard Operating Procedure (SOP) is to establish guidelines for the collection of soil samples for laboratory analysis. This SOP is applicable to soil samples collected from split-spoon samplers during drilling, hand auger samples, grab samples from stockpiled soils, surface samples, test pit samples, etc.

2.0 CONSIDERATIONS

Soil samples may be collected in either a random or biased manner. Random samples can be based on a grid system or statistical methodology. Biased samples can be collected in areas of visible impact or suspected source areas. Soil samples can be collected at the surface, shallow subsurface, or at depth. When samples are collected at depth the water content should be noted, since generally "soil sampling" is restricted to the unsaturated zone. Equipment selection will be determined by the depth of the sample to be collected. A thorough description of the sampling locations and proposed methods of sample collection should be included in the work plan.

Commonly, surface sampling refers to the collection of samples at a 0 to 6 inch depth interval. Certain regulatory agencies may define the depth interval of a surface sample differently, and this must be defined in the work plan. Collection of surface soil samples is most efficiently accomplished with the use of a stainless steel trowel or scoop. For samples at greater depths a decontaminated bucket auger or power auger may be needed to advance the hole to the point of sample collection. Another clean bucket auger should then be used to collect the sample. To collect samples at depths of greater than approximately six feet the use of a drill rig and split spoon samples will usually be necessary. In some situations, sample locations are accessed with the use of a backhoe.

3.0 MATERIALS/EQUIPMENT

a. A work plan which outlines soil sampling requirements.

b. Field notebook, field form(s), maps, chain-of-custody forms, and custody seals.

c. Decontamination supplies (including: non-phosphate, laboratory grade detergent, buckets, brushes, potable water, distilled water, regulatory-required reagents, aluminum foil, plastic sheeting, etc.).

d. Sampling device (split-spoon sampler, stainless steel hand auger, stainless steel trowel, etc.).

e. Stainless steel spoons or spatulas.

f. Disposable sampling gloves.

g. Laboratory-supplied sample containers with labels.

h. Cooler with blue or wet ice.

i. Plastic sheeting.

j. Black pen and indelible marker.

k. Zip-lock bags and packing material.

l. Tape measure.

m. Paper towels or clean rags.

n. Masking and packing tape.

o. Overnight (express) mail forms.

4.0 DECONTAMINATION

All reusable sampling equipment will be thoroughly cleaned according to the decontamination SOP. Where possible, thoroughly pre-cleaned and wrapped sampling equipment should be used and dedicated to individual sampling locations. Disposable items such as sampling gloves, aluminum foil, and plastic sheeting will be changed after each use and discarded in an appropriate manner.

5.0 PROCEDURE

5.1 Prior to collecting soil samples, ensure that all sampling equipment has been thoroughly cleaned according to the decontamination SOP. If samples are to be collected at depth, then the boring must be advanced with thoroughly cleaned equipment to the desired sampling horizon and a different thoroughly cleaned sampler must be used to collect the sample.

5.2 Using disposable gloves and a pre-cleaned, stainless steel spatula or spoon, extract the soil sample from the sampler, measure the recovery, and separate the wash from the true sample. Where allowed by regulatory agency(ies), disposable plastic spoons may be used.

5.3 Place the sample in a laboratory-supplied, pre-cleaned sample container. This should be done as quickly as possible and this is especially important when sampling for volatile organic compounds (VOCs). Samples to be analyzed for VOCs must be collected prior to other constituents.

5.4 The sample container will be labeled with appropriate information such as, client name, site location, sample identification (location, depth, etc.), date and time of collection, and sampler's initials.

5.5 Using the remaining portion of soil from the sampler, log the sample in detail and record sediment characteristics (color, odor, moisture, texture, density, consistency, organic content, layering, grain size, etc.).

