

**PROJECT OPERATIONS PLAN
MALTA ROCKET FUEL AREA
SUPERFUND SITE
TOWNS OF MALTA AND STILLWATER
SARATOGA COUNTY, NEW YORK**

VOLUME I

March 1991

Prepared by

**Geraghty & Miller, Inc.
Environmental Services
125 East Bethpage Road
Plainview, New York 11803**

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ENVIRONMENTAL CONSTRUCTION 5
WATERBURY, CT.

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**New York State Department of Environmental Conservation****MEMORANDUM**

TO: Daniel Steenberge, Reg. Hazardous Waste Remediation Engineer, Region 5
FROM: Marsden Chen, Bureau of Eastern Remedial Action, DHWR *AB for me*
SUBJECT: Malta Rocket Test Site #546022 - Project Operations Plan
DATE: APR 8 1991

Attached is a copy of the above referenced document for the Malta Rocket Test site.

Please have staff review this document and provide your written comments to Jonathan Greco, of my staff by April 16, 1991.

If you have any questions, he can be reached at (581) 457-3976.

Attachment

TABLES

1. Summary of Data Quality Objectives and Data Gathering Requirements During Remedial Investigation, Malta Rocket Fuel Area Superfund Site, Towns of Malta and Stillwater, Saratoga County, New York.
2. Summary of Analytical Levels Appropriate to Various Data Uses, Malta Rocket Fuel Area Superfund Site, Towns of Malta and Stillwater, Saratoga County, New York.
3. Ground-Water Quantitation Limits and ARARs for the Malta Rocket Fuel Area Superfund Site, Towns of Malta and Stillwater, Saratoga County, New York.
4. Soil Quantitation Limits and ARARs for the Malta Rocket Fuel Area Superfund Site, Towns of Malta and Stillwater, Saratoga County, New York.
5. Air ARARs (Including OSHA Requirements) for the Malta Rocket Fuel Area Superfund Site, Towns of Malta and Stillwater, Saratoga County, New York.
6. Waste and Sludge ARARs for the Malta Rocket Fuel Area Superfund Site, Towns of Malta and Stillwater, Saratoga County, New York.
7. Sampling Plan Summary, Malta Rocket Fuel Area Superfund Site, Towns of Malta and Stillwater, Saratoga County, New York.
8. Air Sample Locations/Parameters, Malta Rocket Fuel Area Superfund Site, Towns of Malta and Stillwater, Saratoga County, New York.
9. Field Instrument Calibration Summary, Malta Rocket Fuel Area Superfund Site, Towns of Malta and Stillwater, Saratoga County, New York.
10. Sample Matrices, Malta Rocket Fuel Area Superfund Site, Towns of Malta and Stillwater, Saratoga County, New York.
11. Sample Containers and Preservation, Target Compound List (TCL) Parameters, Malta Rocket Fuel Area Superfund Site, Towns of Malta and Stillwater, Saratoga County, New York.
12. Current Occupational Airborne Contaminant Standards and Guidelines.
13. Contingency Plans for Potential Problems, Malta Rocket Fuel Area Site, Towns of Malta and Stillwater, Saratoga County, New York.

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- 3a. Potentiometric Level Contour Map for Shallow Wells, August 5, 1986.
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5. Previous Sampling Locations, Proposed Monitoring Wells, Stream Sampling Locations, Soil Sampling Locations, and the Early Warning System.
6. Proposed Schedule of Remedial Investigation Activities, Malta Rocket Fuel Area, Malta/Stillwater, New York.
7. Malta Rocket Fuel Area Project Organization.
8. Site Work Zones and Decontamination Procedure.
9. Windrose Diagram for 1989 at Station No. 14735, Albany, New York.
10. Emergency Response Plan for the Malta Rocket Fuel Area Superfund Site, Towns of Malta and Stillwater, Saratoga County, New York.

APPENDICES - VOLUME II

- A. Curriculum Vitae of Project Personnel.
- B. Field Documentation Forms.
- C. Soil-Gas Survey Grids.
- D. Geophysical Survey Grids.
- E. Laboratory Quality Assurance Project Plans.
- F. QA/QC Short Form.
- G. Health and Safety Plan Enclosures.

PROJECT OPERATIONS PLAN
MALTA ROCKET FUEL AREA SUPERFUND SITE
TOWNS OF MALTA AND STILLWATER
SARATOGA COUNTY, NEW YORK

1.0 INTRODUCTION

The Project Operations Plan (POP) presents the Field Sampling and Analysis Plan (FSAP), the Quality Assurance Project Plan (QAPP), and the Health and Safety Plan (HASP) for the Remedial Investigation (RI) of the Malta Rocket Fuel Area (MRFA) Superfund site, Towns of Malta and Stillwater, Saratoga County, New York. This plan supplements the Revised RI Work Plan that was prepared by Geraghty & Miller, Inc. in December 1990 and which received conditional approval from the United States Environmental Protection Agency (USEPA) in February 1991.

The purpose of the RI is to identify potential sources of contamination, to define the nature and extent of contamination, if any, at the site, to provide data with which to assess the potential risk to human health and the environment, and to acquire the necessary data to develop and evaluate potential remedial alternatives. Data will be collected to characterize the quality of all environmental media at the specific areas of concern. If contamination is identified, and additional investigation is necessary to fully characterize the extent of contamination, focused data collection activities will be developed to fulfill the purpose of the RI and to meet data quality objectives.

1.1 PROJECT OPERATIONS PLAN SUMMARY

The POP contains descriptions of all project operations or procedures which must be followed in the course of the RI, as well as supplemental information concerning site location, site history, and project organization. The major sections of the POP, containing the RI procedures, are the following:

- Field Sampling and Analysis Plan
- Quality Assurance Project Plan
- Health and Safety Plan
- Site Management Plan

1.1.1 Field Sampling and Analysis Plan Summary

The FSAP (Section 5.0) defines the sampling approach and procedures to be followed during the field investigation. Specifically, the FSAP addresses:

- Field Sampling Procedures
- Decontamination
- Sample Packaging and Shipment
- Responsibilities of Site Personnel
- Analytical Program
- Documentation
- Quality Assurances/Quality Control (QA/QC) of Field Activities

1.1.4 Site Management Plan Summary

The Site Management Plan Summary (SMP, Section 8.0) contains practical information pertaining to all field activities. Specifically, the SMP addresses:

- Site Access
- Site Security
- Field Office
- Site Operations
- RI Schedule
- Contingency Plan

1.2 SITE LOCATION AND DESCRIPTION

The MRFA site is located in the Towns of Malta and Stillwater, Saratoga County, New York (Figure 1). The site is 445 acres in size. The Test Station, where the majority of activities occurred, is 165 acres in size and contains 33 test structures/complexes erected during the course of research activities. The remaining 280 acres are primarily undeveloped forest. A circular easement of one-mile radius consisting of an additional 1,800 acres was established to prohibit human habitation and hunting. Consequently, the nearest residences are situated over one mile from the center of the test station. The nearest drinking water supply is provided by the Luther Forest Well Field, approximately 6,000 ft southwest of the nearest site boundary, and is monitored quarterly in accordance with a Work Plan approved by EPA (Dunn Geoscience, 1990).

The site and surrounding areas contain well drained soils and gently undulating upland. Several deep ravines with flowing streams are situated on the easement property. Detailed descriptions of the site geology, hydrology and other site features are provided in Section 2.0 of the Revised RI Work Plan.

1.3 SITE HISTORY AND EXISTING DATA

1.3.1 Site History Summary

Historical records available to date indicate that the following activities occurred at the MRFA site:

- Chemical waste storage and disposal
- Open-pit burning
- Solid waste storage and disposal
- Rocket-fuel testing
- Artillery testing
- Fuel-mixing
- Uranium enrichment research
- PCB use in transformers
- Storage of fuels and pressurized gases in aboveground and underground storage tanks
- Storage of explosive material in bunkers

An unknown quantity of waste was discarded in drums and buried in disposal areas D-2, D-4 and D-5 (Figure 2). Chemical wastes were stored aboveground in storage area S-4. Open-pit burning was practiced in disposal area D-1. In 1985, a buried stainless-steel drum of triethyl aluminum was discovered in disposal area D-6, a possible disposal site for additional waste materials. The rocket test complexes identified in Figure 2 may have been used to test various rocket-fuel propellants, propulsion systems, rocket exhausts, and to perform cryogenic research. Some or all of these activities may have contributed to site contamination. An area of approximately 200 ft by 300 ft (Area A) was historically used for fuel-mixing operations (see Figure 2). A magazine area consisting of four bunkers was used for the storage of chemicals, explosive materials, and ordnance. A structure (GE-Exxon Nuclear Building Area) at the northwestern perimeter of the site is believed to have been

used for uranium enrichment research (see Figure 5). Disposal Area D-3, which is located in a ravine along the primary access road (Figure 5), was reportedly used by the NYSDOT for disposal of construction debris. Other potential sources of contamination include septic tanks, leach fields, dry wells, filled-in ponds, drainage ditches, lagoons, aboveground storage of scrap metals, transformers, underground storage tanks for fuels and pressurized gases, and aboveground fuel storage tanks (see Figure 2).

Specific historical details are discussed in Section 2.3, Sections 4.11 to 4.30, and Appendix D of the Revised RI Work Plan for the Malta Rocket Fuel Area prepared by Geraghty & Miller in February 1991.

Further investigation into historical operations and chemical or waste handling procedures will be carried out during the Literature Search Task (Section 4.0). If additional areas of concern are identified, a plan of investigation for each area will be proposed for EPA approval.

1.3.2 Existing Data Summary

The following are existing data summaries from Section 3.1 and Sections 4.11 to 4.30 of the Revised RI Work Plan. Detailed discussions of analytical results from previous sampling events are provided therein.

In 1985, Geraghty & Miller performed a soil, ground-water and ambient air quality investigation at the Berth 24 test pad located on the Wright-Malta property to obtain background data for GE prior to site renovations (Figure 4). Soil samples were collected at monitoring well MW-9S (now destroyed). Water samples were collected from MW-9S and from Supply Wells 1D and 2D which serve the Wright-Malta test station. No soil contamination was detected. Carbon tetrachloride and trichloroethene were detected in both the monitoring well and water supply samples. A follow-up soil quality investigation was conducted in November 1985 to evaluate soil that was excavated from Disposal Area

D-6 and used as cover material at Berth 24 during regrading activities. These data demonstrated the presence of benzene and toluene at one boring location and bis(2-ethylhexyl)phthalate at seven boring locations. The phthalate compound is suspected of being a laboratory artifact.

In 1986, Geraghty & Miller collected shallow soil samples and installed four monitoring wells MW-1 through MW-4 adjacent to the southeastern boundary of the Wright-Malta parcel (Figure 4). This work was conducted as a site assessment for GE in advance of a possible construction project. No priority pollutant VOC contamination was detected in the soil. Water-level measurements demonstrated that ground-water flow is to the southwest at this location. Low concentrations of several chemicals were detected at the monitoring wells. A magnetometer survey was also performed, and no buried ferromagnetic material was identified. Geologic logs, well construction diagrams, water-level measurements, and analytical data are provided in the Revised RI Work Plan as Appendices A, B, C, and E, respectively.

In April 1985 and August 1986, the New York State Department of Environmental Conservation (NYSDEC) and the New York State Department of Health (NYSDOH) collected water samples from the on-site supply wells, which were found to be contaminated with chloroform, carbon tetrachloride, trichloroethylene, and dibromochloromethane. To remediate the site's drinking water supply, ground water from the supply well is being treated by air stripping. All historical water-quality data developed for this program will be obtained during the literature search.

In 1986, Blasland & Bouck Engineers, P.C. performed a hydrogeologic and water-quality investigation at the MRFA Test Station. They installed 11 monitoring wells and conducted an aquifer test on Supply Well No. 1. Boron, aluminum, carbon tetrachloride and trichloroethene were identified at a number of well locations at the property boundary and in ravine 2A (Appendix E of the Revised RI Work Plan). The NYSDEC and the NYSDOH also collected surface-water samples from ravines near the MRFA Test Station. Specifically,

samples were collected at ravines 3, 4, 5, 6A, 6B, 7 and 8 (Figure 5) and analyzed for purgeable halocarbons. Available laboratory data are provided in Appendix E of the Revised RI Work Plan. In 1986, Blasland & Bouck collected two samples from ravine 2A (Figure 5) and analyzed them for purgeable halocarbons, aromatic purgeables, acid extractables, base neutrals and organochlorine pesticides. Low concentrations of chloroform, carbon tetrachloride and trichloroethene were reported in ravine 2A by Blasland & Bouck.

The NYSDEC selected split ground-water samples from wells installed by Dunn Geoscience Corporation as part of the Early Warning Monitoring System between the MRFA and the Luther Forest Well Field. This work is conducted in accordance with the work plan approved by the EPA. Samples have been collected quarterly since 1987 at six wells and four stream locations in the network; in 1990, four additional wells at the test station (10S, 10D, 13S, and 13D) were added to the monitoring network. Samples are analyzed for volatile organic compounds (VOCs). To date, there is no evidence of impact from the MRFA on ground water at the Luther Forest Well Field based on these results (Dunn Geoscience 1989).

At the present time, it is not known whether the information provided above represents a complete history of the MRFA site. Efforts to obtain additional information will be made during the Literature Search described in Section 4.0.

Due to the extensive nature of background reports, a document repository will be established with the EPA, NYSDEC and the local library. Copies of each available report will be filed in the document repositories. The test station will also be requested to keep a similar document repository. The filing system is discussed in Section 5.3 of the Revised RI Work Plan submitted to the EPA in February 1991.

1.3.3 Potential Chemicals of Concern

Samples of soil, septic tank sludge, ground water, and surface water have indicated the presence of VOCs, phthalates, PCBs and/or metals. A limited number of VOCs, including carbon tetrachloride, trichloroethene, toluene and 1,2-dichloroethene, have been identified. The presence of phthalates must be confirmed, as these chemicals are common laboratory artifacts. PCB Aroclor 1254 was observed in only one ground water sample, from Well MW-1, at 2.5 ug/l; the presence of this compound must also be confirmed. Metals concentrations must be evaluated with respect to naturally occurring metals in both soil, ground water and surface water. These data may not completely characterize potential contamination at the MRFA site and, therefore, risks cannot be assessed at this time. The RI is designed to collect extensive information on potential contaminants at the site. Both the nature and extent of any contamination will be defined in various media.

1.3.4 Potential Mechanisms of Chemical Release

Historical information indicates that sources of contamination may include buried and surface materials, and soils contaminated by previous site activities. Given the information to date, the potential mechanisms of chemical release from the site include:

- Discharge to ground water
- Shallow ground-water discharge to the ravines
- Surface-water runoff
- Volatilization from surface and subsurface soils to ambient air
- Entrainment of contaminated surface soils in air with deposition on- or off-site

Of the above release mechanisms, releases to ground water and surface water have been observed. Ambient air quality data in a limited area have indicated no impact. Data characterizing exposures as a result of the remaining release mechanisms have not been collected to date. Other exposure mechanisms may be identified during the RI.

2.0 PROJECT ORGANIZATION AND RESPONSIBILITIES

The project organization and responsibilities for the RI activities are described below. A project organization chart is provided in Figure 7 and curriculum vitae of project personnel are provided in Appendix A.

Primary responsibility for project management is shared between the RI Project Officer (Facility Coordinator) and RI Project Manager. They will be responsible for the coordination of all personnel on site, and for providing technical assistance for all activities which are directly related to the determination of the hydrogeologic conditions and the environmental quality of the site.

Responsibility for all quality assurance/quality control review lies with the RI Quality Assurance Officer. Data processing will be overseen and reviewed by the RI Project Hydrogeologist and RI Quality Assurance (QA) Officer. The RI Project Officer and RI Project Manager will review all environmental and hydrogeologic data. If quality assurance problems or deficiencies requiring special action are identified, the RI Project Officer, RI Project Manager, and RI QA Officer will determine the appropriate corrective action consistent with the data quality objectives of the remedial investigation. A summary of the responsibilities of each team member is provided below.

2.1 RI PROJECT OFFICER/FACILITY COORDINATOR

The RI Project Officer (Facility Coordinator) will have overall responsibility for the RI and will serve as the primary contact with the EPA Remedial RI Project Manager. In addition, the RI Project Officer will be responsible for implementing the recommendations of the RI QA Officer. The RI Project Officer will communicate any change in the scope of work or approach to the EPA and follow with a letter documenting the change.

2.2 RI PROJECT MANAGER

The RI Project Manager will be responsible for implementing the RI Work Plan and the POP. Specifically, the RI Project Manager will:

- Direct and coordinate the activities of the field teams. This function will include scheduling field tasks so that resource needs (e.g., equipment, personnel) and timing requirements (e.g., soil-gas work must be completed before well installation begins) can be met. This function will also include ensuring the implementation of modified procedures based on scope changes or field audits.
- Notify the RI Field Manager of the schedules for collecting and shipping samples and receipt of data packages.
- Identify and communicate issues that require significant changes in scope or budget to the RI Project Officer.
- Coordinate the evaluation of data as they are generated and recommend changes in the approach to the RI Project Officer as needed.
- Manage the budget for RI activities.
- Provide deliverables in accordance with the project schedule.
- Supervise the laboratory, ensuring adherence to the scope of work, and participating in protocol and budget decisions.

2.3 RI FIELD MANAGER

Before sampling, the RI Field Manager will be the focal point for all project information and instructions provided by the RI Project Manager and RI Project Officer. The RI Field Manager will also be responsible for determining specific equipment needs. The RI Field Manager will also:

- Oversee all field activities, supervise all field personnel and be responsible for ensuring that sampling protocols and QC procedures are followed.
- Supervise sample packaging and will review all documentation prepared by the sampling teams including, but not limited to, photographs, field notebooks, and chain-of-custody paperwork.
- Be responsible for monitoring the activities of subcontractors and conducting the primary review of subcontractor invoices.
- Coordinate with the laboratory and be responsible for providing the sampling teams with appropriate sample bottles, blanks, blank water, paperwork, and special instructions for completing the documentation.
- Track the samples daily and provide copies of the appropriate paperwork to the project file.
- Be responsible for communicating sample projections to the laboratory.
- Be responsible for ensuring that validated data are entered accurately into the project database.

2.4 RI PROJECT HYDROGEOLOGIST

The RI Project Hydrogeologist will be responsible for the coordination of all personnel on site, and for providing technical assistance when required. The RI Project Hydrogeologist, or his or her designee, will be present during all sampling activities. He or she will keep a general site log describing activities on site, which will include the identification of personnel entering the site, and the recording of general observations regarding site activities.

The RI Project Hydrogeologist will be responsible for adherence to all QA/QC guidelines as defined in this work plan. Additional responsibilities of the RI Project Hydrogeologist are:

- Update equipment or procedures based upon new information gathered during the site operation.
- Notify local public emergency officers, including police and fire departments, of the nature of the team's operations and for posting these department's telephone numbers.
- Supervise the field technicians.
- Supervise the completion of all sampling and documentation.
- Ensure the proper handling and shipping of the samples.
- Be responsible for the accurate completion of the field notebook.
- Communicate with on-site personnel and log all communications.

- Be responsible for providing technical supervision of the drilling subcontractor.
- Be responsible for the geologic logging performed during the soil boring and well installation program.
- Collect and screen borehole and test pit soil samples, conduct walk-through surveys, and geophysically log boreholes.
- Be responsible for the installation of all monitoring wells.
- Be responsible for conducting an aquifer test.

2.5 RI FIELD TECHNICIANS

RI Field Technicians (field teams) will collect sediment, ground-water and surface soil samples, conduct soil-gas surveys, and collect wipe samples.

2.6 RI SITE SAFETY COORDINATOR

A RI Site Safety Coordinator will be part of each field team. The RI Field Manager or his or her designee may also serve as the RI Site Safety Coordinator. The RI Site Safety Coordinator will be responsible for ensuring that all team members adhere to the site safety requirements as described in the Health and Safety Plan. Additional responsibilities will be to:

- Modify the levels of protection based upon site conditions.
- Determine and post locations and routes to medical facilities and arrange for emergency transportation, if required, to medical facilities.

- Monitor sampling team members for symptoms of exposure, heat stress, etc.
- Provide emergency medical care and first aid as necessary on site. The RI Site Safety Coordinator also has the responsibility to stop any field operation that threatens the health or safety of the team, the surrounding populace, or the environment.

2.7 RI QUALITY ASSURANCE OFFICER

The RI QA Officer will support the RI Project Officer and RI Project Manager in planning and meeting the project's QA requirements. The RI QA Officer will:

- Monitor compliance with data quality objectives.
- Serve in a lead role in implementing the RI and FSAP and ensuring that the HASP requirements are met.
- Oversee and review data processing.
- Consult with the RI Project Manager if quality assurance problems or deficiencies require special attention.

3.0 SAMPLING PROGRAM OBJECTIVES

3.1 PROJECT OBJECTIVES

The MRFA RI is designed to collect, present and discuss necessary data with which to identify potential sources of contamination, to determine the nature and extent of contamination, to assess potential risk posed by the site, and to support the development of a feasibility study (FS). Specifically, the project objectives are to:

- Characterize contaminant source areas at the site.
- Characterize contamination at the site and adjacent areas.
- Define the site geology and hydrology to evaluate ground-water flow and potential contaminant migration.
- Determine the relationship between primary contaminant sources and release mechanisms and secondary contaminant sources.
- Identify and evaluate potential contaminant pathways, routes of contaminant release and potential contaminant migration offsite.
- Obtain data which will be used in an assessment of public health and environmental risks associated with site contamination.
- Obtain data to identify and evaluate potential remedial alternatives.

This information will be gathered as described in Section 5.0. If a subsequent investigation is necessary, based on the results obtained during this phase of the RI, a supplemental Revised RI Work Plan will be developed.

3.2 DATA QUALITY OBJECTIVES

Data obtained during the MRFA site RI will be used to make decisions for a variety of purposes including characterizing the nature and quality of soil, sediment, ground water, air and surface water; identifying sources of contamination; defining the nature and horizontal and vertical extent of contamination; assessing potential health risks; and initiating the development of potential remedial alternatives.

In order to best utilize the data generated during the RI, a clear definition of data objectives and procedures is required. This is accomplished through the development of data quality objectives (DQOs) which relate the extent and quality of data to be gathered in the RI to their ultimate objective. DQOs are qualitative and quantitative goals for precision, accuracy, reproducibility, comparability, and completeness specified for each data set. DQOs for the MRFA RI are provided in Table 1.

DQOs are based on the concept that different data uses may require different levels of data quality. DQOs are defined with respect to types, numbers, and locations of samples that will be collected, and the quality assurance levels associated with the analysis. The guidance document, "Data Quality Objectives for Remedial Response Activities" (USEPA 1987) has been used for determining the analytical levels required to obtain confidence levels appropriate for the intended data use. The analytical levels required for specific data uses and the types of analyses needed to achieve an analytical level are provided in Table 2. Where data have multiple uses, the uses have been prioritized and assigned the highest analytical level for a particular use.

Level 1 through 5 data are briefly defined as follows:

- Level 1 - Field screening or analysis using portable instrumentation.
- Level 2 - Field analysis using more sophisticated instruments.
- Level 3 - Engineering data.
- Level 4 - CLP routine analytical services analytical methods.
- Level 5 - CLP non-standard services analytical methods.

The MRFA RI will generate Levels 1, 2, 3, 4, and 5 analytical data. Level 1 data are not typically suitable to support the risk assessment and alternatives evaluation. Level 2 analytical data may be used in the alternatives evaluation when accompanied with appropriate QA/QC procedures. Methods to acquire Level 4 and 5 analytical data will have quantitation limits that will allow comparison with ARARs (Tables 3 through 6) and support risk assessment and remedial action evaluation.

The Level 1 data to be generated at the MRFA site include field screening surveys using photoionization detectors, flame-ionization detectors, oxygen/explosimeters, and scintillometers. Field measurements of water levels and parameters, such as pH, temperature, and specific conductance of water samples are also examples of Level 1 data. These types of data will be used to monitor the health and safety of field personnel, to assist in the determination of soil boring or sampling locations, and to evaluate the adequacy of well development and purging procedures. The electromagnetic survey using the EM-31 instrument or equivalent to identify the presence of buried magnetic or non-magnetic material will yield Level 2 qualitative data as a guide to selection of soil boring and test pit locations.

Soil-gas analyses and on-site field screening of soil samples will yield semi-quantitative data of Level 2 quality. The soil-gas analyses will be supported by QA/QC sample analyses. Based on the results of initial field screening for radiation with a scintillometer, a spectroscope may be used to identify specific radioactive isotopes (Level 2 data).

Level 3 laboratory analysis will be performed on wipe samples for radioactive analysis.

Laboratory analyses of samples from the MRFA site will be performed to obtain Level 4 data. These analyses will include the routine analytical services (RAS) provided by the Contract Laboratory Program (CLP). Level 4 data have standard detection limits and documentation suitable for the risk assessment and evaluation of potential remedial alternatives.

Level 5 data include non-conventional parameters (for example, boron which is not on the TAL) and all analyses performed using the CLP Special Analytical Services (SAS) such as Method 524.2 for analysis of VOCs at detection levels less than the RAS. Level 5 data will include analyses for polychlorinated dibenzo-p-dioxins and polychlorinated dibenzofurans in soil. Level 5 data will also include geotechnical parameters and analysis of wipe samples for PCBs or radioactive parameters (gross alpha, gross beta, radium 226, and radium 228) and for radioactivity in sediment samples collected from dry wells at the GE/Exxon Nuclear facility.

3.2.1 Quality of Existing Data

A limited quantity of data have been gathered during previous investigations of the MRFA site. Available data (refer to Section 3.1 of the Revised RI Work Plan) have been reviewed to assess analytical levels. During the performance of the Literature Search (Section 4.0), a review and evaluation of any newly-obtained data will be made.

The 1987 analytical results of water and sludge samples from the septic tank are assumed to be Level 2 data; however, gas chromatographic analysis (USEPA Method 602) of four samples collected January 12, 1987 were analyzed beyond the recommended 7-day holding time.

Available ground-water data collected by Geraghty & Miller are Level 3 data. The 1986 Blasland & Bouck ground-water analytical results may be considered Level 4 data. QA/QC samples and matrix spike analyses were reported and data qualifiers were indicated on the laboratory data sheets. In addition, personnel from NYSDEC were present during the sampling of monitoring wells and took duplicate samples for some of the wells. Analytical results of samples analyzed by the NYSDEC laboratory compared well with analytical results of duplicate samples analyzed by York Laboratories for Blasland & Bouck.

4.0 LITERATURE SEARCH

The first task of the RI is a literature search to further determine the history of operations at the site. The literature search report will be submitted approximately two months after approval of the POP and prior to undertaking the field investigation. As stated in Section 4.2 of the Revised RI Work Plan, the Literature Search Report will include the following information where available:

- Summary of site history including a history of operations.
- Review of previous publications and reports.
- Review of correspondence between PRPs and regulatory agencies.
- Evaluation of historical aerial photographs and historical maps.
- Interviews of persons associated with the site.
- Investigation into the nature of chemicals used at the site.
- Review of available regulatory agency files.
- Summary of previous analytical data.
- Summary of well information.
- Maps of utilities and potential source areas.
- A New York State 1A Cultural Resources Survey.
- Inventory of underground and aboveground storage tanks, septic tanks and leaching fields.

5.0 FIELD SAMPLING AND ANALYSIS PLAN

5.1 FIELD INVESTIGATION STATEMENT OF WORK

This statement of work outlines the RI investigation to be conducted at the MRFA site. Specific areas of concern to be investigated are:

- Scrap Metal Storage Areas S-1, S-2, and S-3.
- Chemical Storage Area S-4.
- Former Burning Pit D-1.
- Solid Waste Disposal Area D-2.
- NYSDOT Disposal Area D-3.
- Drum Disposal Areas D-4 and D-5.
- Drum Disposal Area D-6.
- Rocket Test Gantries.
- Area A (Fuel-Mixing Area).
- Septic Tanks/Leach Fields.
- Dry Wells.
- Filled-in Ponds.
- Existing Pond and Drainage Ditch.
- Lagoon at MTI Test Station.
- Clearing in Woods Called the Ice Pond.
- GE/Exxon Nuclear Building Area.
- PTI Test Station.
- Underground Storage Tanks.
- Aboveground Storage Tanks.

Figures 4 and 5 include all areas proposed for the investigation. All soil, sediment, sludge, and water samples will be analyzed for the Target Compound List/Target

Analyte List (TCL/TAL) of parameters plus boron unless a modified list of compounds has been approved by the EPA. (For the purpose of this RI, reference to the TCL will include the TAL plus boron as a constituent.) Laboratory analysis will be performed for the TCL compounds plus 30 Tentatively Identified Compounds (TICs) in accordance with Contract Laboratory Program (CLP) protocols, which include up to 10 volatile organic compounds (VOCs) and 20 semivolatile compounds of greatest apparent concentration that are not targeted. Organic compounds will be analyzed using gas chromatograph/mass spectrometer (GC/MS) methods as specified in the CLP procedures. The analyte list may be reduced in subsequent phases (or sampling rounds) if initial analyses indicate that fractions of the TCL (for example, metals) are not present at levels which exceed background conditions/regulatory levels in an area being investigated. The analytical methods and quality QA/QC procedures are described in detail in the QAPP (Section 6.0).

5.2 FIELD INVESTIGATION OVERVIEW

Field investigation of the areas of concern shall generally include a soil-gas survey, a geophysical survey, and investigations of the nature and extent of contamination of the soil, surface water, sediment, ground water, and air. The methods proposed for these investigations include:

- Ambient air investigation.
- Soil-gas survey using a transportable gas chromatograph equipped with flame ionization and electron capture detectors.
- Geophysical surveys.
- Radiation survey.
- Surface soil sampling.
- Soil borings and subsurface soil sampling.
- Test pit excavation and soil sampling.
- Ground-water monitoring well installation.
- Borehole geophysical logging.

- Synoptic water-level measurements.
- Ground-water sampling.
- Aquifer testing.
- Sediment sampling.
- Surface water/sludge sampling.
- Wipe sampling.
- Step 1 habitat-based assessment.

All sampling and analysis activities are summarized in Table 7.

A number of activities are generally applicable to field sampling and analysis procedures. These activities are described in Section 5.3, prior to discussions of field sampling and analysis.

5.3 GENERAL FIELD SAMPLING AND ANALYSIS PROCEDURES

The following activities are generally applicable to field sampling and analysis:

- Mobilization.
- Field Documentation.
- Sample Designation.
- Sample Designation.
- Chain of Custody.
- Laboratory Documentation.
- Demobilization.

Descriptions of these activities are provided below.

5.3.1. Mobilization

Each field team member will attend an orientation meeting to become familiar with the history of the site, health and safety plan, and field sampling procedures.

Equipment mobilization will entail the ordering, purchase, and if necessary, fabrication of all sampling equipment needed for the field investigation. A complete inventory of available equipment will be conducted and any additional equipment required will be secured. A field office trailer will be installed and utility connections will be established.

Mobilization will also include the establishment of a decontamination pad. The decontamination pad will be located in the Contamination Reduction Zone (CRZ), the area between the Exclusion Zone (contaminated area) and the Support Zone (clean area), defined in the Health and Safety Plan (HASP) (Figure 8).

Empire Soils Investigation, Inc. of Ballston Spa, New York, the drilling subcontractor, will be responsible for constructing the decontamination pad so that it is large enough to accommodate the drill rig, is plastic lined, is sloped and curbed to drain to a sump. The subcontractor will provide decontamination equipment (steam cleaner, brushes, buckets, soap and water, etc.).

The decontamination pad will be the place to clean rigs entering and leaving the site, and will be a collection point for decontamination fluids generated during sampling.

5.3.2 Field Documentation

Field log books, documentation logs, and photographs will be used to document the data collection activities. Entries will be made in as much detail as possible so situations and conditions may be reconstructed with minimal reliance on memory.

All incoming data will be logged and dated. All information generated from field sample activities will be documented on appropriate forms, samples of which include the following:

- Sample/Core Log,
- Water Sampling Log,
- Chain-of-Custody Record,
- Daily Log,
- Drilling and Installation of Monitoring Daily Checklist,
- Utilities and Structures Checklist,
- Location Sketch,
- Water Level/Pumping Test Record,
- Materials/Cost Log,
- Sample Container Inventory,
- Well Construction Log,
- Sampling of Monitoring Wells Daily Checklist, and
- Telephone Conversation Log.

Sample copies are provided in Appendix B.

5.3.3. Sample Designation

Each sample will be given a unique designation which will be recorded in the field log book on the Sample/Core Log (soils), on the Water Sampling Log (water), on the label

affixed to the sample container, and on the Chain-of-Custody Record. The sample designation will consist of four elements.:

- a. the site code,
- b. the matrix code,
- c. the location number, and
- d. the consecutive sample number from the location

The site code for this project is MRFA. The sample matrix codes are as follows:

Ground-Water Monitoring Wells (M)

Subsurface Soil (S)

Sediment (SD)

Surface Water (SW)

Surface Soil (SS)

Soil Vapor (SV)

Soil Head Space (HS)

For the monitoring well locations, the location number will be the well number. The field team will assign a number to each sampling station for other environmental matrices, prior to sample collection.

For ground-water samples, the consecutive two-digit sample number will be the number of the sample collected from an individual location. This number will reflect the round of sampling (i.e., first, second, etc.) or if, for some reason, resampling is conducted at a particular site.

