SUPPLEMENTAL GROUND-WATER INVESTIGATION WORK PLAN

Dec 8, 1997

Ron Hill Dry Cleaners
74 Forest Avenue
Glen Cove, New York

December 8, 1997

Prepared for:

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DEC 16 1997

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ROUX

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APPENDICES

1.0 INTRODUCTION

Roux Associates, Inc. (Roux Associates) has been retained to conduct a Supplemental Ground-Water Investigation at the former Ron Hill Dry Cleaners located at 71 Forest Avenue, Glen Cove, New York (Site #1-30-071). This Work Plan describes in detail the tasks that will be implemented during the investigation. The objectives of the Supplemental Investigation include:

- Enhance the upgradient ground-water monitoring capability at the Site through the installation of an additional upgradient well.
- Reconfirm the gradient and local ground-water flow direction.
- Evaluate current ground-water quality at the Site through sampling the four existing wells and the new upgradient well.
- Evaluate upgradient sources of tetrachloroethylene through a database search and an area reconnaissance.

Presented below is a description of the proposed activities that will be implemented to satisfy the stated objectives.

2.0 SCOPE OF WORK

2.1 Survey of Existing Monitoring Wells

Roux Associates will re-survey, relative to a common Site datum, ground-water elevations in the existing Site monitoring wells (W-1 through W-4). The objective of the survey will be to establish current Site ground-water flow direction and to determine the location of the proposed upgradient ground-water monitoring well. This Task will include the measurement of only one round of ground-water elevations. In addition, the condition of each well will be evaluated by reviewing available well construction specifications and sounding each well to verify construction.

2.2 Upgradient Monitoring Well Installation

Roux Associates will install a monitoring well (W-5) to evaluate ground-water quality at the extreme upgradient Site property boundary. The exact location and depth of the well will be determined based on the location(s) of any upgradient properties of concern, current ground-water flow conditions established in the previous task and general field conditions. Based upon the available data, it is anticipated that the well will be installed at the northeast corner of the Site and will be approximately a total of 95 feet deep, 15 feet below the water table.

The well will be installed using a hollow stem auger drill rig. To evaluate stratigraphy at the Site, the borehole will be sampled at five foot intervals with a split-spoon sampler to the bottom of the borehole. A standard 140-pound drop hammer will be used to drive the split-spoon sampler and blow counts will be recorded for each six inches of drive. A visual description of each split-spoon sample will be logged in the field for geologic characteristics, odors and staining. All samples will be screened for VOCs using a PID. A representative portion of each split-spoon sample will be placed in a jar for visual record. All drilling and soil sampling equipment will be steam cleaned and decontaminated prior to initiating field work.

After the screen and riser pipe are set in the borehole, a gravel pack will be employed in the annulus and will extend two feet above the top of the screen. A two foot bentonite pellet layer will be installed above the gravel pack and the remaining annular space will be grouted with a bentonite/cement slurry. The PVC riser pipes will be finished flush with grade and completed with a locking protective steel casing set in cement. The cement base around each casing will be mounded in order to direct surface runoff away from the well.

The monitoring well will be developed either by surge block or centrifugal pump in order to ensure the removal of fine material and to ensure a good hydraulic connection between the well and the surrounding aquifer. Equipment used to develop the well will be decontaminated before use. The development of the well will continue until the turbidity of the discharged water is 50 nephelometric turbidity units (NTUs) or less for a minimum of three consecutive measurings at every well volume. Well development monitoring will be supplemented by additional measurements of pH, conductivity and temperature. These measurements will be collected concurrently with the turbidity measurements. If the turbidity of the ground water in the wells cannot be reduced to that level, the field geologist, in consultation with the NYSDEC, will document the problem, record the turbidity measurement achieved and deem the well to be developed. Following development, the wells will be allowed to reach equilibrium before ground-water samples are collected. All development water will be discharged on-site downgradient of the sampling point. All development water will be screened for VOCs and visual contamination. If contamination is observed, water will be contained in 55-gallon drums and stored on-site. A sample will be collected from the drums and analyzed for TCL organics and TAL inorganics to determine if on-site or off-site disposal is necessary. Off-site disposal of drums is not included in the work plan.

The Health and Safety Plan that will be utilized during the well installation and subsequent sampling is contained in Appendix A.

The upgradient well will then be surveyed consistent with the existing wells as discussed above in Section 2.1 and one complete round of ground-water elevations will be measured from all Site monitoring wells (W-1 through W-5).

2.3 Ground-Water Sampling

The objective of this task is to characterize current ground-water quality and determine if upgradient ground-water sources of contamination are impacting the 71 Forest Avenue Property.

Following installation and development of the new well, a round of ground-water sampling including all five site wells will be performed. All ground-water samples will be collected by a field hydrogeologist who will maintain all related chain-of-custody and QA/QC documentation. Prior to bailing or removing water from the wells, the volume of water in each well will be calculated. A total of three well casing volumes will be removed from each well prior to the collection of ground-water samples. This purge water will be handled in the same manner as the well development water. Ground-water samples will be obtained with a new disposable Teflon™ bottom-loading bailer suspended by new polypropylene cord. All of the ground-water samples will be analyzed for volatile organic compounds (VOCs) using Method ASP 95-4.

One duplicate sample and one trip blank will also be collected during ground-water sampling. The duplicate sample will be assigned a different sample identification number than the monitoring well from which it is collected. The trip blank will be prepared with deionized water provided by the analytical laboratory. The water will be poured into 40 ml vial and sealed in the lab and will then accompany the sample bottles from the lab into the field and will then be shipped back to the lab unopened. Both the duplicate sample and the trip blank will be analyzed for VOCs using Method ASP 95-4.

Samples collected for laboratory analysis will be placed in appropriate glassware prepared and supplied by the analytical laboratory. Each sample will be properly identified, packed in coolers on ice, and shipped overnight to the analytical laboratory under full chain-of-custody procedures.

All field sampling and analytical procedures are described in detail in the Sampling and Analytical Plan (SAP) presented in Appendix B.

2.4 Database Search and Area Reconnaissance

Available federal and state lists of hazardous waste sites will be examined to determine the presence of registered sites under the Resource, Conservation and Recovery Act (RCRA), Comprehensive Environmental Response, Compensation, and Liability Information System (CERCLIS), and National Priorities List (NPL) within a one-mile radius of the Site. In addition, aboveground and underground storage tank registrations, release notifications, and any adverse soil and ground-water concerns within a one-half mile radius of the Site will be reviewed. Specifically, any information pertaining to any upgradient sites will be evaluated to determine the likelihood of an off-site source(s) of ground-water contamination.

Roux Associates will conduct an area reconnaissance ("windshield survey") to verify the location of any upgradient sites identified during the database search that have the potential for a release of chlorinated solvents. In addition, during the reconnaissance, the current use of each site will be determined and any obvious environmental concerns (i.e., poorly secured drum storage areas, above ground tanks, etc.) will be identified. Furthermore, during the reconnaissance, the condition of relevant other sites of concern not identified during the database search will be documented.

2.5 Prepare Supplemental Ground-Water Investigation Report

Upon completion of the ground-water analyses, a Supplemental Ground-Water Investigation report will be prepared. All collected field and lab information shall be organized into a detailed draft report. The report will include but will not be limited to the following:

- Executive Summary;
- objectives of the Supplemental Ground-Water Investigation;
- updated ground-water quality database for the Site;
- hydrogeologic conditions including ground-water flow direction and gradient;

- evaluation of upgradient contaminant sources;
- analytical data and QA/QC reports;
- supporting data such as well logs, well construction diagrams, water level measurements and PID readings; and
- Conclusions and Recommendations.

APPENDIX A

Health and Safety Plan

Ron Hill Dry Cleaners
74 Forest Avenue
Glen Cove, New York

HEALTH AND SAFETY PLAN

Ron Hill Dry Cleaners
71 Forest Avenue
Glen Cove, New York

December 8, 1997

Approvals:

Remedial Engineering, P.C. Project Manager	James J. Schaefer, Jr..	Date
Roux Associates, Inc. Health and Safety Manager	Linda M. Wilson	Date
Roux Associates, Inc. Site Health and Safety Manager		Date

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1.0 GENERAL

This site-specific Health and Safety Plan (HASP) has been prepared in accordance with 29 CFR 1910.120 Occupational Safety and Health Administration (OSHA) Hazardous Waste Operations, and Roux Associates, Inc. (Roux Associates) Standard Operating Procedures (SOPs). It addresses all activities to be performed during the investigation at the Ron Hill Dry Cleaner Site, 71 Forest Avenue, Glen Cove, New York (Site). The HASP will be implemented by the designated Site Health and Safety Officer (SHSO) during work at the Site.

Compliance with this HASP is required for all Roux Associates employees and third parties who enter this Site. Assistance in implementing this HASP can be obtained from Roux Associates' Health and Safety Manager (HSM). The content of this HASP may undergo revision based upon additional information made available. Any changes proposed must be reviewed and approved by Roux Associates' HSM or her designee.

Scope of Work

The Scope of Work for this investigation will include implementation of the following tasks:

- survey existing monitoring wells;
- ground-water monitoring well installation; and
- ground-water sampling.

2.0 EMERGENCY INFORMATION

Multiple emergency services may be obtained from 911. More specific numbers for local services are listed below.

Type	Name	Telephone Numbers
Police	City of Glen Cove	(516) 676-1000
Fire	City of Glen Cove	(516) 676-0366
Hospital	North Shore University Hospital at Glen Cove	(516) 674-7306
National Response Center		(800) 424-8802
Poison Control Center	Nassau County Medical Center	(516) 542-2323
Roux Associates' Health and Safety Manager	Linda Wilson	(516) 232-2600

The route to Glen Cove Community Hospital is as follows.

Exit Site turning right on Forest Avenue. Take Forest Avenue to Walnut Road. The Hospital is on the right side of Walnut Road.

3.0 HEALTH AND SAFETY PERSONNEL DESIGNATIONS

Roux Associates has designated health and safety personnel to be responsible for the implementation of this HASP for Roux Associates employees, and to provide assistance to the contractor for health and safety-related issues.

Personnel Designation	Responsibilities
Health and Safety Manager (HSM)	Implementation and modification of the HASP. Will assign health and safety duties. Provides adequate resources for field health and safety personnel. Ensures that field personnel are trained and aware of Site conditions. Schedules adequate personnel and equipment to perform job safely.
Site Health and Safety Officer (SHSO)/ Site Emergency Coordinator	Conducts safety briefings and worker awareness meetings. Ensures compliance with HASP. Notifies HSM of accidents/ incidents. Coordinates health and safety activities. Makes contact with local emergency groups prior to beginning work on-site. Responsible for evacuation, emergency treatment, and emergency transport of personnel.
Field Crew Personnel	Report unsafe or hazardous conditions to SHSO. Understand the information contained in this HASP.

4.0 SITE HISTORY AND PHYSICAL DESCRIPTION

This section provides a brief summary of the location and history of the Captain's Cove Site.

4.1 Location

The Site consists of a one-story, 3,600 square concrete block building with no basement on a 33,668 square foot plot. The property is located at the northeast intersection of Forest Avenue and Bryce Avenue in Glen Cove, New York. The areas to the south, east, and west of the building are asphalt paved. There is a grass area located to the north of the building. No fencing is currently located on the property.

4.2 Site History

The existing building was erected in 1963 to be utilized as a drive-in cleaning establishment. The site was vacated in 1993 and is currently vacant. Therefore, the property has been utilized as a dry cleaning establishment for approximately thirty (30) years. Prior to the erection of the building in 1963, the property was vacant land.

Previous reports indicated shallow soil contamination by tetrachloroethene, acetone, and xylenes above acceptable levels. Ground water was also contaminated by tetrachloroethene, trichloroethene, 1,2-dichloroethene, and chlorobenzene at levels above standards. An inside trough located along the northern and western walls of the building contained high levels of contamination.

The soil trench located inside of the building on site was excavated in order to remove the most heavily contaminated soil. Soil samples were screened with a Microtip photoionization detector. The excavated contaminated soil was stockpiled on and covered with polyethylene sheeting outside of the building. The area was backfilled with clean fill. Stockpiled soil samples were obtained for disposal purposes.

Then contaminated soil stockpiled on site (72.92 tons) was removed on April 27, 1994 and disposed of on April 29, 1994 at E/Q Wayne Disposal Inc., a hazardous waste facility in Belleville, Michigan. A generator's USEPA ID number, NY0000228239, was obtained for the site in order to remove the soil.

5.0 HAZARD ASSESSMENT

The potential hazards associated with the anticipated investigation activities include chemical and physical hazards. There is little potential for encountering biological hazards due to the nature of the work location and the activities to be conducted.

5.1 Chemical Hazards

Previous investigations have shown the presence of various organic compounds in soil and ground water at the Site. The toxicological, physical, and chemical properties of these potential contaminants are presented in Table 1. This table includes permissible exposure levels which will establish the level of protection. The potential for encountering these contaminants exists during intrusive activities such as drilling.

5.2 Physical Hazards

A variety of physical hazards may be present during Site activities. These hazards are similar to those associated with any construction-type project. These physical hazards are due to motor vehicle and heavy equipment operation, the use of power and hand tools, hazardous working surfaces, and handling and storage of fuels. These hazards are not unique and are generally familiar to most field personnel. Additional task-specific requirements will be covered during safety briefings.