5.6 If soil samples are to be composited in the field, then equal portions from selected locations will be placed on a clean plastic sheet and homogenized. Alternately, several samples may be submitted to the laboratory for compositing by weight. The method used is dependent upon regulatory requirements. Specific compositing procedures shall be approved by the appropriate regulatory agency and described in the work plan. Samples to be analyzed for VOCs will not be composited unless required by a regulatory agency.

5.7 After the sample has been collected, labeled, and logged in detail, it is placed in a zip-lock bag and stored in a cooler at 4°C.

5.8 A chain-of-custody form is completed for all samples collected. One copy is retained and two are sent with the samples in a zip-lock bag to the laboratory. A custody seal is placed on the cooler prior to shipment.

5.9 Samples collected from Monday to Friday are to be delivered to the laboratory within 24 hours of collection. If Saturday delivery is unavailable, samples collected on Friday must be delivered by Monday morning. Check the work plan to determine if any analytes require a shorter delivery time.

5.10 The field notebook and appropriate forms should include, but not be limited to the following: client name, site location, sample location, sample depth, sample identification, date and time collected, sampler's name, method of sample collection, number and type of containers, geologic description of material, description of decontamination procedures, etc. A site map should be prepared with exact measurements to each sample location in case follow-up sampling is necessary.

5.11 All reusable sampling equipment must be thoroughly cleaned in accordance with the decontamination SOP. Following the final decontamination (after all samples are collected) the sampling equipment is wrapped in aluminum foil. Discard any gloves, foil, plastic, etc. in an appropriate manner that is consistent with site conditions.

END OF PROCEDURE

STANDARD OPERATING PROCEDURE 5.4 FOR SCREENING SOIL SAMPLES FOR VOLATILE ORGANIC VAPORS USING A PORTABLE PHOTOIONIZATION DETECTOR

Date: May 5, 2000

1.0 PURPOSE

The purpose of this standard operating procedure (SOP) is to establish guidelines for screening soil samples for volatile organic vapors using a portable photoionization detector (PID). This SOP is applicable to soil samples collected from split-spoon samplers during drilling, hand auger samples, and grab samples from stockpiled soils.

2.0 CONSIDERATIONS

The primary objective of photoionization screening of soil samples is to obtain a qualitative understanding of the distribution of volatile organic compounds (VOCs) in soil. The proper design of an organic vapor screening program requires an understanding of site hydrogeology, potential source areas, and potential constituents of concern. Sample locations and frequency must be fully defined in the work plan. The work plan should outline the type of lamp to be utilized in the PID based on the ionization potentials and response factors of the constituents of concern. The work plan must also clearly describe the heating or equilibration procedures to be employed if they differ from those described in this SOP. Regardless of the specific equilibration procedure employed, it is imperative that each sample be treated identically to allow the photoionization results from different locations to be compared. Observations such as water, clay, and organic content should be noted to facilitate interpretation of the data. Every effort should be made to collect a representative portion of soil from the sampling device.

3.0 MATERIALS/EQUIPMENT

a. A work plan which outlines photoionization screening requirements.

b. Decontamination supplies (including: non-phosphate, laboratory grade detergent, buckets, brushes, potable water, distilled water, regulatory-required reagents [e.g., acetone, nitric acid, hexane, etc.], aluminum foil, plastic sheeting, etc.).

c. Field notebook, field form(s), maps, chain-of-custody forms.

d. Sampling device (split-spoon sampler, stainless steel hand auger, stainless steel trowel, etc.).

e. Stainless steel spoons or spatulas.

f. Disposable plastic spoons.

g. Plastic sheeting.

h. Aluminum foil.

i. Mason jars or driller's jars.

j. Water bath (hot plate, extension cord, water tray, thermometer).

k. Photoionization detector with charging unit.

l. Calibration gases with regulator.

m. Indelible marker.

n. Masking tape.

o. Disposable sampling gloves.