Example:

MRFA/M-21/01 (denotes the first sample collected from Monitoring Well M-21)

Example:

MRFA/M-22/02 (denotes the second round sample collected from Monitoring Well M-22).

For the subsurface soils, the last two sample numbers will reflect the sample interval depths in the test boring.

Example:

MRFA/S-1/10-12 (denotes the split-spoon sample collected from Test Boring S-1 at a depth of 10 to 12 feet).

Blind field replicate samples will be given fictitious numbers which will be recorded in the field notes and project file.

Trip blank, container blanks, and field equipment blank samples will be labeled as TB, CB, and FB, respectively, followed by a number and the date of shipment to the laboratory for trip blanks and date of concern for field blanks.

Example:

TB-1-01/01/91, and TB-2-01/01/91 (denote two trip blank samples shipped on this date to the laboratory).

Example:

CB-1-01/01/91 (denotes container blank collected on this date).

Example:

FB-1-01/01/91 (denotes field equipment blank collected on this date).

Incoming documents will be date-stamped and filed. If distribution is necessary, the documents will be distributed to project personnel. In addition, all notes from project meetings and telephone conversations will be filed along with other project documents.

5.3.4 Chain-of-Custody Procedures

The sampling team will be responsible for maintaining custody of the samples until they are delivered to the overnight common carrier or courier for shipment to the laboratory. All samples shipped to a laboratory will be accompanied by the Chain-of-Custody Record (Appendix B) or an equivalent form provided by the laboratory. The Chain-of-Custody Record will be completed in the field; the original form will accompany the shipment and a copy will be retained by the Field Manager in the field project file. The Chain-of-Custody form will list each of the individual sample containers and will be signed by the sampling team members who participated in collecting the samples.

A separate Chain-of-Custody Record form will be filled out for the contents of each shipment container (cooler). The form will be placed in a plastic bag and taped to the underside of the lid of the cooler.

To provide a means of detecting any potential tampering during shipment, all shipment containers (coolers) will be affixed with signed sample seals (Appendix B). Two seals will be affixed to each cooler, on opposite ends. In addition, a 2-inch wide transparent tape will be wrapped entirely around the cooler.

If the shipment is sent by common carrier, an air bill of lading will be used. Receipts from couriers, air bills and bills of lading will be retained in the field project file.

5.3.5 Laboratory Documentation

All laboratory documentation will be filed at the RI Project Officer's office. Full Contract Laboratory Program (CLP) documentation will be maintained for the purpose of validating analytical data collected during the RI. All summary reports will be kept in the project file.

5.3.6 Demobilization

Equipment will be demobilized after each phase of field activities as necessary. Demobilization may include, but may not be limited to, sampling equipment, drilling subcontractor equipment, health and safety decontamination equipment, and field office trailer and utility hookups.

5.4 AMBIENT AIR INVESTIGATION

The MRFA site may impact local ambient air quality through intrusive RI activities or through site remediation should it be required. To document present ambient air quality, an assessment of meteorological conditions and a background ambient air survey will be performed. During RI activities, on-site air quality will be monitored using direct reading instruments to assure worker safety and to minimize public exposure. Should remedial activities be necessary, the background ambient air survey will be repeated to determine the impact of remedial activities on ambient air quality. These values will be contrasted with the previously determined background values to assess any degradation in air quality. Each of these activities is more fully described in the following sections.

5.4.1 Assessment of Meteorological Conditions

The MRFA site is located approximately 30 miles from Albany, New York in the towns of Malta and Stillwater. Albany is the closest National Weather Service Location and

would provide a general forecast for anticipated meteorological conditions at the MFRA site. The 1988 Annual Summary of Local Climatological Data was obtained for Albany, New York from the National Climatic Data Center and provides the following meteorological descriptions:

- Wind velocities are moderate.
- The north-south Hudson River Valley has a marked effect on the lighter winds.
- In the warm months, average wind direction is generally from the south.

The Support Center for Air Quality Regulatory Modeling in Research Triangle Park, North Carolina was contacted to provide an additional source of meteorological data. Using hourly observations for 1989, a windrose figure was generated to illustrate the percent frequency of occurrence of wind direction for six wind speed classifications. Figure 9 illustrates the winds were predominately from either the north or the south, with a southerly wind occurring for 18.2 percent of the year.

5.4.2 Background Air Quality

As part of the RI for the MRFA site, a background air monitoring program will be conducted to assess the nature and extent of air contaminants in the vicinity of the former rocket test area. Upwind and downwind sampling will be performed at the site perimeter, at locations described in Section 5.4.2.2, to characterize the concentration of VOCs and total suspended particulate matter (TSP) in the ambient air. The above parameters are believed to be representative of former on-site rocket fuel testing.

The net downwind concentration for the compounds in question will be compared with ambient air Multimedia Environment Goals (MEGs, USEPA 1979) and with New York State Air Guide-1 ambient guideline concentrations. These data will also serve as input for a baseline risk assessment to gauge the potential health effects of contaminant release via the air pathway. The results from this baseline air quality study will be contrasted with

results from a second investigation performed during site remediation, if remediation is determined to be necessary. In this manner, any degradation in air quality attributable to the remedial technology will be assessed. The comparison of background and during-remediation studies will furnish the data necessary to safeguard public health with respect to off-site migration of contaminants via the air pathway.

5.4.2.1 Compound Specific Field and Analysis Procedures

Based on current knowledge of the site, a 3-day upwind and downwind air monitoring program for characterization of subject compounds will be performed. A sample duration of 4 hours per test will permit suitable quantities of subject compounds to be obtained thus meeting the detection limits of the chosen analytical procedures. This program is intended to produce data indicative of air quality with regard to VOC and TSP at the property line over a finite time period. As samplers will be maintained downwind of the site, measured values will approximate a worst-case situation that could potentially be experienced by a downwind receptor at the site perimeter. Any contribution from the upwind sampler will be subtracted, yielding the net impact of the site.

Target VOCs designated by the test program will be obtained on a Tenax adsorbent medium in accordance with applicable specifications of Method TO-1 (USEPA, 1988). Samples will be analyzed for VOCs by a thermal desorption purge and trap technique in accordance with EPA Method 5040/8240. Compound separation will be achieved by a gas chromatographic procedure employing a mass spectrometer (GC/MS) for sample quantification and confirmation. Specific compounds of concern will comprise the EPA Method 8240 list. In addition, other tentatively-identified compounds will be reported as determined from the GC/MS scan. Table 5 presents the 8240 list of target VOCs for the ambient air investigation.

The flow rate for the TO-1 adsorbent train will be maintained by a calibrated critical flow orifice. Maintenance of a vacuum of 17 inches of mercury (Hg) or greater downstream

of the orifice will verify attainment of critical flow conditions. Each orifice will be calibrated using a bubble calibration meter (mini-BUCK Model M-5 or equivalent) with a calibration adsorbent module inline. Calibrations will be performed before and after field testing in accordance with Section 2.1.2 of the Quality Assurance Handbook for Air Pollution Measurement Systems Volume II Ambient Specific Methods (USEPA, 1986). The true sampling rate for the test period will be calculated as the average of the pre-test and post-test calibrations. Based on a nominal flow rate of 200 milliliters per minute (ml/min), a total sample volume of 0.05 m³ will be obtained for the 4-hour test period.

TSP will be determined through the use of high-volume air samplers (General Metal Works Model GMWS-2310 ACCU-VOL or equivalent) in accordance with the method presented in 40 CFR, Part 50, Appendix B. An 8 x 10 inch glass fiber filter (Gelman Type A/E or equivalent) will be utilized for collection and subsequent gravimetric analysis for determination of particulate matter concentrations.

For the high-volume samplers, a calibrated flow rate of 42 cubic feet per minute (ft³/min) will be maintained by an integral electronic mass flow controller during the 4-hour test period. A nominal sample volume of 10,100 ft³ (386 m³) is anticipated from this determination. Sampler calibration will follow the procedure documented in the Federal Register, Volume 47, Number 234, pp. 54896-54921.

5.4.2.2 Field Sampling Network Operation

Prior to performing field measurements on each day of the test program, one upwind and one downwind sampling site will be selected with the aid of a portable wind indication system (Qualimetrics Windicator Model 2361 or equivalent). Selection of the upwind station will be made in an attempt to characterize the background ambient air quality. The downwind locations will be chosen to represent air quality near the downwind perimeter and to reflect the quality of the air impacting the local population. These selections will be deferred until the day of testing at which time current meteorological data may be reviewed.

By deducting upwind levels (background) from downwind concentrations, the true impact of the site on ambient air quality may be determined. During each test period, meteorological data including ambient air temperature, soil surface temperature, barometric pressure, wind speed and direction will be recorded at 15-minute intervals. Once testing commences, should recorded wind direction indicate a shift in wind direction, the test will be temporarily stopped to permit an assessment of the true wind direction. In the event that a sustained shift in average wind direction of greater than a 45-degree angle occurs, the sampling stations will be repositioned to maintain their upwind/downwind orientation with respect to the site.

The above sampling program will be performed on three consecutive days to adequately characterize upwind and downwind concentrations under present site conditions. Identical procedures will be instituted during remediation to determine any degradation in air quality. Quality assurance measures incorporated into the test program will include the use of collocated samplers, trip blanks, and a series canister to assess potential VOC breakthrough. A summary report will be prepared addressing the field sampling methodology and specific compound concentrations recorded at the site perimeter. Table 8 presents the samples currently anticipated during the background air quality investigation.

5.4.2.3 Quality Assurance/Quality Control

To ensure the generation of data of sufficiently high quality from both field sampling and laboratory analyses, the following quality assurance (QA) procedures will be observed:

1. One unused glass fiber (8 x 10 inch) and one Tenax trap will be selected per test, in the field, to serve as trip blanks. These will be analyzed for TSP and VOC in the same manner as field samples. Any amount of target compounds quantified in the blanks will be deducted from the results of the field samples.

2. To validate the adsorption efficiency of the Tenax resin for VOCs, a second Tenax trap will be utilized in series with the primary trap. The backup trap will be analyzed separately to determine potential compound breakthrough. This analysis will be incorporated at a different sampling station during each of the 3 days of testing.
3. One collocated sampler (1-ACCU-VOL and 1-Tenax trap) will be operated at a different upwind or downwind sampling location on each day of testing. The results of this sample will be reported along with other field results and will be used to assess the precision or repeatability of the overall field sampling and analytical technique.

Prior to field sampling, all ACCU-VOL or equivalent flow controlled samplers will be calibrated with a General Metal Works Model G33ST, NBS traceable, Variable Resistance Calibrator or equivalent. Calibrations will be performed in accordance with the procedures outlined in the Federal Register, Volume 47, Number 234, pp. 54896-54921, December 6, 1982. In-line critical flow orifices for the TO-1, Tenax volatile organics train will be calibrated in accordance with Section 2.1.2 of the Quality Assurance Handbook for Air Pollution Measurement Systems, Volume II, Ambient Specific Methods (USEPA, 1986).

5. Chain-of-custody forms will be initiated by the air sampling team leader and shall accompany all field samples and blanks in transit to the analytical laboratory. Site name, sample location, sample number, date and time of collection will be recorded on the forms. Chain-of-custody forms will track samples through all phases of field collection and analysis.

5.4.3 Ambient Air Quality During RI Activities

During any intrusive RI activity, protective measures will be followed to minimize the impact of site activities on worker safety and public health. Protocols for the analysis of ambient air quality in the breathing zone during intrusive RI activities to protect worker

safety are included in the HASP. Similar protocols will be followed to protect public health during site investigation. VOC measurements will be taken at locations outside the exclusion zone using direct reading instruments (DRIs) such as the HNU or TIP photoionization meters (PID). The instrument will be equipped with an 11.7 electron volt (eV) ultraviolet lamp. The PID will be capable of measuring the presence of compounds with an ionization potential (IP) below 11.7 eV including chloroform (IP=11.4) and carbon tetrachloride (IP=11.5).

Should the action levels specified in the HASP be exceeded on-site or at the exclusion zone, confirmation of the presence or absence of chloroform and carbon tetrachloride will be evaluated through the use of colorimetric detector tubes. A field portable gas chromatograph equipped with a photoionization detector will also be available on-site should further air quality evaluations be required during RI activities.

5.5 SOIL-GAS SURVEYS

Soil-gas analysis is a qualitative to semi-quantitative technique, which will be used to evaluate the areal extent of VOC contamination in shallow soils. The accuracy and precision of the technique may vary due to field, instrument, and geologic conditions. A transportable gas chromatograph equipped with an electron capture detector (ECD) and a flame ionization detector (FID) will be used to analyze soil-gas survey samples.

A soil-gas survey will be performed at all areas of suspected contamination at the MRFA site, with the possible exception of the magazine area (refer to Section 4.30 of the RI Work Plan for the rationale concerning testing in the magazine area). The targeted sample areas are:

- Scrap Metal Storage Areas S-1, S-2 and S-3,
- Chemical Storage Area S-4,
- Former Burning Pit D-1,

- Solid Waste Disposal Area D-2,
- NYSDOT Disposal Area D-3,
- Drum Disposal Areas D-4 and D-5,
- Drum Disposal Area D-6,
- Rocket Test Gentries,
- Area A (Fuel-Mixing Area),
- Septic Tanks/Leach Fields,
- Filled-in Ponds,
- Existing Pond and Drainage Ditch,
- Ice Pond Area,
- GE-Exxon Nuclear Building Area,
- Underground Storage Tanks,
- Select Aboveground Storage Tanks, and
- Triangular Parcel of Land Adjacent to the Southern Corner of the Test Station.

The location of these sites are depicted in Figures 2, 4, and 5. The proposed soil-gas grids are provided in the above order in Appendix C. Proposed sampling grids for septic tanks/leach fields, underground storage tanks and aboveground storage tanks will be included in the Literature Search Report as it is not known which sites will be included in the investigation at this time.

5.5.1 Survey Grid Definition

Prior to initiating the survey, sample locations will be staked on evenly spaced grids, to the extent allowed by field conditions. The orientation of the survey lines, perpendicular to the baseline, will be established using a Brunton™ compass or equivalent. In the event of obstructions such as trees, buildings, etc., a sampling point nearby will be substituted for that shown on the applicable soil-gas grid figure. A fiberglass tape will be used for all measurements.

5.5.2 Soil-Gas Sampling Procedure

A rotary hammer driller with a 1 1/2-inch bit will be used to obtain access to the soil beneath asphalt and cement, if necessary. The soil-gas survey will be performed by installing and sampling a small-diameter hollow probe with a slotted point at the bottom. A 1/2-inch diameter borehole will be advanced into the soil approximately 2 to 3 ft below land surface with a slide hammer and solid rod; the solid rod will be removed and a 1/4-inch diameter hollow, stainless-steel tube with 1/8-inch diameter Teflon™ tubing inside it will be inserted into the borehole. A nail inserted into the end of the Teflon™ tubing will prevent clogging of the assembly as it is lowered into the borehole. The nail will be removed from the Teflon™ tubing and the tubing attached to a battery-operated diaphragm pump. Due to soil permeability variations, the pumping time to be used at the site will be determined by a pumping time study (Section 5.5.3). A 300-microliter sample will be collected with a gas-tight syringe through a septum in a stainless steel tee installed in the Teflon™ tubing. The sample will be collected after a period of time to be determined by a pumping time study (Section 5.5.3).

5.5.3 Pumping Time Study

The above procedure will be repeated until five samples, at 1 minute intervals, are collected. The pumping time to be used at the site will correspond to the time when the highest concentrations of VOCs is detected. If VOCs are not detected in the first borehole, the pumping time study will be repeated. If by the third borehole, compounds are not detected, a pumping time of 2 minutes will be used.

5.5.4 Gas Chromatograph Calibration

The gas chromatograph (GC) will be calibrated with air standards for compounds previously associated with the site. Specifically, the GC will be calibrated for carbon tetrachloride, trichloroethene, toluene, and trans-1,2-dichloroethene. Standards will be

prepared by introducing a known volume of the compound into a one liter (L) Tedlar™ bag which has previously been filled with ultra zero air. The amount of each compound injected into the Tedlar™ bag is based on the following formula:

$$\text{amount of compound added (ul)} = A \times 760/P$$

where A = concentration of the compound, parts per million by volume (ppmv), P = vapor pressure of the compound, mm/Hg.

For each initial calibration, the standards will be injected into the GC five times. An average response factor will be obtained by dividing the concentration of the standard by the average area under the peak from the five injections.

5.5.5 Compound Identification and Quantification

The GC will identify all peak areas greater than 0.1 volt seconds (VS) as unknowns. The GC operator will match the retention times of the most recent standard with the unknowns. If the retention times match, the compound will be identified and quantified by multiplying the area (in VS) of the compound by the response factor calculated from the initial calibration. The final concentration will be reported in ppmv/ppbv.

5.5.6 Blanks

Blanks will be run to determine if there is carry-over from the previous samples and standards. The blanks will include the following: GC blanks, syringe blanks, and equipment blanks. A GC blank will be run at the start of each day's sampling to ensure a steady baseline. This will be done by starting a GC analysis without injecting a sample. Syringe blanks will be analyzed following the completion of the calibration runs by injecting 500 ul of ambient air into the GC (500 ul is the maximum capacity of the syringe). Syringe blanks will also be analyzed periodically during the day. If contamination is detected in the syringe,

it will be cleaned by using a methanol and organic-free water rinse. Equipment blanks will be analyzed following every sample where a positive result is obtained. Equipment blanks will be collected by removing the sampling assembly from a borehole and running the pump for a few minutes in order to draw ambient air through the system. An air sample will be collected from the stainless steel equipment and analyzed with the GC. If contamination is detected in the equipment blank sample, it will be removed by purging the equipment with the sampling pump until the contamination is no longer detected.

5.5.7 Quality Control

In addition to the calibration analyses, duplicate analyses will be run once every ten samples or as necessary. Continuing calibration analyses shall be performed as required or a minimum of once every 3 hours by injecting 300 ul of the standard into the GC. The retention time of each compound will then be checked for peak drift by comparing the new retention time with the one from the previous standard analysis.

Replicate samples will be collected at a rate of one per 15 soil-gas samples. Samples will be collected in Tedlar™ bags and two injections will be made into the GC to obtain duplicate results as a check on instrument performance.

5.5.8 Detection Limits

Analyte detection at a particular location is representative of vapor, dissolved, and/or liquid phase contamination at that location. The presence of detectable levels of target compounds in the vadose zone is dependent upon several factors, including the presence of vapor phase hydrocarbons or dissolved or liquid concentrations adequate to facilitate volatilization into the unsaturated zone.

The following are estimated detection limits based on discussions with laboratory chemists who will be analyzing air samples using ECD/FID detectors:

	<u>Compound</u>	<u>Approximate Detection Limit (ppbv)</u>
1.	Carbon tetrachloride	2
2.	Trichloroethene	3
3.	Toluene	3
4.	trans,1,2-Dichloroethene	4

5.6 GEOPHYSICAL SURVEYS

A geophysical survey of the MRFA site will be conducted to detect the presence of buried magnetic or non-magnetic material. The objective is to search for buried metal, which may include stainless steel drums, to a depth of approximately 10 ft. The electromagnetic induction method will be employed using the Geonics™ EM-31 electromagnetic instrument or equivalent, which detects any electrical conductor including stainless steel. The magnetic method and ground penetrating radar may also be employed in areas where the electromagnetic data are inconclusive due to interferences from either natural or manmade site conditions. The measurements are expected to be influenced by the local geology to some extent.

A geophysical survey will be conducted at the following sites:

- Scrap Metal Storage Areas, S-1, S-2 and S-3,
- Chemical Storage Area S-4,
- Solid Waste Disposal Area D-2,
- Drum Disposal Areas D-4 and D-5,
- Drum Disposal Area D-6,
- Area A (Fuel-Mixing Area), and
- Filled-in Ponds.

The locations of these sites are depicted in Figures 2 and 4. The survey grids appear in the above order in Appendix D.

5.6.1 Measuring Point Selection

The survey area will be inspected to identify powerlines, suspected covered pipelines, fences, and other metallic objects which may influence the magnetic readings. Site features identified during the Literature Search will also be considered in the measuring point selection. Of particular interest will be the existence and location of any near-surface magnetic features that might mask targets.

A grid comprised of evenly spaced lines to the extent practical will be surveyed using pin flags, a Brunton™ compass, and a fiberglass tape. Once the grid has been surveyed, measurement points will be designated at the nodes of the grid. In the event of obstructions such as trees, or buildings, a sampling point nearby will be substituted for that shown on the applicable soil-gas grid figure.

5.6.2 Electromagnetic Methods

Electromagnetic methods will be used to search for buried drums. These techniques will have the potential to detect any kind of metal and reinforced plastic drums. The EM-31, manufactured by Geonics, Inc. of Toronto or equivalent, will be used to measure the bulk conductivity of the ground. It is also to measure the signal which is out of phase with the primary field. Under some conditions, this responds to metal better than the conductivity anomaly and would not be observed on the in-phase data. However, there would need to be a significant quantity in order for them to create such an anomaly. Since the instrument measures bulk conductivity, it will be influenced by local geology. Thus, it may not be as effective for ferromagnetic objects detection as the magnetic method.

On arrival in the field, the batteries and the calibration of the instrument will be checked according to the operators manual. The readings will be taken in the vertical dipole mode to attain a 20-ft depth of penetration. A data logger will be used to record the data. Both the conductivity (out-of-phase) and in-phase readings will be taken. Care will be taken

to ascertain that the logger is recording the data correctly. This will be done by recording only two lines initially and downloading the data into a portable computer in the field to visual check the data integrity. Readings will be obtained along lines spaced 10 ft apart. Since reading time is virtually instantaneous with a data logger, readings will be taken every 5 ft. The data will be loaded onto a computer and the resultant contour maps and profiles will be used for interpretation. The lines used for the survey will be surveyed using a steel measuring tape and compass prior to the geophysical survey.

5.7 RADIATION SURVEY

A walk-through radiation survey of the buildings and grounds of the GE-Exxon Nuclear Building Area, including utility bunkers and the deep caisson under the tower building, will be made with a real-time detection instrument to assess the potential presence of residual radiation. A Victoreen™ geiger counter, Model 493 or an equivalent, will be used to measure total counts of radiation just above ground surface. Readings will be evaluated in terms of available information regarding natural background levels of radiation, as well as a walk-through survey of areas believed to be unaffected by test station activities, such as wooded areas. If readings above background are detected, soil samples will be taken for laboratory analysis.

5.8 SURFACE-SOIL SAMPLING

5.8.1 Site-Wide Surface-Soil Survey

Surface soil sampling will be conducted as part of a site-wide surface soil survey. This task addresses the potential presence of surface soil contamination at the site, if any. The survey will focus on currently known areas which may be of concern, and on areas which may be identified during the Literature Search. The Literature Search Report will be the basis for determining which areas will be sampled and whether a modified list of parameters

can replace the TCL parameters. Sampling activities will be conducted in a phased approach to determine if the initial sampling of these areas warrants further sampling.

In addition to the literature search, a site reconnaissance tour will be conducted to observe and select the areas which will be included in the survey. A geophysical survey will be conducted, if necessary, and a soil sampling plan will be prepared after the areas of concern have been determined.

5.8.2 Background-Soil Survey

A background-soil survey will be conducted to provide a statistical data base for comparison and assessment of the on-site concentrations.

- a. Three soil borings will be drilled in undisturbed areas on the easement property, approximately 50 ft beyond the perimeter fenceline of the Test Station, and on an approximate 120 degree spacing around the Test Station (see Figure 5). The borings will be continuously sampled to a depth of 6 ft below ground surface.
- b. One sample from each boring from the 0 to 2 ft interval will be submitted for laboratory testing of the TCL metal parameters plus boron and inorganic parameters. In addition, one sample will be collected at one location, to be analyzed for the full TCL, to confirm that the locations are appropriate for background samples. An HNU or other PID instrument will be used to screen all three boreholes and the samples with the highest PID reading, if any, will be selected for TCL analysis. If no PID readings are observed, the sample for full TCL analysis will be selected at random unless visual observation indicates the possibility of contamination.
- c. If the sampling described in (a) and (b) above does not adequately characterize background concentrations, additional soil sampling may be required.

5.8.3 Surface-Soil Sampling Near Storage Tanks

Surface soil samples will be taken if stained soil is present around underground and aboveground storage tanks, except for tanks that have been excluded from the program (e.g., tanks only used for storage of No. 2 heating oil). The stained area will be mapped with respect to the tank locations and one surface soil sample will be collected from the stained area at each tank and will be analyzed for TCL parameters, unless a modified list of compounds has been approved by EPA. However, stained soil will not be sampled if a soil boring is advanced in the stained area. In that case, the sample with the highest PID measurement will be analyzed for TCL parameters. Soil samples will be collected regardless of whether tanks are full or empty.

5.8.4 Surface-Soil Sampling Procedure

Each sample will be composited from a depth of six inches below grade over an area of approximately 36 square inches.

A description of the sample including date sampled, location, depth, grain size and color will be recorded. A stake marked with the sample number will be driven into the ground to identify the sample location. Sampling will be conducted using the following protocol:

1. The sampling station location will be identified and recorded. A clean, stainless steel trowel will be driven into the soil by hand. Disposable gloves will be worn during sampling and will be changed between samples.
2. The sample will be placed into an appropriate container.

3. Care will be exercised to avoid breakage and to eliminate the entry or contact of any substance with the interior surface of the bottles, vials or caps other than the sediment or soil sample being collected. Caps will not be removed until the actual time of sampling and then just long enough to fill the container.
4. VOC vials will be filled to the maximum extent possible to minimize the volume of headspace within the vial.
5. The samples for the remainder of the parameters will be collected in the specified containers, ensuring that the sample volume is adequate for the required analyses.
6. Samples containers will be labeled with the depth and date of sample collection. All samples will be preserved at approximately 4°C by placing the containers into iced laboratory coolers as soon as possible.
7. The coolers will be stored in a secure area until they are relinquished to a common carrier or courier for overnight delivery to the laboratory. Surface sediment and soil samples will be shipped on a daily basis, if practical.

5.8.5 Equipment Decontamination

Equipment used to sample the soil (e.g., stainless steel spatula) will be decontaminated prior to and between collecting each sample. Disposable gloves will be worn while equipment is cleaned to avoid contamination, and the gloves will be changed frequently. The procedure for cleaning sampling equipment will be as follows:

1. A 2-percent solution of Micro™ and distilled water will be prepared in a clean bucket.
2. The spatula will be immersed in the Micro™ solution.
3. All equipment will be scrubbed with a brush to remove any adhering particles.

4. All equipment will be rinsed with the following solutions in sequence:
 - potable water
 - 10% Nitric acid (HNO_3) solution,
 - distilled water,
 - methanol and allowed to air dry, and
 - distilled water
5. Clean equipment will be placed on a clean polyethylene sheet.

5.9 SUBSURFACE-SOIL SAMPLING

Soil borings will be drilled at the MRFA site using hollow stem auger drilling to collect samples for the determination of geology and soil quality.

A background subsurface soils survey for TCL metal parameters plus boron will be conducted to provide a statistical data base for comparison and assessment of the on-site concentrations. The survey will consist of three soil borings which will be drilled in undisturbed areas on the easement property (see Figure 5). The borings will be continuously sampled to a depth of 6 ft below ground surface (see Section 5.9.3 for sample collection protocols).

The soil borings in the following potential source areas (Figures 4 and 5) will be drilled in the "hot spots" as identified by the soil-gas survey, where possible. The borings will be continuously sampled to a depth of 6 ft or until 2 ft of undisturbed material is encountered, whichever is greater. One sample from each boring will be analyzed for the Contract Laboratory Program (CLP) Target Compound List (TCL) of parameters plus boron unless a modified list of compounds is approved by the USEPA.

- Scrap Metal Storage Area S-1 (2 borings),
- Scrap Metal Storage Area S-2 (2 borings),
- Scrap Metal Storage Area S-3 (3 borings),

- Former Burning Pit D-1 (1 boring),
- Solid Waste Disposal Area D-2 (3 borings),
- NYSDOT Disposal Area D-3 (2 borings),
- Rocket Test Gantries (2 to 4 borings per area),
- Area A (6 borings),
- Leach Fields (1 boring per field),
- MTI Test Station (2 borings),
- Ice Pond Area (2 borings),
- GE-Exxon Nuclear Building Area (2 borings),
- PTI Test Station (2 borings),
- Select Underground Storage Tanks (to be determined), and
- Select Aboveground Storage Tanks (to be determined).

The number of samples collected during each level of the Revised RI Work Plan is listed in Table 10.

Alternative procedures will be employed at a number of potential source areas. These areas and their specific modifications are summarized below and described in further detail in Section 4.11 to 4.30 of the Revised RI Work Plan.

- Former Burning Pit D-1 - Sample analysis of the boring will include TCL parameters plus dibenzo-p-dioxins and dibenzofurans.
- NYSDOT Disposal Area D-3 - The borings will be continuously sampled until 2 ft. of the natural soil below the base of the fill is reached. Should disposed material interfere, the location will be noted, and, if necessary, drilling will cease. If drilling is stopped, a second attempt to drill will be made within 6 ft of the first hole. If interference again occurs, a test pit will be dug at that location.

- Leach Fields - One soil boring will be drilled in each leach field to a depth below the base of the leach field.
- GE-Exxon Nuclear Building Area - As the borehole is advanced, the soil will be scanned with a real-time radiation detector. The analysis of one soil sample will include radiation parameters. The sample will be chosen based on the results of the real-time radiation detector.
- Underground and Aboveground Storage Tanks - Two soil borings will be drilled at each tank which was not used solely for VOC products or petroleum products.

5.9.1 Hollow-Stem Auger Drilling

Hollow-stem auger drilling uses truck-mounted equipment capable of rotating a drill bit on a string of auger flights. Drill cuttings are continuously lifted to the surface on the outside of the auger flights. Drill rods and a plug are used inside the flights to block the entrance to the drill cuttings. The plug is removed for split-barrel core (split-spoon) sampling inside the flights. The auger drilling technique is planned for the entire drilling program. However, if geologic conditions exist which warrant use of an alternative drilling technique, alternative methods will be evaluated. EPA will be notified if an alternative method is required.

5.9.2 Borehole Logging

1. During drilling, boring logs will be prepared in the field by an experienced hydrogeologist or geologist. Each well log shall be signed by the preparer, as borings are drilled.

2. All log entries will be printed. Photo reproductions shall be clear and legible. Illegible or incomplete logs will not be accepted. Logs will be the subject of ongoing quality control review by supervisory technical personnel for the duration of the program.
3. Borehole depth information will be from direct measurements accurate to the nearest 0.1 ft.
4. Location sketches referenced by measured distances to prominent surface features, will be shown on, or attached to the log.
5. Unconsolidated materials will be described as follows:
 - a. descriptive USCS classification;
 - b. Consistency of cohesive materials or apparent density of non-cohesive materials;
 - c. moisture content assessment, e.g., moist, wet; saturated, etc.;
 - d. color;
 - e. other descriptive features (bedding characteristics, organic materials, macrostructure of fine-grained soils; e.g., root holes, fractures, etc.);
 - f. depositional type (alluvium, till, loess, etc.);
6. Stratigraphic/lithologic changes will be identified on the log and recorded to the nearest 0.1 ft. Gradational transitions, changes identified from cuttings or methods other than direct observation and measurement will be identified by a horizontal dashed line at the appropriate scale depth based upon the best judgment of the logger.

7. Logs will identify the depth at which water is first encountered, the depth to water at the completion of drilling, and the stabilized depth to water. The absence of water in borings will also be indicated. Stabilized water-level data will include time allowed for levels to stabilize.
8. Logs will show borehole and sample diameters and, if applicable, depths at which drilling or sampling methods or equipment were changed. Logs will show the total depth of penetration and sampling.
9. If applicable, logs will identify drilling fluids used including, as appropriate, source of makeup water and drilling fluid additives by brand and product name, and mixture proportions. Logs will also identify any drilling fluid losses including depths at which they occur, rate of loss, and total volume lost.
10. Logs will include all other information relevant to a particular investigation, including but not limited to, odors; HNU measurements or other field screening or test results; and any observed evidence of contamination in samples, cuttings or drilling fluids.
11. A well construction diagram will be prepared depicting well depths and materials.

5.9.3 Formation Sampling

Split-spoon samples of unconsolidated sediments will be collected through the auger flights prior to advancing the drill bit. A standard split-barrel core sampler, 24 inches long and 2 inches in diameter, will be used for sampling. The sampler will be advanced into the formation by dropping a conventional 140 pound hammer from a height of 30 inches on the sampling assembly. In addition to the drilling and sampling equipment, the following equipment will be used during the subsurface soil sampling program.

- Micro™ Laboratory Cleaner

- 10-percent Nitric Acid Solution
- Methanol
- Brushes
- Plastic Buckets
- Distilled Water
- Plastic Sheeting
- Stainless-Steel Spatula
- Photoionization Detection Instrument
- Health and Safety Equipment (discussed in detail in the Health and Safety Plan)
- Sample Containers

Soil samples from the shallow well boreholes will be recovered using a split-barrel core sampler at 2-ft intervals within the first 10 ft; at 5-ft intervals to the bottom of the boring; and at changes in lithology. Samples from deep well boreholes will be collected at 10-ft intervals from the bottom of the shallow well borehole to the confining layer.