5.2.1 Noise

Noise is a potential hazard associated with the operation of heavy equipment, power tools, pumps, and generators. High noise operations will be evaluated at the discretion of the SHSO. Personnel with 8-hour time-weighted-average exposures exceeding 85 dBA must be included in a hearing conservation program in accordance with 29 CFR 1910.95.

5.2.2 Heat Stress

Heat stress is a significant potential hazard and can be associated with heavy physical activity and/or the use of personal protective equipment (PPE) in hot weather environments.

Heat cramps are brought on by prolonged exposure to heat. As an individual sweats, water and salts are lost by the body resulting in painful muscle cramps. The signs and symptoms of heat cramps are as follows:

- severe muscle cramps, usually in the legs and abdomen;
- exhaustion, often to the point of collapse; and
- dizziness or periods of faintness.

First aid treatment includes shade, rest and electrolyte fluid replacement therapy. Normally, the individual should recover within one-half hour. If the individual has not recovered within 30 minutes and the temperature has not decreased, the individual should be transported to a hospital for medical attention.

Heat exhaustion may occur in a healthy individual who has been exposed to excessive heat while working. The circulatory system of the individual fails as blood collects near the skin in an effort to rid the body of excess heat. The signs and symptoms of heat exhaustion are as follows:

- rapid and shallow breathing;
- weak pulse;
- cold and clammy skin with heavy perspiration;
- skin appears pale;
- fatigue and weakness;
- dizziness; and
- elevated body temperature.

First aid treatment includes cooling the victim, elevating the feet, and replacing fluids and electrolytes. If the individual has not recovered within 30 minutes and the temperature has not decreased, the individual should be transported to the hospital for medical attention.

Heat stroke occurs when an individual is exposed to excessive heat and stops sweating. This condition is classified as a **MEDICAL EMERGENCY**, requiring immediate cooling of the victim and transport to a medical facility. The signs and symptoms of heat stroke are as follows:

- dry, hot, red skin;
- body temperature approaching or above 105°F;
- large (dilated) pupils; and
- loss of consciousness - the individual may go into a coma.

First aid treatment requires immediate cooling and transportation to a medical facility.

Heat stress (heat cramps, heat exhaustion, and heat stroke) is a significant hazard if any type of PPE (semipermeable or impermeable) which prevents evaporative cooling is worn in hot weather environments. Local weather conditions may require restricted work schedules in order to adequately protect personnel. The use of work/rest cycles (including working in the cooler periods of the day or evening) and training on the signs and symptoms of heat stress should help prevent heat-related illnesses from occurring. Work/rest cycles will depend on the work load required to perform each task, type of protective equipment, temperature, and humidity. In general, when the temperature exceeds 88°F, a 15 minute rest cycle will be initiated once every two hours. In addition, potable water and fluids containing electrolytes (e.g., Gatorade) will be available to replace lost body fluids.

5.2.3 Cold Stress

Cold stress is a danger at low temperatures and when the wind-chill factor is low. Prevention of cold-related illnesses is a function of whole-body protection. Adequate insulating clothing must be used when the air temperature is below 40°F. In addition, reduced work periods followed by rest in a warm area may be necessary in extreme conditions. Training on the signs and symptoms of cold stress should prevent cold-related illnesses from occurring. The signs and symptoms of cold stress include the following:

- severe shivering;
- abnormal behavior;

- slowing;
- weakness;
- stumbling or repeated falling;
- inability to walk;
- collapse; and/or
- unconsciousness.

First aid requires removing the victim from the cold environment and seeking medical attention immediately. Also, prevent further body heat loss by covering the victim lightly with blankets. Do not cover the victim's face. If the victim is still conscious, administer hot drinks, and encourage activity, such as walking wrapped in a blanket.

6.0 TRAINING REQUIREMENTS

The Hazardous Waste Operations and Emergency Response Rule (29 CFR 1910.120) requires that all personnel be trained to recognize on-site hazards, understand the provisions of this HASP, and be made aware of the responsible health and safety personnel. This section discusses the means to meet these requirements.

6.1 Basic Training

All Site personnel who will perform work in areas where the potential for toxic exposure exists will be health and safety-trained prior to performing work on-site, per OSHA 29 CFR 1910.120(e). Training records will be submitted to and maintained by the SHSO on-site, as described in Section 6.4.

6.2 Site-Specific Training

Health and safety-related training that will specifically address the activities, procedures, monitoring and equipment for the Site operations will be provided to all Site personnel and visitors by the SHSO. It will include Site and facility layout, hazards, emergency services at the Site and will detail all provisions contained within this HASP. This training will also allow field workers to clarify anything they do not understand, and to reinforce their responsibilities regarding safety and operations for their particular activity. Site-specific training will be documented and kept as part of the project records.

6.3 Safety Briefings

Project personnel will be given briefings by the SHSO on an as-needed basis to further assist them in conducting their activities safely. Safety briefings will be held when new operations are to be conducted, whenever changes in work practices must be implemented, before work is begun at each location, and each Monday morning. Records of safety briefings will be kept as part of the project records.

6.4 Record Keeping Requirements

All record keeping requirements mandated by OSHA 29 CFR 1910.120 will be strictly followed. Specifically, all personnel training records, injury/incident reports, medical examination records and exposure monitoring records will be maintained by Roux Associates and each contractor for a period of at least thirty years after the employment termination date of each employee. Pertinent health and safety training and medical certifications will be kept onsite during the field operations. The SHSO shall maintain a daily written log of all health and safety monitoring activities, and monitoring results shall become part of the project records.

7.0 MONITORING PROCEDURES FOR SITE OPERATIONS

The SHSO will record wind direction and temperature during monitoring in the logbook. All monitoring equipment will be calibrated per the owner's manual which will be kept onsite, or at least monthly according to Site inspection rules.

7.1 Intrusive Operations

Data from previous investigations have identified the presence of organic compound in soil and ground water. Air monitoring will be performed to establish the concentrations of these constituents during intrusive activities (e.g., drilling) using a photoionization detector (PID),

The SHSO will monitor the breathing zone with the PID in continuous operating mode and with the alarm activated. The alarm will be set at 5 parts per million (ppm), which is below the permissible exposure level (PEL) for all constituents of concern. If the PID indicates that total vapor exceeds the 5 ppm level, the SHSO will order cessation of the activity until all personnel within the work zone have donned a full face air purifying respirator, or until the nature of the hazard has been more thoroughly evaluated.

7.2 Non-Intrusive Operations

Based on the current understanding of Site conditions, monitoring may be performed using on the first day of non-intrusive operations, and periodically thereafter if the PID readings indicate a more accurate assessment is warranted.

8.0 MEDICAL SURVEILLANCE REQUIREMENTS

Medical surveillance specifies any special medical monitoring and examination requirements as well as stipulates that all Roux Associates personnel and contractors are required to pass the medical surveillance examination or equivalent for hazardous waste work required by 29 CFR 1910.120. As a minimum, the examination will include:

- complete medical and work histories;
- EKG;
- urinalysis;
- physical exam;
- eye exam;
- blood chemistry;
- pulmonary function test; and
- audiometry.

The examination will be taken annually, at a minimum, and upon termination of employment with the company. Additional medical testing may be required by the HSM in consultation with the company physician and the SHSO if an overt exposure or accident occurs, or if other Site conditions warrant further medical surveillance.

9.0 ZONES, PROTECTION AND COMMUNICATIONS

Work zones, levels of personal protection, and means of communication are described in the following sections.

9.1 Site Zones

Roux Associates employs the following three zone approach to Site operations.

- the Work Zone;
- the Contamination Reduction Zone; and
- the Support Zone.

9.1.1 Work Zone

The Work Zone is the area where work will be conducted. The Work Zone will be designated by a temporary barrier consisting of red barricade tape. No personnel shall work in the Work Zone without a buddy. All workers within the Work Zone shall wear the proper PPE (see Section 9.2). No unauthorized persons will be allowed in the Work Zone during Site activities.

No personnel are allowed in the Work Zone without:

- a buddy;
- the proper PPE;
- medical authorization; and
- training certification.

9.1.2 Contamination Reduction Zone

A Contamination Reduction Zone (CRZ) will be established between the Work Zone and the Support Zone. The CRZ will provide for full personnel and portable equipment decontamination (Section 9.3). The CRZ will also contain safety and emergency equipment such as first aid equipment (bandages, blankets, eye wash) and containment equipment (adsorbent, fire extinguisher).

9.1.3 Support Zone

The Support Zone is considered the uncontaminated area and will provide for team communications and emergency response. Appropriate safety and support equipment will be located in this zone. The Support Zone will be located upwind of Site operations, if possible and may be used as a potential evacuation point. No potentially contaminated personnel or materials are allowed in this zone except appropriately packaged/ decontaminated and labeled samples, and drummed wastes.

9.2 Personal Protection

This section describes the levels of protection which will be required by on-site personnel during the remediation activities.

9.2.1 General

The level of protection to be worn by field personnel and visitors will be defined and controlled by the SHSO with approval of the HSM. Where more than one hazard area is indicated, further definition shall be provided by review of Site hazards, conditions, and operational requirements and by monitoring at the particular operation being conducted.

During intrusive activities, continuous monitoring will be performed using the PID. Protection may be upgraded or downgraded by the SHSO in conjunction with the HSM based upon the PID instrument.

9.2.2 Respiratory Protection and Clothing

Three levels of protective equipment are discussed below including Level D, Level C, and Level B.

<u>Level D Protection</u>

1. PPE:
   - Cotton coveralls
   - Cotton gloves
   - Boots/shoes, leather or chemical-resistant, steel toe and shank

- Boots (outer), chemical-resistant (disposable)
- Safety glasses or chemical splash goggles
- Hard hat
- Escape mask

2. Criteria for selection

   PID readings in the breathing zone are less than 5 ppm. Work functions preclude splashes, immersion, or potential for unexpected inhalation of any chemicals.

NOTE: Modifications of Level D will be used to increase the level of skin protection during activities which increase the degree of contact with chemical hazards. These modifications include the use of chemical/corrosion resistant coveralls (e.g., tyveks), and chemical resistant gloves.

Level C Protection

1. PPE:
   - Full face, air purifying, cartridge-equipped respirator (Mine Safety and Health Administration [MSHA]/National Institute for Occupational Safety and Health [NIOSH] approved)
   - Chemical-resistant clothing (coverall; hooded, two-piece chemical splash suit; chemical-resistant hood and apron; disposable chemical-resistant coveralls)
   - Cotton or synthetic coveralls*
   - Goves (inner), chemical-resistant - latex
   - Gloves (outer), chemical-resistant - nitriles
   - Boots (inner), chemical-resistant, steel toe and shank
   - Boots (outer), chemical-resistant (disposable)
   - Hard hat (face shield)
   - Escape mask
   - 2-Way radio communications (intrinsically safe)*

   *Optional

2. Criteria for selection

- Continuous total vapor readings register between 5 ppm and 25 ppm on PID.
- Measured air concentrations of identified substances (organic vapors) will be reduced by the respirator to at or below the substance's exposure limit, and the concentration is within the service limit of the canister.
- Atmospheric contaminant concentrations do not exceed Immediately Dangerous to Life and Health (IDLH) levels.
- Atmospheric contaminants, liquid splashes, or other direct contact will not adversely affect the small area of skin left unprotected by chemical-resistant clothing.
- Job functions have been determined not to require self-contained breathing apparatus.

Level B Protection

1. PPE:

- Pressure-demand, self-contained breathing apparatus (MSHA/NIOSH approved)
- Chemical-resistant clothing (overall and long-sleeved jacket; coveralls; hooded, one or two-piece chemical-splash suit; disposable chemical-resistant coveralls)
- Coveralls
- Gloves (inner), chemical-resistant - latex
- Gloves (outer), chemical-resistant - nitriles
- Boots (inner), chemical-resistant, steel toe and shank
- Boots (outer), chemical-resistant (disposable)
- Hard hat (face shield)
- 2-way radio communications (intrinsically safe)

2. Criteria for Selection

Meeting any one of these criteria warrants use of Level B protection:

- PID readings in the breathing zone are greater than 25 ppm and less than 500 ppm.
- The type(s) and atmospheric concentration(s) of toxic substance(s) have been identified and require the highest level of respiratory protection, but a lower level of skin and eye protection. These would be atmospheres:
  - -- with IDLH concentrations

    or

-- exceeding limits of protection afforded by a full face, air purifying mask

or

-- containing substances requiring air-supplied equipment, but substances and/or concentrations do not represent a serious skin hazard.

- The atmosphere contains less than 19.5 percent oxygen.
- Operations at the Site make it highly unlikely that the small, unprotected arc of the head or neck will be contacted by splashes of extremely hazardous substances.
- If work is performed in an enclosed space.

9.3 Decontamination Procedures

A steam cleaner will be utilized to decontaminate heavy equipment used in drilling. Personnel should exercise caution when using a steam cleaner. The high pressure steam can cause burns. Protective gloves, face shields, hard hats, steel-toed boots, and Tyvek suits or rain gear will be worn when using steam cleaners.

9.3.1 Contamination Prevention

Adequate contamination prevention should minimize worker exposure and help ensure valid sample results by precluding cross-contamination. Procedures for contamination avoidance include the following.

Personnel

- Do not walk through areas of obvious or known contamination;
- Do not handle contaminated materials directly;
- Make sure all PPE has no cuts or tears prior to donning;
- Fasten all closures on suits, covering with tape, if necessary;
- Take particular care to protect any skin injuries;
- Stay upwind of airborne contaminants;
- Do not carry cigarettes, gum, etc., into contaminated areas; and
- Use disposables to cover nondisposable equipment when contact is probable.