4.0 DECONTAMINATION

Where possible, thoroughly pre-cleaned and wrapped sampling equipment must be used and dedicated to individual sampling locations. Disposable items such as sampling gloves, aluminum foil, and sample jars will be changed after each use and discarded in an appropriate manner. If only photoionization results are to be obtained, then split-spoon samples and hand augers may be cleaned with a soap and water wash and potable water rinse or steam cleaning, and a final distilled water rinse. However, if samples are to be collected concurrently for laboratory analytical results, then all reusable sampling equipment must be thoroughly decontaminated according to the SOP for decontamination of field equipment.

5.0 CALIBRATION

The PID must be calibrated according to the manufacturer's specifications at a minimum frequency of once per day prior to collecting photoionization readings. In addition, periodic checks (e.g., every 2 hours or every ten samples) with the standard gas will be conducted to confirm that the calibration has not drifted. The time, date, and calibration procedure must be clearly documented in the field notebook and the calibration log. If at any time the photoionization results appear erratic or inconsistent with field observations, then the unit must be recalibrated. If calibration is difficult to achieve, then the unit's lamp should be checked for dirt or moisture and cleaned, as necessary. During humid or wet conditions, the unit should be calibrated on a more frequent basis as determined by field personnel.

6.0 PROCEDURE

6.1 Extract the soil sample from the sampler, quickly measure the recovery, and separate the wash from the true sample by using a dedicated, stainless steel spatula. Where allowed by regulatory agency(ies), disposable plastic spoons may be used.

6.2 Place the sample in a pre-cleaned glass jar (as quickly as possible to avoid loss of VOCs) filling the jar half full. Place an aluminum foil seal between the glass and metal cap and screw tight.

6.3 Label jars with the boring number, depth of sample, date of collection and blow counts. In addition, the field personnel will ensure the following: samples are taken at appropriate depths; unrepresentative portions of the sample are discarded properly; that the sampler is decontaminated properly between use; and the driller uses proper methods during sample collection and does not use oil or grease on tools entering the borehole.

6.4 Log the sample in detail and record sediment characteristics (color, odor, moisture, texture, density, consistency, organic content, and layering).

6.5 After the sample has been collected, heat the sample under controlled conditions in a water bath for a 2 minute period.

6.6 Ensure that the PID has been calibrated and that the calibration information is documented in the field book. Pierce the aluminum foil seal with the probe from the PID and measure the relative concentration of VOCs in the headspace of the soil sample. The initial (peak) reading must be recorded.

6.7 Record the PID reading in the field notebook, on an appropriate field form, and on the base map, if appropriate.

6.8 Place any material not representative of the interval sampled in a pile with the other cuttings from the borehole.

6.9 If only photoionization results are to be obtained, then reusable sampling devices may be cleaned with a soap and water wash and a potable water rinse. The sampler will then be rinsed with distilled water, assembled and placed on plastic sheeting for reuse. A more rigorous decontamination procedure is required when samples are also being collected for laboratory analysis. Refer to the SOP for collection of soil samples for laboratory analysis for additional information.

END OF PROCEDURE

STANDARD OPERATING PROCEDURE 9.1
FOR DECONTAMINATION OF FIELD EQUIPMENT

Date: May 5, 2000

1.0 PURPOSE

The purpose for this standard operating procedure (SOP) is to establish the guidelines for decontamination of all field equipment potentially exposed to contamination during drilling, and soil and water sampling. The objective of decontamination is to ensure that all drilling, and soil-sampling and water-sampling equipment is decontaminated (free of potential contaminants): 1) prior to being brought onsite to avoid the introduction of potential contaminants to the site; 2) between drilling and sampling events/activities onsite to eliminate the potential for cross-contamination between boreholes and/or wells; and 3) prior to the removal of equipment from the site to prevent the transportation of potentially contaminated equipment offsite.