It will be the responsibility of the hydrogeologist to make certain that the sampling device is cleaned between sampling intervals in accordance with the decontamination protocols described in Section 5.9.5. The sampling protocol is as follows:

1. A clean split-barrel sampler will be given to the driller (or helper) by the field hydrogeologist, both of whom will be wearing clean, disposable gloves.
2. The sample will be collected by the driller using the standard penetration method.
3. The field hydrogeologist will take the split-spoon sampling device from the driller and place it on clean polyethylene sheeting.
4. The end cap will be unscrewed and the spoon opened to expose the sample.

5. A clean stainless-steel spatula will be used to remove and discard the top 2 to 3 inches of the sample. The core sample will be split down the middle and one-half of the sample will be placed in a jar and the head space will be checked for total volatile organic compounds (TVOC). The remainder of the sample will be placed in glass jars, and stored on ice until the selection of samples for laboratory analysis is determined. (The screening procedure is described in Section 5.9.4.).
6. After the soil samples for laboratory analysis of TCL parameters have been selected, the samples will be placed in pre-washed jars supplied by the laboratory. The split-spoon core will be trimmed with a clean knife and spatula. The outside of each core will be trimmed off, and samples will be cut to the size of the sample container. The sample container will be filled with as much sample as possible. First, the VOC vials will be filled to the maximum extent possible to minimize the volume of headspace within the vial. Next, the samples for organic analyses and inorganic parameters will be taken. Decontaminated tools, including spatulas and narrow spoons, will be used to pack the sample in the container. Samples will be stored in a secure area until they are relinquished to a common carrier or courier for overnight delivery to the laboratory. The samples will be shipped within 48 hours of collection.
7. The sample label will be completed (project, location, depth, date), attached to the sample container, and covered with transparent tape.
8. The sample/core log form will be completed. A copy is provided in Appendix B.
9. Each sample scheduled for laboratory analysis will be preserved in accordance with the protocols outlined in the QAPP (Section 6.0) and shipped to the laboratory via overnight courier.
10. The sampling equipment will be decontaminated as described in Section 5.9.5.

5.9.4 Field Screening for Total Volatile Organic Compounds

The head space in each sample jar will be checked for Total Volatile Organic Compounds (TVOCs) by a photoionization detection instrument (PID), such as the HNU, to aid in the selection of samples for laboratory analysis. The instrument will be calibrated according to the manufacturer's instructions. Calibration procedures are provided in Table 9. The sampling procedure is as follows:

1. The sample will be allowed to equilibrate to room temperature.
2. The lid of the sample jar will be removed and the aluminum foil pierced.
3. A PID measurement will be taken.

The sample with the highest Hnu reading from each boring site will be submitted to the laboratory for analysis of the TCL as outlined in the QAPP (Section 6.0). Samples may be composited over a zone greater than 2 ft in thickness if the TVOC readings indicate a larger zone of soil has been affected. In cases where PID readings are not above background throughout the full hole depth, a sample will be selected for analysis based on other factors such as soil discoloration, appearance, texture, or depth.

5.9.5 Equipment Decontamination

The drill casings, rods, samplers, tools, rig, and any piece of equipment that comes in contact (directly or indirectly) with the formation, will be steam cleaned on-site prior to drilling. Equipment will be steam cleaned at a specific decontamination area, between each borehole, and prior to leaving the site. All on-site steam cleaning activities will be monitored by the RI hydrogeologist.

Equipment used to sample unconsolidated sediments (for example, split-spoon samplers, stainless steel spatulas) will be decontaminated prior to collecting each sample. Disposable gloves will be worn while equipment is cleaned to avoid contamination, and the gloves will be changed frequently. The procedure for cleaning sampling equipment prior to collecting a sample for chemical analysis is as follows:

1. A 2 percent solution of Micro™ and distilled water will be prepared in a bucket.
2. The split-spoon sampler will be disassembled and all parts and the spatula will be immersed in the Micro™ solution.
3. All equipment will be scrubbed with a brush to remove any adhering particles.
4. All equipment will be rinsed with the following solvents in sequence:
 - potable water,
 - 10 percent nitric acid (HNO₃) solution,
 - distilled water,
 - methanol and allowed to air dry, and
 - distilled water.
5. Clean equipment will be placed on a clean polyethylene sheet.
6. The clean split-barrel core sampler will be reassembled and transferred to the driller (or helper) making sure that the individual is wearing clean, disposable gloves.
7. If the soil sample is only being collected for geologic samples, Step 4 (above) will not be required.

5.9.6 Disposal of Drill Cuttings and Fluids

Cuttings and fluids generated during drilling and development will be temporarily drummed until they can be removed from the drilling area for disposal. The method of disposal will be determined after the analytical program is complete and the nature of the cuttings and fluids can be determined.

5.9.7 Borehole Completion

Each borehole will be sealed by pumping grout through a tremie pipe set at the bottom of the borehole. The grout will consist of a mixture of 95 percent cement and 5 percent pure bentonite. A stake or marker will be placed in the borehole to serve as a reference point.

5.10 TEST PIT EXCAVATION AND SAMPLING

Test pits will be excavated at selected locations to determine the nature of the subsurface materials and any geophysical anomalies in the following potential source areas (see Figure 4):

- Drum Disposal Area D-4 (4 pits),
- Drum Disposal Area D-5 (3 pits),
- Drum Disposal Area D-6 (2 pits), and
- Filled-in Ponds (1 to 2 pits per pond, depending on the former pond's size).

5.10.1 Excavation

The test pits will be excavated using a backhoe capable of digging a 12-foot deep trench. Each pit will have a minimum dimension of 4 ft wide by 8 ft long with a maximum depth of 10 ft or until 2 ft of undisturbed material is encountered, whichever is greater. At

each pit, the overburden will be carefully excavated and placed beside the trench. This material will be used to backfill the trench after completion of the excavation. During excavation, soil will be placed on polyethylene sheeting. Every effort will be made to minimize the potential for drum or tank rupture. Personnel and equipment within the exclusion zone, including the backhoe and operator, will remain upwind of the test pit during the investigation, whenever possible. At no time will anyone enter the test pits. The cabin of the backhoe will be equipped with explosion-proof glass, and all HASP (Section 7.0) protocols will be followed by all field personnel in the exclusion zone.

5.10.2 Test-Pit Soil Sampling

An HNU or an equivalent photoionization detector will be used to scan the soil in each backhoe bucket. All field readings will be recorded on a Daily Log (Appendix B). A soil sample will be collected periodically as follows:

1. The sampling station location will be identified and recorded. A clean stainless steel trowel will be driven into the soil that has been placed beside the trench. The field geologist will collect samples from the soil as 2-ft intervals are excavated.
2. The samples will be placed in the appropriate containers.
3. Care will be exercised to avoid breakage and to eliminate the entry or contact of any substance with the interior surface of the bottles, vials or caps other than the sediment or soil sample being collected. Caps will not be removed until the actual time of sampling and then just long enough to fill the container.
4. VOC vials will be filled first and to the maximum extent possible to minimize the volume of headspace within the vial.

5. The samples for the remainder of the parameters will be collected in the specified containers, ensuring that the sample volume is adequate for the required analyses.
6. Sampling containers will be labeled with the depth and date of sample collection. All samples will be preserved at approximately 4°C by placing the containers into iced laboratory coolers as soon as possible.
7. The coolers will be stored in a secure area until they are relinquished to a common carrier or courier for overnight delivery to the laboratory. Surface sediment and soil samples will be shipped on a daily basis, if practical.

The sample with the highest field PID reading for each pit will be shipped for laboratory analysis. Samples will be preserved and shipped in accordance with the protocols outlined in the QAPP (Section 6.0). A soil/sediment sampling log will be completed in indelible ink to permanently document each individual sample collected. In addition to the identification markings on the container, other pertinent information relative to a sample or group of samples, such as color and grain size, will be documented.

A photograph will be taken as each individual sample is collected. The film roll and photograph numbers corresponding to an individual sample will be logged next to the sample identification numbers on the soil/sediment sampling log. The sample identification number will be written on the back of the corresponding photograph after the film is processed.

When the test pit has been excavated to specified dimensions and sampling has been completed, photographs will be taken highlighting the stratification of the soil and debris on vertical surfaces of the test pit. Flash equipment will be used to illuminate darkened areas of the pit. A "target pole," similar to a level rod, with 6-inch black and white blocked increments will be placed in the test pit and photographed along with the soil stratigraphy to help judge the depth and thicknesses of the strata when the photographs are being

studied. Detailed field notes will include physical description, color, shape, orientation, depth to any buried materials, and the film roll and photograph number.

Should it be necessary to leave the site during the period when the pit is open, it will be barricaded to prevent accidental entry by personnel or equipment. When the investigation of an individual test pit is complete and the field manager is satisfied that all available information has been documented, the pit will be backfilled using the "last out- first in" method whenever possible. The backfilled material will be compacted/tamped back into place using the bucket of the backhoe. The centerline of both ends of the test pit will be marked with 4-foot long stakes. The stakes will be topped with flagging of sufficient quantity and length to be visible to surveyors from 100 yards away.

Prior to leaving the exclusion zone, and after each test pit, sampling equipment including the bucket and other backhoe parts will be pressure-steam cleaned directly over the backfilled excavation to ensure that soils and wash water do not run off from the test pit area.

5.10.3 Buried Drum And/Or Tank Handling and Sampling

Drums encountered during test pit excavation will be sampled to characterize the contents. The procedures for handling, opening, sampling and disposal are described below.

Drum and/or tank sampling may be hazardous to worker health and safety because it may involve direct contact with unidentified wastes. If a drum or tank is encountered during test pit excavation, a drum grapppler will be attached to the backhoe for removal. This is recommended to keep the operator removed from the drum or tank thereby reducing the likelihood of injury if the drum or tank detonates or ruptures. If a drum or tank is leaking, the backhoe operator will be instructed to immediately place it into an overpack. In case of an explosion, grapppler claws and a shield will help protect the operator by deflecting the force of explosion. All site personnel involved with the handling or sampling

of drums will be made fully aware of all safety procedures detailed in the HASP (Section 7.0), to maximize worker safety.

Drums and/or tanks will be opened and sampled on-site. Drums and tanks will be opened by one of the following remote-controlled devices:

- pneumatically operated impact wrench to remove drum bungs
- hydraulically or pneumatically operated drum and/or tank pierce

If the drum or tank is swelling or bulging, all steps will be performed with greater care. Excess pressure in a drum or tank will be released in a remote location.

Samples will be obtained with a bailer lowered through the pierced hole in the drum or tank. Drums and tanks will be analyzed for RCRA hazardous waste characterization parameters. Sample containers are described in the QAPP (Section 6.0).

5.10.3.1 Disposal

The fate of buried drums and tanks will be determined after the contents have been analyzed. All waste materials will be disposed of in accordance with prevailing Federal and New York State regulations.

5.11 GROUND-WATER MONITORING WELL INSTALLATION AND DEVELOPMENT

Twenty-three new monitoring wells will be installed at the site to supplement the existing ground-water monitoring well network (Figures 4 and 5). In some cases, two-well clusters (one shallow and one deep well) will be installed. The new well locations are:

- Four new shallow and deep-well clusters (eight wells) in downgradient directions along the northwestern boundary of the main testing area (Figure 5);
- One well cluster (two wells) downgradient of Power Technology Inc. (PTI) in the easement area (Figure 5);
- One well cluster (two wells) downgradient of Berth 24 in the easement area (Figure 5);
- One new shallow well in the north-central test station area, upgradient of PTI (Figure 4);
- One new shallow well to form a cluster with existing supply Well 1D (Figure 4);
- One new shallow well upgradient of existing supply Well 2D (Figure 4);
- Three new shallow wells at the northern boundary of the site (northwestern corner near GE-Exxon Nuclear Building), in order to determine ground-water flow in this area (Figure 5);
- One new shallow well downgradient of Area A (Figure 4);
- One new shallow well downgradient of Disposal Area D-4 (Figure 4);
- One new shallow well downgradient of Disposal Area D-5 (Figure 4);
- One new shallow well upgradient of Disposal Area D-6 (Figure 4); and

- One new shallow well downgradient of Disposal Area D-6 (Figure 4).

The purpose of the new wells is to expand the site hydrogeologic characterization into known disposal areas and to hydraulically downgradient locations to define ground-water flow patterns and the horizontal and vertical extent of contaminant migration.

5.11.1 Borehole Drilling

All new monitoring wells will be drilled using hollow-stem auger equipment. No drilling problems are anticipated with this method; however, an alternative drilling method will be proposed for the deep wells if hollow-stem auger is found to be infeasible during the drilling program. The auger method will use 4- and 6-inch (ID) hollow-stem augers to install 2- and 4-inch stainless-steel monitoring wells. The hollow-stem auger drilling technique is described in detail in Section 5.9.1.

5.11.2 Formation Sampling

Samples of geologic material from the shallow well boreholes will be collected using a split-barrel core sampler at 2-ft intervals within the first 10 ft, at 5-ft intervals to the bottom of the boring, and at changes in lithology. Samples from deep well boreholes will be collected at 5-ft intervals from the bottom of the shallow well borehole to the confining layer. The formation will be sampled and logged as described in detail in Section 5.9.2.

5.11.3 Shelby Tube Sampling

At each deep well location an "undisturbed" sample of the blue clay layer will be collected using a sterile Shelby Thin Wall Tube Sampler. This sampler, consisting of a stainless steel, thin wall tube will be secured to a ball check valve. The head will be threaded to receive standard drill rods from an auger rig. The 30-inch long, 3-inch diameter tube will be advanced into the formation under hydraulic pressure exerted by the drill rig.

The sample will also be extruded from the ground by a drill rig and both ends of the tube will be covered with plastic caps, secured with tape, and dipped in wax to complete an air-tight seal. The sample will then be properly labeled and sent for testing of the following parameters: grain size distribution, soil permeability, atterburg limits, unconfined pressure strength, moisture content, bulk density, chloride, percent ash, fusion temperature, and a microbiological assay.

5.11.4 Monitoring Well Construction

The installation of the monitoring wells will begin as soon as practical after borehole completion. 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 breakdowns, or sudden inclement weather, installation will be resumed as soon as practical.

The shallow monitoring wells will be constructed of 2-inch diameter, flush-joint stainless steel casing with 10 ft of 2-inch, 0.010-slot stainless steel screen. The deep monitoring wells will be constructed of 4-inch diameter stainless steel casing and 10 ft of 6-inch, 0.010-slot stainless steel screen to facilitate ground-water sample collection. The screen, casing, and couplers will be new material. The lengths of casing and screen will be measured and recorded by the hydrogeologist prior to installation.

The shallow monitoring wells will be completed at the water table, approximately 40 to 50 ft below ground surface (bgs) and screened in the upper 10 ft of the saturated zone. The deep wells will be completed above a blue clay confining unit which has previously been identified at the site. At the present time, it is not known whether the clay layer is contiguous or present at the same depth throughout the site. Based on currently available information, the depth to clay is anticipated to be 80 ft. To investigate the continuity and depth to clay in a progressive manner, the first monitoring wells installed will be in areas

near those known to contain the clay. The remaining wells will be installed sequentially from this area outward.

5.11.4.1 Gravel Pack and Borehole Annulus Seal

A gravel pack will be installed in the borehole annulus around the screen. Morie sand or the equivalent will be used for the gravel pack, and a weighted steel tape will be placed down the annulus periodically to measure the depth to the gravel pack as it is installed to ensure that it is not bridging and that it is installed to 2 ft above the top of the screen.

A representative sample of the gravel packing material will be supplied by the driller prior to use. The sample will be described, in writing, according to the following general guidelines: lithology, grain-size distribution, trade name (if any), source (including company and location), and its suitability for use determined in advance of well construction.

A 2-ft thick bentonite slurry seal (polymer-free, 100-percent bentonite) will be pumped through a tremie pipe to the top of the gravel pack. The thickness of the slurry seal will be verified by field measurements of the depth to the gravel pack and the depth to the top of the seal.

A slurry of bentonite (5 percent)/cement (95 percent) will be pumped through a tremie pipe in the annulus between the borehole and the well casing. The bentonite/cement grout will be placed from the top of the bentonite slurry seal to 2 ft below grade. A protective steel casing and locking cap assembly will be placed over the well head in concrete to secure the well.

5.11.4.2 Well Construction Diagram

A well construction diagram will be prepared by the on-site hydrogeologist and will contain the following information:

- The bottom of the borehole (that part of the borehole most deeply penetrated by drilling and/or sampling),
- The screen setting,
- The gravel pack interval,
- The bentonite seal interval,
- The grout interval,
- The borehole and well casing diameter,
- The height of the well casing (without cap/plug) above ground surface, and
- The height of the protective casing.

The well construction diagram will be included as part of the field QA/QC procedures. An example of the well construction diagram form is provided in Appendix B.

5.11.5 Well Development

A record of well development will be maintained as part of the QA/QC procedures. Well development will be accomplished by pumping and back washing with a submersible pump, compressed air and mechanical surging of the well, or a combination of these techniques. Development will continue until the well responds to water-level changes in the formation, all traces of drilling fluid are removed, and the well produces clear, sediment-free water to the extent practical. A level of 50 turbidity units (NTUs) on a turbidimeter will be a development goal. For each well, a one-pint sample of the last water to be removed

during development will be obtained and inspected by the hydrogeologist for relative clarity and turbidimeter reading to determine whether development is complete.

Dispersing agents, acids, disinfectants, or other additives will not be used during development, nor will they be introduced into the well at any time. During development, water will be removed from the entire column of water standing in the well by periodically lowering and raising the pump intake. The disposal of development water for each well will be determined by water quality data obtained from existing neighboring wells. Disposal methods may include discharge to on-site pond, treatment by the existing air-stripper or containerization on-site.

The following data will be recorded as part of the development and QA/QC procedures:

- The development technique used,
- The static water level measured from the top of the well casing before and 24 hours after development is completed,
- The calculated quantity of fluid standing in the well prior to development,
- The sounded well depth before and after development to determine if siltation has occurred inside the well,
- The physical appearance of the water including changes during development in clarity, color, particulates, and odor, and
- The type and size/capacity of pump used.

5.11.6 Equipment Decontamination

All drilling equipment and tools will be thoroughly steam cleaned on-site prior to drilling, between boreholes, and before leaving each area of investigation. Split-barrel core samplers will be decontaminated according to the procedure provided in Section 5.9.5.

The decontamination procedures for the submersible pump are as follows:

1. Personnel will wear disposable gloves at all times during the decontamination procedure and will change gloves as necessary.
2. The pump will be removed from the well and placed, with the electrical cord, into a clean bucket. The equipment will be rinsed with potable water.
3. The interior and exterior of the pump will be rinsed with a 2-percent Micro™ solution. A brush will be used to scrub the pump and cord to remove surficial contaminants.
4. The pump and the electrical cord will be placed in a clean pail and the interior and exterior will be rinsed with copious amounts of distilled water.
5. The clean pump and cord will be placed in a clean plastic bag.

5.11.7 Disposal of Drill Cuttings and Fluids

All drill cuttings and fluids will be drummed at the well location until arrangements are made for proper disposal.

5.11.8 Elevation Survey

Upon completion of the drilling program, an elevation survey will be conducted by a New York State certified surveyor. The ground elevation and top of casing (TOC) elevation, in feet above National Geodetic Vertical Datum (NGVD), will be determined for all new ground-water monitoring wells. These data will be used in the construction of ground-water elevation maps.

5.12 BOREHOLE GEOPHYSICAL LOGGING

Natural gamma geophysical logs will be obtained from three selected deep wells to provide additional data for geological interpretation of site conditions. A Model II Mount Sopris Instrument Company Logging System™ or equivalent will be used. The criteria for selection of the three deep wells for logging are:

- Adequate spatial distribution,
- Observed complexity in the geologic logs, and
- Ability to fill data gaps.

A gamma measurement of naturally-occurring radiation from materials encountered in the borehole will be used as a qualitative supplement to geologic data for stratigraphic correlation and permeability estimates. The magnitude of counts-per-second readings is an indication of the presence (or absence) of clay or other minerals emitting natural gamma radiation.

5.12.1 Borehole Logging Procedure

The following procedures will be followed at each geophysical logging location:

1. A sufficient length of cable will be spooled out to allow the Model II probe to be centered over the well. Tension will be kept on the cable at all times to avoid forming a loop on the drum and tangling the mechanism.
2. The probe will be placed in the well and the tripod which supports the probe will be centered over the well.
3. The SPEED control will be turned fully counter-clockwise and the DIRECTION switch will be set in the OFF position when not running the winch.
4. The distance from the reference point to the main measuring point will be set on the probe into the DEPTH PRESENT switch on the Cable Depth and Speed Module. The LOAD button will be pressed and the SYSTEM switch will be checked for the proper display.
5. The PEN-STANDBY-RECORD switch will be turned to PEN. This will activate the pens (to preview the borehole on the trip down), and turns off the chart drive.
6. The direction switch will be turned to DOWN and the probe will be lowered to the bottom of the borehole. During this time, the output from the Logging Module will be monitored to select the proper ranges to be used while logging. If the cable becomes slack, the winch will be stopped immediately.
7. The Direction switch will be placed in the UP position after the bottom of the borehole is reached. Slack will then be taken out of the cable, and it will be stopped on a full depth increment (i.e., fractional part equal to zero). The pen will be

correlated to the depth displayed on the Cable Depth and Speed Module with a bold grid line on the chart paper. The CHART RATIO switch will be set to the desired ratio and the PEN-STANDBY-RECORD switch will be set to RECORD.

8. The probe will be lowered back down to the bottom of the hole, the pen(s) will be set on the paper, the Direction switch will be set to UP, the settings on the Logging Module will be checked, and the probe will be raised to the top of the borehole.
9. After the top of the borehole is reached, the SPEED control will be turned fully counterclockwise and the Direction switch will be set to STOP.
10. The instrument power and winch power switches will be turned to OFF. The probe will be removed from the borehole and wiped clean.

5.12.2 Equipment Decontamination

The logger probe and cable will be cleaned with a solution of Micro™ laboratory-grade detergent and potable water, and rinsed with distilled water before and after logging each well site.

5.13 WATER-LEVEL MEASUREMENT

Two to five synoptic rounds of water-level measurements will be made at all new and existing wells. Subsequently, water levels will be measured quarterly for one year to determine seasonal fluctuations. Care will be taken to avoid cross-contamination. Measurements will be taken last at source area monitoring wells to avoid cross contaminating wells. All equipment will be thoroughly cleaned using a Micro™ solution between measurements.

Although non-aqueous phase liquids are not expected at the MRFA site, a water/product interface probe will be used for water-level measurements to be conservative. The measurement will be recorded in the Water Sampling Log and the Water Level/Pumping Test Log during the aquifer test (Appendix B). The water-level will be measured as follows:

1. The interface probe will be rinsed with detergent solution and distilled water, then dried with a clean cloth.
2. The probe will be lowered slowly down the center of the casing.
3. The depth to water and to product, if any, will be measured relative to the top of well casing and recorded in the field notes.
4. The water-level elevation relative to NGVD will be calculated by subtracting the depth to water from the top of the casing elevation (measuring point).

5.14 GROUND-WATER SAMPLING

Ground-water samples will be collected from all new and existing wells and new supply wells. Strict quality-control procedures will be maintained during sampling, sample handling, and analysis.

Two rounds of ground-water samples will be collected from each new monitoring well and tested for the TCL parameters. If Special Analytical Services are necessary to meet ARARs and TBCs, they will be considered in the second round of ground-water sampling (Table 7). This is discussed in detail in the QAPP (Section 6.0).

The ground-water sampling plan is as follows:

- a. A ground-water sample will be collected from each of the three supply wells (1D, 2D, and 3D) and tested for the TCL parameters.
- b. A ground-water sample will be collected from each of the 15 existing monitoring wells (shallow wells 2S, 3S, 4S, 10S, 11S, 13S, MW-1, MW-2, MW-3, MW-4 and deep wells 4D, 10D, 11D, 13D, and 14D) and tested for the TCL parameters.
- c. A second sampling round of new and existing wells will be necessary to confirm the results obtained during the first round. The second round of samples will be analyzed for the full TCL or SAS as needed.

Quality control includes proper sampling procedures for well purging prior to sampling, sample-removal methods that utilize acceptable materials for all equipment and supplies, sample processing (including filtration, preservation, labeling, and filling bottles), and sample shipment. The RI Field Manager will work closely with the laboratory to assure that samples reach the laboratory in proper condition.

Geraghty & Miller's ground-water sampling protocol is based on technically sound standard practices as published in, for example, "Manual of Ground-Water Sampling Procedures," by Salf et al., NWWA/USEPA, 1981, "Handbook for Sampling and Sample Preservation of Water and Wastewater," (USEPA, 1982), and "RCRA Ground-Water Monitoring Technical Enforcement Guidance Document," (USEPA, 1986). All pertinent information regarding ground-water sampling procedures will be recorded on daily logs and sampling logs. Copies of these forms are provided in Appendix B.

5.14.1 Preparation for Sampling

A written sampling fact sheet summarizing the information in this POP that is needed by the field team will be prepared by the RI Project Manager. The fact sheet will include the protocol to be followed, information on the types and nature of hazardous chemicals that may be encountered, handling, storage, and transportation procedures, and references to the appropriate HASP procedures in which the need for special protective gear is indicated.

Upon arrival at the site, sampling personnel will check in with the appropriate staff at the plant to discuss the sampling team's daily activities, to coordinate sampling team activities with any site activities, and to obtain necessary clearances. Sampling personnel will check the wells for damage, record the well designations, wipe the tops of the wells clean, then remove the cap and wipe the top of the well casing with a clean cloth. Plastic sheeting will be placed around the well to protect sampling equipment from potential contamination.

The depths of the wells to be sampled will be measured (sounded) prior to sampling. The sampling team will calculate the volume of water in the well and to determine if formation material has accumulated in the well. The well depth will be measured to an accuracy of 0.1 ft.

The height of the measuring point above ground surface (the stick-up) will be measured as an indication of whether the well has been disturbed since installation. The

stick-up will be measured to an accuracy of 0.01 ft.

Prior to purging and sampling, the static water level in the well will be measured and the volume of standing water will be calculated. Water levels will be measured prior to water sampling, and the date and time of each measurement will be recorded. Each measurement will be made to an accuracy of 0.01 ft below the measuring point. Care will be taken to avoid cross contamination of wells by thoroughly cleaning the measuring instrument between wells. The procedure has been outlined in Section 5.9.5.

5.14.2 Sampling Equipment

All equipment will be thoroughly cleaned before use. Any supplies, such as tubing, that cannot be properly cleaned after use will be discarded in an appropriate manner. Equipment that will come into contact with the ground-water sample will be decontaminated according to the procedures outlined in the Section 5.9.5. Water level tapes will be cleaned with a laboratory-grade 2-percent Micro™ solution, and rinsed with distilled water prior to use. A new length of polypropylene cord will be attached to the bailer prior to sample collection. Equipment such as conductivity and pH meters will be calibrated according to manufacturer's instructions.

The following equipment will be available:

Measuring tape and chalk or electric prob (M-Scope)	Prefilters (cellulose-based membrane)
Clean rags	Filters (0.45-um, and 5-um cellulose-based membrane)
Distilled water	Filter funnels (Gelman polyethylene or glass)
Plastic sheeting	Vacuum flasks (1-liter polyethylene or glass)

Polypropylene rope	Vacuum pump (electric or hand-operated)
PVC bailers	Thermometers
Micro™ laboratory cleanser	Sample bottles
Buckets, graduated level	Indelible marking pens
Gloves (Latex, Nitrile, or equivalent)	Scrub brushes
pH Meter and buffers	Stainless-steel submersible pump*
Conductivity meter and standard	3/4-inch and 1/2-inch polyethylene tubing
Beakers	Centrifugal pump*
Clear tape	

* The selected pump will be dependent upon depth to water.

5.14.3 Well Evacuation

Standing water will be removed from the well casing prior to collecting ground-water samples. A stainless-steel submersible pump, will be used based on the known depth of the water table.

Before the submersible pump is lowered into a well, the pump and the polyethylene discharge tubing will be cleaned with a Micro™ solution followed by a rinse with distilled water. New tubing will be dedicated to each well sampled. The pump will be lowered slowly into the well on a safety line and just below the anticipated dynamic (pumping) water level. Once the pump has been lowered to the desired setting, the safety line will be secured. The water level in the pumped well will be monitored so that, in the event that it

drops near the pump intake, the pump can be lowered or the discharge reduced. Care will be taken to insure that the water column above the pump is removed from the well prior to sampling.

Three times the calculated volume of water in the well will be removed to ensure collection of a sample which is representative of the screened zone. The volume of standing water in each well will be calculated by subtracting the depth to water from the sounded depth of the well; this number will be multiplied by a coefficient which relates the diameter of the well to gallons per linear foot, to obtain the volume of standing water in the well. If the well cannot maintain a continuous yield until three volumes are evacuated, it will be pumped dry and sampled after the water level recovers.

5.14.4 Ground-Water Sample Collection

After well evacuation, a ground-water sample will be collected with a bottom-filling bailer. The bailer will be lowered slowly so that the water surface is minimally disturbed. Water will enter the bailer through a hole in the bottom-end plug and will be prevented from draining out by an inert ball-check valve. The plug fits tightly inside the bailer and requires no adhesives which could contaminate the sample. A polypropylene cord with a stainless-steel leader will be used to raise and lower the bailer, and the cord will be discarded after each well is sampled. The bailer will not come in contact with any surfaces outside the well casing. The bailer and stainless-steel leader will be cleaned according to the decontamination procedures outlined in Section 5.9.5. Sampling personnel will wear a new pair of disposal gloves for each well sampled and when handling a clean bailer.

5.14.4.1 Filling Sample Containers

The containers will be inspected to ensure that they are the correct type and number and have the correct preservative, if required. The labels will be properly filled out as described below and affixed to the containers. Samples will be carefully poured into the containers, avoiding agitation or turbulence which can result in the loss of VOCs and/or excessive oxygenation of the samples. Care will be exercised to avoid breakage and to prevent contact of any foreign substance with the interior surface of the bottles, vials, or caps. Caps will not be removed until sampling actually occurs and just long enough to fill the container. The vials for VOC samples will be topped-off to eliminate any headspace or air bubbles and will be tightly closed with Teflon™ septa held in place by open-top screw caps. The sample containers will be kept cool, dust-free, and out of the sun. The procedures that RI personnel will follow to collect samples are described below:

1. All containers will be labeled, marked with project information (see Section 5.3.3), well, and date, and wrapped with clear tape.
2. The bailer will be disassembled and cleaned according to the decontamination procedures described in Section 5.9.5. Clean gloves will be worn by personnel when they are handling a clean bailer.
3. The bailer will be reassembled and placed on clean plastic sheeting. An appropriate length of polypropylene cord will be attached to the bailer and a secure knot will be tied.
4. The bailer will be lowered into the water column gradually to minimize turbulence. The bailer will be allowed to sink and become fully submerged. Water from the first bailer will be discarded before the bailer is refilled.

5. The 40-ml vials for VOCs will be filled slowly and checked to ensure that there are no air bubbles.
6. After VOC samples have been collected, field parameters will be analyzed from the next sample. The temperature will be recorded. Specific conductance and pH measurements will be taken after the conductivity meter has been calibrated with a standard and adjusted for temperature, and the pH meter has been calibrated with pH 4 and 7 buffers. The pH electrode, and conductance cell, will be immersed in a beaker filled with the sample which will be swirled prior to recording the data.
7. The remaining containers will be filled in the order of the parameters' volatilization sensitivity as follows: semivolatiles, pesticides/PCB, and metals.
8. Prior to metals sampling, the sampling equipment will be cleaned with 2-percent Micro™ solution and rinsed with distilled water. The sample will be filtered through a 0.45-micrometer (um) filter. Prefilters or a 5.0-um filter will only be used if the sample cannot be filtered through the 0.45-um filter due to excessive suspended particulate matter. After filtration, the sample will be transferred to the pre-acidified container for metals analysis, and pH paper will be used to ensure that the sample has been acidified to less than 2 pH units.
9. The well cap will be closed and the well will be locked.
10. Samples will be packed on ice in a cooler and the Water Sampling Log form and Chain-of-Custody form (Appendix B) will be completely filled out. Samples will be delivered or shipped to the laboratory within 24 hours after sample collection and the receiver's signature will be recorded on the Chain-of-Custody form.
11. The cord, gloves, and sheeting will be discarded in a proper manner, and the bailer will be decontaminated and placed in a clean plastic bag.

5.14.5 Sample Containers and Preservation

Prior to implementation of the field sampling program, the laboratory will be contacted to obtain sample-handling specifications. These specifications will comply with EPA requirements for sample handling and analysis and will be cross-checked with RI chemists. If any questions or problems arise, the laboratory will be contacted to resolve the problems.

5.14.5.1 Sample Containers

Acceptable containers for water samples are made of glass, or polyethylene plastic. The type of container used will depend on the specific analyte being investigated. Polyethylene containers will be used for samples for inorganic parameters, and glass containers will be used to collect samples for organic analysis. Glass containers will have Teflon™-lined lids or septa. When organic compounds (other than VOCs) are sampled, amber-tinted glass containers will be used to inhibit photochemical reactions that may influence the concentrations. Specific containers and preservatives for each analysis are provided in Table 11.

5.14.5.2 Preservation

Samples will be preserved at approximately 4°C in a sealed cooler during transport to the laboratory for analysis. Frozen, plastic-ice containers will be used in shipping and the type of preservation used will be recorded in the Sampling Log (Appendix B). Appropriate chemical preservation will be performed in the field at the time of sampling. Analyses will be performed as soon as possible within the EPA and Standard Methods holding times as described further in the QAPP, Section 6.0.