Sampling/Monitoring

- When required by the SHSO, cover instruments with clear plastic, leaving opening for sampling and exhaust ports; and
- Bag sample containers prior to the placement of sample material.

Heavy Equipment

- Care should be taken to limit the amount of contamination that comes in contact with heavy equipment;
- If contaminated tools are to be placed on non-contaminated equipment for transport to the decontamination pad, plastic should be used to keep the equipment clean; and
- Excavated soils should be contained and kept out of the way of workers.

9.3.2 Decontamination

All personnel and equipment exiting the Work Zone shall be thoroughly decontaminated. Figures 1, 2 and 3 illustrate decontamination procedures for Levels D, C and B, respectively. Safety briefings shall explain the decontamination procedures for personnel and portable equipment for the various levels of protection. Heavy equipment will be decontaminated with a steam cleaner.

9.3.3 Disposal Procedures

All discarded materials, waste materials, or other objects shall be handled in such a way as to preclude the potential for spreading contamination, creating a sanitary hazard, or causing litter to be left at the Site. All potentially contaminated materials (e.g., soil, clothing, gloves, etc.) will be bagged or drummed, as necessary, and segregated for disposal. All contaminated materials shall be disposed of in accordance with appropriate regulations. All non-contaminated materials shall be collected and bagged for appropriate disposal as normal domestic waste. All waste disposal operations conducted by Roux Associates will be monitored by the SHSO and carried out under the appropriate level of personal protection.

9.4 Standard Operating Procedures/Safe Work Practices

This section discusses safe work practices to be used during all activities. In addition, non-monitoring safety-related procedures are described.

9.4.1 Communications

- Telephones -- A telephone will be available for communication with emergency support services/facilities.
- Hand Signals -- To be employed by personnel required to have Level C protection. They shall be known by the entire field team before operations commence and covered during Site-specific training.

The following hand signals will be used, if needed:

Signal	Meaning
Hand gripping throat	Out of air, can't breath
Grip partner's wrist	Leave area immediately
Hands on top of head	Need assistance
Thumbs up	I'm all right, okay
Thumbs down	No, negative

9.4.2 General Safe Work Practices

- Eating, drinking, chewing gum or tobacco, smoking, or any practice that increases the probability of hand to mouth contact and ingestion of material is prohibited onsite except in lunch room or designated office areas.
- Hands must be washed thoroughly upon leaving the Work Zone or before eating, drinking, or any other activities.
- Contaminated protective equipment shall not be removed from the Site until it has been decontaminated and properly packaged and labeled.
- Portable eyewash stations shall be located in the decontamination staging area in the Support Zone.
- No facial hair, which interferes with a satisfactory fit of respiratory equipment, will be allowed on personnel that may be required to wear respiratory protective equipment.
- An emergency first aid kit and fire extinguisher shall be onsite in the Support Zone at all times.

- All respiratory protection selected to be used onsite shall meet MSHA/NIOSH requirements for the existing contaminants.
- Any skin contact with surface and ground water shall be avoided.
- No contact lenses may be worn.

9.4.3 Waste Disposal

All waste disposal operations shall be monitored by the SHSO and performed using the appropriate level of personal protection. Personnel shall wear the prescribed clothing, especially eye protection and chemical resistant gloves, when handling or drumming waste materials. Contamination avoidance shall be practiced at all times.

9.4.4 Heavy Equipment and Drill Rig Safety

Typical machinery to be found at this site may include pumps, compressors, generators, portable lighting systems, fork lifts, trucks, dozers, backhoes, and drill rigs. From a safety standpoint, it is important for all site workers to be continually aware of the equipment around them. It poses a serious hazard if not operated properly, or if personnel near machinery cannot be seen by operators.

Drilling crews are confronted with all of these heavy equipment hazards. They must be responsible for housekeeping around the rig because of the rods, auger sections, rope, and hand tools cluttering the operation. Maintenance is a constant requirement. Overhead and buried utilities require special precautions because of electrical and natural gas hazards. Electrical storms may seek out a standing derrick. The hoist or cathead rope poses specific hazards that must be respected. A clean, dry, sound rope should always be used. Hands should be kept away from the test hammer. Hearing loss, while not an immediate danger, is considerable over time. Hearing protection must be worn.

9.4.5 Confined Space Entry

The scope of work does not require personnel to enter any confined space during the conduct of this project. Confined space is defined as having limited or restricted means of entry or exit, is large enough for an employee to enter and perform assigned work, and is not designed for

continuous occupancy by the employee. These spaces include, but are not limited to, underground vaults, tanks, storage bins, pits and diked areas, vessels, and silos.

A permit-required confined space is one that meets the definition of confined space, and has one or more of the following characteristics:

- contains or has the potential to contain a hazardous atmosphere;
- contains a material that has the potential for engulfing an entrant;
- has an internal configuration that might cause an entrant to be trapped or asphyxiated by inwardly converging walls or by a floor that slopes downward and tapers to a smaller cross section; and/or
- contains any other recognized serious safety or health hazards.

10.0 EMERGENCY PLAN

As a result of the hazards onsite and the conditions under which operations are conducted, the possibility of an emergency exists. An emergency plan is required by OSHA 29 CFR 1910.120 to be available for use and is included below. A copy of this plan shall be posted in the Support Zone at each work site.

10.1 Site Emergency Coordinator(s)

The SHSO shall act as the Site Emergency Coordinator to make contact with the local fire, police and other emergency units prior to beginning work onsite. In these contacts, the SHSO will inform the emergency units about the nature and duration of work expected at the Site and the type of contaminants and possible health or safety effects of emergencies involving these contaminants.

The SHSO or his designee shall implement this emergency plan whenever conditions at the Site warrant such action. The coordinator(s) will be responsible for assuring the evacuation, emergency treatment, emergency transport of Site personnel as necessary, and notification of emergency response units and the appropriate management staff.

10.2 Evacuation

In the event of an emergency situation, such as fire, explosion, significant release of particulates, etc., an air horn or other appropriate device will be sounded by the SHSO for approximately ten seconds indicating the initiation of evacuation procedures. All persons in both the restricted and non-restricted areas will evacuate and assemble near the Support Zone or other safe area as identified in advance by the SHSO. Under no circumstances will incoming personnel or visitors be allowed to proceed into the evacuated area once the emergency signal has been given. The SHSO must see that access for emergency equipment is provided and that all combustible apparatus has been shutdown once the alarm has been sounded. Once the safety of all personnel is established, the fire department and other emergency response groups will be notified by telephone of the emergency. The hospital route will be posted onsite (Figure 1). Any other excavation routes will be specified by the appropriate emergency personnel.

10.3 Potential or Actual Fire or Explosion

If the potential for a fire exists or if an actual fire or explosion occurs, the following procedure will be implemented:

- immediately evacuate the Work Zone as described above (Section 10.2); and
- notify fire department and security.

10.4 Environmental Incident (Release or Spread of Contamination)

The SHSO shall instruct a person onsite to immediately contact police and fire authorities to inform them of the possible or immediate need for nearby evacuation. If a significant release (above the reportable quantity as described in 40 CFR 302) has occurred, the National Response Center and other appropriate groups should be contacted. Those groups will alert National or Regional Response Teams as necessary. The personnel listed below shall be notified as necessary.

Name	Type	Telephone #
Fire Department		(516) 676-0366
Hazardous Material Emergency Response		911
Police Department		(516) 676-1000
Ambulance		(516) 676-1000
Poison Control Center		(516) 542-2323
Hospital	North Shore University Hospital at Glen Cove	(516) 674-7306
National Response Center (Release or Spill)		(800) 424-8802
Site Health and Safety Officer		On-Site
Health and Safety Manager	Linda Wilson	(516) 232-2600
Project Manager	James Schaefer	(516) 232-2600

10.5 Personal Injury

Emergency first aid shall be applied onsite as deemed necessary to stabilize the patient. Notify the emergency units as deemed necessary.

10.6 Overt Personnel Exposure

If an overt exposure to toxic materials should occur, the exposed person shall be treated onsite as follows:

Skin Contact:	Wash/rinse affected area thoroughly with copious amounts of soap and water, then provide appropriate medical attention. An eyewash and/or emergency shower or drench system will be provided onsite at the CRZ and/or support zone, as appropriate. Eyes should be rinsed for at least fifteen (15) minutes upon chemical contamination.
Inhalation:	Move to fresh air and/or if necessary, decontaminate and transport to the hospital.
Ingestion:	Decontaminate and transport to emergency medical facility.
Puncture Wound or Laceration	Decontaminate and transport to emergency medical facility. SHSO will provide medical data sheets to medical personnel as requested.

10.7 Adverse Weather Conditions

In the event of adverse weather conditions, the SHSO will determine if work can continue without sacrificing the health and safety of field workers. Some of the items to be considered prior to determining if work should continue are:

- heavy rainfall;
- potential for heat stress;
- potential for cold stress and cold-related injuries;
- limited visibility;
- potential for electrical storms;
- potential for malfunction of health and safety monitoring equipment or gear; and
- potential for accidents.

11.0 AUTHORIZATIONS

Personnel authorized to enter the Site while operations are being conducted must be approved by the SHSO and the Project Manager. This document will be completed when the subcontractors have assigned trained personnel for the Site. Authorization will require completion of appropriate training courses, medical examination requirements as specified by OSHA 29 CFR 1910.120, and review and sign-off of this HASP.

The following Roux Associates personnel are authorized to perform work onsite:

Personnel authorized to enter the Site are:

1. James Schaefer
2. Craig Werle
3. Linda Wilson
4. Robert Tweeddale
5. Nicole Gorelick

12.0 FIELD TEAM REVIEW

Each person entering the Site and each field member shall sign this section after site-specific training is completed and before being permitted to work onsite.

I have read and understand this Site-Specific Health and Safety Plan. I will comply with the provision contained therein.

Site/Task: _____

Name Printed	Signature	Date

Table A-1. Toxicological, Physical, and Chemical Properties of Compounds Potentially Present at the _____ Glen Cove, New York

Compound	CAS#	TLV (mg/m^3)	IDLH (ppm)	PEL (mg/m^3)	Routes of Exposure	Toxic Properties	Target Organs	Physical/Chemical Properties
1,2-dichloroethene	540-59-0	790 200 ppm	4,000	790 200 ppm	Dermal; ingestion; inhalation	CNS depressant Epigastric cramps Sensory irritant Dermatitis	CNS stomach skin	Colorless liquid BP = 59°F LEL = 9.7% UEL = 12.8%
Chlorobenzene	108-90-7	350 75 ppm	1,000	350 75 ppm	Dermal; ingestion; inhalation	Eye and nose irritant CNS depressant	CNS eyes nose skin	Colorless liquid with almond-like odor BP = 270°F FI = 4 82°F LEL = 1.3% UEL = 9.6%
Tetrachloroethene	127-18-4	335 50 ppm	None	170 25 ppm	Dermal; inhalation; ingestion	CNS depression Liver damage Sensory irritant	CNS liver skin eyes kidneys	Liquid Ether-like odor BP = 121.20°C
Trichloroethene	79-01-6	270 50 ppm	None	270 50 ppm	Dermal; inhalation; ingestion	CNS depression Sensory irritant Kidney damage Liver damage Heart damage	CNS skin eyes kidney liver CVS	Liquid Flammable BP = 86.7°F LEL = 12.5% UEL = 90%

TLV - Threshold Limit Value - must not be exceeded over 8 hour shift
IDLH - Immediately Dangerous to Life and Health - maximum concentration from which one could escape in 30 minutes without a respirator
PEL - Permissible Exposure Limit - must not be exceeded over 8 hour shift
mg/m^3 - milligrams per cubic meter
ppm - Part Per Million
CNS - Central Nervous System
CVS - Cardiovascular System
GI tract - Gastrointestinal tract
BP - Boiling Point
FP - Flash Point
UEL - Upper Explosive Limit
LEL - Lower Explosive Limit

Table A-1. Toxicological, Physical, and Chemical Properties of Compounds Potentially Present at the _____ Glen Cove, New York

Compound	CAS#	TLV (mg/m^3)	IDLH (ppm)	PEL (mg/m^3)	Routes of Exposure	Toxic Properties	Target Organs	Physical/Chemical Properties

°F - degrees Fahrenheit
°C - degrees Celsius

References

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APPENDIX B

Sampling and Analysis Plan

Supplemental Ground-Water Investigation

SAMPLING AND ANALYSIS PLAN
SUPPLEMENTAL GROUND-WATER INVESTIGATION

Ron Hill Dry Cleaners
74 Forest Avenue
Glen Cove, New York

December 8, 1997

Prepared for:

Rosenman & Colin

Prepared by:

ROUX ASSOCIATES, INC.
1377 Motor Parkway
Islandia, New York 11788

ROUX

W/PF14002Y.100B/CV

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TABLES

ATTACHMENTS

1.0 INTRODUCTION

Roux Associates, Inc. (Roux Associates) has developed a work plan to conduct a Supplemental Ground-Water Investigation at 71 Forest Avenue, Glen Cove, New York (NYSDEC Site #1-30-071). The Work Plan and this Sampling and Analysis Plan (SAP) have been developed by Roux Associates in accordance with direction provided in the United States Environmental Protection Agency (USEPA) guidelines.