In considering decontamination procedures, state and federal regulatory agency requirements must be considered because of potential variability between state and federal requirements and because of variability in the requirements of individual states. Decontamination procedures must be in compliance with state and/or federal protocols in order that regulatory agency(ies) scrutiny of the procedures and data collected do not result in non acceptance (invalidation) of the work undertaken and data collected.

2.0 PROCEDURE FOR DRILLING EQUIPMENT

The following is a minimum decontamination procedure for drilling equipment. Drilling equipment decontamination procedures, especially any variation from the method itemized below, will be documented on an appropriate field form or in the field notebook.

2.1 The rig and all associated equipment should be properly decontaminated by the contractor before arriving at the test site.

2.2 The augers, drilling casings, rods, samplers, tools, rig, and any piece of equipment that can come in contact (directly or indirectly) with the soil, will be steam cleaned onsite prior to set up for drilling to ensure proper decontamination.

2.3 The same steam cleaning procedures will be followed between boreholes (at a fixed on-site location[s], if appropriate) and before leaving the site at the end of the study.

2.4 All on-site steam cleaning (decontamination) activities will be monitored and documented by a member(s) of the staff of Roux Associates, Inc.

2.5 If drilling activities are conducted in the presence of thick, sticky oils (e.g., PCBs) which coat drilling equipment, then special decontamination procedures may have to be utilized before steam cleaning (e.g., hexane scrub and wash).

2.6 Containment of decontamination fluids may be necessary (e.g., rinseate from steam cleaning) or will be required (e.g., hexane), and disposal must be in accordance with state and/or federal procedures.

3.0 PROCEDURE FOR SOIL-SAMPLING EQUIPMENT

The following is a minimum decontamination procedure for soil-sampling equipment (e.g., split spoons, stainless-steel spatulas). Soil-sampling equipment decontamination procedures, especially any variation from the method itemized below, will be documented on an appropriate field form or in the field notebook.

3.1 Wear disposable gloves while cleaning equipment to avoid cross-contamination and change gloves as needed.

3.2 Steam clean the sampler or rinse with potable water. If soil-sampling activities are conducted in the presence of thick, sticky oils (e.g., PCBs) which coat sampling equipment, then special decontamination procedures may have to be utilized before steam cleaning and washing in detergent solution (e.g., hexane scrub and wash).

3.3 Prepare a non-phosphate, laboratory-grade detergent solution and distilled or potable water in a clean bucket.

3.4 Disassemble the sampler, as necessary and immerse all parts and other sampling equipment in the solution.

3.5 Scrub all equipment in the bucket with a brush to remove any adhering particles.

3.6 Rinse all equipment with copious amounts of potable water followed by distilled or deionized water.

3.7 Place clean equipment on a clean plastic sheet (e.g., polyethylene)

3.8 Reassemble the cleaned sampler, as necessary.

3.9 Transfer the sampler to the driller (or helper) making sure that this individual is also wearing clean gloves, or wrap the equipment with a suitable material (e.g., plastic bag, aluminum foil.

As part of the decontamination procedure for soil-sampling equipment, state and/or federal protocols must be considered. These may require procedures above those specified as minimum for Roux Associates, Inc., such as the use of nitric acid, acetone, etc. Furthermore, the containment and proper disposal of decontamination fluids must be considered with respect to regulatory agency(ies) requirements.

4.0 PROCEDURE FOR WATER-SAMPLING EQUIPMENT

The following is a decontamination procedure for water-sampling equipment (e.g., bailers, pumps). Water-sampling equipment decontamination procedures, especially any variation from the method itemized below, will be documented on an appropriate field form or in the field notebook.

4.1 Decontamination procedures for bailers follow:

a. Wear disposable gloves while cleaning bailer to avoid cross-contamination and change gloves as needed.

b. Prepare a non-phosphate, laboratory-grade detergent solution and potable water in a bucket.

c. Disassemble bailer (if applicable) and discard cord in an appropriate manner, and scrub each part of the bailer with a brush and solution.

d. Rinse with potable water and reassemble bailer.

e. Rinse with copious amounts of distilled or deionized water.

f. Air dry.

g. Wrap equipment with a suitable material (e.g., clean plastic bag, aluminum foil).

h. Rinse bailer at least three times with distilled or deionized water before use.