5.14.6 Field Analyses

Measurements for temperature, pH, and specific conductance will be made in the field at the time of sampling because these properties may change during storage. Approximately 250 ml of sample will be placed in a clean, unpreserved polyethylene container. The container will be covered if the thermometer or probes are not inserted immediately. Field measurements will be taken and recorded on the Water Sampling Log (Appendix B).

5.14.6.1 Temperature

Temperature will be measured with a rapidly equilibrating, mercury-filled Celsius thermometer.

5.14.6.2 pH

The pH will be determined with a glass hydrogen-ion electrode compared against a reference electrode of known potential by means of a pH meter. Because pH is exponentially related to concentration, great care will be exercised in making a measurement. At the beginning of the sampling day, the pH meter will be calibrated with standard two-buffer solutions.

Before a measurement is made, the probe will be completely rinsed with deionized or distilled water. The probe will be lowered into a container of sample and allowed to equilibrate. To facilitate equilibration, the probe will be used to stir the water gently. A pH reading will be made as soon as the reading on the meter equilibrates. Between measurements, the probe will be immersed in deionized water. The pH meter will be recalibrated periodically during the sampling round to ensure accurate and precise measurements (Table 9).

5.14.6.3 Specific Conductance

The ability of a solution to conduct an electrical current is a function of the concentration and charge of the ions in solution and the rate at which the ions move under the influence of an electrical potential. A battery-powered meter will be used to take the conductivity measurements. The probe will be kept clean and calibrated daily with a conductivity standard.

To measure the sample's specific conductance, the instrument will be adjusted to the sample temperature, and the probe will be lowered into the sample and stirred gently. A reading can be taken within seconds after immersion. Before each use, the probe will be periodically cleaned with deionized or distilled water. The conductivity meter will be recalibrated periodically during the sampling round to ensure accurate and precise measurements (Table 9).

5.14.7 Quality Control Sample Collection

Replicate and blank samples will be used to monitor sampling and laboratory performance. To ensure unbiased handling and analysis by the laboratory, the identify of replicate samples will be disguised by means of coding.

5.14.7.1 Replicate Analyses

Replicate samples will be collected from the same well to provide laboratory reproducibility. When collecting samples for VOC analysis, the water from the bailer will be distributed first to fill one VOC container and then to fill the second VOC container. For other analytes, which require greater sample volumes, a common container will be filled with well water which will then be used to fill the sample containers. The common container will be a clean bucket or distilled water container. The frequency of replicate analyses is discussed further in the QAPP (Section 6.0).

5.14.7.2 Blanks

Trip blanks will be incorporated into this field investigation. They will consist of organic-free water prepared by the laboratory which will travel unopened with the sample bottles. They will be analyzed with the samples for VOCs to detect whether samples have been contaminated by VOCs as a result of handling in the field, during shipment, or in the laboratory. One trip blank will accompany each day's shipment of water samples sent to the laboratory for VOC analysis. Further discussion of trip blank analyses is provided in the QAPP (Section 6.0).

An equipment blank (field blank) will not be collected since sampling will be performed by bailers dedicated to each well. Thus, the possibility of cross contamination will be eliminated. Instead, a container blank will be collected to assure the integrity of the sample containers. The container blank will consist of laboratory prepared organic-free water poured into the sample container. One container blank will be taken for each shipment of sample containers from the laboratory.

5.14.8 Field Documentation

The handling history of all ground-water samples and blanks collected will be carefully recorded on appropriate forms to document the integrity of each sample, from the time the sampling team enters the site, through sample collection and shipment.

5.14.8.1 Daily Log

Daily logs will be used by the field team to record all sampling events and field observations. Entries in the daily logs will be dated by the person making the entry, and the logs will be kept in a secure, dry place. The following information will be included on the log forms:

1. Date and time of arrival at site,
2. Client,
3. Location,
4. Weather,
5. Sampling team members,
6. Work progress,
7. QC samples,
8. Departure time,
9. Delays,
10. Unusual situations,
11. Well Damage,
12. Departure from established QA/QC field procedures and explanation,
13. Instrument problems, and
14. Accidents.

5.14.8.2 Water-Sampling Log

The sampling team will prepare a Water Sampling Log (Appendix B) at the time of sampling to record information about each sample collected. In addition to project information, the log will include the following:

1. Date and time of sampling,
2. Well evacuation data,
3. Physical appearance of samples,
4. Field observations,
5. Results of field analyses,
6. Sampling method and material,
7. Constituents sampled for,
8. Sample container and preservation, and
9. Sampling personnel.

5.14.8.3 Sample Labels and Chain-of-Custody Form

Sample labels will be affixed to the sample containers prior to the time of sampling and will not be affixed to lids or caps. The labels will be filled out by sampling personnel and the Chain-of-Custody form (Appendix B) will be completed in the field before the sampling team leaves the site. Labels will be filled out according to Section 5.3.3 and will include sample identification, project number, date and time collected, analyses to be performed, and pH adjustment information when required.

The sampling team will be responsible for maintaining custody of the samples until they are delivered to the carrier or the laboratory. The Chain-of-Custody will then be signed and custody formally relinquished. The containers, bearing custody seals, will be in view at all times or will be stored in a secure place restricted to authorized personnel.

5.14.9 Equipment Decontamination

Before sampling begins, between each well sampled, and prior to leaving the site, all non-disposable equipment will be decontaminated. The submersible pump will be decontaminated as described in Section 5.11.5.

The decontamination procedure for the dedicated bailers is as follows:

1. Personnel will wear disposable gloves at all times during the decontamination procedure and will change gloves as necessary.
2. The bailer will be disassembled and each part will be rinsed with a 2-percent solution of Micro™ and distilled water.

3. Each part of the bailer will be scrubbed with a brush and a 2-percent solution of Micro™ to remove surficial contaminants. Each part will then be rinsed with copious amount of distilled water.
4. The bailer will be reassembled and rinsed with distilled water.
5. The clean bailer will be placed in a clean plastic bag.

5.15 AQUIFER TESTING

Aquifer tests are planned to measure the response of the aquifer to a stress imposed on it such as the withdrawal or injection of water. By using appropriate formulas and graphical techniques, drawdown and recovery data collected during an aquifer test will be used to determine aquifer coefficients (transmissivity, hydraulic conductivity, and storage coefficient).

During the progress of the RI, data will be collected and evaluated on a continuing basis to determine the most suitable location for aquifer testing. At a minimum, the data to be evaluated will include geologic conditions as documented in drilling logs; hydraulic properties to be estimated from slug tests; and locations and design of existing wells. In addition, the optimum location for aquifer testing may be influenced by the results of the literature search, soil-gas surveys, or analysis of ground-water quality.

We will attempt to conduct a 48- to 72-hour pumping test at either supply well 1D or 2D to determine aquifer hydraulic properties. A step test may be necessary prior to the pumping test to determine the optimum pumping rate unless the data are readily available. Data from the pumping test will be used to determine aquifer coefficients of transmissivity and storage, hydraulic conductivity, and the capture zone of the well. If either Well 1D or 2D is not capable of supplying a yield necessary to stress the aquifer, a test well will be installed in the most appropriate area of the site (i.e. that which may require remediation

through a pump and treat system). Prior to conducting the aquifer test, the following will be conducted:

- a. Two new well clusters and one deep well (a total of five wells) will be installed for the specific purpose of obtaining water-level measurements in areas where monitoring wells do not exist. The wells will be installed using similar methods as those for the proposed monitoring wells.
- b. Baseline trends will be established by continuous measurements of water levels in selected monitoring wells for at least 3 days prior to the start of pumping. Throughout the pumping and recovery periods of the test, water levels will be recorded frequently at wells within the 800 ft anticipated radius of influence of the pumping well and at regular, but less frequent intervals, at wells beyond this distance. A full round of water-level measurements will be obtained at the end of the drawdown period.
- c. Ground-water samples will be collected from the pumping well at the end of the drawdown and recovery periods to evaluate changes in ground-water chemistry as a result of pumping. The ground-water samples will be tested for VOCs or those analytes deemed appropriate based on the two rounds of ground-water sampling for TCL parameters conducted prior to the aquifer test. A list of analytes for aquifer test samples will be proposed to EPA based on these data.
- d. Slug testing of selected wells will be conducted to provide additional data on the aquifer's hydraulic conductivity in areas of the site not influenced by the aquifer test. The wells to be selected for slug testing will be located in areas of the test station that may require remediation and/or areas where data gaps exist.
- e. Aquifer testing will be performed after water-quality data from the new and existing wells are received. Discharge water will be released into the on-site pond.

5.15.1 Installation of Discharge Measurement and Control Devices

An in-line flow meter will be installed on the discharge pipe near the well head to monitor the flow rate of pumped water. In addition, an orifice and manometer may be installed at the end of the discharge line (if feasible), and the discharge rate will be determined from published orifice tables. The selected orifice will be attached to the discharge pipe and have a sharp, machined edge of dimensions that conform to standard orifice/weir design specifications. The last 6 feet of discharge pipe will be level and straight. During pumping, the discharge pipe will be full of water at all times, and the water will flow freely from the orifice. The manometer nipple tapping into the discharge pipe will be horizontal and flush with the inside of the pipe.

The discharge rate during the test will be controlled by an in-line gate valve located near the end of the discharge pipe. If possible, a second valve will be installed at the well head to make additional adjustments to the discharge rate. Based on data obtained during the step test, both valves will be pre-set and marked for the desired pumping rate.

A pumping rate will be selected after the step-drawdown test and review of the time versus drawdown graphs are developed. The rate chosen will stress the aquifer so that drawdown will be observed in the observation wells and aquifer coefficients will be determined by standard graphical techniques.

5.15.2 Barometer Installation

A continuous recording barometer will be installed at the site. If needed, data from this instrument will be used to correct aquifer test data for changes in barometric pressure during the pumping test. If the aquifer behaves like a confined system, significant barometric changes will affect water-level measurements.

5.15.3 Rain Gauge Installation

A rain gauge will be installed at the site and monitored on a regular basis, as heavy precipitation can cause a significant rise in the water levels, particularly in shallow aquifers. We will make every attempt to conduct the aquifer test under optimum meteorological conditions.

5.15.4 Conducting the Aquifer Test

The following sections provide protocols for conducting aquifer tests:

5.15.4.1 Slug Test Procedure

Slug tests will be performed to estimate the hydraulic conductivity of the unconsolidated deposits. The wells will be selected to provide areal coverage of the MRFA site and to represent a range of hydraulic conductivities as determined from a complete review of soil boring logs after monitoring well installation and sampling. The tests will be conducted by using a bailer, a data logger, and a 5-10 psi pressure transducer probe.

The following procedures will be followed while conducting the slug tests:

1. The static water level in the well will be measured using a wetted tape or an M-scope.
2. A 5-10 psi probe will be lowered into the well to approximately 7 to 10 ft below the water table (the static depth of the probe).
3. The calibration of the probe will be checked simultaneously reading the water level recorded by the data logger at the depth of the submerged probe and lowering the probe exactly 1.0 ft as measured with a chalked tape. The data logger should read exactly 1 ft lower than the original static depth of the probe.

4. The transducer cord will be taped to the well casing and a non-leaking bailer will be lowered into the well.
5. The water level in the well will be allowed to equilibrate.
6. The top of the bailer will be set below the water table.
7. The bailer will be withdrawn without interfering with the transducer cable. The data logger will be started about 15 seconds prior to withdrawal of the bailer to ensure accurate pre-test data.
8. The bailer water will be poured into a bucket which will be poured into a 55-gallon drum.
9. The bailer and probe will be decontaminated between wells to prevent the potential of cross contamination. Decontamination procedures will consist of washing the equipment with a 2-percent Micro™ solution followed by a thorough rinsing with distilled water.

5.15.4.2 Preliminary Aquifer Test (Step Test)

Several days before the scheduled aquifer test, a short trial step test will be conducted to check the performance of the pumping well and establish the pumping rate to be used for the final test. The well will be pumped at increasing rates to observe the water-level drawdown. The amount and rate of water-level drawdown observed during preliminary testing will be used to determine the proper settings necessary for each water-level measuring device (for example, selection of the proper gear ratios for the Leopold-Stevens™ recorders or equivalent and pressure range for the transducers).

5.15.4.3 Constant-Rate Test

The aquifer test will not be started until the water level in the aquifer has returned to the nonpumping static conditions observed prior to the preliminary aquifer test. The test will begin on the hour or half hour, and all watches will be synchronized prior to the start of the test. The test will be conducted at the flow rate determined during the step test. The well will be pumped at a constant and continuous rate for the specified test length.

During the constant-rate test, the well will be pumped at a constant rate for 48 hours. Drawdown will be measured throughout the test at specified time intervals to provide the data necessary to quantitatively characterize the aquifer. Wells selected for monitoring water-levels during the aquifer test will be determined in the field after development and step-drawdown testing. Automatic water-level recorders will be used to provide a detailed, continuous drawdown record which will be periodically checked by manually measuring the water level with a steel tape and chalk or an electronic sounding device (M-scope). The wells that will be monitored by automatic water-level equipment will be those within the greatest influence of the pumping well. This will be determined after evaluating water-levels taken during development and step-drawdown testing.

5.15.4.4 Frequency of Measurement

The time of drawdown and recovery measurements is important because drawdown is logarithmically related to time. Therefore, there is a progressively longer time period is allowed between measurements as the test progresses. To provide the recommended frequency of measurement, a uniform plot of water-level data on a logarithmic scale will be as follows:

<u>Elapsed Time (minutes)</u>	<u>Frequency of Measurement</u>
0 - 1	Every 15 seconds
1 - 5	Every 30 seconds
5 - 10	Every minute
10 - 130	Every 2 minutes
30 - 60 (1 hour)	Every 5 minutes
60 - 120	Every 10 minutes
120 - 180	Every 20 minutes
180 - 360	Every 30 minutes
360 - 1,440	Every hour
1,440 - end of test	Every 2 hours

A data logger will be programmed to collect water-level measurements in accordance with the above schedule. Manual water-level measurements, using either a chalked steel tape or an M-scope, will be made as close to this schedule as possible. If a scheduled reading is missed, a measurement will be made as soon as possible after the scheduled reading, and the actual time of the measurement will be recorded. The time and value of all water-level measurements will be recorded on Pumping Test forms (Appendix B).

5.15.4.5 Recovery Test

Measuring the recovery of the water levels after the pump is shut down is useful as a method of confirming the results of the drawdown test. Problems can be created by a fluctuating pumping rate during the drawdown phase; therefore, the automatic recorders remain in operation to measure the extended recovery of the water levels. Recovery measurements are useful because the residual drawdowns are a mirror image of the drawdowns in the discharging well with a constant discharge. Therefore, fluctuations in the time versus drawdown plot resulting from erratic pumping rates will be smoothed out using the recovery data. A specific method of analysis of pumping test data will be determined after the data has been collected and thoroughly reviewed.

To confirm the results of the drawdown test, measurements of water levels after shut-down of the test will be collected for a period of approximately 4 hours. The same frequency of measurement schedule described above will apply to measurements collected during the recovery test. The Leopold-Stevens™ recorders or equivalent will continue to measure water levels in selected monitoring wells for an appropriate period of time as dictated by field conditions.

5.15.5 Data Plots

Drawdowns and elapsed times will be calculated and the data will be plotted in the field on appropriated graph paper, semi-logarithmic for pumping wells and semi-and/or full-logarithmic for observation wells. The data plots will be kept current throughout the test so that the optimum test length can be determined.

The specific procedures and calculations to be used to interpret the test data will be determined after the pumping test. However, a semi-logarithmic plot of time versus drawdown in the pumping well and logarithmic plot of times versus drawdown in selected observation wells will be maintained in the field.

5.15.5.1 Data Plot Corrections

Corrections to the drawdown data will be made whenever external phenomena such as barometric pressure, regional water-level trend, nearby pumping, or heavy rainfall, cause changes in water levels. In addition, an appropriate technique will be used to correct for dewatering of aquifer materials, if necessary. Aquifer Test Data analysis is discussed further in Section 5.15.7.

The well will be pumped until the water-levels approach equilibrium conditions. Most likely, drawdown data will have to be corrected for an unconfined system, however, this will be determined after completion of the aquifer test.

5.15.6 Aquifer Test Memorandum

Following the test, field personnel will prepare a memorandum which will summarize the details of the test, including time, pumping rate(s), pump shutdowns, leaks in the discharge line, and weather conditions, which could affect the aquifer test and/or results. This memorandum will be distributed to RI personnel involved with evaluation of pumping test data and will be included in the RI report.

5.15.7 Aquifer Test Data Analyses

An appropriate technique(s) will be used to analyze the data collected during the aquifer test. Specific calculation techniques will be selected after the aquifer test is complete and preliminary evaluation of the data has been made. Preliminary indications are that the aquifer of concern is unconfined (Geraghty & Miller, 1991). Therefore, the methods available for reduction of unconfined aquifer data are believed to be appropriate at this time. These methods are described further below. The appropriate analytical technique can yield information on the well efficiency, safe pumping level, resource evaluation, and aquifer characteristics (transmissivity, hydraulic conductivity, and the storage coefficient).

For each test, the drawdown (decline in ground-water level) observed in the pumping well and in the affected monitoring wells will be plotted versus time. Where site conditions allow drawdowns which are conducive to the analysis of the drawdown versus time data, pumping test analyses will be performed. The pumping test analytical methodology will include a combination of two or more of the following procedures: the Boulton delayed-yield type-curve technique; the Hantush partial penetration type-curve method; the Jacob semilogarithmic method; and a pumping test software package (AQTESOLV™) and a

numerical radial flow model (FEEST™), both of which were developed by the Geraghty & Miller Modeling Group, Reston, Virginia.

5.15.7.1 Boulton Delayed-Yield Method

Boulton derived an integral equation for the drawdown of the water table near a pumping well prior to the flow system's reaching steady-state conditions. This equation is founded partly on a consideration of the vertical flow components that exist near a well during the early portion of a pumping test in an unconfined (water-table) aquifer. Detailed explanations of Boulton's work are documented in a series of his papers (1954a, 1954b, 1963, and 1964). Additional information regarding pumping tests in unconfined aquifers with partially penetrating wells can be found in Prickett (1965), Neuman (1975), and Walton (1978). A simplified presentation of the Boulton delayed-yield type-curve matching technique, as related by Lohman (1972), is described below.

When the Boulton delayed-yield type-curve matching technique is used, water-level drawdown data collected from observation well will be plotted versus time on full logarithmic graph paper of the same scale as the delayed-yield type-curves for analysis and determination of the hydraulic coefficients of transmissivity and storativity. However, before the drawdown versus time data are plotted and analyzed, drawdown measured (observed) during the pumping test will be corrected to account for the partial dewatering of the aquifer. Methods (including the Boulton technique) available for analysis of aquifer pumping test data assume a constant saturated thickness; thus, for the water-table (unconfined) conditions at the site, the observed values of drawdown will be adjusted for the decrease in saturated thickness and then the data will be plotted and used to determine the hydraulic properties of the aquifer.

The corrected data plotted on the appropriate logarithmic paper will be matched to the Boulton delayed-yield type-curves (Lohman, 1972) until the best fit between the plotted drawdown data and a type curve is found.

The transmissivity and storage coefficient of the water-table zone at the site will be calculated by using the match point data values from the type-curve and the drawdown versus time plot.

5.15.7.2 Hantush Partial-Penetration Method

Partially penetrating wells are those in which the length of the well screen is less than the thickness of the aquifer. Ground-water flow towards partially penetrating wells is three-dimensional, unlike the flow toward completely penetrating wells which is two-dimensional and effectively occurs parallel to the bedding planes. As a result, the drawdown observed in partially penetrating wells depends on the length and location of the screens of the observation and pumping wells and the degree of anisotropy of the flow system. (Anisotropy is the condition under which one or more of the hydraulic properties of an aquifer vary according to the direction of flow (Fetter, 1980).

Detailed discussions pertaining to the solution for the drawdown around a partially penetrating well are given by Hantush (1961, 1962, 1964). Supplementary information concerning the analysis of aquifer test data for determining in-situ horizontal and vertical hydraulic conductivity values (aquifer anisotropy) is given by Weeks (1964, 1969) and Witherspoon (1967). A fundamental presentation of the Weeks' method (supplemented with information from Hantush) describing the type-curve matching technique is outlined by Javandel (1984) and is explained below.

When the type-curve matching technique is used, site-specific (pumping test location) well configuration and hydrogeologic conditions will be used to create a series of dimensionless drawdown versus dimensionless time partial-penetration type-curves on logarithmic graph paper for varying anisotropic conditions. Drawdown versus time pumping test data will be plotted on logarithmic graph paper of the same scale as the type curves. The drawdown data will be matched to the type-curves and a match point will be selected. Match point values will then be used to calculate the horizontal and vertical hydraulic

conductivity values and the storage coefficient.

5.15.7.3 Cooper-Jacob Method

Cooper and Jacob (1946) simplified the Theis drawdown equation. The resultant Cooper-Jacob method is simple to apply and can solve for transmissivity and storativity of a confined aquifer. The method predicts accurate results for an unconfined aquifer when well drawdown is less than 10 percent of the aquifer thickness.

When the Cooper-Jacob method is used, water-level drawdown data from observation wells and/or the pumping well will be plotted against time on semilogarithmic paper. Time will be plotted horizontally on the logarithmic scale and water-level drawdown will be plotted vertically on the arithmetic scale. All point, except those representing measurements made during the first 10 minutes, are fitted with a straight line. The slope and intercept of the line are used to determine the aquifer coefficients of transmissivity and storage.

5.15.7.4 AQTESOLV™ Method

The Geraghty & Miller Modeling Group pumping test analysis software package (computer program) called AQTESOLV™ will be used to support the analysis of the drawdown versus time data collected from the aquifer tests. AQTESOLV™ is an interactive, menu-driven program that gives the user control over the analysis of aquifer test data. The program automatically estimates aquifer parameters using the Marquardt nonlinear least-squares technique to provide the best match between observed and calculated water levels (using the Gauss-Newton procedure [Draper and Smith, 1981] with the Marquardt modification [Marquardt, 1963]). AQTESOLV™ also provides the analyst with the option to interactively match type-curves to aquifer test data directly on the computer screen.

AQTESOLV™ uses the following techniques to analyze many types of aquifer tests:

1. Confined aquifer tests using the nonequilibrium methods of Theis (1935) and Cooper-Jacob (1946).
2. Semiconfined (leaky) aquifer tests using the nonequilibrium methods of Hantush with or without storage in the aquitard.
3. Unconfined aquifer tests using the nonequilibrium methods of Theis and Cooper-Jacob with the Jacob correction for reduction in saturated thickness.
4. Recovery tests using the nonequilibrium method of Theis for a confined aquifer.
5. Slug tests using the Bouwer and Rice (1976) method for unconfined and confined aquifers.
6. Aquifer tests affected by recharge and barrier boundaries using an image well analysis.
7. Aquifer tests using the Hantush method for wells that partially penetrate an aquifer.

AQTESOLV™'s automatic parameter estimation feature supplements the classic graphical methods of analysis of pumping test data. The sensitivity of the calculated solutions to changes in individual aquifer parameters will be evaluated and statistical measures of uncertainty will be obtained.

5.15.7.5 FEEST™ Method

The Geraghty & Miller Modeling Group radial inverse solution, two-dimensional finite-element flow code (FEEST™) may also be used to analyze pumping test data. FEEST™ is derived from the SEFTRAN code (Huyakorn et al., 1986), which is a two-dimensional finite-

element model that can be used to simulate ground-water flow and transport processes in fully saturated porous media.

For analyzing pumping test data, only the flow portion of the SEFTRAN code will be used and modified for the FEEST™ model. The FEEST™ code will perform inverse modeling, that is, it will also apply the Marquardt nonlinear least-squares technique to automatically estimate the aquifer parameters to provide the best match between observed and calculated water levels.

5.15.7.6 Alternative Data Analysis Methods

If soil borings drilled during the RI indicate the possibility that the selected aquifer test location is in a confined aquifer, aquifer test data will be analyzed by appropriate methods. The major indication of confined conditions is the presence of a continuous confining layer of low-permeability deposits. Currently, available data indicate that no such layer exists. However, in the unlikely event that additional information indicates confined conditions, alternative data analysis methods include the Theis (1935) and Cooper-Jacob (1946) methods of confined aquifer data analysis.

5.15.7.7 Slug Test Data Analysis

The slug test data will be analyzed by the method of Bouwer and Rice (1976) to estimate the hydraulic conductivity of the formation near the well screen. Since the utility of slug test data is dependent on the conductivity of the formation, an assessment of the reliability of the calculated conductivities will also be prepared. Calculated hydraulic conductivities of highly permeable deposits are generally unreliable when determined by slug testing.

5.16 SEDIMENT SAMPLING

Sediment samples will be collected from the following potential source areas at the MRFA site:

NYSDOT Disposal Area D-3: One sediment sample will be collected from the brook at the base of the fill area.

Rocket-Test Gantries: One sediment sample will be collected from the bottom of each of the three existing quench pits (Test Structures 3, 4, and 25).

Dry Wells: One sediment sample will be collected from the bottom of each dry well. Radioactivity will be included as an analytical parameter for sediment samples collected from the dry well at the GE/Exxon Nuclear Building. The total number of dry wells to be sampled and their location will be included in the Literature Search Report (Section 4.0).

Existing Pond and Drainage Ditch: Two sediment samples will be collected in the pond. Three sediment samples will be collected along the length of the drainage ditch.

Lagoon at MTI Test Station: One sediment sample will be collected from the lagoon.

Samples will be analyzed using CLP for the TCL parameters plus boron.

5.16.1 Sediment Sampling Procedure

Sediment samples will be collected using a stainless steel trowel. Each sample will be collected 6 inches beneath the sediment surface, where applicable. Sampling will be conducted according to the following procedure:

1. The sampling location will be identified and recorded.
2. A clean trowel will be driven into the soil by hand and the sediment sample placed into appropriate containers as described in the QAPP (Section 6.0). Soil coring equipment will be used to obtain sediment samples from the bottom of the quench pits, dry wells, the pond, and the MTI lagoon.
3. The sample container(s) will be labeled with the designation, depth, and date the sample was obtained.
4. Samples will be preserved in accordance with the protocols outlined in the QAPP and shipped to the laboratory via overnight courier.
5. The sampling tool will be decontaminated according to the procedures described in Section 5.16.2.
6. The sample date, location, depth, grain size, and color will be recorded.
7. A stake will be driven into the ground, where applicable, to identify the sample location and marked with the sample number.

5.16.1.1 Field Screening for Total Volatile Organic Compounds

The head space of each sample jar will be checked for volatile organic compounds by a photoionization detection instrument (HNU or TIP). The procedure will be identical to that discussed in Section 5.9.5.

5.16.1.2 Sample Containers

Samples will be submitted for analysis of the TCL compounds. Containers will be supplied by the laboratory and are identified in Table 11.

5.16.2 Equipment Decontamination

Equipment used to sample unconsolidated sediments will be decontaminated prior to collecting each sample. Disposable gloves will be worn while equipment is cleaned to avoid contamination, and the gloves will be changed frequently. The procedure for equipment decontamination is as follows:

1. A 2-percent solution of Micro™ and distilled water will be prepared in a clean bucket.
2. The sampling equipment will be immersed in the Micro™ solution.
3. All equipment will be scrubbed with a brush to remove any adhering particles.
4. All equipment will be rinsed with potable water and allowed to air dry.
5. Clean equipment will be placed on a clean polyethylene sheet.

5.17 SURFACE-WATER/SLUDGE SAMPLING

Surface-water samples will be collected from the following potential sources areas at the MRFA site:

- NYSDOT Disposal Area D-3
- Rocket-Test Gantries
- Septic Tanks

- Existing Pond and Drainage Ditch
- Lagoon at MTI Test Station

NYSDOT Disposal Area D-3: One surface-water sample will be collected from the brook at the base of the fill area. The sample will be collected directly into vials in a pooled-section of the brook.

Rocket-Test Gantries: One water sample will be collected from each quench pit. The sample will be collected from as near the center of the pit as possible, approximately half-way down the water column, using a bottom-filling bailer.

Septic Tanks: Septic tanks near Wright-Malta Buildings 13, 14, and 17; and at MTI, PTI, and GE-Exxon Nuclear Building will be sampled. One sludge sample from each septic system will be collected using a bottom-filling bailer. The samplers will be wearing vinyl gloves and nitrile gloves.

Existing Pond: One sample of pond water will be collected from as near the center of the pond as possible, approximately half-way down the water column, using a bottom-filling bailer.

Lagoon at MTI Test Station: One sample of water will be collected from as near the center of the plastic-lined lagoon as possible, approximately half-way down the water column, using a bottom-filling bailer.

Samples will be analyzed for TCL parameters plus boron.

5.17.1 Surface-Water Sampling Procedure

The following procedure will be followed for surface water sampling:

1. The station number will be recorded and sample bottles will be labeled and wrapped with clear tape.
2. Clean plastic sheeting will be placed near the sampling site and secured at the corners. All equipment used for sampling will be placed on the sheeting. The sampling equipment will be cleaned prior to and after sampling.
3. A bucket will be filled with 2-percent Micro™ solution and all equipment will either be immersed in the bucket or the solution will be poured through it. The equipment will be scrubbed with a brush to remove all surficial contaminants, then rinsed with copious amounts of distilled water. Personnel will wear clean gloves when handling clean equipment, and the equipment will be placed onto clean sheeting.
4. Personnel will stand downstream or at the edge of the pond and will rinse the sample collection device three times in the stream or pond water.
5. A bottom-filling bailer will be lowered from the surface to the approximate center of the surface water body. When the bailer is lifted upwards, the check valve will close permitting the sample to be collected at the desired depth.
6. A portion of the sample will be transferred to the sample bottles and personnel will proceed to the next sample collection point. Sampling will continue in this manner until the entire site has been sampled.
7. Samples will be stored in a cooler with ice packs as specified in the QAPP (Section 6.0).

8. The temperature, pH, and specific conductance will be measured and recorded on the Water Sampling Log (Appendix B).

5.18 WIPE SAMPLING

Wipe samples will be collected during walk-through surveys of the GE/Exxon Nuclear Test Station and the PTI Test Station.

GE/Exxon Nuclear Test Station: A Model 493, Victoreen™ geiger counter will be used to measure total counts of radiation. If levels of radiation of concern are detected, potentially contaminated surfaces will be wiped-sampled.

PTI Test Station: Wipe samples for PCBs will be collected from former PCB transformer locations to be determined in the Literature Search Report (Section 4.0).

5.18.1 Wipe Sampling for Radioactive Material

Wipe samples will be collected in the former GE/Exxon Nuclear Test Station using filter paper and vinyl gloves. Each sample will be collected from a 100 square-centimeter area which will be specified on the sample vial label. Samplers will follow HASP procedures specified in Section 7.0. Samples will be collected according to the following procedure:

1. A smooth sample surface will be selected and its location will be recorded on a Location Sketch (Appendix B).
2. The sampler will wear vinyl gloves and a lab coat to avoid contact with potentially radioactive particles.
3. The sampling surface area will be wiped with the filter paper along a 1 cm wide, 100 cm long swath.

4. The filter paper (sample) will be placed in a coin envelope labeled with a location designation, sample area, and sample date.
5. The envelopes will be sealed and shipped to the laboratory via overnight carrier.
6. The samples will be analyzed for alpha, beta and gamma radiation and specific radio-nuclides if identified by the literature search.
7. The sampled date, location and size will be recorded.
8. A site map will be prepared, and each sample location will be marked and numbered on the map.

5.18.2 Wipe Sampling for PCBs

Wipe samples will be collected in the PTI Test Station area using silaneized glass wool, stainless-steel tweezers and hexane solution. Each sample will be obtained from a 10 cm by 10 cm surface area, and the area size will be specified on the sample-vial label. A field blank will be collected using a 10 cm by 10 cm stainless-steel plate. Samples will be collected according to the following procedure:

1. A 10 cm by 10 cm sampling surface (e.g., floor or desk top) will be selected and located on a building floor plan.
2. A ball of silaneized glass wool will be dipped in laboratory-grade hexane using stainless-steel tweezers.
3. The sampling area will be wiped with the wetted cotton and dipped in the vial of hexane.

4. The procedure will be repeated four to six times until the sample area is wiped completely.
5. The cotton ball will be dropped into the hexane sampling vial at the end of the procedure.
6. The vial will be sealed and labeled with a location designation, size of sample area and date of sample collection.
7. The tweezers will be decontaminated after each sample according to the procedures in Section 5.9.5, but only using Micro™ detergent solution, methanol and distilled water.
8. Each sample will be preserved in accordance with the protocols outlined in the QAPP and shipped to the laboratory via overnight courier.
9. The sample date, location, number of wipes and size of sample area will be recorded.
10. A site map will be prepared, and each sample location will be marked and numbered on this map.

5.19 STEP I HABITAT-BASED ASSESSMENT

A Step I Habitat Based Assessment (HBA) will be performed at the MRFA site by a wildlife biologist. The HBA will describe the natural resources within a half-mile radius of the site in terms of vegetation cover types and associated fish and wildlife populations. The HBA will include a study of significant habitats, wetlands, and regulated streams and lakes at the site, and within a minimum of nine miles downstream of the site. The assessment will also include a site description, resource characterization, and hazard threshold identification.