The primary function of this SAP is to provide guidelines and procedures for field and laboratory personnel to be followed during the characterization of ground water. Furthermore, this SAP outlines the measures that will be taken to verify that data generated by field activities undertaken as part of this project are of quality sufficient to meet the data quality objectives. The SAP combines the elements of a field sampling plan (FSP) and a quality assurance project plan (QAPP) to streamline the project planning process. All field work will be performed in accordance with the previously prepared site-specific Health and Safety Plan (HASP).

2.0 PROJECT OBJECTIVES AND SCOPE

The objectives of this SAP are the following:

- Enhance the upgradient ground-water monitoring capability at the Site through the installation of an additional upgradient well;
- Reconfirm the gradient and local ground-water flow direction; and
- Evaluate current ground-water quality at the Site through sampling the four existing wells and the new upgradient well.

The above-listed tasks are discussed in detail in Section 9.0 of this SAP.

2.1 Scope of Work

The scope of work discussed in the SAP includes the following tasks:

Task 1: Survey Existing Monitoring Wells;

Task 2: Monitoring Well Installation; and

Task 3: Ground-Water Sampling.

The above listed tasks are discussed in more detail in Section 9.0 of this SAP.

2.2 Data Quality Objectives

Data Quality Objectives (DQOs) are qualitative and quantitative statements used to develop a scientific and resource effective sampling design. As stated in the Guidance for the Data Quality Objectives Process (EPA QA/G-4), DQOs are derived from the outputs of each step of the DQO process that:

- classify the study objective;
- define the most appropriate type of data to collect;
- determine the most appropriate conditions from which to collect the data; and
- specify acceptable levels of decision errors that will be used as the basis for establishing the quantity and quality of data needed to support the decision (USEPA, 1994).

The objective of the sampling at the Site is to evaluate ground-water quality conditions from the four existing wells and the new upgradient well to determine the nature, extent and gradients of the constituents of concern. A nonprobabilistic (judgmental) sampling approach will be used to select the specific sampling locations for these areas of concern. A judgmental sampling design consists of directed samples at specific sampling locations to confirm the existence of contamination at these chosen locations based on visual or historical information.

Total study error is the combination of sampling and measurement error. Total study error is directly related to decision error. These decision errors can be controlled through the use of hypothesis testing. For this sampling, the null hypothesis (baseline condition) is that the parameter of interest exceeds the action level. This decision has the smallest degree of decision error. In addition, measurement error is reduced by analyzing individual samples using more precise laboratory methods. Analyses will be performed using NYSDEC Analytical Services Protocol (ASP).

3.0 SAMPLE TYPES, LOCATION AND FREQUENCY

The sample locations will consist of the four existing monitoring wells and the newly installed monitoring well. The location of the new monitoring well will be determined based on the location(s) of any upgradient properties of concern, and current ground-water flow conditions.

Ground-water samples collected during the course of this project will be analyzed in accordance with the specified ASP procedures for low-concentration VOCs. Specifics regarding the collection of samples at each location and for each task are provided in Section 6.0.

Quality Control Checks

This section describes the Quality Control (QC) checks that will be used for this 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 to be submitted are summarized below.

Field duplicates and matrix spike samples and trip blanks are analyzed to assess the quality of the data resulting from the field sampling program. 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. During characterization sampling, one field duplicate sample will be collected for each 20 grab samples collected. Less than 20 samples will be collected, therefore, one duplicate sample will be analyzed.

Matrix spike/matrix spike duplicates (MS/MSDs) are used to evaluate analytical accuracy, and precision, respectively. MS/MSDs will be analyzed by the laboratory at a frequency of one per preparation batch.

Trip blanks are used to determine if any cross contamination between sample containers occurs. One trip blank will be collected in each shipping container.

4.0 QUALITY ASSURANCE OBJECTIVES FOR MEASUREMENT DATA

The overall Quality Assurance (QA) objective is to develop and implement procedures for field sampling, chain of custody, laboratory analysis, and reporting that will provide results which maximize the likelihood that the data are collected, analyzed and documented such that it is defensible. 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.

4.1 Accuracy, Precision, and Sensitivity of Analysis

The fundamental QA objective with respect to accuracy, precision, and sensitivity of analysis for laboratory analytical data is to achieve the QC acceptance criteria of the analytical protocols.

Accuracy, precision and completeness requirements 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 compared to federal and state regulations and guidelines. This will reflect the impact of matrix interferences. Precision, the ability to replicate a value, is monitored through duplicate (replicate) samples. It is assessed for each matrix. Corrective actions and documentation for substandard recoveries, or substandard precision, must be performed by the laboratory.

Instrument sensitivity must be monitored to ensure the data quality through constant 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.

Quality control criteria for laboratory and field analyses are provided in Table 1. Required field and laboratory QC samples and frequencies are summarized in Tables 2 and 3, respectively.

4.2 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 95 percent or more for all samples tested using the ASP/CLP Routine Analytical Services (RAS) methods and 90 percent for other methods. Following completion of the analytical testing, the percent completeness will be calculated by the following equation:

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

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 which 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. The procedures used to obtain the planned analytical data are expected to provide comparable data. These new analytical data, however, may not be directly comparable to existing data because of difference in procedures and QA objectives.

5.0 SAMPLING AND SAMPLE CUSTODY PROCEDURES

The following sections describe the standard protocols to be used by Roux Associates' personnel during the course of sampling activities. The Roux Associates' Standard Operating Procedures (SOPs) included in Attachment 1 will be referenced where applicable.

5.1 Sample Designation

Sample bottles (preserved, if necessary), labels, shipping containers, trip blanks, and field blank water will be provided by the laboratory. During collection of soil 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, field handling information and type of preservative added (if applicable).

The sample identification code provided on each sample label will follow the sample number and coding system described below.

1. Sample location abbreviations will be as follows:

   ground-water sample monitoring well = MW

2. Analytical method designations will be as follows:

   Volatile organic compounds = VOCs

3. QC identifiers (if applicable) will be as follows:

Field duplicate	=	D
Matrix Spike	=	MS
Matrix Spike Duplicate	=	MSD
Trip blank	=	TB

5.2 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 site. In order to accomplish this objective, the following three considerations have been addressed:

- the establishment of discrete work zones in the investigative area;

- the decontamination of field equipment; and
- the security and access procedures for the site.

All personnel who come onto the site, including Site employees, contractors, and observers, will be required to adhere strictly to the conditions imposed herein, and within the provision of the HASP.

5.2.1 Field Work Zones

Field work zones will be limited to areas where intrusive activities, including ground-water sampling and drilling, are conducted. Access will be limited in accordance with the HASP. Control of work zone access will be the responsibility of the Site Manager.

5.2.2 Site Security and Access

The Site is currently active. Site security and access control protocols used by the Site will be followed during implementation of these investigations. At the completion of each working day, all loose equipment (e.g., sampling equipment, water-level measuring devices, coolers, etc.) will be secured. Heavy equipment, such as the drill rig, will remain on-site within the current work zone.

5.3 Field Equipment

All measurement systems utilized in the field will be operated in accordance with the manufacturer's instructions and the applicable SOPs in Attachment 1. Methods of calibrating and maintaining the equipment are provided below.

5.3.1 Equipment Calibration

All measurement equipment will be calibrated according to the manufacturer's recommendations, where applicable. Frequency of instrument calibration will be dictated by the type of measurement device. Table 4 lists the field measurement equipment to be used and the calibration frequency for the instrument. Records of all calibrations (both frequency and results) will be kept in the field or instrument logbook.

5.3.2 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 Section 5.7 and in the SOPs (Attachment 1). Maintenance for measurement and health and safety equipment will be in accordance with the schedule found in Table 4.

Equipment failing to meet manufacturer's minimum specifications will be removed from service immediately and kept out of service until the problem is identified and/or resolved. Records of all routine maintenance and repair will be kept in the instrument or field logbook.

5.4 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 which can be used for reference and information retrieval at a later date. All field documentation will be recorded in bound logbooks or pre-generated activity-specific forms using indelible (water proof) ink. Details of record keeping requirements are described in Attachment 1. Samples of field forms are provided in Attachment 2.

5.4.1 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 pre-generated 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 Attachment 1.

5.4.2 Field Documentation for Drilling

Daily field activities will be summarized in a field notebook to ensure that an accurate record of all field investigation tasks are maintained. Geologic logs will be recorded in the field notebook during the drilling of the monitoring well. For each soil boring completed during these investigations, a geologic log will be prepared. Examples of geologic logs are provided in Attachment 2.

5.4.3 Sampling Documentation

A complete record of how each sample was selected, aliquotted, packaged, and preserved for analysis will be maintained in field logbooks. Specific procedures regarding the level and type of sampling documentation can be found in the activity-specific Roux Associates' SOP in Attachment 1. Sample designation and labeling are provided in Section 5.1. Questions regarding sampling methods and QA will be addressed by the Project Manager, or the Roux Associates' Quality Assurance Coordinator.

5.5 Field Custody Procedures and Documentation

The following sections describe the procedures necessary to document sample custody. The purpose of documenting sample custody is to ensure 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 (Attachment 1). Examples of a chain of custody form and a custody seal can be found in Attachment 2.

5.5.1 Field Custody

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 Site Manager to determine whether proper custody procedures were followed during the field work and to decide if additional samples are required.

Samples must be accompanied by a properly completed chain of custody form (Attachment 2). The sample numbers will be listed on the chain of custody form. 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.

Samples will be packaged for shipment and dispatched to the appropriate laboratory for analysis with a separate signed custody record enclosed in each sample box or cooler. Shipping containers will be locked and/or secured with strapping tape in at least two locations for shipment to the laboratory.

If split samples are requested, a separate chain of custody form 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 will request the representative's signature on the chain of custody form, acknowledging sample receipt. If the representative is unavailable or refuses, this will be noted in the "Received By" space.

If samples are to be collected and delivered directly to the Site Manager, the Site Manager will complete the chain of custody for laboratory shipment and have the field sampler sign in the "sampler" box. If samples are transferred from the field sampler to an intermediary person before being transferred to the Site Manager, a separate chain of custody form from that used to ship samples to the laboratory must be completed for the field transfers. Any questions regarding custody procedures or QA will be addressed by the Site Manager and/or the Quality Assurance Coordinator.

5.5.2 Laboratory Custody

The sample custodian at each laboratory will ensure that chain of custody records are completed upon receipt of the samples and will note questions or observations concerning sample integrity. The quality assurance officer will also ensure 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.

5.6 Sample Handling and Analysis

To assure quality data acquisition, and collection of representative samples, there are selective procedures to minimize sample degradation or contamination. These include procedures for preservation of the samples as well as sample packaging and shipping procedures.

5.6.1 Field Sample Handling and Shipment

All samples will be collected and handled according to the appropriate protocols for each matrix described in the SOPs (Attachment 1). The types of containers, volumes needed and preservation techniques for the VOCs are presented below.

Preservation	Holding Time	Container
HCl to pH<24°C	10 Days	2x40 ml glass vials with
store in dark		teflon lined septum

Sample packaging and shipping procedures are based upon USEPA specifications, as well as U.S. Department of Transportation (DOT) regulations. The procedures vary according to potential sample analytes, concentration, and matrix, and are designed to provide optimum protection for the samples and the public. Sample packaging and shipment must be performed using the general outline described below. Additional information regarding sample handling is provided in the SOPs (Attachment 1).

All samples will be shipped within 48 hours of collection and will be preserved appropriately from 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. Arrange containers in front of assigned coolers.
5. Seal sample containers within plastic zip-lock bags to prevent leakage.
6. Place approximately 2 inches of vermiculite or other packaging material at the bottom of the cooler to act as a cushion for the sample containers.
7. Arrange containers in the cooler so that they are not in contact with the cooler or other samples.
8. Fill remaining spaces with vermiculite or other packaging material.
9. Ensure all containers are firmly packed in vermiculite or other packaging material.
10. If ice is required to preserve the samples, ice cubes should be repackaged in double zip-lock bags, and placed on top of the vermiculite or other packaging material.
11. 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.
12. Separate copies of chain of custody forms. Seal proper copies within a large zip-lock bag and tape to cooler. Retain copies of all forms.
13. Close lid and latch.
14. Secure each cooler using custody seals.
15. Tape cooler shut on both ends.
16. 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.
17. Telephone laboratory contact and provide him/her with the following shipment information:
    - Sampler's name;
    - project name;

- number of samples sent according to matrix and concentration; and
- airbill number.

5.6.2 Laboratory Analysis

Analytical methods for the chemical analysis of constituents of concern have been chosen to provide the highest level of data quality for purposes of the evaluation of remedial alternatives. Laboratory analyses will be conducted using standard methodologies as summarized in Table 1. Applicable QA/QC is described in Table 2 and Table 3 for field QC and laboratory QC, respectively.

5.6.3 Field Analysis

Field analyses for pH_1 Ch, specific conductance, and temperature will be performed in accordance with the SOP in Attachment 1.

5.7 Decontamination Procedures

The procedures for the decontamination of field equipment, personnel and sampling equipment are outlined in the following sections. Detailed procedures for the decontamination of field and sampling equipment are included in the SOPs provided in Attachment 1.

In an attempt to avoid the spread of contamination, all equipment (i.e., drilling tools, sampling equipment, etc.) must be decontaminated at a reasonable frequency in the decontamination area. The location of the decontamination area will be determined prior to the start of operations. All wash water generated during cleaning will be collected and removed for proper disposal.

5.7.1 Drilling Equipment

The rig and all associated equipment will be cleaned by the contractor before arriving at and exiting the site. The augers, drilling casings, rods, samplers, tools, and any piece of equipment that may come in contact (directly or indirectly) with the soil, will be steam cleaned prior to set up for drilling to ensure proper decontamination. The same steam cleaning procedures will be followed for augers and sampling tools used for each borehole.