4.2 Decontamination procedures for pumps follow:

a. Wear disposable gloves while cleaning pump to avoid cross-contamination and change gloves as needed.

b. Prepare a non-phosphate, laboratory-grade detergent solution and potable water in a clean bucket, clean garbage can, or clean 55-gallon drum.

c. Flush the pump and discharge hose (if not disposable) with the detergent solution, and discard disposable tubing and/or cord in an appropriate manner.

d. Flush the pump and discharge hose (if not disposable) with potable water.

e. Place the pump on clear plastic sheeting.

f. Wipe any pump-related equipment (e.g., electrical lines, cables, discharge hose) that entered the well with a clean cloth and detergent solution, and rinse or wipe with a clean cloth and potable water.

g. Air dry.

h. Wrap equipment with a suitable material (e.g., clean plastic bag).

As part of the decontamination procedure for water-sampling equipment, state and/or federal protocols must be considered. These may require procedures above those specified as minimum for Roux Associates, Inc., such as the use of nitric acid, acetone, etc. Furthermore, the containment and proper disposal of decontamination fluids must be considered with respect to regulatory agency(ies) requirements.

APPENDIX B

Field Forms

ROUX

CHAIN OF CUSTODY

№ 07055 Y

ROUX ASSOCIATES, INC.
Environmental Consulting & Management

1377 MOTOR PARKWAY
ISLANDIA, NEW YORK 11749
(631) 232-2600 FAX (631) 232-9898

ANALYSES

PAGE OF

PROJECT NAME

PROJECT NUMBER

PROJECT LOCATION

PROJECT MANAGER

SAMPLER(S)

SAMPLE DESIGNATION / LOCATION	DATE COLLECTED	TIME COLLECTED	SAMPLE MATRIX					TOTAL BOTTLES	NOTES

RELINQUISHED BY: (SIGNATURE)	FOR	DATE	TIME	SEAL INTACT Y OR N	RECEIVED BY: (SIGNATURE)	FOR	DATE	TIME	SEAL INTACT Y OR N
RELINQUISHED BY: (SIGNATURE)	FOR	DATE	TIME	SEAL INTACT Y OR N	RECEIVED BY: (SIGNATURE)	FOR	DATE	TIME	SEAL INTACT Y OR N
RELINQUISHED BY: (SIGNATURE)	FOR	DATE	TIME	SEAL INTACT Y OR N	RECEIVED BY: (SIGNATURE)	FOR	DATE	TIME	SEAL INTACT Y OR N

DELIVERY METHOD

ANALYTICAL LABORATORY

COMMENTS

CUSTODY SEAL

DATE ______________________

SIGNATURE ______________________

ROUX

1377 Motor Parkway
Suite 403
Islandia, New York 11749
631-232-2600

ROUX ASSOCIATES, INC.

DISPOSABLE FIELD EQUIPMENT REQUEST LOG

Name: ______________________ *Date:* ______________ *Office:* ______________

Client / Project Name: ______________________ *Project #:* ______________ *Phase/Task:* _____ / _____

Item	Number of Units	Sizes	Date Needed
Booties			
Gloves / Surgical			
Gloves / Nitriles			
Gloves / Winter Liners			
Polypropylene Rope			
Cotton Rope			
Micro			
Tyvek / Paper			
Tyvek Poly Coat			
Bailers / Polyethylene			
Bailers / Teflon			
Dräeger Tubes			
Respirator Cartridges			
Polyethylene Tubing			
C-Flex Tubing			
Miscellaneous Equipment:			

ROUX ASSOCIATES, INC.