- A. Site Description - The HBA will describe the natural resources associated with the site in terms of the vegetative covertypes and their associated fish and wildlife populations (within 0.5-mile radius). This will include significant habitats, wetlands, regulated streams, lakes, other resources of significance within a minimum 2-mile radius and downstream of the site a minimum distance of 9 miles. Deliverables include:
1. Covertypes Map (within 0.5-mile radius of site)
 - format: NYS Natural Heritage covertypes
 - methods: aerial photos, ground-level photos, USGS topographic maps, soils maps, and a site inspection
 - including: major vegetative communities, wetlands, aquatic habitats, significant habitats (important spawning areas, rookeries), and areas of special concern
 - verification: covertypes accuracy and vegetative species will be checked through limited field observation.
 2. Identification of Special Resources (within 2-mile radius of site and within 2 miles downstream)
 - including: regulated wetlands, streams, lakes, significant habitats, endangered species, and wild and scenic rivers
 - sources: file information from the New York State Department of Environmental Conservation (NYSDEC), United States Fish and Wildlife Service (USFWS), EPA, local bird clubs, colleges or other sources
 3. Habitat Description
 - including: major vegetative communities, typical vegetative species, and general densities within terrestrial, wetland, and aquatic habitats
 - aquatic habitats discussion including: chemical and physical parameters such as water chemistry, temperature, depth, substrate, flow, gradient, and submergent vegetation

B. Resource Characterization - The HBA will describe the following:

1. The fish and wildlife species that would utilize the habitats shown on the covertime map
 - sources: NYSDEC Central and Regional Offices, USFWS, EPA, local bird clubs, colleges, and standard natural history references
2. The general quality of the habitat in providing the needs of organisms:
 - sources: NYSDEC Central and Regional Offices, USFWS, EPA, local bird clubs, colleges, and standard natural history references
 - data collection: chemical and physical water quality data such as pH, alkalinity, hardness, temperature, and dissolved oxygen
 - a reconnaissance survey
3. Any existing stress which may be caused by the site:
 - areas of stressed vegetation, leachate seeps, fish and wildlife mortality, and population impacts

C. Hazard Threshold Identification - The HBA will describe the following:

1. Fish and wildlife related ARAR's and TBC's
 - Freshwater Wetlands Act and implementing regulations (Article 2d ECI, 6NYCRR Part 663 and Part 664) including all regulated wetlands on the site and downgradient of the site (within a minimum 2-mile radius), classification, and location on the covertime map
 - Tidal Wetland Act (Chapter 10 of 6NYCRR Part 611).
 - Regulated streams (Article 15 ECL, 6NYCRR Part 608)

- including location and classification of all streams on site and downgradient of the site (within a minimum of 5 miles downstream), and aquatic resources (fisheries), locations will be shown on a coertype map
 - Navigable Waterbodies (Article 15 ECL, 6NYCRR Part 608)
 - Coastal Zone Significant fish and wildlife habitats including locations shown on a coertype map
 - Significant habitats as recorded by the Natural Heritage Program
 - Wild, Scenic and Recreational Rivers Act
 - Rare, endangered or threatened plant and animal species such as the Karner Blue butterfly
 - NYS Water Quality Standards/Guidance Values (6NYCRR Part 701 and TOGS 1.1.1)
 - NYSDEC sediment criteria
 - Toxicity information from literature reviews where no standards or guidance values exist
2. Exceedance of established limits or mandated standards established in the above regulations, or guidances.

6.0 QUALITY ASSURANCE PROJECT PLAN

6.1 INTRODUCTION

Quality assurance and quality control (QA/QC) measures have been established, and a program to ensure that these measures are applied to the collection and interpretation of all environmental monitoring data at the MRFA site. The Quality Assurance Project Plan (QAPP) is designed to assure that the precision, accuracy, representativeness, comparability, and completeness (the "PARCC" parameters) of the collected data are known, documented, and adequate to satisfy the data quality objectives of the study (Section 3.0).

This plan represents the policies, organization, objectives, data-collection activities, and QA/QC activities that will be utilized to ensure that all data collected during this study are representative of site conditions. Laboratory QA/QC procedures, which will be adhered to by the laboratory, are included in their Quality Assurance Project Plans (Appendix E) and in the United States Environmental Protection Agency (USEPA) Contract Laboratory Program (CLP) Statement of Work (SOW) for organic and inorganic analysis (March 1990). These documents are referenced throughout the QAPP, where appropriate. A QA/QC Short Form for the RI is included in Appendix F.

6.2 DATA COLLECTION

6.2.1 Monitoring Parameters, Sample Matrices, and Frequency of Collection

The FSAP (Section 5.0) describes sample collection, the type and number of samples to be collected and the analytical parameters to be analyzed for each sample.

A list of the Sample Matrices and Analytical Requirements is found in Table 7. The table describes the sample matrices, analytical parameters and methodology, total number of samples to be collected, total number of field duplicates and field blanks and associated laboratory QA/QC requirements. Sampling procedures are provided in the FSAP (Section 5.0).

6.2.2 Laboratory Calibration Procedures

Calibration procedures for laboratory equipment used in the analysis of environmental samples will be performed in accordance with those specified in the USEPA CLP SOW and the laboratory QAPP (Appendix E).

6.3 QUALITY ASSURANCE OBJECTIVES

The overall QA objective is to develop and implement procedures for field sampling, chain-of-custody, laboratory analysis, and reporting that will provide environmental monitoring data of known and acceptable quality. The data must be of sufficient quality for use in comparison with ARARs, risk assessment, feasibility study, and final decision making. The purpose of this section is to address the data quality objectives in terms of accuracy, precision, quantitation limits, representativeness, comparability, and completeness. Specific procedures to be used for sampling, chain-of-custody, calibration of field instruments, laboratory analysis, reporting, internal quality control, audits, preventative maintenance, and corrective actions are described in later sections of this QAPP.

6.3.1 Accuracy

Accuracy is the relationship of the reported data to the "true" value. The accuracy of the methods used for ground-water, surface-water, sediment, and soil samples will be determined from the analysis of matrix spikes (MS) and surrogate spikes. One MS will be collected per 20 samples, or one per 2 weeks if less than 20 samples are collected per week

of sampling activities. The compounds used and their accuracy limits are set by the CLP SOW (USEPA, 1990a & 1990b). Accuracy for the analysis using methodology not specified in the CLP SOW will be assured through standard laboratory QA/QC methods. Laboratory accuracy requirements are provided in Appendix E.

6.3.2 Precision

Measurements of the data precision are necessary to demonstrate the reproducibility of the data. Precision for the CLP Target Compound List (TCL) analyses will be determined from the analysis of matrix spike duplicate (MSD) and replicate samples. One MSD will be collected with each MS. Replicate samples will be collected at a rate of one per fifteen samples.

Precision will also be determined for surface- and ground-water samples by the analysis of duplicate samples. The relative percent difference (RPD) for each compound found will be calculated for later use during data assessment. An advisory limit of ± 20 percent for RPD will be used for sample values greater than 5 times the contract required detection limit (CRDL). Soil and sediment samples will not be duplicated due to the non-homogeneous nature of the samples and the high degree of variability routinely seen with results from duplicate soil analyses. Precision requirements for each laboratory are provided in Appendix E.

6.3.3 Completeness

Completeness is a measure of the amount of valid data obtained from the measurement program, compared to the total amount collected. The validity of the collected data will be evaluated by RI utilizing the appropriate QA/QC guidelines. Laboratory completeness requirements are provided in Appendix E.

6.3.4 Representativeness

All data should be representative of actual conditions at the sampling location. The soil, sediment, surface-water, and ground-water sampling network was designed to provide data representative of site conditions. Considerations for evaluating the representativeness of the data include, but are not limited to, the location being sampled, the methods used to obtain environmental samples at the site, and the appropriateness of the analytical method to the type of sample obtained. All field activities will be performed according to the protocols outlined in the Field Sampling Plan. Laboratory representativeness requirements are provided in Appendix E.

6.3.5 Comparability

Comparability will be achieved by utilizing standardized sampling and analysis methods and data reporting format. To the extent feasible, the environmental data will be generated such that it is comparable. There are certain limitations to this objective due to the fact that historical data were not generated for TCL analytes by CLP methods. The analytical results from the ground-water samples from the existing monitoring wells will be compared to the existing ground-water data base. An evaluation will be performed to determine whether analysis for the TCL has identified any other compounds that were previously unknown at the site.

6.3.6 Quantitation Limits

Quantitation limits for the TCL analyses are provided in the USEPA CLP SOW, (unless dilution or interference effects make it necessary to raise them) and in each Laboratory QAPP (Appendix E). The laboratories will make every effort to achieve quantitation limits as low as practicable and will report estimated concentration values at less than the detection limit by flagging the value with a J.

6.3.7 Field Blanks

To determine if cross contamination has occurred during sampling, one field blank per day of sampling will be collected. Laboratory-grade distilled water will be poured through the sampling device after it is decontaminated and into the laboratory containers. Samples will be analyzed for TCL analytes and boron by USEPA CLP SOW methods. Field blanks will not be collected during surface soil and ground-water sampling since disposable trowels and dedicated bailers will be used, respectively. Instead, container blanks will be collected.

6.3.8 Container Blanks

Container blanks will be collected periodically when field blanks are not collected. Laboratory-grade distilled water will be poured into the empty sample container and sent to the laboratory along with that day's samples. The blanks will be analyzed for TCL analytes and boron by USEPA CLP SOW methods.

6.3.9 Trip Blanks

One trip blank, consisting of two 40-ml glass vials filled with deionized water, will be provided by the selected laboratory for each container used to ship and store volatile organic aqueous and soil samples during each sampling event. Trip blanks for aqueous and soil samples will be analyzed for TCL VOCs by USEPA CLP SOW methods.

6.3.10 Replicate Samples

Replicate samples will be collected to demonstrate the reproducibility of the sampling technique. Replicate analyses will be collected at a minimum rate of one per fifteen samples. This will be apart from the replicates a laboratory must run, and will not be replaced by a laboratory-generated replicate.

The replicate sampling location will be arbitrarily selected for each sampling event. Since the replicate will be blind to the laboratory, it will have a fictitious sampling location on the label and chain of custody. The actual sampling location will be recorded in a daily log.

6.3.11 Matrix Spike/Matrix Spike Duplicate

The matrix spike/matrix spike duplicate (MS/MSD) will be used to assess laboratory accuracy and precision. The MS/MSD will be collected for aqueous samples at a minimum rate of one per group of 20, or one per 2-week sampling event.

6.3.12 Laboratory Blanks

Laboratory blanks are prepared and analyzed by the laboratory. Method blanks will be analyzed for background contamination from the laboratory as specified by the CLP SOWs.

6.4 SAMPLE CUSTODY

Sample custody procedures are designed to provide documentation of preparation, handling, storage, and shipping of all collected samples. An example of the chain-of-custody form, which will be used during this investigation, is attached in Appendix B.

Samples collected during the site investigation will be the responsibility of identified persons from the time they are collected until the derived data, are incorporated into the final report. Stringent chain-of-custody procedures will be followed to document sample possession.

6.4.1 Field Custody

1. The field technician is responsible for the care and custody of the samples collected until they are delivered to the analyzing laboratory or entrusted to a carrier.
2. Log books and other records will always be signed and dated on each page.
3. Chain-of-custody sample forms will be completed to the fullest extent possible prior to sample shipment. They will include the following information: sample number, time collected, source of sample and location, preservative, and name of sampler. These forms will be filled out in a legible manner, using water-proof ink, and will be signed by the sampler. Similar information will be provided on the sample label which will be securely attached to the sample bottle. In addition, sampling forms will be used to document collection, filtration, and preparation procedures.

6.4.2 Transfer of Custody and Shipment

The following procedures will be used when transferring custody of samples:

1. Samples will always be accompanied by a chain-of-custody record. When transferring samples, the individuals relinquishing and receiving them will sign, date, and note the time on the record. This record documents the sample custody transfer from the sampler to the laboratory, often through another person or carrier. Upon arrival at the laboratory, internal custody procedures will be followed, as discussed in the laboratory QAPP (Appendix E).

2. Samples will be packaged properly for shipment and dispatched to the laboratory for analysis, with individual custody records accompanying each shipment. Shipping containers will be sealed for shipment to the laboratory. The method of shipment, courier name, and other pertinent information, will be entered in the remarks section of the custody record.
3. All shipments will be accompanied by the chain-of-custody record identifying the contents. The original record will accompany the shipment; and a copy will be retained by the field sampler.
4. Proper documentation will be maintained for shipments by common carrier.

6.4.3 Sample Preservation and Shipment Procedures

The following procedures will be followed when shipping samples for laboratory analysis:

1. Samples requiring refrigeration will be promptly chilled with ice or "Blue Ice™" to a maximum temperature of 4°C and packaged in an insulated cooler for transport to the analyzing laboratory.
2. Only shipping containers which meet all applicable state and federal standards for safe shipment will be used.
3. The shipping containers will be sealed with tape in a manner that will allow the receiver to quickly identify any tampering which may have occurred during transport to the laboratory.
4. The field chain-of-custody document will be placed inside container in a sealed plastic envelope after the courier has signed the document.

5. Shipment will be made by overnight courier.

6.4.4 Field Documentation Responsibilities

It will be the responsibility of the RI Field Hydrogeologist to secure all documents produced in the field (i.e., geologist's daily logs, lithologic and sampling logs, communications, etc.) at the end of each work day.

6.5 FIELD MEASUREMENT AND CALIBRATION PROCEDURES

Specific conductance, temperature, and pH of ground-water samples will be analyzed in the field at the time of sampling. Photoionization, radiation, monitoring, and geophysical survey equipment will also be used on-site periodically as described in Section 4.0 of the RI Work Plan. Field equipment such as the photoionization equipment (TIP or HNU), the pH and specific conductance meters, geiger counter, and any geophysical equipment used during this project will be calibrated and operated in accordance with the manufacturer's instructions and manuals (Table 9). A log book will be kept which documents the calibration results for each field instrument. The log book will include the date, standards, personnel, and results of the calibration.

6.6 DATA REDUCTION, VALIDATION AND REPORTING

The data generated by the laboratory will be sent to the RI Project Officer, validated by a RI chemist, and stored by the RI Project Manager until completion and acceptance of the RI report.

All data collected in the remedial investigation, including field and laboratory (chemical and geotechnical) results will be reduced, validated, summarized, and reported.

6.6.1 Data Reduction

The reduction of the field data will consist of summarizing the raw field data, including the well logs, and sample locations. Data will be presented in the form of tables, well logs, illustrations, and graphs, as deemed appropriate by the RI Project Manager.

The analytical data from the laboratory will be reduced to appropriate forms as determined by the RI Project Manager. The original data and reduced form will be maintained at the RI office until acceptance of final reports. The reduced data will be checked by a RI scientist against original data to determine if transcription or calculation errors have occurred.

6.6.2 Data Validation

Data validation consists of a stringent review of an analytical chemical data package with respect to sample receipt and handling, analytical methods, data reporting and deliverables, and document control. The quality of data generated by a laboratory is extremely important; it is an integral part of the investigation and should be clearly tied to the project goals. Data used to develop qualitative trends, for example, will not have the same data validation requirements as data used for litigation purposes.

The reviewer will prepare the USEPA Region II CLP Inorganic and Organic Data Review (USEPA, 1990a & 1990b) and Preliminary Data Review (SOP No. HW-6 and SOP No. HW-2) package. After the data are validated, a list of nonconformities will be generated and used to determine whether they meet the data quality objectives. Nonconformities require data qualifiers, which are used to alert the data user to inaccurate or imprecise data. The reviewer may make professional judgments and/or comments on the validity of the overall data package for a sampling event. This is particularly appropriate for sampling events in which there are several quality control criteria out of specification. In these cases, it may be required that the sample be re-analyzed.

The data package will include a data assessment checklist and narrative, a rejection summary form, and an organic and inorganic regional data assessment form. Upon completion, the data package and accompanying data review will be sent to the USEPA Regional Sample Control Center for their review.

The net result will be a data package which has been carefully reviewed for its adherence to prescribed requirements and its suitability for its intended use. Data validation thus plays a major role in determining the confidence with which key technical evaluations will be made.

6.6.3 Data Reporting

The analytical data, including quality control samples, will be reported in tabular form with identification of sample number, matrix, parameters, detection limits, and detected concentrations. Any compounds detected in blank samples will be noted in the table and footnoted on other samples.

6.7 INTERNAL QUALITY CONTROL CHECKS

There are two types of quality assurance mechanisms used to ensure the production of analytical data of known and documented quality: analytical method and program QA. The internal quality control procedures for the analytical services on environmental samples to be provided are specified in the USEPA CLP SOW and Appendix E. These specifications include the types of control samples required (sample spikes, surrogate spikes, reference samples, controls, blanks), the frequency of each control, the compounds to be used for sample spikes and surrogate spikes, and the quality control acceptance criteria. It will be the laboratory's responsibility to document, in each package, that both initial and on-going instrument and analytical QC criteria are met. This documentation will be included in the packages generated by the selected laboratory.

The field-collected quality control sample results will also be compared to acceptance criteria and documented. Any samples in non-conformance with the QC criteria will be identified and re-analyzed by the laboratory, if possible. The following procedures will be employed for the MRFA site samples:

- Proper storage of samples.
- Use of qualified and/or certified technicians.
- Use of calibrated equipment traceable to National Bureau of Standards or USEPA standards.
- Formal independent confirmation of all computation and reduction of laboratory data and results.
- Use of standardized test procedures.
- Inclusion of replicate samples at a frequency of one replicate per fifteen samples.

6.8 PERFORMANCE AND SYSTEM AUDITS

Performance audits of laboratories participating in the CLP are performed quarterly in accordance with the procedures and frequencies established by USEPA for the CLP.

The laboratory may be asked by USEPA to demonstrate its capability to perform analyses in compliance prior to conducting any project analyses. Analyses of performance evaluation (PE) samples may be waived at USEPA's discretion if within the past six months the laboratory has satisfactorily analyzed PE samples submitted by USEPA. In this event, documentation of such prior and recent PE sample analyses will be submitted to the USEPA.

System audits will be performed on a continuous basis, as appropriate, to assure that the work is being implemented in accordance with the approved project SOPs and in an overall satisfactory manner.

- The RI Field Hydrogeologist will supervise and check on a daily basis that field measurements are made accurately, equipment is thoroughly decontaminated, samples are collected and handled properly, and that the field work is accurately and neatly documented. QA checklists will be filled out daily during the drilling, installation, and development of new monitoring wells and during monitoring well sampling. The QA Daily Checklists for these activities are provided in Appendix B.
- The RI QA Officer will review on a timely basis the data packages submitted by the laboratory to check that the data were obtained through the approved methodology with the appropriate level of QC effort and reporting, that holding times were met, and that the results are in conformance with the QC criteria. Every attempt will be made to ensure that holding times, etc. will be adhered to through telephone communication with the appropriate laboratories. On the basis of these factors, the RI QA Officer will evaluate the data quality and limitations.
- The RI Project Manager will oversee the RI Field Hydrogeologist and RI QA Officer, and check that management of the acquired data proceeds in an organized and expeditious manner.
- System audits for the laboratory are performed on a regular basis by USEPA, as well as by appropriate state agencies.

6.9 PREVENTIVE MAINTENANCE

A program for the maintenance of field equipment has been established to ensure the availability of equipment in good working order when and where it is needed:

- The Equipment Manager keeps an inventory of the equipment in terms of item (model and serial number) quantity and condition. Each item of equipment is signed out when in use, and its operating condition and cleanliness checked upon return.

- The Equipment Manager conducts routine checks on the status of equipment, and is responsible for the stocking of spare parts and equipment readiness.
- The Equipment Manager maintains the equipment manual library and trains field personnel in the proper use and care of equipment.
- The RI Field Hydrogeologist works with the Equipment Manager to ensure that the equipment is tested, cleaned, charged, and calibrated in accordance with the manufacturer's instructions before being taken to the job site.

The laboratory follows a defined program to prevent the failure of laboratory equipment and instrumentation. This program, as described in the Laboratory QAPP (Appendix E), includes the periodic inspection, lubrication, cleaning, and replacement of parts of the equipment.

6.10 DATA ASSESSMENT PROCEDURES

All data generated during the RI will be assessed to determine whether it meets the data quality objectives. Data generated in the investigation will be assessed for its representativeness, accuracy, and precision. The completeness of the data will also be assessed by comparing the valid acquired data to the project objectives to see that these objectives are being addressed and met. The specific procedures used to determine data precision, accuracy, and completeness by the analytical laboratories will be provided in the analytical reports. Accuracy will be determined using laboratory spiked samples and laboratory field blanks.

The representativeness of the data will be assessed by determining if the data are consistent with known or anticipated hydrogeologic or chemical conditions and accepted principles. Field measurements will be checked for completeness of procedures and documentation of procedures and results.

Precision and accuracy will be determined using the QC samples. Precision will be examined using replicate samples and accuracy by using blanks and spiked samples.

6.11 CORRECTIVE ACTION

The QA program will enable problems to be identified, controlled, and corrected. Potential problems may involve non-conformance with the SOPs and/or analytical procedures established for the project or other unforeseen difficulties. Any person identifying an unacceptable condition will notify the RI Project Manager. The RI Project Manager, with the assistance of the RI Project Officer and RI Quality Assurance Officer, will be responsible for developing and initiating appropriate corrective action and verifying that the corrective action has been effective.

The laboratory maintains an internal closed-loop corrective action system which operates under the direction of the Laboratory Quality Assurance Officer. This system, which has been designed to identify and correct both immediate and long-term problems, is described in the Laboratory QAPP (Appendix E).

6.12 QUALITY ASSURANCE/QUALITY CONTROL EVALUATION

A QA/QC review and evaluation of laboratory data and sampling and analysis procedures will be completed for each sample within three weeks of completion of the laboratory analyses. The basis for the evaluation of the data will be the procedures provided in the QAPP and the FSAP. The RI Quality Assurance Officer will review the implementation of the QAPP and FSAP on a regular basis and prepare a summary report. This report will include assessment of data quality, and the results of system and/or performance audits. Any significant QA deficiencies will be reported and identified, and corrective actions will be discussed.

7.0 HEALTH AND SAFETY PLAN

7.1 INTRODUCTION

This Health and Safety Plan (HASP) has been developed for the remedial investigation to be conducted at the MRFA Superfund site, Towns of Malta and Stillwater, Saratoga County, New York. The plan provides procedures for use by RI personnel to minimize the potential for accidents from physical hazards and the potential for worker exposure to chemical contaminants in water, soil, and air.

The Scope of Work for the MRFA Site RI is fully described in Section 4.1 of the "Revised Remedial Investigation Work Plan for the Malta Rocket Fuel Area Site, Towns of Malta and Stillwater, Saratoga County, New York, February, 1991." Detailed descriptions of all procedures are contained in the FSAP (Section 5.0). Site activities will be performed in a safe and environmentally acceptable manner. We will ensure that our personnel comply with the specified health and safety requirements.

7.2 PURPOSE/OBJECTIVE

The protection of workers and environmental safety and health are major concerns during this project and cannot be understated. The objective of this HASP is to assure that safe working conditions exist at the site during the field activities. The safety organization and procedures have been established based on an analysis of potential hazards at the MRFA site. Safe work procedures and personal measures have been selected in response to these potential hazards.

This occupational HASP contains the requirements for protection of personnel and the general public during the Remedial Investigation of MRFA site. Site activities which involve walk-through instrumental surveys, drilling soil borings, monitoring well installation,

soil, sediment, ground-water and wipe sampling, trenching, construction of pipelines, well development, aquifer testing, or which otherwise have a potential for exposure to site-contaminated materials are subject to this HASP. This HASP was developed with input from occupational and industrial health and safety personnel, physicians, chemists, and health and safety personnel. In addition, the HASP adheres to the applicable guidelines, texts, and references.

This HASP has been developed based upon a review of the requirements described in the EPA Standard Operating Safety Guide, the U.S. Department of Labor OSHA Standards 29 CFR Part 1910 (especially, 29 CFR 1910.120 covering hazardous waste operations). All reasonable precautions will be taken to ensure the safety and health of workers and the general public. All site activities which might expose personnel to site contamination are subject to this HASP.

7.2.1 Assignment of Responsibilities

All personnel will be responsible for adherence to the safety procedures detailed in this HASP during the performance of the work. In no case may work be performed in a manner that conflicts with the intent of, or the inherent safety and environmental cautions expressed in, these procedures. After due warnings, personnel violating safety procedures will be dismissed from the site and potentially terminated. Field personnel will be properly trained in health and safety regulations associated with handling hazardous materials.

The requirements listed may change as work progresses due to changing conditions, but no changes will be made without prior approval by the RI Site Safety Coordinator.

Avoiding adverse health effects and injuries to the site workers is totally dependent on the contribution of all project participants.

7.2.2 RI Site Safety Coordinator

The RI Site Safety Coordinator will be responsible for providing technical coordination of the health and safety program. The health and safety program includes information on medical programs, training requirements, hazard assessment, personnel air monitoring, personnel protective equipment, respiratory protection, and field implementation. Liaison with officers or representatives of EPA on matters relating to health and safety will be handled by the RI Site Safety Coordinator or the RI Site Safety Officer. The RI Site Safety Coordinator also provides the RI Site Safety Officer with details concerning the complete, work specific, safety and health program.

7.2.3 RI Site Safety Officer/RI Project Hydrogeologist

The RI Site Safety Officer/RI Hydrogeologist will be assigned to monitor the daily activities to ensure that all health and safety procedures/policies are being followed. This includes communicating the specific requirements to all personnel, and consultation with the RI Site Safety Coordinator regarding appropriate changes in health and safety requirements.

7.2.4 RI Project Manager

The RI Project Manager is ultimately responsible for ensuring that all project participants abide by the requirements set forth in this plan. The RI Site Safety Coordinator will report directly to the RI Project Manager.

7.2.5 USEPA Project Manager

The USEPA Project Manager will be notified for his/her approval of any changes made to this HASP.

7.3 HAZARD EVALUATION

Constant attention shall be given to physical hazards which may be encountered during daily work activities, particularly those associated with heavy equipment and chemical hazards. The field activities previously described consist of walk-through instrumental surveys, ambient air, soil-gas, and geophysical surveys, drilling soil borings, monitoring well installation, soil, sampling various media, trenching, well development, and aquifer testing. An evaluation of the potential hazards associated with these activities has been completed utilizing site history and existing sludge, soil, wastewater, surface water, and ground-water sampling data. The following potential exposure pathways have been identified:

- Inhalation of contaminated particles and vapors.
- Ingestion of contamination sediments and surface soils (accidental/poor hygiene).
- Skin absorption and skin contact with contaminated sediments, surface soils, equipment, borehole drilling fluids, and pumped ground-water samples.

7.3.1 Volatile Organic Compounds (VOCs)

VOCs have been identified through a review of the past soil and ground-water sampling results. The primary compounds of concern are chloroform, carbon tetrachloride, and trichloroethylene. Based on the presence of these compounds, minimizing exposed skin and air monitoring will be performed for the protection of the workers. Air monitoring will be conducted prior to and during all tasks performed at this site. These tasks include soil gas and geophysical surveys, soil borings, well installation, sampling various media, aquifer test, etc. Air monitoring will be conducted at the operator's breathing zone to ensure that their exposure to airborne VOC concentrations are not excessive. An upgrade in the protection level will be based on the following action level.

An action level on the PID of 2 ppm needle deflection for a 5 minute sustained period has been established based on the current occupational airborne contaminant standards and guidelines for chloroform and carbon tetrachloride, two common VOCs in ground water at the site. They have the most stringent OSHA standards of the site-specific VOCs. Table 4 contains the current OSHA occupational airborne contaminant standards and guidelines for the pertinent compounds. Table 12 summarizes the current occupational airborne contaminant standards and guidelines for the most common VOCs at the site. Should these compounds be found at those or higher levels, drager tubes for chloroform and carbon tetrachloride will be drawn to confirm the presence of the compounds. Drager tubes for carbon tetrachloride, the VOC most common in ground water at the site, will also be drawn at the beginning of each task and every 2 hours. This will ensure that carbon tetrachloride levels are not in excess of the 2 ppm OSHA standard. Should the action level for chloroform and/or carbon tetrachloride be met or exceeded, the job will be temporarily discontinued, the workers will be moved to a safe area upwind, and a decision will be made by the RI Project Manager to allow the vapors to vent and fall below the action level for these two compounds before the work resumes or to upgrade the protection level.

7.3.2 Flammable/Explosive Gases and Vapors

Since there is a possibility for flammable/explosive gases and vapors to be present during all field investigations, particularly in the investigation of the aboveground and underground tanks that have been used to store VOCs, an explosimeter will also be available for monitoring purposes during each task. Should a meter reading meet or exceed 10 percent of the lower explosive limit (LEL), the standard action level, the work will be discontinued, and the workers will be moved to a safe area until the gases and vapors have vented. Work will resume when readings indicate that the levels are below the 10 percent LEL level.

7.3.3 Ionizing Radiation

In the investigation of the GE/Exxon Nuclear Building and the drywells, site history indicates that there may be a potential exposure to workers based on a possibility that residual uranium exists. In order to protect the workers during the investigation and sample gathering stage, readings will be taken using a geiger-mueller meter equipped with a probe that is capable of measuring alpha and beta particles. An action level or hot line of 375 millirem per hour (mR/hr) has been established. This action level is based on a 1-day, 8-hour shift exposure. This reading will be used as a point in which the investigation will cease temporarily, the workers will move back to an area where the meter readings are at background levels and the RI Project Manager shall be contacted and informed of this situation before proceeding. A secondary level has also been set, since it is anticipated that the investigation of the GE/Exxon Nuclear Building may take up to 10 days, meter readings should not exceed 37.5 mR/hr as an average during these 10 days. If this level is exceeded, full-face air purifying respirators equipped with radionculide cartridges will be used. These two levels have been established based on the current standard of 3 rem for a whole body exposure for any calendar quarter set by the National Council on Radiation Protection (NCRP).

7.3.4 Dioxins and Furans

In the investigation of the burning pit, it may be possible that dioxins and furans are present. In order to protect the workers, dust suppression techniques using a water spray will be used to ensure that airborne dust and ash will be kept to a minimum. If this measure is unsuccessful, workers will be required to wear full-faced air purifying respirators equipped with high efficiency particulate air (HEPA) filter cartridges, along with personal protective equipment to minimize exposed skin.

7.3.5 PCBs

In the investigation of the PTI investigation, measures will also be taken to protect the workers of potential exposure to PCBs. Site history indicates that transformers which may have contained PCBs were removed. In order to protect the workers, dust suppression techniques using a water spray will be used to minimize airborne dust particles. If this measure is unsuccessful, workers will be required to wear full-faced air purifying respirators equipped with HEPA filter cartridges, along with personal protective clothing to minimize exposed skin.

7.3.6 Trenching/Excavation

At the present time, it is not anticipated that workers will enter any of the test pits. Should it be necessary for workers to enter the test pits, health and safety procedures based on the Occupational Safety and Health Administration Regulation, "Excavation," 29 Code of Federal Regulations, Part 1910.26 will be provided.

7.3.7 Explosion Hazard

For the investigation at the magazine area, the work plan has not been finalized at this point and therefore health and safety considerations cannot be finalized. Once the work plan has been finalized, an addendum to this health and safety plan for the investigation of the magazine area will be included, if necessary.

7.4 AIR MONITORING

Air monitoring with direct reading instruments will be performed during all remedial investigation activities. The hazard evaluation section has stipulated the various pieces of equipment needed and they are as follows:

- The main survey instrument will be a photoionization detector (PID) equipped with an 11.7 electron volt (eV) ultraviolet lamp. Equipped with this lamp, the PID will be capable of monitoring the presence of chloroform and other VOCs. This instrument is designed to measure trace qualities of VOCs in air with a parts per million (ppm) sensitivity range.
- Drager colorimetric tubes will also be available at the site. Specific tubes for chloroform and carbon tetrachloride will be available. These tubes will afford the capability of isolating and confirming the presence of chloroform and carbon tetrachloride as specified by the action level.
- An explosimeter will also be available to measure the presence of flammable/explosive gases and vapors. This meter will be used in order to ensure that the flammable/explosive hazard is monitored.
- The Victoreen™ geiger counter or equivalent will also be available on the site. This meter will be equipped with a model 489-35 probe or equivalent which is capable of measuring down to alpha radiation.

7.5 PERSONAL PROTECTIVE EQUIPMENT

Based on the hazard evaluation, it is anticipated that we will begin a modified Level D protection for all tasks in order to minimize exposed skin and direct contact with site contaminants which can be absorbed directly through the skin. These contaminants include carbon tetrachloride, dioxins and furans, and PCBs. Several action levels have been established. For exposure to VOCs, an action level of 2 ppm above background in the worker's breathing zone has been established as the upgrade point based on the presence of chloroform and carbon tetrachloride, two common VOCs in ground water at the site. Should this action level be met or exceeded, and the project manager makes a decision to continue on with the work while the action level is exceeded, the level of protection will be

upgraded to Level C using full-face air purifying respirators equipped with organic vapor cartridges and a dust prefilter. These cartridges will be changed after each shift. HEPA cartridges will be used, if necessary, for dioxins, furans, and PCBs.

In the event that the explosimeter indicates that flammable/explosive vapors/gasses exceed the 10 percent LEL level, the work will be discontinued, the workers will be moved to a safe area, and the vapors and gasses will be permitted to vent to below the 10 percent LEL figure before work can resume.

In the event that the ionizing radiation levels exceed the 37.5 mr/hr level, the level of protection will be upgraded to Level C using full-face air purifying respirators equipped with radionuclide cartridges.