All steam cleaning (decontamination) activities will be monitored and documented by Roux Associates. Specific procedures for decontaminating drilling equipment are provided in the Roux Associates' SOP in Attachment 1.

5.7.2 Personnel Protection

The field work will be performed in level D protection with continuous air monitoring provided to demonstrate the adequacy of this protection. Any decontamination of personnel required will be performed at a designated area of the site and appropriate decontamination materials (e.g., eye wash) will be maintained for use in this area. The required photoionization detector (PID) readings for changing protection levels and other specifics regarding personnel protection and decontamination are discussed in the HASP.

5.7.3 Sampling Equipment

All ground-water sampling equipment will be decontaminated prior to sampling and between sampling locations according to the procedures outlined in the SOPs included in Attachment 1. It is anticipated that disposable bailers will be used; therefore, decontamination will not be required. Soil boring equipment will be decontaminated using steam cleaning equipment, non-phosphate, laboratory-grade detergent solution, and distilled or potable water in a clean bucket

5.8 Waste Handling and Disposal

Wastes generated during performance of field tasks (e.g., drill cuttings) will be containerized in labeled 55-gallon drums and stored within a designated area of the site. Each drum will be labeled with the site name, drum number, date, and nature of contents. Drill cuttings and disposable personnel protective equipment will be stored separately.

The handling of all wastes will conform to all health and safety requirements of the HASP. Composite samples will be collected to characterize the wastes prior to transport and disposal. Sample types, analytical parameters, and number of samples analyzed will be dependent upon state and federal transportation, landfill and/or site disposal requirements, and the requirements of the contracted waste hauler and waste-processing facility for wastes determined to be hazardous.

6.0 CALIBRATION PROCEDURES AND PREVENTIVE MAINTENANCE

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.

6.1 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 ensure 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 ensure the accuracy of measurement systems, and to verify 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 Meter (OVM) or photoionization detector (PID) water-level indicator, interface probe, pH meter, Eh meter, specific conductance meter, and thermometer. 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.

6.2 Laboratory Instruments

The ASP calibration procedures and frequencies are specified in the ASP procedures. In all cases where analyses are conducted according to the ASP procedures, the calibration procedures and frequencies specified in the applicable ASP SOW will be followed.

Records of calibration, repairs, or replacement will be filed and maintained by the designated laboratory personnel performing QC 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; and
- 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."

More detailed information on the calibration of laboratory equipment is presented in the laboratory QA plan.

6.3 Standards/Calibration Solutions Preparation

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

7.0 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. Please note that unless requested by the NYSDEC, an independent validation will not be performed. Both the field and laboratory data will be subjected to a level of data validation commensurate with the required data quality level

7.1 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.

7.1.1 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 will be resolved by the Project Manager. All calculation equations shall also be verified by the Project Manager and individual calculations will be verified at a minimum frequency of 30 percent by the PQAC. Any field information entered into data systems will be subject to the Roux Associates' QA/QC procedures (Attachment 1).

7.1.2 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 will 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 QC criteria as outlined in CLP protocols and/or 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 re-analysis is required; and
- 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.

Data reduction reporting procedures will be those specified in the ASP SOW for organic analyses.

Laboratories will prepare and retain full analytical and QC documentation the same as ASP analyses.

The laboratory will report the data in chronological order along with all pertinent QC data. Laboratories will provide the following information to the prime contractor 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. Analytical results for QC samples, spikes, sample duplicates, initial and continuing calibration verification standards and blanks, standard procedural (method) blanks, laboratory control samples, and Inductively Coupled Plasma (ICP) interference check samples.

4. Tabulation of instrument detection limits determined in pure water.

5. Raw data system printouts (or legible photocopies) identifying: date of analyses, analyst, parameter(s) determined, calibration curve, calibration verifications, method blanks, sample and any dilutions, sample duplicates, spikes and control samples.

6. Sample preparation/extraction/analysis logs including weights, volumes and dilutions.

7.2 Field Data Validation

Field data assessment will be accomplished by the efforts of the Quality Assurance Coordinator and/or Project Manager. The data assessment by the Project Manager or his/her designee will be based on the criteria that the sample was properly collected and handled according to Section 5.0.

8.0 CORRECTIVE ACTIONS

Corrective action generally addresses the need to bring data generating systems back into conformance after some trigger or other criteria have shown the system to be out of conformance. The following paragraphs describe the mechanics of how corrective action will be managed and implemented during the course of this project.

Corrective actions may be required for two classes of problems: analytical and equipment functional problems, and noncompliance problems. Analytical and equipment functional problems may occur during sampling and sample handling, sample preparation, laboratory instrumental analysis, and data review. The need for laboratory analysis corrective actions is based on predetermined limits for acceptability (Section 5.0). By conducting system and performance audits, the Laboratory QA Officer will determine if the overall data generating systems are acceptable.

For noncompliance problems, a formal corrective action program will be determined and implemented at the time the problem is identified. The person who identifies the problem is responsible for notifying the PQAC and/or Project Manager. If the problem is analytical in nature, information on these problems will be promptly communicated to the Laboratory QA Officer and method specific corrective actions will be implemented.

8.1 Field Corrective Action

Corrective actions will be implemented by field personnel and documented in the field record book. No staff member will initiate corrective action without notification through the proper channels. If corrective actions are insufficient, a stop-work order may be issued by the Project Manager.

Technical staff and project personnel will be responsible for reporting all suspected technical or QA nonconformance, or suspected deficiencies of any activity (or issued document) by reporting the situation to the Project Manager or his/her designee. The Project Manager will be responsible for assessing the suspected problems in consultation with the PQAC, and for making decisions based on the potential for the situation to impact the quality of the data. If it is determined that

the situation warrants a reportable nonconformance and/or requires corrective action, then a nonconformance report will be initiated by the field personnel and submitted to the Project Manager for review.

The Project Manager will be responsible for ensuring that corrective action for nonconformances are initiated by:

- evaluating all reported nonconformances;
- controlling additional work on nonconforming items;
- determining disposition or action to be taken;
- maintaining a log of nonconformances;
- reviewing nonconformance reports and corrective actions taken; and
- ensuring nonconformance reports are included in the site documentation project files.

If appropriate, the Project Manager will ensure that no additional work which is dependent on the nonconforming activity be performed until the corrective actions are completed.

Corrective action for field measurements may include the following:

- repeat the measurement to check the error;
- check for all proper adjustments for ambient conditions such as temperature;
- check the batteries;
- recalibration;
- check the calibration;
- replace the instrument or measurement devices; and
- stop work (if necessary).

The Project Manager or his/her designee is ultimately responsible for all site activities. In this role, the Project Manager at times is required to adjust the site programs to accommodate the site program specific needs. The change in the program will be documented on the Field Change

Request form (Attachment 2) that will be signed by the initiators and the Project Manager or his/her designee. The Field Change Request shall be attached to the file copy of the affected document. The Project Manager and the PQAC must approve the change in writing or verbally prior to the field implementation, if feasible. If unacceptable, the action taken during the period of deviation will be evaluated in order to determine the significance of any departure from established program practices and appropriate action will be taken by the Project Manager to document the significance of the problem.

The Project Manager is responsible for the controlling, tracking, and implementation of the identified changes. Reports on all changes will be distributed to all affected parties.

8.2 Laboratory Corrective Action

Corrective action is required whenever an out-of-control event or potential out-of-control event is noted. The corrective action taken will be somewhat dependent on the analysis and the event. These actions are to be implemented in accordance with the laboratory QA plan and the ASP SOWs, as appropriate and applicable.

9.0 FIELD INVESTIGATION PROCEDURES

This section describes the methods to be utilized during implementation of each field task described in the Scope of Work section of the Work Plan. The three field tasks identified in the Work Plan are:

Task 1: Survey Existing Monitoring Wells

Task 2: Monitoring Well Installation

Task 3: Ground-Water Sampling

The balance of this section is organized by task and provides descriptions of the methods to be utilized in the performance of each task.

9.1 Task 1: Survey Existing Monitoring Wells

Ground-water elevations in the existing Site monitoring wells (W-1 through W-4) will be resurveyed relative to a common Site datum. This task will include the measurement of only one round of ground-water elevations. Water levels will be measured to the nearest 0.01 foot using a steel measuring tape. The SOPs which will be followed during the measurement of water levels are provided in Attachment 1. In addition, the condition of each well will be evaluated by reviewing available well construction specifications, and sounding each well to verify construction (Attachment 1).

9.2 Task 2: Monitoring Well Installation

To evaluate ground-water quality at the upgradient Site property boundary, one monitoring well will be installed during this investigation. This well will be drilled using a truck-mounted hollow stem augur rig and will be completed in accordance with the SOPs for constructing monitoring wells in unconsolidated formations (Attachment 1).

During drilling of the well borehole, split-spoon core barrel samples will be collected every five feet from land surface to below the water table. The samples will be visually inspected and a log describing the geologic conditions will be developed. The samples will be screened in the field for evidence of contamination (i.e., staining, odors) and for VOCs using a PID. The sampler will be

placed on clean plastic sheeting and opened Total recovery will be measured and recorded. A representative composite of recovered material will be immediately placed in the proper container, sealed and labeled for visual record.

The monitoring well will be constructed of four-inch diameter PVC with a 20 foot long, 10 slot flush threaded well screen. The well will be packed with an equivalent of Morie No. 0 gravel with the pack extending approximately one to two feet above the well screen. The annular space above the gravel pack will be filled with a one-foot layer of granular bentonite followed by a bentonite based grout to approximately two feet below grade. An outer locking, steel protective casing will be placed over the well casing and the remaining unfilled portion of the annulus filled with concrete.

All drilling equipment that comes in contact, whether directly or indirectly, with soil during drilling operations will be decontaminated prior to mobilizing the drilling rig.

9.3 Task 3: Ground-Water Sampling

Following the installation and development of the proposed upgradient monitoring well, a comprehensive round of ground-water samples will be collected (i.e., 4 existing plus one new monitoring wells).

SOPs for measuring ground-water levels, sounding monitoring wells, purging monitoring wells, sampling monitoring wells, and implementing QA/QC procedures are provided in Attachment 1. All disposable sampling equipment (e.g., ropes, disposable bailers) will be discarded in an appropriate manner. A synopsis of these procedures is provided below.

The monitoring well will be developed either by surge block or centrifugal pump in order to ensure the removal of fine material and to ensure a good hydraulic connection between the well and the surrounding aquifer. Equipment used to develop the well will be decontaminated before use. The development of the well will continue until the turbidity of the discharged water is 50 nephelometric turbidity units (NTUs) or less for a minimum of three consecutive measurings at every well volume. Well development monitoring will be supplemented by additional

measurements of pH, conductivity and temperature. These measurements will be collected concurrently with the turbidity measurements. If the turbidity of the ground water in the wells cannot be reduced to that level, the field geologist, in consultation with the NYSDEC, will document the problem, record the turbidity measurement achieved and deem the well to be developed. Following development, the wells will be allowed to reach equilibrium before ground-water samples are collected. All development water will be discharged on-site downgradient of the sampling point. All development water will be screened for VOCs and visual contamination. If contamination is observed, water will be contained in 55-gallon drums and stored on-site. A sample will be collected from the drums and analyzed for TCL organics and TAL inorganics to determine if on-site or off-site disposal is necessary.

Prior to sampling the well, a water-level and, if present, NAPL thickness measurements will be recorded. The well will be purged prior to sampling. Three to five volumes of standing water will be purged (evacuated) prior to sample collection. Purging will be implemented using a bailer. Removing all stagnant water from the well will ensure the collection of a representative sample from the aquifers. During purging, the following field indicator parameters will be measured approximately every five minutes: pH, Eh, specific conductance, and temperature. The well will be considered stabilized and ready for sample collection when three consistent consecutive readings for pH, specific conductance and temperature are recorded, and the turbidity is less than or equal to 50 nephelometric turbidity units (NTUs) or has stabilized.

Ground-water samples will be poured directly into appropriate laboratory-supplied containers and covered with Teflon™ septa and caps. The sample for VOCs will be decanted with minimum agitation and the vials will be filled to exclude headspace.

The upgradient well will then be surveyed consistent with the existing wells as discussed above in Section 2.1 and one complete round of ground-water elevations will be measured from all Site monitoring wells (W 1 through W 5).

Table 1. Project Quality Control Summary

Parameter	Media	Quantitation Limit[a]	Estimated Accuracy	Estimated Precision[b]	Completeness	Analysis Method
TCL Volatile Organic Compounds	Water	1 µg/L - 5 µg/L	60 - 140%	30 RPD	95%	ASP 95-4[c]
pH	Water	0.1 unit	NA	NA	90%	150.1[d]
Eh	Water	NA	NA	NA	90%	SOP
Specific Conductance	Water	NA	NA	NA	90%	120.1[d]
Temperature	Water	NA	NA	NA	90%	170.1

µg/L - micrograms per liter

RPD - Relative Percent Difference
NA - Not applicable
SOP - Standard Operating Procedure

a. Quantitation limits are based on Contract Laboratory Program (CLP) Statement of Work requirements (where applicable).
b. Actual limits for matrix spikes, system monitoring compounds, and laboratory control samples are provided in the ASP Statement of Work.
c. Analytical Services Protocols.
d. Standard Methods for the Examination of Water and Wastewater.