FIELD EQUIPMENT REQUEST LOG

Name: ______________________ *Date:* ______________ *Prj. Mgr.* ______________ *Office:* ______________

Client /
Project Name: ______________________ *Project #:* *Phase/Task:* ___ / ___

ITEM	Number of Units	Date Needed By	Estimated Date of Return
Liquid Measurement			
Interface Probe			
Water-Level Indicator			
Data Logger - Hermit System			
Liquid Sampling Equipment			
Submersible Pump			
Peristaltic Pump			
Rediflow Pump and Controller			
Teflon / Stainless Steel Bailers			
Product Bailer			
Soil / Soil Gas Sampling			
Vacuum Pump			
Stainless Steel Hand Auger			
Gasoline Powered Drill			
Field Analysis / Meters			
Photoionization Detector (PID)			
Multi-Gas Meter (Gas Tech)			
pH / Conductivity / DO / Temperature Meter (Aquacheck, Hori			
Turbidmeter			
Dräeger Tube Kit			
Air Particulate Monitor (Miniram)			
Flame Ionization Detector (FID)			
Subsurface Measurements			
Magnetic Locator			
Cable Locator			
Conductivity Meter			
Bison Resistivity Unit			
Miscellaneous			
Surveying Equipment			
Electricl Generator			
Bosch Rotary Hammer Drill			
Vehicle			
Digital Camera			

APPENDIX C

Data Validation Services Résumé

JUDY V. HARRY
P. O. Box 208
120 Cobble Creek Rd.
North Creek, NY 12853

Occupation:	Data Validator/Environmental Technical Consultant
Years Experience:	27
Education:	B.S., Chemistry, Magna cum laude, 1976, Phi Beta Kappa
Certifications:	New York State Woman-Owned Business Enterprise (WBE)

Relevant Work History:

Data Validation Services: September 1989 - present

Sole proprietor of Data Validation Services, providing consultation/validation services to various regulatory and commercial clients.

These services include the review of analytical laboratory data for compliance with respect to specific protocols, accuracy and defensibility of data, verification of reported values, and evaluation of quality parameters for analytical usability of results. Approved by USEPA, NYSDEC, NJDEP, and NYCDEP as a data validator for projects, including USEPA Superfund and lead sites, and those contracted through the NYSDEC Division of Hazardous Waste Remediation, Division of Solid Waste, and Division of Water Quality.

Performed validation for compliance with protocols including USEPA OLM, USEPA OLC, USEPA ILM, USEPA DFLM, USEPA SOW3/90, USEPA SOW 7/87 CLP, USEPA SOW 2/88 CLP, USEPA SW846, RCRA, AFCEE, NYS 6 NYCRR Part 360, 40 CFR, air analysis methods, 1989/1991/1995 NYSDEC ASPs, and 1987 NYSDEC CLP. Performed validation according to the USEPA National and Regional SOPs and Functional Guidelines, AFCEE requirements, NYSDEC Validation Scope of Work, and NJDEP Division of Hazardous Site Mitigation/ Publicly Funded Site Remediation SOPs.

Performed validation for USEPA Superfund Sites including Salem Acres, York Oil, Port Washington L-4 Landfill, Bridgeport Rental and Oil Services, MMR/ OTIS AFB, and Peter Cooper site; and for USEPA lead sites including SJ&J Piconne, Maska, Bowe System, and Syossett Landfill, involving CLP, RAS, and SAS protocols.

Contracted for NYSDEC Superfund Standby Contracts with LMS Engineers, Camp Dresser & McKee, Malcolm-Pirnie, Ecology & Environment, and EC Jordan, involving samples collected at NYS Superfund Sites and analyzed under the NYSDEC ASP.