7.5.1 Levels of Protection

The following levels of protection will be utilized at the MRFA site:

7.5.1.1 Level D Protection

- Chemically resistant coveralls (all tasks).
- Hard hat.
- Eye protection (safety glasses, goggles, face shield).
- Steel toe and shank boots.
- Chemically resistant outer boots.
- Chemically resistant gloves.

- Hearing protection, NRR rating of 37 decibels (required during well installation).
- Splash suit (required during pumping tests).

7.5.1.2 Level C Protection

- Chemically resistant coveralls.
- Hard hat.
- Eye protection (safety glasses, goggles, face shield).
- Steel toe and shank boots.
- Chemically resistant outer boots.
- Full-face respirator.
- Organic vapor cartridges and dust prefilter for VOCs and contaminated particulates (change after each 8 hour shift).
- Radionuclide cartridges (to be used during the GE/Exxon Nuclear Building investigation and dry well investigation).
- Chemically resistant gloves.
- Duct taping gloves and boots.
- Splash suit (required during pumping tests).

- Hearing protection, noise reduction rating of 37 decibels (required during well installation).

7.6 HEALTH AND SAFETY PROCEDURES

7.6.1 Regulated Areas

The site shall be divided into three delineated zones (Figure 8), as follows:

- Exclusion Zone - This zone includes the actual areas of contamination. This zone has the highest inhalation exposure potential and/or presents a high probability of skin contact with cutaneous or percutaneous effecting chemicals.
- Decontamination Zone - This zone includes the areas immediately surrounding the Exclusion Zone. This zone has the next highest inhalation hazard, but does not have a high probability of skin contact with cutaneous or percutaneous effecting chemicals.
- Clean Zone (Support Zone) - This zone covers all area outside of the above zones. Adverse exposure to chemicals is unlikely.

7.6.2 Decontamination

The process of removing or neutralizing contaminants that have accumulated on personnel and equipment is critical to personnel. Decontamination protects workers from hazardous substances that may contaminate and eventually permeate the protective clothing, respiratory equipment, tools, vehicles, and other equipment used on site; it protects all site personnel by minimizing the transfer of harmful materials into clean areas; it helps prevent mixing of incompatible chemicals; and it protects the community by preventing uncontrolled transportation of contaminants from the site.

Prior to leaving the MRFA site at the end of the day, all protective clothing will be washed and rinsed to remove potentially-contaminated sediments from boots, gloves, and respirators. The clothing will be removed and properly stored or disposed of in trash bags or 55-gallon drums until removal from site. All decontamination water will be stored until it can be disposed of properly.

7.6.2.1 Personal Decontamination Procedures and Guidelines

Personal decontamination will be performed after completion of tasks whenever potential for contamination exists, and upon leaving the exclusion zone.

1. Boots will be washed in Micro™ solution and rinsed with water. If disposable latex booties are worn over boots in the work area, they will be rinsed with Micro™ solution, removed, and discarded into a Department of Transportation (DOT) approved 55-gallon drum.
2. Outer gloves will be washed in Micro™ solution, rinsed, removed, and discarded into a DOT approved 55-gallon drum.
3. Disposable coveralls ("Tyveks") will be removed and discarded into a DOT approved 55-gallon drum.
4. Inner gloves will be removed and discarded.
5. At the end of the work day, personnel will shower the entire body, including hair, either at the work site or at home.
6. Respirators (if worn) will be sanitized.

7.6.2.2 Health and Safety Monitoring Equipment Decontamination

1. Before use, the base of the instrument will be wrapped in plastic to eliminate contact with soil and to reduce the need for subsequent cleaning.
2. Equipment surfaces that had possible contact with contaminated materials will be wiped with a paper towel wet with Micro™ solution, followed by a towel with methanol solution, followed by three rinses with a towel wet with distilled water. All used paper towels will be disposed in a DOT approved 55-gallon drum.

7.6.3 Access

Access to contaminated work areas (exclusion and decontamination reduction zones) shall be regulated and limited to authorized persons. A daily roster containing the date, the person's name, the person's signature, the time of entry, and the time of exit shall be kept of all persons working in such areas. Any visitors to the area must present proper identification and be authorized to be on site. Visitors must comply with all aspects of the HASP and shall sign the site visitors log included in Appendix G.

7.6.4 Posting/Barricades

Warning signs shall be posted and hung, as applicable, in readily visible locations in or near contaminated work areas. Barricades and barricade tape shall be utilized to prevent access to various work areas.

7.6.5 General Work Practices

- At least one copy of this procedure will be available at each job work site.

- Contaminated protective equipment, such as respirators, hoses, boots, etc., will not be removed from the regulated areas until it has been cleaned, or properly packaged and labeled.
- No food or beverages will be present or consumed in the regulated areas. No tobacco products will be present or used and cosmetics shall not be applied in the regulated areas.
- Containers will be moved only with the proper equipment and will be secured during transport to prevent dropping or loss of control.
- During the operation, all employees will be required to wash their hands and face before eating, drinking, smoking, or applying cosmetics.
- Portable eyewash stations will be located in the regulated area near work activities.
- All personnel will be required to field wash, as a minimum, at the end of their shift before leaving the job site if they are contaminated. Hands and face will be washed during breaks.
- All personnel will avoid contact with potentially contaminated substances. Walking through puddles or mud, or kneeling on the ground, will be avoided whenever possible.
- Monitoring equipment will not be placed on potentially contaminated surfaces.
- Field personnel will observe each other for signs of toxic exposure. Indications of adverse effects include, but are not limited to:

- changes in complexion and skin discoloration,
- changes in coordination,
- changes in demeanor,
- excessive salivation and pupillary response, and
- changes in speech pattern.

Field personnel will be cautioned to inform each other of non-visual effects of toxic exposure such as:

- headaches,
- dizziness,
- nausea,
- blurred vision,
- cramps, and
- irritation of eyes, skin, or respirator tract.

7.6.6 Drilling Activities

Drilling activities shall comply with the following rules:

1. Before drilling, the existence and location of underground pipe, electrical equipment, etc., will be determined. This will be done, if possible, by contacting the appropriate utility company to mark the location of their lines. If the utility company cannot be utilized, an appropriate device, such as a pipe locator, shall be used to locate the service line.
2. Combustible gas readings of the general work area will be made.

3. No ignition sources will be permitted if the ambient airborne concentration of flammable vapors exceeds 10 percent of the lower explosive limit (LEL) when drilling. A combustible gas indicator will be available to make this determination.

7.6.7 Heavy Equipment Operation

The following information warrants extra attention regarding work around heavy equipment (drilling rigs, front end/backhoe loaders, etc.).

- Use common sense.
- Hard hats and safety glasses will be worn at all times on site. Other protective gear as specified in the HASP is applicable as well.
- Pay attention at all times.
- Maintain visual contact at all times.
- Establish hand signal communication when verbal communication is difficult. Specify one person per work group to give hand signals to equipment operators.
- Be aware of footing at all times.
- All heavy equipment will have backup alarms of some type.
- Only licensed, qualified people will operate heavy equipment.
- Use chains, hoists, straps, and other equipment to safely aid in moving heavy materials.

- Use proper personal lifting techniques. Use your legs, not your back.
- Never walk directly in back of, or to the side of, heavy equipment without the operators' knowledge.
- Never use a piece of equipment unless you are familiar with its operation. This applies to heavy as well as light equipment (for example, chain saws).
- Pipe sections and other materials to be utilized during this project are extremely heavy. Make sure all precautions have been taken prior to the moving. Let the equipment, not your body, do the moving.
- Be sure that no underground or overhead power lines, sewer lines, gas lines, or telephone lines, will present a hazard in the work area.
- Get help whenever you are in doubt about a material's weight. Use the buddy system.
- Ensure that air bottles are secured properly to heavy mobile equipment.

7.6.8 Heat Stress

Heat stress may be of concern depending upon the ambient temperature.

One or more of the following control measures can be used to help control heat stress:

- Provision of adequate liquids to replace lost body fluids. Employees must replace water and salt lost from sweating. Employees will be encouraged to drink more than the amount required to satisfy thirst. Thirst satisfaction is not an accurate indicator of adequate salt and fluid replacement.

- Replacement fluids can be a 0.1 percent salt water solution, commercial mixes such as Gatorade™ or Quick Kick™, or a combination of these and fresh water.
- Establishment of a work regimen that will provide adequate rest periods for cooling down. This may require additional shifts for workers or earlier/later work schedules.
- Cooling devices such as vortex tubes or cooling vests can be worn beneath protective garments.
- All breaks are to be taken in a shaded rest area.
- Employees will remove impermeable protective garments during rest periods.
- Employees will not be assigned other tasks during rest periods.
- All employees will be informed of importance of adequate rest, acclimatization and proper diet in the prevention of heat stress.

7.6.9 Cold Stress

If the project extends into the winter, cold stress could be an occupational stress which needs to be addressed.

- Persons working outdoors in temperatures at or below freezing may be frostbitten. Extreme cold for a short time may cause severe injury to the surface of the body, or result in profound generalized cooling, causing death. Areas of the body which have high surface-area-to-volume ratio such as fingers, toes, and ears, are the most susceptible.

- Two factors influence the development of a cold injury: ambient temperature and the velocity of the wind. Wind chill is used to describe the chilling effect of moving air in combination with low temperature. For instance, 10°F with a wind of 15 miles per hour (mph) is equivalent in chilling effect to still air at -18°F.
- As a general rule, the greatest incremental increase in wind chill occurs when a wind of 5 mph increases to 10 mph. Also, water conducts heat 240 times faster than air. Thus, the body cools suddenly when chemical-protective equipment is removed if the clothing underneath is perspiration soaked.
- Local injury resulting from cold is included in the generic term frostbite. There are several degrees of damage. Frostbite of the extremities can be categorized into:
 - Frostbite nip or initial frostbite: characterized by suddenly blanching or whitening of skin.
 - Superficial frostbite: skin has a waxy or white appearance and is firm to the touch, but tissue beneath is resilient.
 - Deep frostbite: tissues are cold, pale, and solid; extremely serious injury.
 - Systemic hypothermia is caused by exposure to freezing and rapidly dropping temperature. Its symptoms are visually exhibited in five stages: (1) shivering, (2) apathy, listlessness, sleepiness, and sometimes rapid cooling of the body to less than 95°F, (3) unconsciousness, glassy state, slow pulse, and slow respiratory rate, (4) freezing of the extremities, and finally (5) death.
- Thermal socks, long cotton or thermal underwear, hard hat liners and other cold weather gear can aid in the prevention of hypothermia.

- Blankets, warm drinks (other than caffeinated coffee) and warm break areas are essential.
- The overall goal is to keep from getting wet. When wet, the employee should dry off and change clothes.
- Cold stress training is also appropriate for work at the site.

7.7 TRAINING

All employees attend a 40-hour health and safety training course for conducting work at hazardous waste sites. This course satisfies the initial training requirements of 29 CFR 1910.120 (OSHA regulation of hazardous waste site activities). Site personnel also receive annual 8 hour refresher training and 8 hour project manager training when applicable.

7.7.1 Contractors

Prior to initiating site work, all site personnel and subcontractors will be required to attend Tailgate Safety Meetings given by the RI Site Safety Officer. This session will include, but is not limited to, the following topics:

- Site history
- Specific hazards
- Hazard recognition
- Standard operation procedures
- Decontamination (personnel and equipment)
- Emergency procedures
- Respirator fit test and use

These meetings will be recorded on the "Tailgate Safety Meeting" forms included in Appendix G.

7.8 HEALTH MONITORING

Geraghty & Miller has established a Health Monitoring Program with occupational health specialists at the Plainview Medical Group, Plainview, New York. Geraghty & Miller personnel receive yearly physicals consisting of the following:

- Personal, family and environmental history.
- Hands-on physical examination.
- Snellen's eye examination.
- Hearing test.
- Respirator clearance.
- EKG and pulmonary function for those involved in Levels C and B work.
- Pap Smear (females over age 21).
- Hemoccult testing (over age 40).
- Laboratory Testing.

A. Complete Blood Count

- Red Blood Count.
- White Blood Count.
- Differential Screening.
- Hemoglobin.
- Hematocrit.

B. Urine Analysis

- Sugar.
- Albumin.
- Specific Gravity.
- Microscopic.

C. Laboratory Chemistries

- A.G. Ration.
- Albumin.
- Alkaline Phosphatase.
- Bilirubin, Total.
- Calcium.
- Chloride.
- Cholesterol.
- Creatinine.
- GGT.
- Globulin.
- Glucose.
- Iron.
- Lactic Dehydrogenase (LDH).
- Phosphorous.
- Potassium.
- Protein, Total.
- SGOT.
- SGPT.
- Sodium.
- Triglycerides.
- Urea Nitrogen (BUN).
- Uric Acid.

D. Special Testing

- PCBs in serum.
- Serum and Plasma Cholinesterase.
- Heavy Metals Screen (Blood) for field personnel.

7.9 EMERGENCY PROCEDURES

The RI Site Safety Coordinator shall be notified of any on-site emergencies and be responsible for ensuring that the appropriate procedures are followed. Table 10 is a summary of the general emergency response plan. In addition, the following standard emergency procedures will be used by on-site personnel.

7.9.1 Personal Injury in the Exclusion Zone

In the event of an injury in the exclusion zone, all site personnel shall exit at the exclusion zone and assemble at the decontamination line. The on-site hydrogeologist should evaluate the nature of the injury and the affected person should be decontaminated to the extent practical prior to movement to the support zone. Appropriate first aid should be initiated, and an immediate request should be made for an ambulance (if necessary) and the designated medical facility will be notified (if required). No persons shall reenter the exclusion zone until the cause of injury or symptoms is determined.

7.9.2 Personal Injury in the Support Zone

In the event an injury occurs in the support zone, the on-site hydrogeologist and/or safety manager must be notified immediately. Appropriate first aid will be administered and, if necessary, the injured individual will be sent to the designated medical facility. If the injury does not affect the performance of site personnel, operations may continue.

Any injury/illness to an employee will be recorded on the OSHA 101 form included in Appendix G. The SSO will be responsible for completing this form and forwarding it to the Office Health and Safety Manager within 6 working days. In the event of one or more fatalities or five or more hospitalized injuries/illnesses as a result of a single event, the office Health and Safety Manager will be notified immediately and this event

will be reported to OSHA within 48 hours. Subcontractors will be recommended to follow these same procedures for their employees.

7.9.3 Fire/Explosion

In the event a fire or explosion occurs at the site, the fire department shall be alerted and all personnel moved to a safe distance from the area.

7.9.4 Personal Protective Equipment Failure

If any site worker experiences a failure or alteration of protective equipment that affects the protection factor, that person and his/her buddy shall immediately leave the exclusion zone. Reentry shall not be permitted until the equipment has been repaired or replaced.

7.10 EMERGENCY PHONE NUMBERS

Emergency phone numbers and directions to the nearest medical facility are provided below. This information will be posted at conspicuous places in the support zone.

- Police (518) 885-6761
- Fire (518) 885-1701
- Ambulance (518) 885-6761
- Hospital (518) 584-6000

7.10.1 Directions to Hospital

Leaving the west access road from the site, proceed west along Dunning Street, pass under the Northway and continue onto Route 67. When you come to a "Y" intersection, bear to the right; this is Ballston Avenue. When you come to Church Avenue, make a

right turn and continue on until you reach the West High Street intersection. Make a left turn and the hospital is at 221 West High Street.

Saratoga Hospital
221 West High Street
Ballston Spa, New York 12020
Telephone No. (518) 584-6000

7.11 SAFETY EQUIPMENT

Safety equipment to be kept on site:

1. First aid kit.
2. Eye wash station.
3. Type A, B, and C fire extinguishers.
4. Potable water.
5. Gatorade (for summertime).
6. Hot drinks (for wintertime).
7. Ice chest.
8. Paper cups.

8.0 SITE MANAGEMENT PLAN

8.1 SITE ACCESS

Access to the site is via Route 67, Plains Road (Figure 1). Site entry procedures and site control are described further in the HASP.

8.2 SITE SECURITY

The Wright-Malta, MTI and PTI facilities are located within a fenced area of approximately 2,500 ft by 2,500 ft (the Test Station). The facilities employ an electrical security and surveillance system which includes electronic gates. All visitors are required to sign a guest book upon presenting proper identification.

A survey of site security will be made during the period that the literature search is being conducted. In addition to assessing the condition of fencing and surveillance systems, the need for additional security outside the main test station, specifically, the NYSDOT disposal area and the GE-Exxon Nuclear Building Area, will be evaluated. If it is determined that either of these areas is a threat to human health and/or the environment, the owners will be requested to install a chain-link fence. The results of the security survey shall be presented to EPA and, if EPA determines that additional security is needed, the PRPs will submit a proposal addressing security concerns.

Security of all on-site and off-site wells will be ensured by locked well caps which will be provided during well installation. One key will unlock all of the well caps.

Any partially completed boreholes will be secured overnight by the drill crew. The drill shaft will be left in the hole to obstruct it, or a steel plate will be placed over the hole and secured by the weight of the drill head and shaft. The drilling area will be

clearly staked and marked by caution tape. Traffic cones will be deployed where necessary. All excavated soil exhibiting positive readings on a portable soil organic vapor analyzer will be placed on plastic and covered with polyethylene overnight to prevent leaching or wind dispersion. All contaminated drill cuttings will be placed in DOT-certified drums. The drums will be properly labeled and secured. All portable sampling and drilling equipment will be stored in a locked on-site trailer. Any additional case-specific security issues will be implemented after consulting with the project manager.

8.3 FIELD OFFICE

Field operations will be based in an office trailer, which will be placed in a location central to current RI activities. The trailer will be moved as necessary.

8.4 SITE OPERATIONS

The roles and responsibilities of MRFA RI personnel are described in Section 2.0. Curriculum vitae of RI personnel are provided in Appendix A.

8.5 FIELD OPERATIONS SCHEDULE

Field investigation activities are expected to last approximately 12 months. A detailed schedule is provided in Figure 6.

8.6 CONTINGENCY PLAN

Problems may occur during remedial planning projects. Table 13 contains contingency plans for several potential problems that may arise at the MRFA site. Implementation of these contingency plans will require work plan amendments in most cases. The Health and Safety Plan (Section 7.0) also requires specific contingency

procedures in the event of fire, explosion, ionizing radiation hazard, and chemical concentrations which may exceed action levels.

8.6.1 Alternative Geophysical Methods

As discussed in Section 5.6, the primary geophysical method to be used is electromagnetics. However, this method has certain shortcomings. In areas containing clay or highly conductive local geology, the magnetic method or ground penetrating radar may be used to produce clearer results.

8.6.1.1 Magnetic Methods

Magnetic methods measure the strength of the magnetic field about 6 ft above the ground surface. Buried metal objects influence this field and create anomalies in the otherwise fairly constant field. However, the methods detect only ferromagnetic materials and aluminum, stainless steel and plastic are not observed. The anomalies may be interpreted to give approximate depths to the body causing the anomaly and to estimate the amount of iron present.

The G-856 Memory-Mag™ proton precession magnetometer, manufactured by EG&G Geometrics of Sunnyvale, California or an equivalent, will be used for any magnetic surveys. In order to detect small numbers of drums, readings will be taken along lines spaced at approximately 10 ft. The vertical gradient of the magnetic field will be measured and interpreted. Since the magnetic method is not significantly influenced by local geology, it may be used as an alternative to the electromagnetic method in zones of high interference.

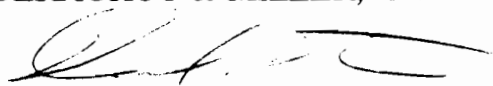
8.6.1.2 Ground Penetrating Radar

Ground Penetrating Radar (GPR) also uses electromagnetic waves but measures the time they take to reflect from geologic boundaries rather than the inductive effects recorded by the conductivity method. Since electromagnetic waves are severely attenuated by clay, a clay free soil is needed. Penetration can be up to 100 ft in ideal conditions.

The GPR instrument will be towed along the ground with the antenna placed as close to the ground as possible. A flat surface will be desirable. Because of its focused signal, which reflects off of many features, the GPR survey results may not necessarily indicate conductive or magnetic bodies. Only if the approximate location of the reinforced plastic drums were known, then GPR will be an appropriate tool. Thus, it will be the last method of choice.

Respectfully submitted,

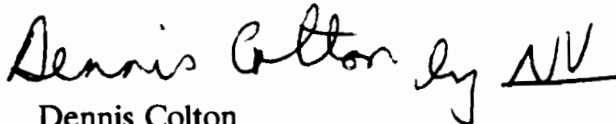
GERAGHTY & MILLER, INC.



David V. Stockar
Staff Scientist



Laine Vignona
Principal Scientist/Project Manager



Dennis Colton
Project Officer/Facility Coordinator

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Table 1. Summary of Data Quality Objectives and Data Gathering Requirements During Remedial Investigation, Malta Rocket Fuel Area Site, Towns of Malta and Stillwater, Saratoga County, New York.

<u>1. Remedial Action Objective</u>			
Control human exposure to contaminants in air			
<u>Objective of Program</u>			
- o Characterize air quality - o Identify areas of concern - o Evaluate areas of concern	Media Air <u>Contaminants of Concern</u> VOCs Particulates		
<u>Type of Investigation</u>			
- o Ambient air quality - o Background air quality			<u>Prioritized Data Uses</u> - o Site screening - o Health & Safety - o Risk Assessment
<u>Data Gathering Program</u>			
- o Analyzes meteorological conditions - o Conduct upwind and site survey using - o Evaluate area of concern using portable GC - o Monitor during drilling period - o Conduct upwind and downwind air monitoring program	<u>Appropriate Analytical Level</u> N/A 1 2 1 2	<u>Analyses Planned</u> N/A * Refer to Section 4.10.1 Refer to Section 4.10.1 Refer to section 4.10.1 Refer to Section 4.10.2	

*Refers to the Revised RI Work Plan, February 1991.

Table 1. Summary of Data Quality Objectives and Data Gathering Requirements During Remedial Investigation, Malta Rocket Fuel Area Site, Towns of Malta and Stillwater, Saratoga County, New York.

<u>2. Remedial Action Objective</u>				
Control human exposure to contaminated surfaces				
<u>Objective of Program</u>				
o Verify site security	Media	Surface soils/structures	<u>Contaminants of Concern</u>	
o Locate potential source areas				
o Characterize extent of surface contamination				
o Evaluate direct contact exposures				
o Evaluate remedial alternatives				
<u>Type of Investigation</u>				
o Surface Soil Samples	Prioritized Data Uses	o Site Screening		
o Field Reconnaissance		o Health & Safety		
o Wipe Samples		o Risk Assessment		
		o Remedial Alternatives		
<u>Data Gathering Program</u>				
o Conduct security survey of site	Appropriate Analytical Level	Analyses Planned		
o Conduct scintillometer survey			N/A	* Refer to Section 4.33
o Analyze areas of concern with spectroscopy			1	Refer to Section 4.26
o Collect wire samples from areas of radiation concern			2	Refer to Section 4.26
o Conduct sitewide surface soils survey			5	Refer to Section 4.26
o Collect wop sample from area of PCB concern			N/A	Refer to Section 4.51
o Collect surface soil samples from areas of concern			5	Refer to Section 4.27
			4	Refer to Section 4.28, 4.29

*Refers to the Revised RI Work Plan, February 1991.

Table 1. Summary of Data Quality Objectives and Data Gathering Requirements During Remedial Investigation, Malta Rocket Fuel Area Site, Towns of Malta and Stillwater, Saratoga County, New York.

<u>3. Remedial Action Objective</u>		<u>Media</u>
Control human exposure to contaminants in surface water and sediments		Surface water/sediments
<u>Objective of Program</u>		<u>Contaminants of Concern</u>
- o Assess background conditions - o Identify potential contaminants - o Characterize contaminants - o Evaluate potential contamination migration - o Evaluate remedial alternatives		Specific contaminants cannot be identified at this time. Radioactivity
<u>Type of Investigation</u>		<u>Prioritized Data Uses</u>
- o Literature Search - o Field Reconnaissance - o Soil-Gas survey - o Surface water/Sediment samples		- o Site Screening - o Health & Safety - o Site Characterization - o Risk Assessment - o Remedial Alternatives
<u>Data Gathering Program</u>		<u>Analyses Planned</u>
- o Conduct literature search - o Conduct field reconnaissance after rainfall - o Identify data gaps - o Conduct soil-gas survey of existing pond, lagoon, and drainage ditch - o Collect surface water samples - o Collect sediment samples		* Refer to Section 4.9 Refer to Section 4.9 Refer to Section 4.9 Refer to Section 4.23, 4.24 Refer to Section 4.15, 4.23, 4.24 Refer to Section 4.15, 4.23, 4.24
		<u>Appropriate Analytical Level</u>
		N/A
		N/A
		N/A
		2
		4
		4

*Refers to the Revised RI Work Plan, February 1991.

Table 1. Summary of Data Quality Objectives and Data Gathering Requirements During Remedial Investigation, Malta Rocket Fuel Area Site, Towns of Malta and Stillwater, Saratoga County, New York.

<u>4. Remedial Action Objective</u>		<u>Media</u>
Subsurface soil/groundwater contamination with VOCs		Soil-gas
<u>Objective of Program</u>		<u>Contaminants of Concern</u>
- o Soil-gas sampling to evaluate - Source areas - Shallow soils contamination by VOCs - Possibly groundwater contamination by VOCs		- o VOCs - o Other specific contaminants cannot be identified at this time
	<u>Type of Investigation</u>	<u>Prioritized Data Uses</u>
	Soil-gas survey	- o Evaluate potential source areas - o Refine soil boring locations
<u>Data Gathering Program</u>	<u>Appropriate Analytical Level</u>	<u>Analyses Planned</u>
Conduct soil-gas survey at selected locations using portable GC	2	* Refer to Section 4.4, 4.11, 4.12, 4.13, 4.14, 4.15, 4.16, 4.17, 4.18, 4.19, 4.22, 4.25, 4.28, 4.29, 4.31

*Refers to the Revised RI Work Plan, February 1991.

Table 1. Summary of Data Quality Objectives and Data Gathering Requirements During Remedial Investigation, Malta Rocket Fuel Area Site, Towns of Malta and Stillwater, Saratoga County, New York.

<u>5. Remedial Action Objective</u>		<u>Media</u>
Control potential for migration of contaminants from subsurface source materials		Subsurface source materials and soils
<u>Objective of Program</u>		<u>Contaminants of Concern</u>
o Evaluate buried source materials/soils		Specific contaminants cannot be determined at this time
<u>Type of Investigation</u>		<u>Prioritized Data Uses</u>
o Geophysical Survey		o Site Screening
o Test pits of selected areas of concern		o Site Characterization
o Soil sample collection		o Remedial Alternatives
<u>Data Gathering Program</u>		<u>Analyses Planned</u>
Conduct electromagnetic induction method geophysical survey		* Refer to Sections 4.11, 4.12, 4.14, 4.16, 4.17, 4.19, 4.22
Excavate test pits at selected areas of concern		Refer to Sections 4.17, 4.22
Collect soil samples of test pits		Refer to Sections 4.17, 4.22
Collect samples from septic tanks		Refer to Section 4.20

*Refers to the Revised RI Work Plan, February 1991.

Table 1. Summary of Data Quality Objectives and Data Gathering Requirements During Remedial Investigation, Malta Rocket Fuel Area Site, Towns of Malta and Stillwater, Saratoga County, New York.

<u>6. Remedial Action Objective</u>		
Control the potential for migration of contaminants from soil to ground water		
<u>Objectives of Program</u>		
- o Assess background conditions - o Evaluate source areas - o Evaluate subsurface geology - o Identify contaminants - o Characterize nature and extent of soils contamination	Media Soil, unconsolidated deposits	Contaminants of Concern VOCs Other specific contaminants cannot be identified at this time
<u>Type of Investigation</u>		
Soil borings Test Pits Formation/sludge sampling Geophysical logging Field screening Shelby tube sampling Geotechnical analysis		<u>Prioritized Data Uses</u> - o Site Characterization - o Risk Assessment - o Site-specific parameters
<u>Data Gathering Program</u>		
Conduct literature search	N/A	<u>Analyses Planned</u> * Refer to Section 4.2 Refer to Section 4.5.2 Refer to Section 4.7.1 Refer to Section 4.7.1
Conduct background soils survey	4	
Collect split-spoon soils samples during well drilling program	5	
Collect shelly tube samples of 1 lacustrine blue clay during well drilling	5	

*Refers to the Revised R1 Work Plan, February 1991.

Table 1. Summary of Data Quality Objectives and Data Gathering Requirements During Remedial Investigation, Malta Rocket Fuel Area Site, Towns of Malta and Stillwater, Saratoga County, New York.

<u>Data Gathering Program</u>	<u>Appropriate Analytical Level</u>	<u>Analyses Planned</u>
Conduct natural gamma geophysical logs of selected locations	2	Refer to Section 4.7.1
Conduct soil boring program at selected locations	4 or 5 depending on location	* Refer to Section 4.11, 4.12, 4.13, 4.14, 4.15, 4.18, 4.19, 4.20, 4.23, 4.24, 4.25, 4.26, 4.27, 4.28, 4.29
Conduct geotechnical analyses on soils	2 or 5	Refer to Section 3.5.3
Excavate test pits or test trenches at selected locations	4	Refer to Section 4.15, 4.16, 4.17, 4.22
Collect sludge/sediment samples from selected locations	4 or 5 depending on location	
7. Remedial Action Objective		
Control human exposures to contaminants in ground water		
<u>Objective of Program</u>	<u>Media</u>	<u>Contaminants of Concern</u>
- o Evaluate subsurface geology/hydrogeology - o Identify constituents of concern - o Evaluate groundwater contamination - o Assess exposures to contaminated groundwater - o Evaluate Remedial alternatives for groundwater	Groundwater	VOCs Other specific contaminants cannot be identified at this time
<u>Type of Investigation</u>	<u>Prioritized Data Uses</u>	
- o Sampling of existing wells - o Installation and sampling of monitoring wells - o Water level measurements - o Aquifer testing	- o Site Characterization - o Risk Assessment - o Remedial Alternatives	

*Refers to the Revised RI Work Plan, February 1991.

Table 1. Summary of Data Quality Objectives and Data Gathering Requirements During Remedial Investigation, Malta Rocket Fuel Area Site, Towns of Malta and Stillwater, Saratoga County, New York.

<u>Data Gathering Program</u>	<u>Appropriate Analytical Level</u>	<u>Analyses Planned</u>
Install 21 new monitoring wells	N/A	* Refer to Section 4.7
Collect synoptic rounds of water level measurements	1	Refer to Section 4.7
Collect water samples from new monitoring wells	4	Refer to Section 4.7.1
Collect water samples from existing wells	4	Refer to Section 4.7.2
Collect 2nd round of water samples from all wells	4	Refer to Section 4.7.2
Evaluate available data to determine aquifer test location	N/A	Refer to Section 4.8
Conduct aquifer testing program	varies; 1, 2, and 4	Refer to Section 4.8

*Refers to the Revised RI Work Plan, February 1991.

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Table 2. Summary of Analytical Levels Appropriate to Various Data Uses, Malta Rocket Fuel Area Superfund Site, Towns of Malta and Stillwater, Saratoga County, New York.

<u>Data Uses</u>	<u>Analytical Level</u>	<u>Type of Analysis</u>
- o Assist in identifying sample locations - o Site characterization - o Monitoring during implementation - o Health and safety	Level 1 - (Screening)	- o Total organic/inorganic vapor detection using portable instruments - o Field test kits - pH, conductivity, temperature
- o Relative concentrations - o Site characterization - o Evaluation of alternatives - o Engineering design - o Monitoring during implementation	Level 2 - (Field Analysis)	- o Variety of organics by GC; inorganics by AA; XRF - o Tentative ID: analyte specific - o Detection limits vary from low ppm to low ppb - o Portable/mobile instrumentation
- o Confirmational, but with less documentation - o Risk assessment - o PRP determination - o Site characterization - o Evaluation of alternatives - o Engineering design - o Monitoring during implementation	Level 3 - (Engineering)	- o Organics/inorganics using EPA procedures other than CLP - o Can be analyte-specific - o RCRA characteristic tests
- o Rigorous - o Risk assessment - o PRP determination - o Evaluation of alternatives - o Engineering design	Level 4 - (Confirmational)	- o TCL organics/inorganics by GC/MS; AA; ICP - o Low ppb detection limit
- o Site-specific conditions/parameters - o Risk assessment - o PRP determination	Level 5 - (Nonstandard)	- o Nonconventional parameters - o Method-specific detection limits - o Modification of existing methods - o Appendix 8 parameters - o TICs

Table 3. Ground- Water Quantitation Limits and ARARs for the Malta Rocket Fuel Area Superfund Site, Towns of Malta and Stillwater, Saratoga County, New York.