Table 2. Field Quality Control Sample Frequency			
Parameters	**Media**	**Trip Blank[a]**	**Field Duplicates[b]**
pH/Eh/Temperature/Specific Conductance[c]	Water	NA	1/20

NA - Not applicable

a. Where applicable, one per twenty or fewer field samples, or one per shipment container (VOC only), whichever is more frequent.
b. Where applicable, one per twenty or fewer field samples.
c. Field parameters.

Table 3. Laboratory Quality Control Sample Frequency

Parameter	Media	Method Blank[a]	MS/MSD[a]	Laboratory Replicate[a]	Analysis Method
TCL Volatile Organic Compounds	Water	1/20	1/20	1/20	ASP 95-4[b]

NA - Not applicable
MS/MSD/MSB - Matrix Spike/Matrix Spike Duplicate/Matrix Spike Blank

a. Where applicable, one per twenty or fewer field samples, or one per analytical batch, whichever is more frequent
b. Analytical Services Protocol

Table 4. Field Equipment Calibration Requirements and Maintenance Schedule		
Equipment Type	**Calibration Requirements**	**Maintenance Schedule**
PID	Manufacturer's Directions	Recharge or replace battery. Regularly clean lamp window. Regularly clean and maintain the instrument and accessories.
pH Meter	Manufacturer's Directions	Per manufacturer's specifications and as needed based on calibration checks.
Eh Meter	Manufacturer's Directions	Per manufacturer's specifications and as needed based on calibration checks.
Specific Conductance Meter	Manufacturer's Directions	Per manufacturer's specifications and as needed based on calibration checks.
Thermometer	Manufacturer's Directions	Regularly check for breakage.
Personal Protective Equipment	Not Applicable	Integrity/function test prior to donning equipment. Visual inspection for defects/leakage for all reusable gear.
Magnetometer	Manufacturer's Directions	Replace batteries as necessary.
Surveying Instruments	Attachment A-1	Regularly clean instrument lenses.
Interface Probe/ Water-Level Indicator	Manufacturer's Directions	Replace batteries as necessary.

ATTACHMENT 1

Roux Associates'
Standard Operating Procedures

STANDARD OPERATING PROCEDURE FOR SURVEYING DISTANCES AND ELEVATIONS

Date: May 15, 1990 Revision Number: 0

Corporate QA/QC Manager: Michael A. DeCillis

1.0 PURPOSE

The purpose of this Standard Operating Procedure (SOP) is to establish guidelines for surveying distances and elevations. This SOP applies to the following automatic level instruments: Wild-Heerbrugg models NA-1, NA-20, NA-24, and NA-28; and Lietz model C40.

2.0 CONSIDERATIONS

2.1 Personnel

Two people are required to conduct land surveying activities. The instrument person is responsible for collecting measurements with the automatic level. The leveling staff person is responsible for holding the leveling staff at given locations.

2.2 Equipment

The basic equipment required for surveying includes a tripod, an automatic level and a leveling staff (or rod). The leveling staffs and the tripods may vary slightly from office to office, but no discussion is warranted. The automatic levels are all quite similar in construction and operation. The primary differences are in the telescope, compensator setting, and leveling accuracy which are described in the technical data sections of the respective operator's manuals. Certain features such as the optical sight, pentaprism for viewing the circular bubble, and coarse/fine focusing vary between models, and in some cases these features are absent.

A composite description of automatic level features is provided in Exhibit A. The individual features are identified and briefly described. Those who are unfamiliar with the automatic level must seek instruction and practice with the instrument and the operator's manual prior to entering the field.

2.3 Equipment Assembly and Set Up

Tripod

The tripod is set up by fully extending each leg and locking the legs in place with the clamp screws. The legs are spread out until the tripod head is roughly at chin level and the leg tips form an equilateral triangle. While confirming that the tripod head is approximately level, push the legs into the ground by stepping on

the tripod points. If the tripod is to be set up on smooth surfaces, then care must be taken to make sure the legs do not shift at all during measurements. In paved areas, putting the tripod points in cracks, grooves, or small holes helps to secure the legs. If the instrument is set up on asphalt in hot weather, then blocks or "shoes" must be placed under the tripod points to prevent it from sinking into the soft surface.

Automatic Level

Place the automatic level on the tripod head and anchor it using the centering screw. The base of the automatic level should be approximately centered within the tripod head. The instrument is leveled by adjustment of the three footscrews located between the instrument and the base plate. The adjustment is continued until the circular bubble is centered. Rotate the instrument 90° without disturbing the tripod, and ensure that the circular bubble is still centered. At this point, the instrument is set up to collect measurements.

Leveling Staff

The leveling staff is usually in three sections, each four or five feet in length. The leveling staff is extended to the desired length and carefully secured to prevent slipping of the sections. The leveling staffs which Roux Associates, Inc. (Roux Associates) uses are engineer's scale and graduated in 0.01 foot increments. The leveling staff is held at the desired location and a staff level (bubble) is used to confirm that the leveling staff is perfectly vertical. A turning plate should be used at turning point locations in grass, soft dirt, or bumpy areas. When on smooth hard surfaces, it is sometimes more suitable to use an "X" marked with chalk or crayon on a suitable location.

2.4 Elevations

When surveying to collect elevation data, a benchmark is required. The benchmark may be a known elevation (e.g., United States Geological Survey [USGS]) or an arbitrary elevation (e.g., assign 100.000 at a permanent location). Once the benchmark elevation has been established, the height of the properly leveled instrument is determined from a backsight. A backsight is taken from the instrument to the leveling staff at a point of known elevation (e.g., benchmark). The backsight reading added to the known elevation of the benchmark is the height of the instrument. When collecting elevation data, the leveling staff reading is always at the intersection of the vertical cross hair and the middle horizontal cross hair. The upper and lower horizontal cross hairs are for distance determination. Once the instrument height has been established, the leveling staff is moved to a location where the actual elevation will be determined. The

automatic level is aligned with the new location, but is never releveled between a backsight and a foresight. A foresight is taken from the instrument to the leveling staff at a point where the elevation is to be determined (e.g., a monitoring well). The elevation of the new location (e.g., a monitoring well, turning point, etc.) is determined by subtracting the foresight reading from the height of the instrument. After collecting a foresight reading, the instrument person moves to a new location, levels the instrument, and collects a backsight reading. The leveling staff person remains at the location of known elevation. When the new backsight reading is collected, the height of the instrument is established and the leveling staff person moves to a new location. By repeating this procedure in a "leap-frog" manner, a "loop" is completed through all locations where elevations are desired and terminated with a foresight to the original benchmark for closure.

In order to determine the closure accuracy, the sum of all the backsights is subtracted from the sum of all the foresights. If the absolute difference is less than 0.02 foot, then the survey loop is considered accurate for determining the measuring points for monitoring wells. If the difference is greater than 0.10 foot and the calculations are correct, the survey loop must be repeated. If the difference is between 0.02 and 0.10 foot, then the project manager must determine if the accuracy is sufficient based on factors such as data needs, hydraulic gradient, topography, etc.

Items which can help ensure closure accuracy are discussed below. The length of any foresight or backsight must not exceed 100 feet. The length of the backsight and foresight for a given pair of readings must be approximately equal. By doing this, any minor internal adjustment problems are naturally eliminated. The instrument and the leveling staff must be carefully leveled and any instrument movement eliminated. If the leveling staff is not perfectly vertical, then a larger reading will result. On windy days, it is advisable to only extend the leveling staff as necessary. Both the instrument person and the leveling staff person must pay due attention to soft ground, grass, etc. and utilize "shoes" or turning plates where appropriate. Care must be taken during each reading to ensure that the middle horizontal cross hair is used. Errors from misreading the cross hairs are often made when the instrument is set too high or too low for the instrument person's natural line of sight. To eliminate reading errors, it is suggested that the reading be taken, written in the field notebook, and then confirmed with a second reading.

2.5 Distances

Horizontal distances can be easily measured with an automatic level. It is especially useful for measurements across busy roads, rivers, wetlands, hilly terrain, etc. However, if the distances are short and unobstructed it is often easier to use a 100-foot cloth tape measure.

The instrument person sets up and levels the instrument at point A. The leveling staff person places the leveling staff at point B. The top cross hair reading is subtracted from the bottom cross hair reading. The difference multiplied by 100 is the horizontal distance from point A to point B.

3.0 MATERIALS/EQUIPMENT

a. A work plan which outlines surveying requirements.

b. Field notebook, field surveying forms, maps, benchmark information.

c. Automatic level in carrying case.

d. Leveling staff.

e. Staff level (bubble).

f. Tripod.

g. Turning plate.

h. Lumber crayon or chalk.

i. Feet (or small pieces of wood to be placed beneath tripod legs when set up on asphalt in hot weather, etc.).

j. Flogging tape and spray paint.

k. Machete.

l. Pocket transit.

4.0 CALIBRATION

The automatic levels which Roux Associates owns are high quality instruments which hold their adjustment extremely well. Calibration, therefore, is not necessary for field personnel. It is advisable, however, to check the circular bubble and horizontal line-of-sight occasionally (i.e., quarterly). The procedures are easy and can be found in the operator's manual.

5.0 PROCEDURES

5.1 The instrument person sets up the tripod at the first station (ST-1). DO NOT set up the stations any further than 100 feet from the benchmark or turning points because, to do otherwise, would compromise the accuracy of the measurements. The instrument is now ready to be leveled.

5.2 The instrument is leveled by adjustment of the three footscrews between the instrument and the instrument base plate. The adjustment is continued until the level bubble is centered. Once this has been done, the instrument is not releveled until it is set up at a new station. An exception to this is if the tripod is moved (kicked, etc.) or for some other reason the instrument is no longer level (i.e., tripod legs sink in asphalt), in which case the instrument must be releveled. DO NOT relevel the instrument between backsights and foresights.

5.3 The instrument, once leveled, is turned by use of the horizontal drive screw to come into line to sight the leveling staff at the benchmark. The instrument is adjusted until the leveling staff numbering and points are in sharp focus. The cross hairs of the instrument are focused by use of the knob on the eyepiece (if present).

5.4 The button below the eyepiece (if present) is pushed as a final check to ensure that the automatic internal compensator has brought the line of sight to horizontal. Now record the number that is read at the intersection of the vertical and middle horizontal cross hairs that extend across the entire field of view. This number is recorded in the field notebook to the nearest 0.001 foot. This establishes the height of the instrument.

5.5 The leveling staff person picks up their equipment and moves past the instrument station to the next turning point. A turning plate should be used to turn in grass or dirt areas. When on pavement, it is sometimes more suitable to use an X marked on a suitable area of the pavement. The intersection of the two lines is used as the point and the lines are used to line up the staff or rod, placing the line in the middle of each face or edge of the rods.

5.6 The instrument is not moved other than to rotate the instrument by use of the horizontal drive screw to sight the new location of the leveling staff and focusing of the instrument. The instrument is NOT releveled by use of the foot screws between backsights and foresights. Once the instrument has been focused on the staff at the new location, the compensator button is pushed (if present) and the leveling staff reading is recorded. This reading is a foresight that establishes the elevation at the turning point and is recorded in the foresight column.

5.7 The instrument is moved past the turning point and the procedures are repeated until the final destination is reached.

5.8 After the final destination has been reached and the foresight establishing its elevation has been recorded, a loop should be closed to the original benchmark to confirm that no errors were made (Exhibit B). This can be done by going back through the same stations and turning points or returning by a separate route. If the same stations and turning points are used, then the leveling staff person should stay on the final destination. The instrument stays at the same general location but is moved enough to require releveling (i.e., move the legs outward or inward several inches). The instrument is then releveled. This will make another turning point in the loop and will ensure that if an error was made in the final foresight reading, the loop to the original benchmark will not close. After the instrument has been releveled, a backsight is recorded and procedures 5.1 to 5.6 are repeated until the leveling staff person reaches the original benchmark and the instrument person performs a foresight to the staff at this location.

5.9 The field notebook should have the same number of backsights and foresights if the leveling was conducted as described above and no side shots were made. (A side shot is a case where two or more foresights are made from the same station and same instrument height. However, because the side shots are not an integral part of the loop as are turning points, an error in the staff reading will not be caught, yet, the loop will still close.) It is therefore recommended that each elevation to be established be treated as a turning point and that side shots not be utilized.

5.10 To check the loop for closure, sum the column of foresights, then sum all the backsights. The difference between these two totals is the closure error. If the closure error is within the tolerance limits set by the project manager, then the leveling is completed and the equipment should be packed up and returned to the office. If the closure error exceeds the tolerance limits set by the project manager, then the loop needs to be redone.

STANDARD OPERATING PROCEDURE FOR THE CONSTRUCTION, DEVELOPMENT, AND ABANDONMENT OF MONITORING OR OBSERVATION WELLS IN CONSOLIDATED FORMATIONS

Date: May 15, 1990 Revision Number: 0

Corporate QA/QC Manager: Michael A. DeCillis

1.0 PURPOSE

The purpose of this standard operating procedure (SOP) is to describe the considerations and procedures for constructing ground-water monitoring or observation wells in consolidated (bedrock) formations. Well development and abandonment (closure) procedures will also be addressed in this SOP. The United States Environmental Protection Agency (USEPA), the United States Geological Survey (USGS), and state regulatory agency procedures will be reviewed and considered in conjunction with the extensive experience of Roux Associates, Inc. (Roux Associates) to determine appropriate well construction and abandonment procedures. Discussions will be held with the appropriate agencies to resolve conflicting procedures and finalize well construction and abandonment methods. The well construction and, if necessary, abandonment will be detailed in the work plan.