Validated data for NYSDEC Phase II remedial investigations, RI/FS projects, and PRP oversite projects for hazardous waste sites. Was the primary contractor for Lawler, Matusky & Skelly Engineers during fifth and sixth round Phase II investigation, reviewing results for TCL/ TAL analyses performed according to EPA CLP and 1989 NYSDEC ASP. Provided data validation for NYSDEC Phase II investigations for Gibbs & Hill, Inc, reviewing results from TCL/TAL analyses performed in accordance with the 1989 NYSDEC ASP.

Performed validation services for clients conducting RI/FS activities involving samples of many matrices, including waste, air, sludges, leachates, solids/sediments, aqueous, and biota; clients have included Arcadis Geraghty & Miller, Barton & Loguidice, Bergmann Associates, Blasland, Bouck & Lee, Camp Dresser & McKee, C&S Consulting Engineers, Clough Harbour & Associates, Columbia Analytical Services, C.T. Male, Dames & Moore, Day Engineering, EA Engineering, Ecology & Environment, EC Jordan, Environmental Chemical Corporation, EHRT, ENSR Consulting, ERM-Northeast, Fagan Engineers, Fanning Phillips & Molnar, FluorDaniel GTI, Foster Wheeler Environmental Corp, Frontier Technical, Galson Consultants, Geomatrix Consultants, GZA Environmental, Handex of N, H2M Group, IT Corp, JTM Associates, Leader Environmental, Lockwood, Kessler & Bartlett, LMS Engineers, Malcolm-Pirnie, Metcalf & Eddy, O'Brien & Gere Engineers, Parsons Engineering-Science, Plumley Engineering, Prescott Environmental, P. W. Grosser, Rizzo Associates, Roux Associates, Sear Brown Group, SECOR, Shaw Environmental, ThermoRemediation Inc., TRC Environmental, Turnkey Environmental Restoration, TVGA Engineering, URS Consultants, Wehran Emcon, Weston, YEC, and private industries.

Validator for investigations at the Knolls Atomic Power Laboratory site. Validator for NYSDEC and NJDEP sites for samples analyzed according to EPA CLP SOPs, with validation performed according to NJDEP validation procedures. Validator for numerous landfill site investigations for TCL/TAL and NYS 6 NYCRR Part 360 analytes.

Provided consultation services to laboratories regarding analytical procedures and protocol interpretation, and to law firms for litigation support.

Provided services to firms involving audits of environmental analytical laboratories to determine analytical capability, particularly for compliance with NYSDEC ASP and AFCEE requirements.

Guest speaker on a panel discussing Data Review/Compliance and Usability, for an analysts workshop for the New York Association of Approved Environmental Laboratories, 1993.

Adirondack Environmental Services: June 1987 - August 1989

Senior mass spectroscopist for AES. Responsible for GC/MS analyses of environmental samples by USEPA and NYSDEC protocols; development of the GC/MS laboratory, initiating the instrumental and computer operations from the point of installation; and for implementing the procedures and methodologies for Contract Laboratory Protocol.

CompuChem Laboratories: May 1982 - January 1987

Managed a GC/MS production laboratory; developed, implemented, and supervised QA/QC criteria at three different levels of review; and was responsible for the development and production of the analysis of environmental and clinical samples. Directed a staff of 23 technical and clerical personnel, and managed the extraction and GC/MS labs and data review operations.

Research Triangle Institute: December 1979 - May 1982

Worked as an analytical research chemist responsible for development of analytical methods for the EPA Federal Register at RTI. This involved analysis of biological and environmental samples for priority pollutants, primarily relating to wastewaters and to human sampling studies. Method development included modification and interfacing of the initially developed Tekmar volatile purge apparatus to GC/MS, and the analysis and resolution/identification of individual PCB congeners within Aroclor mixtures by capillary column and mass spectra.

Guardsman Chemical Company: February 1977 - November 1979

Performed all quality control functions for the manufacturing plant. Performed research and development on coatings and dyes.

Almay Cosmetics: May 1976 - December 1976

Product evaluation chemist. Responsible for analytical QC of manufactured products.