Parameters	RAS Quantitation Limits (ppm)	USEPA MCL (ppm)	Revised 10NYCRR Subpt 5-1 (ppm)	10NYCRR Part 170 (ppm)	6NYCRR Part 703 (ppm)	TOGS Values (ppm)	NYS Ambient Water Quality Standards 6NYCRR		40 CFR 264 (ppm)
							Part 701 (ppm)	Part 701 (*)	
Inorganics:									
Aluminum	--	--	--	--	--	--	--	0.1	--
Antimony	--	--	--	--	--	0.003	--	--	--
Arsenic	--	0.05	--	0.05	0.025	--	0.05	--	0.05
Barium	--	1.0	--	1.0	1.0	--	1.0	--	1.0
Beryllium	--	--	--	--	--	0.003	0.011 (j)	--	--
Cadmium	--	0.01	--	0.01	0.01	--	0.01	--	0.01
Calcium	--	--	--	--	--	--	--	--	--
Chromium	--	0.05	--	--	--	--	0.05	--	0.05
Chromium (VI)	--	--	--	0.05	0.05	--	0.011	--	--
Cobalt	--	--	--	--	--	--	0.005	--	--
Copper	--	--	--	<0.2	1.0	--	0.2	--	--
Iron	--	--	--	0.05	0.3 (c)	--	0.3	--	--
Lead	--	0.05	--	0.05	0.025	--	0.05	--	0.05
Magnesium	--	--	--	--	--	35	35	--	--
Manganese	--	--	--	0.3 (c)	0.3	--	0.3	--	--
Mercury	--	0.002	--	0.005	0.002	--	0.002	--	0.002
Nickel	--	--	--	--	--	--	(*)	--	--
Potassium	--	--	--	--	--	--	--	--	--
Selenium	--	0.01	--	0.01	0.02	--	0.01	--	0.01
Silver	--	0.05	--	0.05	0.05	--	0.05	--	0.05
Sodium	--	--	--	<20	--	--	--	--	--
Thallium	--	--	--	--	--	0.004	0.008	--	--
Vanadium	--	--	--	--	--	--	0.014	--	--
Zinc	--	--	--	<0.3	5	--	0.3	--	--
Cyanide	--	--	--	<0.1	0.2	--	0.1	--	--
Boron	--	--	--	1.0	--	--	10.0	--	--

All ARARs are in Milligrams per Liter unless indicated (mg/L).

- ARARs Applicable or Relevant and Appropriate Requirements.
- MCL Maximum Contaminant Levels.
- TOGS New York State Department of Environmental Conservation Technical and Operational Guidance Series.
- PCBs Polychlorinated biphenyls.
- SPDES State Pollutant Discharge Elimination System.
- ND Not detected.
- No standard available.
- (*) Exp (0.76[in (ppm hardness)] + 1.06)
- (a) Currently there are no Federal or New York State standards for soil or sediment samples.
- (b) Effluent standards provided are those specified in the current Gruman SPDES Permit (effective date July 1, 1989).
- (c) Combined concentration of Iron and Manganese shall not exceed 0.5 mg/L.
- (d) Total Trihalomethanes shall not exceed 0.1 mg/L.
- (e) Total Phenolic Compounds.
- (f) Applies to total of Para (i.e., 1,4-) and Ortho (i.e., 1,2-) isomers only.
- (g) MCL for Styrene will be set after public comment period.
- (h) Flow limit is not applicable to stormwater runoff conditions.
- (i) Sum of concentrations of parameters given above.
- (j) 1.1 ppm when hardness is greater than 75 ppm.

Standard in bold is less than Routine Analytical Services (RAS) Quantitation Limit.

Table 3. Ground- Water Quantitation Limits and ARARs for the Malta Rocket Fuel Area Superfund Site, Towns of Malta and Stillwater, Saratoga County, New York.

Parameters	RAS Quantitation Limits (ppm)	USEPA MCL (ppm)	Revised 10NYCRR Subpt 5-1 (ppm)	10NYCRR Part 170 (ppm)	6NYCRR Part 703 (ppm)	TOGS Values (ppm)	NYS Ambient Water Quality Standards 6NYCRR Part 701 (ppm)	40 CFR 264 (ppm)
Volatile Organics:								
Chloromethane	0.01	--	0.005	--	--	--	0.05	--
Bromomethane	0.01	--	0.005	--	--	--	0.05	--
Vinyl chloride	0.01	0.002	0.002	--	0.005	--	0.05	--
Chloroethane	0.01	--	0.005	--	--	--	0.05	--
Methylene chloride	0.005	--	0.005	--	--	0.05	0.05	--
Acetone	0.01	--	0.05	--	--	--	0.05	--
Carbon disulfide	0.005	--	0.05	--	--	--	0.05	--
1,1-Dichloroethene	0.005	0.007	0.005	--	--	--	0.05	--
1,1-Dichloroethane	0.005	--	0.005	--	--	0.00007	0.05	--
1,2-Dichloroethene	0.005	--	0.005	--	--	0.05	0.05	--
Chloroform	0.005	0.1 (d)	0.1 (d)	--	--	--	0.05	--
1,2-Dichloroethane	0.005	0.005	0.005	--	0.1	0.0008	0.0002	--
2-Butanone	0.01	--	0.05	--	--	--	0.0008	--
1,1,1-Trichloroethane	0.005	0.2	0.005	--	--	0.05	0.05	--
Carbon tetrachloride	0.005	0.005	0.005	--	0.005	--	0.05	--
Bromodichloromethane	0.005	0.1 (d)	0.1 (d)	--	--	0.05	0.05	--
1,1,2,2-Tetrachloroethane	0.005	--	0.005	--	--	0.0002	0.05	--
1,2-Dichloropropane	0.005	--	0.005	--	--	0.05	0.05	--
trans-1,2-Dichloropropene	0.005	--	0.005	--	--	--	0.05	--
Trichloroethene	0.005	0.005	0.005	--	0.010	--	0.05	--
Dibromochloromethane	0.005	0.1 (d)	0.1 (d)	--	--	0.05	0.05	--

All ARARs are in Milligrams per Liter unless indicated (mg/L).

ARARs	Applicable or Relevant and Appropriate Requirements.	(b)	Effluent standards provided are those specified in the current Grumman SPDES Permit (effective date July 1, 1989).
MCL	Maximum Contaminant Levels.	(c)	Combined concentration of Iron and Manganese shall not exceed 0.5 mg/L.
TOGS	New York State Department of Environmental Conservation Technical and Operational Guidance Series.	(d)	Total Trihalomethanes shall not exceed 0.1 mg/L.
PCBs	Polychlorinated biphenyls.	(e)	Total Phenolic Compounds.
SPDES	State Pollutant Discharge Elimination System.	(f)	Applies to total of Para (i.e., 1,4-) and Ortho (i.e., 1,2-) isomers only.
ND	Not detected.	(g)	MCL for Styrene will be set after public comment period.
--	No standard available.	(h)	Flow limit is not applicable to stormwater runoff conditions.
(a)	Currently there are no Federal or New York State standards for soil or sediment samples.	(i)	Sum of concentrations of parameters given above.

Standard in bold is less than Routine Analytical Services (RAS) Quantitation Limit

Table 3. Ground- Water Quantitation Limits and ARARs for the Malta Rocket Fuel Area Superfund Site, Towns of Malta and Stillwater, Saratoga County, New York.

Parameters	RAS Quantitation Limits (ppm)	USEPA MCL (ppm)	Revised 10NYCRR Subpt 5-1 (ppm)	10NYCRR Part 170 (ppm)	6NYCRR Part 703 (ppm)	TOGS Values (ppm)	NYS Ambient Water Quality Standards	
							Part 701 (ppm)	40 CFR 264 (ppm)
Volatile Organics: (cont'd)								
1,1,1,2-Trichloroethane	0.005	--	0.005	--	--	0.0006	0.0006	--
Benzene	0.005	0.005	0.005	--	ND	--	0.05	--
cis-1,3-Dichloropropene	0.005	--	0.005	--	--	--	0.05	--
Bromoform	0.005	0.1 (d)	0.1 (d)	--	--	0.05	0.05	--
2-Hexanone	0.01	--	0.05	--	--	0.05	0.05	--
4-Methyl-2-pentanone	0.01	--	0.05	--	--	--	0.05	--
Tetrachloroethene	0.005	--	0.005	--	--	0.0007	0.05	--
Toluene	0.005	--	0.005	--	--	0.05	0.05	--
Chlorobenzene	0.005	--	0.005	--	--	0.02	0.02	--
Ethylbenzene	0.01	--	0.005	--	--	0.05	0.05	--
Styrene (g)	0.01	--	0.005	--	0.931	--	0.05	--
Total Xylenes	0.005	--	0.005	--	--	0.05	0.05	--
Pesticides/PCBs:								
alpha-BHC	0.00005	--	0.005	--	ND	--	--	--
beta-BHC	0.00005	--	0.005	--	ND	--	--	--
delta-BHC	0.00005	--	0.005	--	ND	--	--	--
gamma-BHC (lindane)	0.00005	0.004	0.004	0.056	ND	--	0.000009	0.004
Heptachlor	0.00005	--	0.005	0.018	ND	--	0.000001 (f)	--
Aldrin	0.00005	--	0.005	0.017	ND	--	0.000009	--
Heptachlor Epoxide	0.00005	--	0.005	0.018	ND	--	0.000009	--
Endosulfan I	0.00005	--	0.005	--	--	--	0.000001 (f)	--
Dieldrin	0.0001	--	0.005	0.017	ND	--	0.000001 (f)	--
4,4'-DDE	0.0001	--	0.005	--	ND	--	0.00001	--

All ARARs are in Milligrams per Liter unless indicated (mg/L).

ARARs Applicable or Relevant and Appropriate Requirements.

MCL Maximum Contaminant Levels.

TOGS New York State Department of Environmental Conservation

Technical and Operational Guidance Series.

PCBs Polychlorinated biphenyls.

SPDES State Pollutant Discharge Elimination System.

ND Not detected.

-- No standard available.

(a) Currently there are no Federal or New York State standards for soil or sediment samples.

Standard in bold is less than Routine Analytical Services (RAS) Quantitation Limit.

(b) Effluent standards provided are those specified in the current Gruman

SPDES Permit (effective date July 1, 1989).

(c) Combined concentration of Iron and Manganese shall not exceed 0.5 mg/L.

(d) Total Trihalomethanes shall not exceed 0.1 mg/L.

(e) Total Phenolic Compounds.

(f) Applies to total of Para (i.e., 1,4-) and Ortho (i.e., 1,2-) isomers only.

(g) MCL for Styrene will be set after public comment period.

(h) Flow limit is not applicable to stormwater runoff conditions.

(i) Sum of concentrations of parameters given above.

(j) Standard for Aldrin and Dieldrin combined.

Table 3. Ground- Water Quantitation Limits and ARARs for the Malta Rocket Fuel Area Superfund Site, Towns of Malta and Stillwater, Saratoga County, New York.

Parameters	RAS		USEPA MCL (ppm)	Revised 10NYCRR Subpt 5-1 (ppm)	10NYCRR Part 170 (ppm)	6NYCRR Part 703 (ppm)	TOGS Values (ppm)	NYS Ambient Water Quality Standards	
	Quantitation Limits (ppm)							6NYCRR Part 701 (ppm)	40 CFR 264 (ppm)
Pesticides/PCBs: (cont'd)									
Endrin	0.0001		0.0002	0.0002	0.001	ND	--	0.0002	0.0002
Endosulfan II	0.0001		--	0.005	--	--	--	0.000009	--
4,4'-DDD	0.0001		--	0.005	--	ND	--	0.00001	--
Endosulfan Sulfate	0.0001		--	0.005	0.042	--	--	--	--
4,4'-DDT	0.0001		--	0.005	0.065	ND	--	0.00001	0.1
Methoxychlor	0.0005	0.1	--	0.05	0.006	0.035	--	0.035	--
Chlorodane(alpha)	0.00005	--	--	0.005	0.005	0.0001	--	--	0.005
Chlorodane(gamma)	0.00005	--	--	0.005	0.005	0.0001	--	--	0.005
Toxaphene	0.001	0.005	0.005	0.005	--	ND	--	0.000005	--
Arochlor-1016	0.0005	--	--	0.001	--	0.0001	--	0.00001	--
Arochlor-1221	0.0005	--	--	0.001	--	0.0001	--	0.00001	--
Arochlor-1232	0.0005	--	--	0.001	--	0.0001	--	0.00001	--
Arochlor-1242	0.0005	--	--	0.001	--	0.0001	--	0.00001	--
Arochlor-1248	0.0005	--	--	0.001	--	0.0001	--	0.00001	--
Arochlor-1254	0.001	--	--	0.001	--	0.0001	--	0.00001	--
Arochlor-1260	0.001	--	--	0.001	--	0.0001	--	0.00001	--
Endrin Ketone	0.0001	--	--	0.005	--	--	--	0.05	--
Endrin Aldehyde	0.0001	--	--	0.005	--	--	--	0.05	--
PCBs	--	--	--	0.001	--	0.0001	--	0.00001	--

All ARARs are in Milligrams per Liter unless indicated (mg/L).

ARARs	Applicable or Relevant and Appropriate Requirements.	(b)	Effluent standards provided are those specified in the current Gruman SPDES Permit (effective date July 1, 1989).
MCL	Maximum Contaminant Levels.	(c)	Combined concentration of Iron and Manganese shall not exceed 0.5 mg/L.
TOGS	New York State Department of Environmental Conservation Technical and Operational Guidance Series.	(d)	Total Trihalomethanes shall not exceed 0.1 mg/L.
PCBs	Polychlorinated biphenyls.	(e)	Total Phenolic Compounds.
SPDES	State Pollutant Discharge Elimination System.	(f)	Applies to total of Para (i.e., 1,4-) and Ortho (i.e., 1,2-) isomers only.
ND	Not detected.	(g)	MCL for Styrene will be set after public comment period.
--	No standard available.	(h)	Flow limit is not applicable to stormwater runoff conditions.
(a)	Currently there are no Federal or New York State standards for soil or sediment samples.	(i)	Sum of concentrations of parameters given above.

Standard in bold is less than Routine Analytical Services (RAS) Quantitation Limit.

Table 3. Ground- Water Quantitation Limits and ARARs for the Malta Rocket Fuel Area Superfund Site, Towns of Malta and Stillwater, Saratoga County, New York.

Parameters	RAS Quantitation Limits (ppm)	USEPA MCL (ppm)	Revised 10NYCRR Subpt 5-1 (ppm)	10NYCRR Part 170 (ppm)	6NYCRR Part 703 (ppm)	TOGS Values (ppm)	NYS Ambient Water Quality Standards 6NYCRR Part 701 (ppm)	40 CFR 264 (ppm)
Semivolatiles:								
Phenol(s)	0.01	--	0.05	0.001	0.001 (e)	--	0.001	--
bis(-2-Chloroethyl)ether	0.01	--	0.005	--	0.001	--	0.05	--
2-Chlorophenol	0.01	--	0.005	--	0.001 (e)	--	0.05	--
1,3-Dichlorobenzene	0.01	--	0.005	--	--	--	0.02	--
1,4-Dichlorobenzene	0.01	0.075	0.005	--	4.7 (f)	--	0.03	--
1,2-Dichlorobenzene	0.01	--	0.005	--	4.7 (f)	--	0.05	--
2-Methylphenol	0.01	--	0.05	--	0.001 (e)	--	0.05	--
2,2'-oxybis(1-Chloropropane)	0.01	--	0.005	--	--	--	0.05	--
4-Methylphenol	0.01	--	0.05	--	0.001 (e)	--	0.05	--
n-Nitroso-di-n-dipropylamine	0.01	--	0.05	--	--	--	0.05	--
Hexachloroethane	0.01	--	0.005	--	--	0.03	0.03	--
Nitrobenzene	0.01	--	0.005	--	--	0.05	0.05	--
Isophorone	0.01	--	0.05	--	--	--	0.05	--
2-Nitrophenol	0.01	--	0.005	--	0.001 (e)	--	0.05	--
2,4-Dimethylphenol	0.01	--	0.05	--	--	0.05	0.05	--
bis(-2-Chloroethoxy)methane	0.01	--	0.005	--	0.001 (e)	--	0.05	--
2,4-Dichlorophenol	0.01	--	0.005	--	--	--	0.05	--
1,2,4-Trichlorobenzene	0.01	--	0.005	--	0.001 (e)	0.0003	0.0003	--
Naphthalene	0.01	--	0.05	--	--	0.01	0.01	--
4-Chloroaniline	0.01	--	0.005	--	--	--	0.05	--

All ARARs are in Milligrams per Liter unless indicated (mg/L).

ARARs	Applicable or Relevant and Appropriate Requirements.	(b)	Effluent standards provided are those specified in the current Gruman SPDES Permit (effective date July 1, 1989).
MCL	Maximum Contaminant Levels.	(c)	Combined concentration of Iron and Manganese shall not exceed 0.5 mg/L.
TOGS	New York State Department of Environmental Conservation Technical and Operational Guidance Series.	(d)	Total Trihalomethanes shall not exceed 0.1 mg/L.
PCBs	Polychlorinated biphenyls.	(e)	Total Phenolic Compounds.
SPDES	State Pollutant Discharge Elimination System.	(f)	Applies to total of Para (i.e., 1,4-) and Ortho (i.e., 1,2-) isomers only.
ND	Not detected.	(g)	MCL for Styrene will be set after public comment period.
--	No standard available.	(h)	Flow limit is not applicable to stormwater runoff conditions.
(a)	Currently there are no Federal or New York State standards for soil or sediment samples.	(i)	Sum of concentrations of parameters given above.

Standard in bold is less than Routine Analytical Services (RAS) Quantitation Limit.

Table 3. Ground-Water Quantitation Limits and ARARs for the Malta Rocket Fuel Area Superfund Site, Towns of Malta and Stillwater, Saratoga County, New York.

Parameters	RAS	USEPA	Revised	10NYCRR	6NYCRR	TOGS	NYS Ambient Water	
	Quantitation Limits (ppm)	MCL (ppm)	10NYCRR Subpt 5-1 (ppm)	Part 170 (ppm)	Part 703 (ppm)	Values (ppm)	Quality Standards 6NYCRR Part 701 (ppm)	40 CFR 264 (ppm)
Semivolatiles (cont'd):								
Hexachlorobutadiene	0.01	--	0.005	--	--	0.0005	0.0005	--
4-Chloro-3-methylphenol	0.01	--	0.005	--	0.001 (e)	--	0.05	--
2-Methylnaphthalene	0.01	--	0.05	--	--	--	--	--
Hexachlorocyclopentadiene	0.01	--	0.005	--	--	0.001	0.001	--
2,4,6-Trichlorophenol	0.01	--	0.005	--	0.001 (e)	--	0.05	--
2,2,4,5-Trichlorophenol	0.05	--	0.005	--	0.001 (e)	--	0.05	--
2-Chloronaphthalene	0.01	--	0.005	--	--	0.01	0.01	--
2-Nitroaniline	0.05	--	0.005	--	--	--	0.05	--
Dimethylphthalate	0.01	--	0.05	--	--	0.05	--	--
Acenaphthylene	0.01	--	0.05	--	--	--	--	--
3-Nitroaniline	0.05	--	0.005	--	--	--	0.05	--
Acenaphthene	0.01	--	0.05	--	--	0.02	0.02	--
2,4-Dinitrophenol	0.05	--	0.005	--	0.001 (e)	--	0.05	--
4-Nitrophenol	0.05	--	0.005	--	0.001 (e)	--	0.05	--
Dibenzofuran	0.01	--	0.05	--	--	--	0.05	--
2,4-Dinitrotoluene	0.01	--	0.005	--	--	--	0.05	--
2,6-Dinitrotoluene	0.01	--	0.005	--	--	0.00007	0.05	--
Diethylphthalate	0.01	--	0.05	--	--	0.05	--	--
4-Chlorophenyl-phenylether	0.01	--	0.005	--	--	0.05	0.05	--
Fluorene	0.01	--	0.05	--	--	0.05	--	--
4-Nitroaniline	0.05	--	0.005	--	--	--	0.05	--
4,6-Dinitro-2-methylphenol	0.05	--	0.005	--	0.001 (e)	--	0.05	--

All ARARs are in Milligrams per Liter unless indicated (mg/L).

- ARARs Applicable or Relevant and Appropriate Requirements.
- MCL Maximum Contaminant Levels.
- TOGS New York State Department of Environmental Conservation Technical and Operational Guidance Series.
- PCBs Polychlorinated biphenyls.
- SPDES State Pollutant Discharge Elimination System.
- ND Not detected.
- No standard available.
- (a) Currently there are no Federal or New York State standards for soil or sediment samples.
- (b) Effluent standards provided are those specified in the current Grumman SPDES Permit (effective date July 1, 1989).
- (c) Combined concentration of Iron and Manganese shall not exceed 0.5 mg/L.
- (d) Total Trihalomethanes shall not exceed 0.1 mg/L.
- (e) Total Phenolic Compounds.
- (f) Applies to total of Para (i.e., 1,4-) and Ortho (i.e., 1,2-) isomers only.
- (g) MCL for Styrene will be set after public comment period.
- (h) Flow limit is not applicable to stormwater runoff conditions.
- (i) Sum of concentrations of parameters given above.

Standard in bold is less than Routine Analytical Services (RAS) Quantitation Limit.

Table 3. Ground- Water Quantitation Limits and ARARs for the Malta Rocket Fuel Area Superfund Site, Towns of Malta and Stillwater, Saratoga County, New York.

Parameters	RAS Quantitation Limits (ppm)	USEPA MCL (ppm)	Revised 10NYCRR Subpt 5-1 (ppm)	10NYCRR Part 170 (ppm)	6NYCRR Part 703 (ppm)	TOGS Values (ppm)	NYS Ambient Water Quality Standards 6NYCRR Part 701 (ppm)	40 CFR 264 (ppm)
Semivolatiles (cont'd):								
N-Nitrosodiphenylamine	0.01	--	0.005	--	--	0.05	0.05	--
4-Bromophenyl-phenylether	0.01	--	0.005	--	--	--	0.05	--
Hexachlorobenzene	0.01	--	0.005	--	0.00035	--	0.05	--
Penta-chlorophenol	0.05	--	0.005	--	0.021	--	0.001	--
Phenanthrene	0.01	--	0.05	--	--	0.05	--	--
Anthracene	0.01	--	0.05	--	--	0.05	--	--
Carbazole	0.01	--	0.05	--	--	--	--	--
Di-n-butylphthalate	0.01	--	0.05	--	0.77	--	--	--
Fluoranthene	0.01	--	0.05	--	--	0.05	--	--
Pyrene	0.01	--	0.05	--	--	0.05	--	--
Butylbenzylphthalate	0.01	--	0.05	--	--	--	--	--
3,3'-Dichlorobenzidine	0.01	--	0.005	--	--	--	0.05	--
Benzo(a)anthracene	0.01	--	0.05	--	--	0.000002	--	--
bis(2-Ethylhexyl)phthalate	0.01	--	0.05	--	4.2	--	--	--
Chrysene	0.01	--	0.05	--	--	0.000002	--	--
Di-n-octyl phthalate	0.01	--	0.05	--	--	0.05	--	--
Benzo(k)fluoranthene	0.01	--	0.05	--	--	0.000002	--	--
Benzo(b)fluoranthene	0.01	--	0.05	--	--	0.000002	--	--
Benzo(a)pyrene	0.01	--	0.05	--	ND	--	--	--
Indeno(1,2,3-c d)pyrene	0.01	--	0.05	--	--	0.000002	--	--
Dibenz(g,h)anthracene	0.01	--	0.05	--	--	--	--	--
Benzo(g,h,i)perylene	0.01	--	0.05	--	--	--	--	--

All ARARs are in Milligrams per Liter unless indicated (mg/L).

ARARs	Applicable or Relevant and Appropriate Requirements.	(b)	Effluent standards provided are those specified in the current Gruman
MCL	Maximum Contaminant Levels.	(b)	SPDES Permit (effective date July 1, 1989).
TOGS	New York State Department of Environmental Conservation	(c)	Combined concentration of Iron and Manganese shall not exceed 0.5 mg/L.
	Technical and Operational Guidance Series.	(d)	Total Trihalomethanes shall not exceed 0.1 mg/L.
PCBs	Polychlorinated biphenyls.	(e)	Total Phenolic Compounds.
SPDES	State Pollutant Discharge Elimination System.	(f)	Applies to total of Para (i.e., 1,4-) and Ortho (i.e., 1,2-) isomers only.
ND	Not detected.	(g)	MCL for Styrene will be set after public comment period.
--	No standard available.	(h)	Flow limit is not applicable to stormwater runoff conditions.
(a)	Currently there are no Federal or New York State standards for soil or sediment samples.	(i)	Sum of concentrations of parameters given above.

Standard in bold is less than Routine Analytical Services (RAS) Quantitation Limit.

Table 4. Quantitation Limits and Soil ARARs for the Malta Rocket Fuel Area Superfund Site, Towns of Malta and Stillwater, Saratoga County, New York.

Parameters	RAS Quantitation Limits (ppm)	NYS Sediment Criteria (12/89) (ppm)	Reportable Quantities of Hazardous Substances 6NYCRR Part 597 (pounds)
Inorganics:			
Aluminum	--	--	--
Antimony	--	--	1
Arsenic	--	5	1
Barium	--	--	--
Beryllium	--	--	1
Cadmium	--	0.8	1
Calcium	--	--	--
Chromium	--	26	1
Chromium (VI)	--	--	--
Cobalt	--	--	1
Copper	--	19	1
Iron	--	--	--
Lead	--	55	1
Magnesium	--	--	--
Manganese	--	1200	--
Mercury	--	0.6	1
Nickel	--	75	1
Potassium	--	--	--
Selenium	--	--	1
Silver	--	--	100
Sodium	--	--	10
Thallium	--	--	--
Vanadium	--	--	--
Zinc	--	145	1
Cyanide	--	--	10
Boron	--	--	--

Standard in bold is less than Routine Analytical Services (RAS) Quantitation Limit.

Table 4. Quantitation Limits and Soil ARARs for the Malta Rocket Fuel Area Superfund Site, Towns of Malta and Stillwater, Saratoga County, New York.

Parameters	RAS Quantitation Limits (ppm)	NYS Sediment Criteria (12/89) (ppm)	Reportable Quantities of Hazardous Substances 6NYCRR Part 597 (pounds)
Volatile Organics:			
Chloromethane	0.01	--	1
Bromomethane	0.01	--	1
Vinyl chloride	0.01	--	1
Chloroethane	0.01	--	1
Methylene chloride	0.005	--	1
Acetone	0.01	--	1
Carbon disulfide	0.005	--	100
1,1-Dichloroethene	0.005	0.02	1
1,1-Dichloroethane	0.005	--	1
1,2-Dichloroethene	0.005	--	1
Chloroform	0.005	--	1
1,2-Dichloroethane	0.005	0.7	1
2-Butanone	0.01	--	1
1,1,1-Trichloroethane	0.005	--	1
Carbon tetrachloride	0.005	0.6	100
Bromodichloromethane	0.005	--	--
1,1,2,2-Tetrachloroethane	0.005	0.3	1
1,2-Dichloropropane	0.005	--	1
trans-1,3-Dichloropropene	0.005	--	--
Trichloroethene	0.005	--	1
Dibromochloromethane	0.005	--	--

Standard in bold is less than Routine Analytical Services (RAS) Quantitation Limit.

Table 4. Quantitation Limits and Soil ARARs for the Malta Rocket Fuel Area Superfund Site, Towns of Malta and Stillwater, Saratoga County, New York.

Parameters	RAS	NYS	Reportable Quantities of Hazardous Substances 6NYCRR Part 597 (pounds)
	Quantitation Limits (ppm)	Sediment Criteria (12/89) (ppm)	
Volatile Organics (cont'd):			
1,1,2-Trichloroethane	0.005	--	1
Benzene	0.005	0.6	1
cis-1,3-Dichloropropene	0.005	--	1
Bromoform	0.005	--	1
2-Hexanone	0.01	--	--
4-Methyl-2-pentanone	0.01	--	--
Tetrachloroethene	0.005	0.8	1
Toluene	0.005	--	1
Chlorobenzene	0.005	--	1
Ethylbenzene	0.01	--	1
Styrene (g)	0.01	--	1
Total Xylenes	0.005	--	1
Pesticides/PCBs:			
alpha-BHC	0.0017	--	1
beta-BHC	0.0017	--	1
delta-BHC	0.0017	--	1
gamma-BHC (Lindane)	0.0017	--	1
Heptachlor	0.0017	0.0008	1
Aldrin	0.0017	0.1	1
Heptachlor Epoxide	0.0017	0.0008	1
Endosulfan I	0.0017	0.03	1
Dieldrin	0.0033	0.1	1
4,4'-DDE	0.0033	0.01	1

Standard in bold is less than Routine Analytical Services (RAS) Quantitation Limit.

Table 4. Quantitation Limits and Soil ARARs for the Malta Rocket Fuel Area Superfund Site, Towns of Malta and Stillwater, Saratoga County, New York.

Parameters	RAS	NYS	Reportable Quantities of Hazardous Substances 6NYCRR Part 597 (pounds)
	Quantitation Limits (ppm)	Sediment Criteria (12/89) (ppm)	
Pesticides/PCBs (cont'd):			
Endrin	0.0033	0.8	1
Endosulfan II	0.0033	0.03	1
4,4'-DDD	0.0033	0.01	1
Endosulfan Sulfate	0.0033	--	1
4,4'-DDT	0.0033	0.01	1
Methoxychlor	0.017	0.6	1
Chlorodane(alpha)	0.017	0.001	1
Chlorodane(gamma)	0.017	0.001	1
Toxaphene	0.16	0.02	1
Arochlor-1016	0.033	--	1
Arochlor-1221	0.067	--	1
Arochlor-1232	0.033	--	1
Arochlor-1242	0.033	--	1
Arochlor-1248	0.033	--	1
Arochlor-1254	0.033	--	1
Arochlor-1260	0.033	--	1
Endrin Ketone	0.033	--	--
Edrin Aldehyde	0.033	--	1
PCBs	0.033	0.008	1

Standard in bold is less than Routine Analytical Services (RAS) Quantitation Limit

Table 4. Quantitation Limits and Soil ARARs for the Malta Rocket Fuel Area Superfund Site, Towns of Malta and Stillwater, Saratoga County, New York.

Parameters	RAS Quantitation Limits (ppm)	NYS Sediment Criteria (12/89) (ppm)	Reportable Quantities of Hazardous Substances 6NYCRR Part 597 (pounds)
Semivolatiles:			
Phenol(s)	0.33	0.6	1
bis(-2-Chloroethyl)ether	0.33	0.01	1
2-Chlorophenol	0.33	--	1
1,3-Dichlorobenzene	0.33	12	1
1,4-Dichlorobenzene	0.33	12	1
1,2-Dichlorobenzene	0.33	12	1
2-Methylphenol	0.33	--	--
2,2'-Oxybis (1-Chloropropane)	0.33	--	100
4-Methylphenol	0.33	--	--
n-Nitroso-di-n-dipropylamine	0.33	--	--
Hexachloroethane	0.33	--	1
Nitrobenzene	0.33	--	1
Isophorone	0.33	--	1
2-Nitrophenol	0.33	--	1
2,4-Dimethylphenol	0.33	--	1
bis(-2-Chloroethoxy)methane	0.33	--	1
2,4-Dichlorophenol	0.33	--	1
1,2,4-Trichlorobenzene	0.33	91	100
Naphthalene	0.33	--	1
4-Chloroaniline	0.33	--	1

Standard in bold is less than Routine Analytical Services (RAS) Quantitation Limit.

Table 4. Quantitation Limits and Soil ARARs for the Malta Rocket Fuel Area Superfund Site, Towns of Malta and Stillwater, Saratoga County, New York.

Parameters	RAS Quantitation Limits (ppm)	NYS Sediment Criteria (12/89) (ppm)	Reportable Quantities of Hazardous Substances 6NYCRR Part 597 (pounds)
Semivolatiles (cont'd):			
Hexachlorobutadiene	0.33	0.3	1
4-Chloro-3-methylphenol	0.33	--	--
2-Methylnaphthalene	0.33	--	--
Hexachlorocyclopentadiene	0.33	4.4	1
2,4,6-Trichlorophenol	0.33	--	10
2,4,5-Trichlorophenol	1.6	--	10
2-Chloronaphthalene	0.33	--	100
2-Nitroaniline	1.6	--	1
Dimethylphthalate	0.33	--	--
Acenaphthylene	0.33	--	1
3-Nitroaniline	1.6	--	1
Acenaphthene	0.33	730	1
2,4-Dinitrophenol	1.6	--	10
4-Nitrophenol	1.6	--	1
Dibenzofuran	0.33	--	--
2,4-Dinitrotoluene	0.33	--	1
2,6-Dinitrotoluene	0.33	0.1	100
Diethylphthalate	0.33	--	1
4-Chlorophenyl-phenylether	0.33	--	100
Fluorene	0.33	--	1
4-Nitroaniline	1.6	--	1
4,6-Dinitro-2-methylphenol	1.6	--	--

Standard in bold is less than Routine Analytical Services (RAS) Quantitation Limit.

Table 4. Quantitation Limits and Soil ARARs for the Malta Rocket Fuel Area Superfund Site, Towns of Malta and Stillwater, Saratoga County, New York.

Parameters	RAS Quantitation Limits (ppm)	NYS Sediment Criteria (12/89) (ppm)	Reportable Quantities of Hazardous Substances 6NYCRR Part 597 (pounds)
Semivolatiles (cont'd):			
N-Nitrosodiphenylamine	0.33	--	100
4-Bromophenyl-phenylether	0.33	--	100
Hexachlorobenzene	0.33	0.15	1
Penta-chlorophenol	1.6	40	1
Phenanthrene	0.33	--	1
Anthracene	0.33	102	1
Carbazole	0.33	--	--
Di-n-butylphthalate	0.33	--	1
Fluoranthene	0.33	--	1
Pyrene	0.33	--	1
Butylbenzylphthalate	0.33	--	1
3,3'-Dichlorobenzidine	0.33	--	1
Benzo(a)anthracene	0.33	--	--
bis(2-Ethylhexyl)phthalate	0.33	119.7	1
Chrysene	0.33	--	1
Di-n-octyl phthalate	0.33	--	1
Benzo(b)fluoranthene	0.33	--	1
Benzo(k)fluoranthene	0.33	--	1
Benzo(a)pyrene	0.33	0.7	1
Indeno(1,2,3-c d)pyrene	0.33	--	1
Dibenz(g,h)anthracene	0.33	--	1
Benzo(g,h,i)perylene	0.33	--	1

Standard in bold is less than Routine Analytical Services (RAS) Quantitation Limit.