Monitoring wells will be completed in bedrock formations for the purposes of measuring ground-water levels and collecting ground-water samples. Ground-water level data will be used to calculate ground-water elevations which may be used, if appropriate for the bedrock system, to describe head and flow relationships. Ground-water samples will also be used to quantify water-quality conditions.

Observation wells will be completed in bedrock formations for the purpose of collecting water-level data from aquifer tests. Slug tests, step-drawdown tests, and constant-rate pumping tests (refer to the respective SOPs) may be conducted to qualitatively or quantitatively characterize flow system hydraulic parameters and/or intra-aquifer and inter-aquifer hydraulic connection.

2.0 PROCEDURE FOR WELL CONSTRUCTION

The installation of each bedrock well will begin immediately after borehole completion and geophysical logging, if implemented. The original rock coring (corehole) may have to be enlarged (reamed) to accommodate appropriate-sized casing (and screen, if necessary). Once well installation has begun, no breaks in the process will be made until the well has been completed and secured against unauthorized access. In cases of unscheduled delays, such as personal injury, equipment breakdown or sudden inclement weather, installation will be resumed as soon as practical. If conditions are such that this course of action cannot be followed (e.g., friable or void-filled bedrock), then construction of the well may have to proceed as the borehole is drilled.

2.1 The well will be constructed with the appropriate type and diameter steel casing (and/or steel or PVC casing and screen, if conditions necessitate this) and will be at least 4 inches in diameter to readily accommodate purging and water-sampling devices. However, if the well's purpose is multiple (pumping tests, remote sensing, water-level recorder station, etc.), a larger diameter well may be needed to accommodate pumps, floats, or sensors.

2.2 Fittings (couplings) will not restrict the inside well diameter, as steel casing will be welded and/or flush-joint threaded, and PVC joints will be internally threaded. Glues, solvents, or chemical cleaners will not be used in the construction of the wells. All casings, fittings, and screens will be new material. The well screens will be fabricated and have an inside diameter equal to the well casing. The lengths of casing and screen will be measured and recorded on an appropriate field form and in the field notebook by the field hydrogeologist prior to installation.

2.3 It is anticipated that wells in consolidated formations will be completed as open hole wells and therefore be installed as follow:

a. An appropriate size steel casing will be set a minimum of 5 feet into competent bedrock and pressure grouted through the inside of the casing using a cement and bentonite mixture. The grout will first fill the well casing, and then fill the annular space from the bottom of the borehole up, to seal-off overlying formations.

b. After the grout solidifies, the casing will be drilled out (using a bit of equal diameter as the casing) and an open hole will be drilled below the steel casing to the appropriate depth in the bedrock.

c. If a discrete depth in the bedrock is to be tapped by the well (open to the formation), then overlying portions of the formation(s) will be cased off with a steel casing to permit well completion in the zone of interest.

d. If the bedrock cannot support an open hole (i.e., formation collapse) then a cased and screened well will be installed as described below (Section 2.4).

e. A locking steel protective casing or curb box will be set over the well and cemented in place, or welded to the steel casing to prevent water from ponding at the top of the well or directly entering the well, and safeguard the well from accidental damage or vandalism.

2.4 Bedrock wells in noncompetent or void-filled consolidated formations that are subject to collapse will be installed as follow:

a. An appropriate size steel casing will be set and grouted into competent bedrock and drilled-out (as described above in Sections 2.3 a, b and c).

b. The screen and casing will be lowered into the steel-cased borehole to the appropriate depth. Screen and casing materials may be either stainless steel or PVC. A bottom plug, well cap, and flush-joint sections will be used.

c. A gravel pack (quartz sand or pea gravel) will be emplaced around the screen from a few feet below the bottom of the screen to several feet (approximately 5) above the screen to avoid applying the weight of the casing on the screen (i.e., support the well until the grout solidifies) and to allow for potential settlement during subsequent development. The placement of the gravel pack may require the use of a tremie pipe.

d. An approximate 3-foot bentonite seal (powder or pellets) will be placed on top of the gravel pack.

e. The remaining annulus will be grouted to within a few feet of land surface. If PVC casing is used inside the steel outer casing, then extreme care must be taken in grouting the annular space in lifts (specified lengths) to avoid deformation of the PVC casing by the heat of curing and/or the weight of the grout.

f. A locking steel protective casing or curb box will be set over the well and cemented in place, or welded to the steel casing to prevent water from ponding at the top of the well or directly entering the well, and to safeguard the well from accidental damage or vandalism.

2.5 Each well will be properly identified with the appropriate information (e.g., local well number, state permit number [if applicable], etc.). The top of the well casing will serve as the measuring point (MP) for ground-water level measurements. The MP will be surveyed to the nearest 0.01 foot relative to a common datum (e.g., mean sea level) by trained Roux Associates, Inc. personnel or a professional, state-licensed surveyor, as defined in the work plan.

2.6 If required, well clusters will be constructed. A well cluster is defined as a group of two or more wells, located adjacent to or very near each other, which penetrate different depths of the aquifer or formation. Each well is open to, or screened at, a different depth to obtain data defining the vertical distribution of water levels

and water quality in the aquifer or formation. In the event that a well cluster is drilled, one large-diameter (e.g., 8-inch, 10-inch, etc.) borehole may be drilled and each well in the cluster may be individually cased within that one borehole; however, the preferred method is to drill individual boreholes for each well in the cluster.

2.7 Each well will have a location sketch, a well construction log, and a geologic log showing the casing placement and materials used to fill the annular space between the well casing and borehole. The appropriate log will show the depths of each casing material and discuss the geologic variability at the site. A description of the surface soils, if present, and the unsaturated zone materials down to and including the ground water is required.

The following information, if applicable, will be included on the well log:

a. Project number.

b. Date and initials of scientist documenting the well information.

c. Date and time of construction.

d. Well location.

e. Well and permit number.

f. Borehole diameter.

g. Well depth.

h. Casing material.

i. Screen material.

j. Screen slot size and length.

k. Gravel pack type and size (depths from _____ to _____).

l. Bentonite pellets (depths from _____ to _____).

m. Bentonite grout (depths from _____ to _____).

n. Cement grout (depths from _____ to _____).

o. Ground-surface elevation.

p. Measuring point elevation.

q. Well height above or depth below land surface.

r. Depth ground water encountered.

3.0 DESCRIPTION OF WELL DEVELOPMENT

3.1 Before a newly constructed well can be used for water-quality sampling, measuring water levels, or aquifer testing, it must be developed. Well development refers to the procedure used to clear the well and formation around the screen of fine-grained materials (sands, silts, and clays) produced during drilling or naturally occurring in the formation. Well development continues until the well responds to water-level changes in the formation (i.e, a good hydraulic connection is established between the well and formation) and the well produces clear, sediment-free water to the extent practical.

3.2 Depending on the drilling technique used, composition of the formation screened, and well diameter and construction materials, well development may include one or more of the following techniques.

a. Bailing.

b. Pumping (centrifugal, submersible, or air).

c. Backwashing.

d. Surging (mechanical).

e. Jetting.

f. A combination of the above.

3.3 A 1-pint sample of the last water removed during development will be obtained and inspected by the field hydrogeologist for relative clarity to determine whether development is complete. A turbidimeter may be used to evaluate the clarity of the water removed from the well during development (and its use may also be stipulated by a regulatory agency). Well development procedures will be recorded on the well construction log form and will also be documented in the field notebook.

3.4 Dispersing agents, acids, disinfectants, or other additives will not be used during development nor will they be introduced into the well at any other time unless specifically stipulated in the work plan. During development, water will be removed from the entire column of water standing in the well by periodically lowering and raising the pump intake. Well development will include the rinsing of the interior well casing above the water column in the well using only water from that well.

4.0 WELL ABANDONMENT OR CLOSURE

4.1 Upon the completion of the investigation, a determination will be made as whether to maintain the well or to close it (i.e., abandon and seal it). If the client and Roux Associates agree to abandon the well, then the state will be notified and a request will be presented for well abandonment. Upon state approval to seal the well, appropriate state well abandonment forms will be completed. Following state approval, the abandonment of any well will be in accordance with local, state and/or Federal regulations.

4.2 For each abandoned well, the procedure will be documented on an appropriate field form and in the field notebook. Documentation may include, where appropriate, the following:

a. Well designation.

b. Location with respect to the replacement well, if replaced (e.g., 30 feet north and 40 feet west of Well MW-1). A location sketch should be prepared.

c. Open depth prior to grouting and any other relevant circumstances (e.g., formation collapse).

d. Well casing left in the borehole by depth, size, and composition.

e. A copy of the geologic log.

f. A revised diagram of the abandoned well using the well construction log form.

g. Additional items left in hole by depth, description, and composition (e.g., lost tools, bailers, etc.).

h. A description and daily quantities of grout used to compensate for settlement.

i. The date of grouting.

j. The level of water prior to grouting and the date and time measured.

k. The remaining casing, size, and composition above or below ground surface reported in depths or heights from ground surface.

l. Any other state or local well abandonment reporting requirements.

STANDARD OPERATING PROCEDURE FOR MEASURING WATER-LEVELS AND SOUNDING A WELL WITH A STEEL TAPE

Date: December 21, 1989

Revision Number: 0

Corporate QA/QC Manager: Michael A. DeGilio (QAM)

1.0 PURPOSE

The purpose for this standard operating procedure (SOP) is to establish the guidelines for using steel measuring tapes. A steel tape is used to measure the depth to ground water below an established (surveyed) measuring point (MP) and/or to sound a well (i.e., to measure the depth of well). Measuring the depth to water (DTW) below the surveyed MP provides information for calculating ground-water elevations needed to construct ground-water elevation maps and determine the direction of ground-water flow. A well is sounded to determine the total depth of the well (i.e., to provide information regarding potential siltation problems (filling-in with sediment)). This can be used to eliminate possible confusion concerning identification of the well in cases where there are several similar, adjacent, unlabeled wells. Depth to water and sounding data can also be used to calculate the volume of standing water in the well (which is a prerequisite for purging a well before well sampling, and will be addressed in respective SOPs).

A steel tape is the preferred water-level measuring device because it is the most accurate, especially when measurements are taken under static conditions. However, this technique may be inappropriate under nonstatic (changing) conditions such as aquifer tests when water levels may be changing rapidly or when water is cascading into a well. These conditions would require the use of an electronic sounding device (refer to SOP for Measuring Water Levels using an Electronic Sounding Device (M-Scope).

2.0 DECONTAMINATION

The steel tape must be precleaned (decontaminated) using a non-phosphate, laboratory-grade solution and rinsed with copious amounts of distilled or deionized water. This process is repeated before each measurement and following the final measurement.

3.0 PROCEDURE

3.1 If the well is not vented, then remove the cap and wait several minutes for the water level to equilibrate. Take several measurements to ensure that the water level measured is in equilibrium with the aquifer (i.e., not changing substantially).

3.2 The tape will be equipped with a weight to ensure the tape is held vertically and is kept taut when lowered into the well. Measure and record the distance from the bottom of the tape to the bottom of the weight to ensure the proper depth is measured when sounding a well.

3.3 If a water-level measurement is to be taken, then apply chalk (e.g., carpenter's chalk) to the bottom few feet of the tape and lower it into the water.

3.4 The top of the tape is held at an even-foot increment at the MP. This is the "held" value, and is recorded as such.

3.5 The tape is rolled up, and the cut (i.e., the mark between the dry and wet chalk) is noted. This "wet" value is measured accurately to the nearest 0.01 foot, and is recorded as such. The difference between the "held" value and the "wet" value is the DTW.

3.6 Always remeasure at least one well, preferably the first well measured, to see if the static water level has changed (e.g., due to pumping in the area, tidal effects, etc.).

3.7 If there are previous water-level measurements available for the wells, then have these data available to compare the measurements with those just taken. Use these data to see if water levels are similar or if they have changed. If water levels have changed, then check if the changes are consistent (i.e., all up or all down) and make sense.

3.8 Water-level elevations are calculated by subtracting the DTW from the MP and a water-elevation map is constructed (contoured) on a well location map. This also provides a check to evaluate if the water levels make sense (or anomalies are evidenced). Remeasure the well(s) where anomalies are found as a check on the initial measurement(s).

3.9 If anomalies persist or water-level trends are different from the historical database, then check to see if hydrogeologic conditions and/or stresses have changed (e.g., discharge areas, pumping and/or injection wells, etc.).

3.10 If the well is being sounded (depth measured), then lower the tape to the bottom of the well and measure its length accurately from the MP to the nearest 0.01 foot. Compare the sounded depth to the as-built well construction log (diagram). This will determine if siltation has occurred and redevelopment is necessary to establish a good hydraulic connection between the well screen and the aquifer.

3.11 All pertinent data will be recorded in the field notebook and on appropriate field forms, and initialed and dated.

STANDARD OPERATING PROCEDURE FOR COLLECTION OF QUALITY CONTROL SAMPLES FOR WATER-QUALITY DATA

Date: May 15, 1990 Revision Number: 0

Corporate QA/QC Manager: Michael A. DeCelles

1.0 PURPOSE

The purpose of this standard operating procedure (SOP) is to explain the quality control (QC) measures taken to ensure the integrity of the samples collected and to establish the guidelines for the collection of QC samples. The objective of the QC program is to ensure that water-quality data of known and reliable quality are developed.

Because valid water-chemistry data are integral to a hydrogeologic investigation that characterizes water-quality conditions, the data will be confirmed by QC samples. Without checks on the sampling and analytical procedures, the potential exists for contradictory or incorrect results. The acceptance of water-quality data by regulatory agencies and in litigation-support investigations depends heavily on the proper QC program to justify the results presented. The QC sampling requirements must be determined by the project manager and be clearly defined in the work plan. If data validation (for in-house purposes or for compliance with the United States Environmental Protection Agency [USEPA] regulations) is stipulated as part of the hydrogeologic investigation, QC sampling must be conducted.

2.0 QUALITY CONTROL SAMPLES

2.1 Samples taken for analysis of compounds require the use of quality control samples to monitor sampling activities and laboratory performance. Types of quality control samples may include replicate and/or replicate split, trip blank, field equipment blank, matrix spike and matrix spike duplicate, and fortification. A discussion pertaining to each quality control sample follows:

a. Replicate and Replicate Split - Replicate sample analysis is done to check on the reproducibility of results either within a laboratory or between laboratories. A replicate sample is called a split sample when it is collected with or turned over to a second party (e.g., regulatory agency, consulting firm) for an independent analysis. Replicate samples are aliquots (equal portions) from a sample in a common container.

To collect a replicate sample, water from the bailer or pump will be distributed first to fill one container and then to fill the second container. Adequate water should be available to fill the bottles completely before they are capped. If the water is insufficient to fill all the bottles at once, then incrementally fill each bottle with water from two or more bailer volumes or pump cycles.

For some test substances, water may have to be accumulated in a common container and then decanted slowly into the sample bottles. The work plan should be checked for a description of how replicate samples are to be collected. Additionally, in the case of wells that recover slowly and produce insufficient water to fill all the replicate sample containers, the containers should be filled incrementally and kept on ice in the cooler in between filling periods.

b. Trip Blank - A trip blank sample is a sample bottle that is filled with "clean" (e.g., distilled/deionized) water in the laboratory, and travels unopened with the sample bottles. (The USEPA now uses the phrase "demonstrated analyte free water.") It is opened in the laboratory and analyzed along with the field samples for the constituent(s) of interest to detect if contamination has occurred during field handling, shipment, or in the laboratory. Trip blanks are primarily used to check for "artificial" contamination of the sample caused by airborne volatile organic compounds (VOCs) but may also be used to check for "artificial" contamination of the sample by a test substance or other analyte(s). One trip blank per cooler containing VOC samples, or test substance of other analyte(s) of interest would accompany each day's samples.

c. Field Equipment Blank - A field equipment blank (field blank) sample is collected to check on the sampling procedures implemented in the field. A field blank is made with "clean" (e.g., distilled/deionized/demonstrated analyte free) water by exposing it to sampling processes (i.e., the clean water must pass through the actual sampling equipment). For example, if samples are being collected with a bailer, the field blank would be made by pouring the clean water into a bailer which has been decontaminated and is ready for sampling, and then pouring from the bailer into the sample containers. If a metals equipment blank is to be made, and the water was filtered, then the sample must be filtered (i.e., exposed to the sampling process). One equipment blank would be incorporated into the sampling program for each day's collection of samples and analyzed for the identical suite of constituents as the sample. In some situations one equipment blank will be required for each type of sampling procedure (e.g., split-spoon, bailer, hand auger).

A special type of field blank may be needed where ambient air quality may be poor. This field blank sample would be taken to determine if airborne contaminants will interfere with constituent identification or quantification. This field blank sample is a sample bottle that is filled and sealed with "clean" (e.g., distilled/deionized/demonstrated analyte free) water in the analytical laboratory, and travels unopened with the sample bottles. It is opened in the field and exposed to the air at a location(s) to check for potential atmospheric interference(s). The field blank is resealed and shipped to the contract laboratory for analysis.

d. Matrix Spike and Matrix Spike Duplicate - Spikes of compounds (e.g., standard compound, test substance, etc.) may be added to samples in the laboratory to determine if the ground-water matrix is interfering with constituent identification or quantification, as well as a check for systematic errors and lack of sensitivity of analytical equipment. Samples for spikes are collected in the identical manner as for standard analysis, and shipped to the laboratory for spiking. Matrix spike duplicate sample collection, and laboratory spiking and analysis is done to check on the reproducibility of matrix spike results.

e. Fortification - A fortification, which is performed in the field, is used to check on the laboratory's ability to recover the test substance (analyte) added as well as its stability between fortification and analysis.

A field fortification (spike) is prepared by filling the container(s) with field or distilled/deionized/demonstrated analyte free water (as specified by the laboratory) to a predetermined volume (as specified by the laboratory) and adding the spike (supplied by the laboratory). The predetermined volume of water is measured with a clean (decontaminated) graduated cylinder. Field spikes will be prepared following the collection, labeling, and sealing of nonspiked samples in a separate cooler. The spike is kept at a safe distance from the sampling point (e.g., in the hotel room).

2.2 The work plan must be referred to for details regarding the type of QC samples to be collected and the QC sample collection method.

3.0 PROCEDURE

3.1 Implement QC sampling as outlined above, depending on the type of QC sample(s) specified in the work plan.

3.2 Ensure unbiased handling and analysis of replicate and blank QC samples by concealing their identity by means of coding so that the analytical laboratory cannot determine which samples are included for QC purposes. Attempt to use a code that will not cause confusion if additional samples are collected or additional monitoring wells are installed. For example, if there are three existing monitoring wells (MW-1, 2 and 3), do not label the QC blank MW-4. If an additional monitoring well were installed, confusion could result.

3.3 Label matrix spike and field fortification (spike) QC samples so that the analytical laboratory knows which samples are to be spiked in the laboratory and which samples were fortified (spiked) in the field, respectively. In certain situations, the field fortification will be "blind" or undisclosed to the laboratory to independently verify their analytical ability.

3.4 Verify that each sample is placed in an individual "zip-lock" bag, wrapped with "bubble wrap," and placed in its appropriate container (holder) in the cooler, and that the cooler has sufficient ice (wet ice or blue packs) to preserve the samples for transportation to the analytical laboratory. Consult the site work plan to determine if a particular ice is specified as the preservative for transportation (e.g., the USEPA prefers the use of wet ice because they claim that blue ice will not hold the samples at 4° Centigrade/Celsius).

3.5 Document the QC samples on the appropriate field form and in the field notebook. On the chain-of-custody form, replicate and blank QC samples will be labeled using the codes (Number 3.2, above), and matrix spike and field fortification QC samples will be identified as such (Number 3.3, above).

3.6 Follow standard shipping procedures for samples (i.e., retain one copy of the chain-of-custody form, secure the cooler with sufficient packing tape and a custody seal, forward the samples via overnight [express] mail or hand deliver to the designated analytical laboratory preferably within 24 hours but no later than 48 hours after sampling). However, check the site work plan for information on the analyte(s), as some have to be analyzed immediately (e.g., CN).

STANDARD OPERATING PROCEDURE FOR DECONTAMINATION OF FIELD EQUIPMENT

Date: December 21, 1989

Revision Number: 0

Corporate QA/QC Manager: Michael R. DeVitis

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., rinsate 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.

STANDARD OPERATING PROCEDURE FOR SAMPLE HANDLING

Date: May 15, 1990 Revision Number: 0

Corporate QA/QC Manager: Michael A. de Celles

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., Teflon™) 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., Teflon™). 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 indivudual 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.

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

Date: May 15, 1990

Revision Number: 0

Corporate QA/QC Manager: Michael A. DeCillis

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 onsite.

b. Name, date, and time of arrival onsite 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 onsite 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 onsite.

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.

ATTACHMENT 2

Field Forms

CUSTODY SEAL

DATE _____

SIGNATURE _____

ROUX

ROUX

CHAIN OF CUSTODY

№ 02835Y

ROUX ASSOCIATES INC
Environmental Consulting & Management
1377 MOTOR PARKWAY
ISLANDIA, NEW YORK 11788
(516) 232-2600 FAX (516) 232-9898

ANALYSES

PAGE OF

PROJECT NAME

PROJECT NUMBER

PROJECT LOCATION

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

CONSULTING GROUND WATER GEOLOGISTS

ROUX ASSOCIATES INC

WELL LOG

Project _____

Client _____

Page _____ Of _____

Logged By _____

Owner _____

Well No. _____

Loc. _____

M.P. Elevation _____

Drilling Started _____ Ended _____

Driller _____

Type Of Rig _____

WELL DATA

Hole Diam. (in.) _____

Final Depth (ft.) _____

Casing Diam. (in.) _____

Casing Length (ft.) _____

Screen Setting (ft.) _____

Screen Slot & Type _____

Well Status _____

G W READINGS(1)

Date	DTW MP(2)	Elev. W.T.

SAMPLER

Type _____

Hammer _____ lb.

Fall _____ in.

DEVELOPMENT

SAMPLE No.	SAMPLE Rec.	SAMPLE Depth	SAMPLE Blows 6	Strata Change & Gen. Desc.	Depth (ft.)	SAMPLE DESCRIPTION

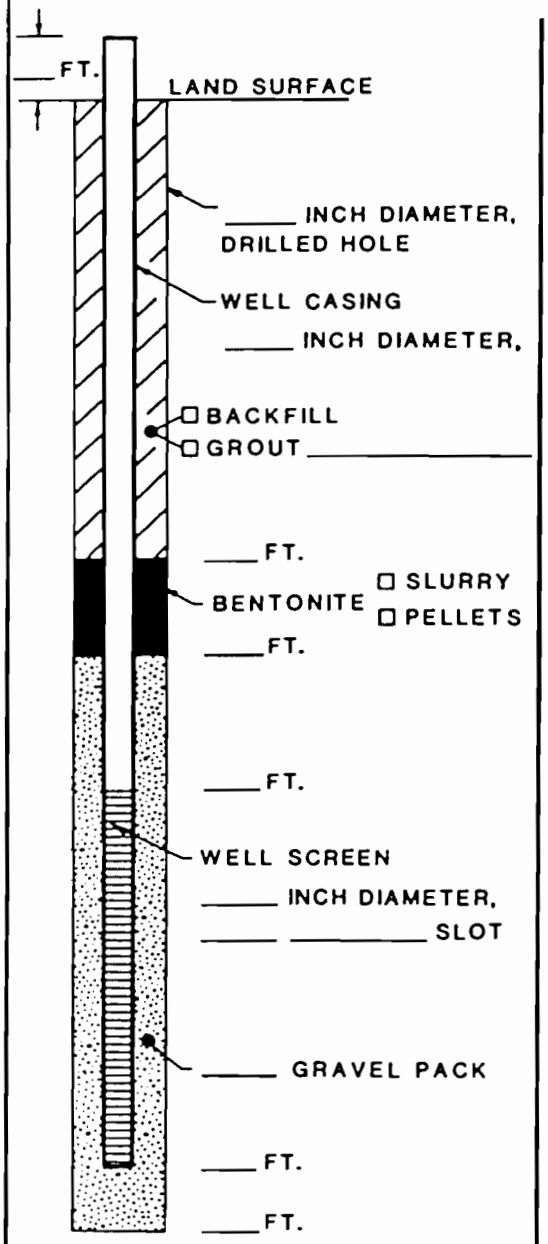
REMARKS: (1) in feet relative to a common datum
(2) from top of PVC casing

ROUX

Consulting Ground-Water Geologists

ROUX ASSOCIATES INC

MONITORING WELL CONSTRUCTION LOG



NOTE:
ALL DEPTHS IN FEET
BELOW LAND SURFACE

PROJECT NAME _____ NUMBER _____

WELL NO. _____ PERMIT NO. _____

TOWN/CITY _____

COUNTY _____ STATE _____

LAND-SURFACE ELEVATION

AND DATUM _____ FEET ☐ SURVEYED

_____ ☐ ESTIMATED

INSTALLATION DATE(S) _____

DRILLING METHOD _____

DRILLING CONTRACTOR _____

DRILLING FLUID _____

_____

DEVELOPMENT TECHNIQUE(S) AND DATE(S)

_____

_____

_____

FLUID LOSS DURING DRILLING _____ GALLONS

WATER REMOVED DURING DEVELOPMENT _____ GALLONS

STATIC DEPTH TO WATER _____ FEET BELOW M.P.

PUMPING DEPTH TO WATER _____ FEET BELOW M.P.

PUMPING DURATION _____ HOURS

YIELD _____ GPM _____ DATE _____

SPECIFIC CAPACITY _____ GPM/FT.

WELL PURPOSE _____

_____

_____

REMARKS _____

_____

_____

_____

_____

_____

HYDROGEOLOGIST _____

1/89

ROUX Consulting Ground-Water Geologists
ROUX ASSOCIATES INC

WELL SAMPLING DATA FORM

CLIENT _____
PROJECT NO. _____
LOCATION _____

WELL NUMBER _____ TYPE OF WELL _____
DATE _____ STORAGE TANK _____
WEATHER _____ TIME OF START _____
SAMPLED BY _____ TIME OF FINISH _____

DEPTH TO BOTTOM OF WELL _____ FT.
DEPTH TO WATER _____ FT.
WATER COLUMN _____ FT.
VOLUME OF WATER IN WELL _____ GAL.
VOLUME OF WATER TO REMOVE _____ GAL.
VOLUME REMOVED _____ GAL.

RATE OF PURGE _____
METHOD OF PURGE _____

PHYSICAL APPEARANCE/COMMENTS

FIELD MEASUREMENTS

TIME	pH	COND	TEMP	TURB	Eh	O^2

TYPES OF SAMPLES COLLECTED

LABORATORY NAME AND LOCATION