Table 5. Air ARARs (Including OSHA Requirements) for the Malta Rocket Fuel Area Superfund Site, Towns of Malta and Stillwater, Saratoga County, New York.

Parameters	6NYCRR Part 257	EPA Ambient Air Quality Standards 40CFR 50 [mg/m(3)]	Reportable Quantities Hazardous Substances 6NYCRR Part 597 (pounds)	OSHA 29CFR1910 [mg/m(3)]
Inorganics:				
Aluminum	--	--	--	15 (a)
Antimony	--	--	1	0.5 (a)
Arsenic	--	--	1	0.01 (a)
Barium	--	--	--	0.5 (a)
Beryllium	0.01 ug/m(3)	--	1	0.002 (a)
Cadmium	--	--	1	0.2 (a)
Calcium	--	--	1	--
Chromium	--	--	--	1 (a)
Chromium (VI)	--	--	1	--
Cobalt	--	--	1	0.05 (a)
Copper	--	--	--	1 (a)
Iron	--	--	--	--
Lead	--	1.5	1	0.05 (a)
Magnesium	--	--	--	--
Manganese	--	--	--	1 (a)
Mercury	--	--	1	0.1 (b)
Nickel	--	--	1	1 (a)
Potassium	--	--	--	--
Selenium	--	--	1	0.2 (a)
Silver	--	--	1000	0.01 (a)
Sodium	--	--	10	--
Thallium	--	--	--	0.1 (a)
Vanadium	--	--	--	0.05 (a)
Zinc	--	--	1	--
Cyanide	--	--	10	5 (a)
Boron	--	--	--	--

- (a) 8-hour time weighted average (TWA).
 (b) Acceptable ceiling concentrations (Ceiling).
 (c) 15-minute short-term exposure limit (STEL).

Table 5. Air ARARs (Including OSHA Requirements) for the Malta Rocket Fuel Area Superfund Site, Towns of Malta and Stillwater, Saratoga County, New York.

Parameters	6NYCRR Part 257	EPA Ambient Air Quality Standards 40CFR 50	Reportable Quantities Hazardous Substances 6NYCRR Part 597 (pounds)	OSHA 29CFR1910 (ppm)
Volatile Organics:				
Chloromethane	--	--	1	50 (a)
Bromomethane	--	--	1000	5 (a)
Vinyl chloride	--	--	1	1 (a)
Chloroethane	--	--	1	1000 (a)
Methylene chloride	--	--	1	500 (a)
Acetone	--	--	5000	750 (a)
Carbon disulfide	--	--	100	4 (a)
1,1-Dichloroethene	--	--	5000	--
1,1-Dichloroethane	--	--	1000	100 (a)
1,2-Dichloroethene	--	--	1000	200 (a)
Chloroform	--	--	5000	2 (a)
1,2-Dichloroethane	--	--	5000	--
2-Butanone	--	--	1000	200 (a)
1,1,1-Trichloroethane	--	--	1000	350 (a)
Carbon tetrachloride	--	--	5000	2 (a)
Bromodichloromethane	--	--	--	--
1,1,2,2-Tetrachloroethane	--	--	1	1 (a)
1,2-Dichloropropane	--	--	1000	75 (a)
trans-1,3-Dichloropropene	--	--	--	--
Trichloroethene	--	--	1000	50 (a)
Dibromochloromethane	--	--	--	--

(a) 8-hour time weighted average (TWA).

(b) Acceptable ceiling concentrations (Ceiling).

(c) 15-minute short-term exposure limit (STEL).

Table 5. Air ARARs (Including OSHA Requirements) for the Malta Rocket Fuel Area Superfund Site, Towns of Malta and Stillwater, Saratoga County, New York.

Parameters	6NYCRR Part 257	EPA Ambient Air Quality Standards 40CFR 50	Reportable Quantities Hazardous Substances		OSHA 29CFR1910 (ppm)
			6NYCRR Part 597 (pounds)	6NYCRR Part 597 (pounds)	
Volatile Organics (cont'd):					
1,1,2-Trichloroethane	--	--	1	1	10 (a)
Benzene	--	--	1000	1000	10 (a)
cis-1,3-Dichloropropene	--	--	5000	5000	1 (a)
Bromoform	--	--	100	100	0.5 (a)
2-Hexanone	--	--	--	--	5 (a)
4-Methyl-2-pentanone	--	--	--	--	--
Tetrachloroethene	--	--	1	1	25 (a)
Toluene	--	--	1000	1000	100 (a)
Chlorobenzene	--	--	100	100	75 (a)
Ethylbenzene	--	--	1000	1000	100 (a)
Styrene (g)	--	--	1000	1000	50 (a)
Total Xylenes	--	--	1000	1000	100 (a)
Pesticides/PCBs:					
alpha-BHC	--	--	1	1	--
beta-BHC	--	--	1	1	--
delta-BHC	--	--	1	1	--
gamma-BHC (Lindane)	--	--	1	1	0.5 mg/m(3) (a)
Heptachlor	--	--	1	1	0.5 mg/m(3) (a)
Aldrin	--	--	1	1	0.25 mg/m(3) (a)
Heptachlor Epoxide	--	--	1	1	--
Endosulfan I	--	--	1	1	0.1 mg/m(3) (a)
Dieldrin	--	--	1	1	0.25 mg/m(3) (a)
4,4'-DDE	--	--	1	1	--

- (a) 8-hour time weighted average (TWA).
 (b) Acceptable ceiling concentrations (Ceiling).
 (c) 15-minute short-term exposure limit (STEL).

Table 5. Air ARARs (Including OSHA Requirements) for the Malta Rocket Fuel Area Superfund Site, Towns of Malta and Stillwater, Saratoga County, New York.

Parameters	6NYCRR Part 257	EPA Ambient Air Quality Standards 40CFR 50	Reportable Quantities Hazardous Substances	
			6NYCRR Part 597 (pounds)	OSHA 29CFR1910 [mg/m(3)]
Pesticides/PCBs (cont'd):				
Endrin	--	--	1	0.1 (a)
Endosulfan II	--	--	1	0.1 (a)
4,4'-DDD	--	--	1	--
Endosulfan Sulfate	--	--	1	--
4,4'-DDT	--	--	1	1 (a)
Methoxychlor	--	--	1	10 (a)
Chlorodane(alpha)	--	--	1	0.5 (a)
Chlorodane(gamma)	--	--	1	0.5 (a)
Toxaphene	--	--	1	0.5 (a)
Arochlor-1016	--	--	10	--
Arochlor-1221	--	--	10	--
Arochlor-1232	--	--	10	--
Arochlor-1242	--	--	10	--
Arochlor-1248	--	--	10	--
Arochlor-1254	--	--	10	--
Arochlor-1260	--	--	10	--
Endrin Ketone	--	--	--	--
Endrin Aldehyde	--	--	1	--
PCBs	--	--	10	--

- (a) 8-hour time weighted average (TWA).
 (b) Acceptable ceiling concentrations (Ceiling).
 (c) 15-minute short-term exposure limit (STEL).

Table 5. Air ARARs (Including OSHA Requirements) for the Malta Rocket Fuel Area Superfund Site, Towns of Malta and Stillwater, Saratoga County, New York.

Parameters	6NYCRR Part 257	EPA Ambient Air Quality Standards 40CFR 50	Reportable Quantities Hazardous Substances 6NYCRR Part 597 (pounds)	OSHA 29CFR1910 (ppm)
Semivolatiles:				
Phenol(s)	--	--	1000	5 (a)
bis(-2-Chloroethyl)ether	--	--	1	--
2-Chlorophenol	--	--	100	--
1,3-Dichlorobenzene	--	--	100	--
1,4-Dichlorobenzene	--	--	100	75 (a)
1,2-Dichlorobenzene	--	--	100	50 (b)
2-Methylphenol	--	--	--	--
2,2'-oxybis (1-Chloropropane)	--	--	1000	--
4-Methylphenol	--	--	--	--
n-Nitroso-di-n-dipropylamine	--	--	--	--
Hexachloroethane	--	--	1	1 (a)
Nitrobenzene	--	--	1000	1 (a)
Isophorone	--	--	5000	4 (a)
2-Nitrophenol	--	--	100	--
2,4-Dimethylphenol	--	--	100	--
bis(-2-Chloroethoxy)methane	--	--	1000	--
2,4-Dichlorophenol	--	--	100	--
1,2,4-Trichlorobenzene	--	--	100	5 (b)
Naphthalene	--	--	100	10 (a)
4-Chloroaniline	--	--	1000	--

- (a) 8-hour time weighted average (TWA).
 (b) Acceptable ceiling concentrations (Ceiling).
 (c) 15-minute short-term exposure limit (STEL).

Table 5. Air ARARs (Including OSHA Requirements) for the Malta Rocket Fuel Area Superfund Site, Towns of Malta and Stillwater, Saratoga County, New York.

Parameters	6NYCRR Part 257	EPA Ambient Air Quality Standards 40CFR 50	Reportable Quantities Hazardous Substances 6NYCRR Part 597 (pounds)	OSHA 29CFR1910 (ppm)
Semivolatiles (cont'd):				
Hexachlorobutadiene	--	--	1	0.02 (a)
4-Chloro-3-methylphenol	--	--	--	--
2-Methylnaphthalene	--	--	--	--
Hexachlorocyclopentadiene	--	--	1	0.01 (a)
2,4,6-Trichlorophenol	--	--	10	--
2,4,5-Trichlorophenol	--	--	10	--
2-Chloronaphthalene	--	--	5000	--
2-Nitroaniline	--	--	5000	3 mg/m3 (a)
Dimethylphthalate	--	--	--	5 mg/m3 (a)
Acenaphthylene	--	--	1	--
3-Nitroaniline	--	--	5000	3 mg/m3 (a)
Acenaphthene	--	--	1	--
2,4-Dinitrophenol	--	--	10	--
4-Nitrophenol	--	--	100	--
Dibenzofuran	--	--	--	--
2,4-Dinitrotoluene	--	--	1000	1.5 mg/m3 (a)
2,6-Dinitrotoluene	--	--	1000	1.5 mg/m3 (a)
Diethylphthalate	--	--	1000	5 mg/m3 (a)
4-Chlorophenyl-phenylether	--	--	5000	--
Fluorene	--	--	1	--
4-Nitroaniline	--	--	5000	3 mg/m3 (a)
4,6-Dinitro-2-methylphenol	--	--	--	--

(a) 8-hour time weighted average (TWA).

(b) Acceptable ceiling concentrations (Ceiling).

(c) 15-minute short-term exposure limit (STEL).

Table 5. Air ARARs (Including OSHA Requirements) for the Malta Rocket Fuel Area Superfund Site, Towns of Malta and Stillwater, Saratoga County, New York.

Parameters	6NYCRR Part 257	EPA Ambient Air Quality Standards 40CFR 50	Reportable Quantities Hazardous Substances 6NYCRR Part 597 (pounds)	OSHA 29CFR1910 [mg/m(3)]
Semivolatiles (cont'd):				
N-Nitrosodiphenylamine	--	--	100	--
4-Bromophenyl-phenylether	--	--	100	--
Hexachlorobenzene	--	--	1	--
Penta-chlorophenol	--	--	10	0.5 (a)
Phenanthrene	--	--	1	--
Anthracene	--	--	1	--
Carbazole	--	--	--	--
Di-n-butylphthalate	--	--	10	5 (a)
Fluoranthene	--	--	1	--
Pyrene	--	--	5000	--
Butylbenzylphthalate	--	--	100	--
3,3'-Dichlorobenzidine	--	--	1	--
Benzo(a)anthracene	--	--	--	--
bis(2-Ethylhexyl)phthalate	--	--	1	--
Chrysene	--	--	1	0.2 (a)
Di-n-octyl phthalate	--	--	1	5 (a)
Benzo(b)fluoranthene	--	--	1	--
Benzo(k)fluoranthene	--	--	1	--
Benzo(a)pyrene	--	--	1	0.2 (a)
Indeno(1,2,3-c d)pyrene	--	--	1	--
Dibenz(g,h)anthracene	--	--	1	--
Benzo(g,h,i)perylene	--	--	1	--

(a) 8-hour time weighted average (TWA).

(b) Acceptable ceiling concentrations (Ceiling).

(c) 15-minute short-term exposure limit (STEL).

Table 6. Waste and Sludge ARARs for the Malta Rocket Fuel Area Superfund Site, Towns of Malta and Stillwater, Saratoga County, New York.

Parameters	6NYCRR	E.P. Toxicity	RCRA	RCRA
	Part 360 (ppm-dry wgt)	6NYCRR Parts 370 - 372 (ppm)	Non-Wastewater 40 CFR 268 (ppm)	Wastewater 40 CFR 268 (ppm)
Inorganics:				
Aluminum	--	--	--	--
Antimony	--	--	--	--
Arsenic	--	5.0	5.0 *	5.0
Barium	--	100	100 *	100
Beryllium	--	--	--	--
Cadmium	10	1.0	1.0 *	1.0
Calcium	--	--	--	--
Chromium	1000	5.0	5.0 *	5.0
Chromium (VI)	--	--	--	--
Cobalt	--	--	--	--
Copper	1000	--	--	--
Iron	--	--	--	--
Lead	250	5.0	5.0 *	5.0
Magnesium	--	--	--	--
Manganese	--	--	--	--
Mercury	10	0.2	0.2 *	0.2
Nickel	200	--	--	--
Potassium	--	--	--	--
Selenium	--	1.0	5.7 *	1.0
Silver	--	5.0	5.0 *	5.0
Sodium	--	--	--	--
Thallium	--	--	--	0.14
Vanadium	--	--	--	--
Zinc	2500	--	--	--
Cyanide	--	--	110	1.9
Boron	--	--	--	--

* Toxicity Characteristic Leachate Procedure (TCLP)

Table 6. Waste and Sludge ARARs for the Malta Rocket Fuel Area Superfund Site, Towns of Malta and Stillwater, Saratoga County, New York.

Parameters	6NYCRR Part 360 (ppm-dry wgt)	E.P. Toxicity 6NYCRR Parts 370 - 372 (ppm)	RCRA		RCRA Wastewater 40 CFR 268 (ppm)
			Non-Wastewater 40 CFR 268 (ppm)		
Volatile Organics:					
Chloromethane	--	--	33		0.19
Bromomethane	--	--	15		0.11
Vinyl chloride	--	--	33		0.27
Chloroethane	--	--	--		--
Methylene chloride	--	--	0.96 *		0.20
Acetone	--	--	0.59 *		0.05
Carbon disulfide	--	--	4.81 *		1.05
1,1-Dichloroethene	--	--	33		0.025
1,1-Dichloroethane	--	--	7.2		0.059
1,2-Dichloroethene	--	--	33		0.054
Chloroform	--	--	5.6		0.046
1,2-Dichloroethane	--	--	7.2		0.21
2-Butanone	--	--	--		--
1,1,1-Trichloroethane	--	--	0.41 *		1.05
Carbon tetrachloride	--	--	0.96 *		0.05
Bromodichloromethane	--	--	--		--
1,1,2,2-Tetrachloroethane	--	--	42		0.057
1,2-Dichloropropane	--	--	18		0.85
trans-1,3-Dichloropropene	--	--	18		0.036
Trichloroethene	--	--	0.091		0.062
Dibromochloromethane	--	--	--		--

* Toxicity Characteristic Leachate Procedure (TCLP)

Table 6. Waste and Sludge ARARs for the Malta Rocket Fuel Area Superfund Site, Towns of Malta and Stillwater, Saratoga County, New York.

Parameters	6NYCRR Part 360 (ppm-dry wgt)	E.P. Toxicity 6NYCRR Parts 370 - 372 (ppm)	RCRA Non-Wastewater 40 CFR 268 (ppm)	RCRA Wastewater 40 CFR 268 (ppm)
Volatile Organics (cont'd):				
1,1,2-Trichloroethane	--	--	7.6	0.030
Benzene	--	--	3.7	0.070
cis-1,3-Dichloropropene	--	--	18	0.036
Bromoform	--	--	15	0.63
2-Hexanone	--	--	--	--
4-Methyl-2-pentanone	--	--	--	--
Tetrachloroethene	--	--	0.05 *	0.079
Toluene	--	--	0.33 *	1.120
Chlorobenzene	--	--	0.05 *	0.15
Ethylbenzene	--	--	0.053 *	0.05
Styrene (g)	--	--	--	--
Total Xylenes	--	--	0.15 *	0.05
Pesticides/PCBs:				
alpha-BHC	--	--	0.066	0.00014
beta-BHC	--	--	0.066	0.00014
delta-BHC	--	--	0.066	0.023
gamma-BHC (Lindane)	--	0.4	0.066	0.0017
Heptachlor	--	--	0.066	0.0012
Aldrin	--	--	0.066	0.21
Heptachlor Epoxide	--	--	0.066	0.016
Endosulfan I	--	--	0.066	0.023
Dieldrin	--	--	0.13	0.017
4,4'-DDE	--	--	0.087	0.031

* Toxicity Characteristic Leachate Procedure (TCLP)

Table 6. Waste and Sludge ARARs for the Malta Rocket Fuel Area Superfund Site, Towns of Malta and Stillwater, Saratoga County, New York.

Parameters	6NYCRR Part 360 (ppm-dry wgt)	E.P. Toxicity 6NYCRR Parts 370 - 372 (ppm)	RCRA	
			Non-Wastewater 40 CFR 268	Wastewater 40 CFR 268
			(ppm)	(ppm)
Semivolatiles:				
Phenol(s)	--	--	6.2	0.039
bis(-2-Chloroethyl) ether	--	--	--	--
2-Chlorophenol	--	--	5.7	0.044
1,3-Dichlorobenzene	--	--	6.2	0.088
1,4-Dichlorobenzene	--	--	6.2	0.090
1,2-Dichlorobenzene	--	--	6.2	0.036
2-Methylphenol	--	--	--	--
2,2'-oxybis(1-Chloropropane)	--	--	7.2	0.055
4-Methylphenol	--	--	--	--
n-Nitroso-di-n-dipropylamine	--	--	--	--
Hexachloroethane	--	--	28	0.055
Nitrobenzene	--	--	14	0.068
Isophorone	--	--	--	--
2-Nitrophenol	--	--	29	0.12
2,4-Dimethylphenol	--	--	14	0.036
bis(-2-Chloroethoxy)methane	--	--	7.2	0.036
2,4-Dichlorophenol	--	--	14	0.044
1,2,4-Trichlorobenzene	--	--	--	--
Naphthalene	--	--	3.1	0.059
4-Chloroaniline	--	--	16	0.46

* Toxicity Characteristic Leachate Procedure (TCLP)

Table 6. Waste and Sludge ARARs for the Malta Rocket Fuel Area Superfund Site, Towns of Malta and Stillwater, Saratoga County, New York.

Parameters	E.P. Toxicity		RCRA	
	6NYCRR Part 360 (ppm-dry wgt)	6NYCRR Parts 370 - 372 (ppm)	Non-Wastewater 40 CFR 268 (ppm)	Wastewater 40 CFR 268 (ppm)
Semivolatiles (cont'd):				
Hexachlorobutadine	--	--	28	0.055
4-Chloro-3-methylphenol	--	--	--	--
2-Methylnaphthalene	--	--	--	--
Hexachlorocyclopentadiene	--	--	--	--
2,4,6-Trichlorophenol	--	--	--	--
2,4,5-Trichlorophenol	--	--	--	--
2-Chloronaphthalene	--	--	5.6	0.055
2-Nitroaniline	--	--	--	--
Dimethylphthalate	--	--	28	0.54
Acenaphthylene	--	--	--	--
3-Nitroaniline	--	--	--	--
Acenaphthene	--	--	--	--
2,4-Dinitrophenol	--	--	160	0.12
4-Nitrophenol	--	--	29	0.12
Dibenzofuran	--	--	--	--
2,4-Dinitrotoluene	--	--	140	0.32
2,6-Dinitrotoluene	--	--	28	0.55
Diethylphthalate	--	--	28	0.54
4-Chlorophenyl-phenylether	--	--	--	--
Fluorene	--	--	--	--
4-Nitroaniline	--	--	--	--
4,6-Dinitro-2-methylphenol	--	--	--	--

* Toxicity Characteristic Leachate Procedure (TCLP)

Table 6. Waste and Sludge ARARs for the Malta Rocket Fuel Area Superfund Site, Towns of Malta and Stillwater, Saratoga County, New York.

Parameters	6NYCRR Part 360 (ppm-dry wgt)	E.P. Toxicity 6NYCRR Parts 370 - 372 (ppm)	RCRA Non-Wastewater 40 CFR 268 (ppm)	RCRA Wastewater 40 CFR 268 (ppm)
Semivolatiles (cont'd):				
N-Nitrosodiphenylamine	--	--	--	--
4-Bromophenyl-phenylether	--	--	15	0.055
Hexachlorobenzene	--	--	37	0.055
Penta-chlorophenol	--	--	--	--
Phenanthrene	--	--	--	--
Anthracene	--	--	--	--
Carbazole	--	--	--	--
Di-n-butylphthalate	--	--	--	--
Fluoranthene	--	--	8.2	0.068
Pyrene	--	--	--	--
Butylbenzylphthalate	--	--	--	--
3,3'-Dichlorobenzidine	--	--	--	--
Benzo(a)anthracene	--	--	--	--
bis(2-Ethylhexyl)phthalate	--	--	--	--
Chrysene	--	--	28	0.54
Di-n-octyl phthalate	--	--	8.2	0.059
Benzo(b)fluoranthene	--	--	28	0.54
Benzo(k)fluoranthene	--	--	--	--
Benzo(a)pyrene	--	--	--	--
Indeno(1,2,3-c d)pyrene	--	--	8.2	0.061
Dibenz(g,h)anthracene	--	--	8.2	0.0055
Benzo(g,h,i)perylene	--	--	8.2	0.055
	--	--	--	--

* Toxicity Characteristic Leachate Procedure (TCLP)

Table 7. Sampling Plan Summary, Malta Rocket Fuel Area Superfund Site, Towns of Malta and Stillwater, Saratoga County, New York.

	Ambient Air	Soil Gas	Surface Soils	Background Soils
Data Types	VOC TSP	VOC	TCL	TCL (only inorganics)
Sample Type	Grab	Grab	Composite	Grab
Total Number of Matrix Samples	36	As needed to supplement soil sampling	To be determined by literature review	3
Field Blanks	—	After each sample with substantial contamination	0*	1
Trip Blanks	9	--	1/Sample Shipment	1/Sample Shipment
QA/QC Samples	Series samples	1/15 samples	MS/MSD	MS/MSD
Background Samples	—	1	--	—
Sampling Procedures	Methods T0-1, T0-13	Slam Bar	Disposable Stainless-Steel Trowel	Split spoon
<u>Analytical Methods/Equipment</u>				
Level I Field Screening	—	Field GC	PID	PID
Level II Field Analysis	--	--	--	--
Level III Non-CLP Laboratory Methods	—	--	--	--
Level IV SCLP Methods	GC/MS GC	--	GC/MS GC	GC/MS GC
Level V Non-Standard Methods (Special Analytical Services)	—	--	--	--

TCL Target compounds list, target analyte list plus Boron. Includes analyses for volatile organic compounds (VOC), semi-volatile organic compounds (SVOC) and pesticides/PCBs (Pest/PCB).

SAS Special analytical services.

TOC Total organic carbon.

VOC Volatile organic compounds.

TSP Total suspended particulates.

1 Radioactivity will be the analytical parameters for wipe samples from the GE/Exxon-Nuclear test station.

2 PCBs will be the analytical parameters for wipe samples from PTI facility.

3 Radioactivity will be included as an analytical parameter for sediment samples from GE/Exxon-Nuclear test station dry wells.

MS/MSD Matrix Spike/Matrix Spike Duplicate.

GC/MS Gas Chromatography/Mass Spectrometry.

* Dedicated or disposable sampling device will be used/container blanks will be collected periodically.

Table 7. Sampling Plan Summary, Malta Rocket Fuel Area Superfund Site, Towns of Malta and Stillwater, Saratoga County, New York.

	Soil Test Pits	Soil Borings	Surface Water/ Sludge	Radioactivity Wipe Samples
Data Types	TCL	TCL	TCL	Radioactivity (1)
Sample Type	Grab	Grab	Grab	Grab
Total Number of Matrix Samples	15	124	12	Based on Geiger counter readings
Field Blanks	0*	1/day	0*	1
Trip Blanks	1/Sample Shipment	1/Sample Shipment	1	1
QA/QC Samples	MS/MSD	MS/MSD	1 Replicate, MS/MSD	--
Background Samples	--	--	--	--
Sampling Procedures	Disposable Stainless-Steel Trowel	Split spoon	Dedicated Teflon Bailer/Vial	Filter paper
<u>Analytical Methods/Equipment</u>				
Level I Field Screening	PID	PID	--	Geiger counter
Level II Field Analysis	--	--	--	--
Level III Non-CLP Laboratory Methods	--	--	--	--
Level IV SCLP Methods	GC/MS GC	GC/MS GC	GC/MS AA/ICP	--
Level V Non-Standard Methods (Special Analytical Services)	--	--	--	Alpha, beta and gamma radiation plus specific Radio-Nuclides

TCL Target compounds list, target analyte list plus Boron. Includes analyses for volatile organic compounds(VOC), semi-volatile organic compounds(SVOC) and pesticides/PCBs(Pest/PCB).

SAS Special analytical services.

TOC Total organic carbon.

VOC Volatile organic compounds.

TSP Total suspended particulates.

1 Radioactivity will be the analytical parameters for wipe samples from the GE/Exxon-Nuclear test station.

2 PCBs will be the analytical parameters for wipe samples from PTI facility.

3 Radioactivity will be included as an analytical parameter for sediment samples from GE/Exxon-Nuclear test station dry wells.

MS/MSD Matrix Spike/Matrix Spike Duplicate.

GC/MS Gas Chromatography/Mass Spectrometry.

* Dedicated or disposable sampling device will be used/container blanks will be collected periodically.

Table 7. Sampling Plan Summary, Malta Rocket Fuel Area Superfund Site, Towns of Malta and Stillwater, Saratoga County, New York.

	PCB Wipe Samples	Ground Water		Sediment
		Round 1	Round 2	
Data Types	PCBs (2)	TCL	TCL or SAS	TCL, Radioactivity (3)
Sample Type	Grab	Grab	Grab	Grab
Total Number of Matrix Samples	To be determined by literature review	41	41	To be determined by literature review
Field Blanks	1	0*	0*	0*
Trip Blanks	1	1/Sample Shipment	1/Sample Shipment	1/Sample Shipment
QA/QC Samples	--	Replicate 1/15 MS/MSD	Replicate 1/15 MS/MSD	MS/MSD
Background Samples	--	--	--	--
Sampling Procedures	Silaneized glass wool	Bailer	Bailer	Disposable Stainless-Steel Trowel
<u>Analytical Methods/Equipment</u>				
Level I Field Screening	--	--	--	PID
Level II Field Analysis	--	--	--	--
Level III Non-CLP Laboratory Methods	--	--	--	--
Level IV SCLP Methods	GC/MS GC	GC/MS AA,ICP	GC/MS AA,ICP	GC/MS GC
Level V Non-Standard Methods (Special Analytical Services)	--	--	To be Determined	--

TCL Target compounds list, target analyte list plus Boron. Includes analyses for volatile organic compounds(VOC), semi-volatile organic compounds(SVOC) and pesticides/PCBs(Pest/PCB).

SAS Special analytical services.

TOC Total organic carbon.

VOC Volatile organic compounds.

TSP Total suspended particulates.

1 Radioactivity will be the analytical parameters for wipe samples from the GE/Exxon-Nuclear test station.

2 PCBs will be the analytical parameters for wipe samples from PTI facility.

3 Radioactivity will be included as an analytical parameter for sediment samples from GE/Exxon-Nuclear test station dry wells.

MS/MSD Matrix Spike/Matrix Spike Duplicate.

GC/MS Gas Chromatography/Mass Spectrometry.

* Dedicated or disposable sampling device will be used/container blanks will be collected periodically.

Table 8. Air Sample Locations/Parameters Malta Rocket Fuel Area Superfund Site, Towns of Malta and Stillwater, Saratoga County, New York.

Sampling Method	Compounds	Sample Location				Trip Blank	Series Sample	Total

		Upwind	Downwind 1	Downwind 2	Collected			
Day 1								
HiVol & Filter TO-1, Tenax	Particulate Matter	1	1	1	1	1		5
	TCL: Volatiles	1	1	1	1	1	1	6
Day 2								
HiVol & Filter TO-1, Tenax	Particulate Matter	1	1	1	1	1		5
	TCL: Volatiles	1	1	1	1	1	1	6
Day 3								
HiVol & Filter TO-1, Tenax	Particulate Matter	1	1	1	1	1		5
	TCL: Volatiles	1	1	1	1	1	1	6
TOTAL ANALYSIS								
	Particulate Matter							15
	TCL: Volatiles							18

Table 9. Field Instrument Calibration Summary, Malta Rocket Fuel Area Superfund Site, Towns of Malta and Stillwater, Saratoga County, New York.

<u>Instrument*</u>	<u>Calibration Standard</u>	<u>Calibration Frequency</u>
HNu Systems, Model PI 101 Photoionization Detector	100 parts per million isobutylene/ air mixture, supplied by Alphagaz of Cambridge, Maryland	Daily
Slope Indicator Co., model 51453 (M-Scope)	Weighted Steel Tape	Daily
Leupold & Stevens, Automatic Water-Level Recorder	Weighted Steel Tape	Upon Installation
Orion Research, Model 230A pH Meter	Buffer solution standards of nominal pH 4, 7, and 10, supplied by Laboratory Supplies Company of Hicksville, N.Y.	Every Sample
YSI, Model 33 Conductivity Meter	100, 1000, or 2000 umho standard solution supplied by Biopharm Laboratory Solutions and Chemical Reagents of Anaheim, California	Every Sample
Cole-Parmer, Model 8391-35 Turbidimeter	Standard solutions of 0.5, 5, or 40 NTU supplied by Laboratory Supplies Company of Hicksville, N.Y.	Every Sample
Photovac, Model 10S50 Gas Chromatograph	Site-specific compounds	Every 5 Samples
ECD/FID Gas Chromatograph	Site-specific compounds	Minimum Daily
Victoreen, Model 493 Geiger Counter	Known source of 137Cs gamma radiation amiable from Victoreen Inc., Cleveland, OH.	Daily
Geonics, Model EM-31 Electromagnetic Instrument	Zero to site background	Weekly
EG&G Geometrics, Model G-856 Proton Precession Magnetometer	Set to values on Magnetic map of the area supplied by U.S. Geological Survey, Denver, Co.	Daily
G.S.S.I. Model SIR-10 Ground Penetrating Radar	Zero to site background	Once per Site

* Or equivalent.

Table 10. Sample Matrices, Malta Rocket Fuel Area Superfund Site, Towns of Malta and Stillwater, Saratoga County, New York.

RI Work Plan Task #	Matrix	# of Samples
4.4	Soil Gas	TBD
4.5	Soil	149+
4.7	Ground Water	82+
4.8	Ground Water	1 to 2
4.9	Sediment	TBD
	Surface Water	12
4.10	Air	36
4.11	Soil Gas	30
	Soil	7
4.12	Soil Gas	4
	Soil	3
4.13	Soil Gas	5
	Soil	1
4.14	Soil Gas	8
	Soil	3

USEPA CLP SOW - United States Environmental Protection Agency
Contract Laboratory Program Statement of Work
(Inorganics - July 1988, Organics - February 1988)

USEPA TCL - United States Environmental Protection Agency
Target Compound List (Organic and Inorganic Parameters including Boron).

TBD - To be determined based on dry wells identified as potential
contaminant sources

Radioactivity - Gross Alpha and Beta, any site-specific radio-nuclides.

Table 10. Sample Matrices Malta Rocket Fuel Area Superfund Site, Towns of Malta and Stillwater, Saratoga County, New York.

RI Work Plan Task #	Matrix	# of Samples
4.15	Soil Gas	33
	Soil	2
	Sediment	1
	Surface Water	1
4.16	Soil Gas	32
	Soil	7
4.17	Soil Gas	8
	Soil	2
4.18	Soil Gas	182
	Soil	22 to 44
	Surface Water	3
	Sediment	3
4.19	Soil Gas	14
	Soil	6
4.20	Soil Gas	TBD
	Sludge	6
	Soil	-6
4.21	Sediment	TBD
4.22	Soil Gas	39
	Soil	6

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contaminant sources

Radioactivity - Gross Alpha and Beta, any site-specific radio-nuclides.

Table 10. Sample Matrices, Malta Rocket Fuel Area Superfund Site, Towns of Malta and Stillwater, Saratoga County, New York.

RI Work Plan Task #	Matrix	# of Samples
4.23	Soil Gas	36
	Surface Water	1
	Sediment	5
4.24	Soil	2
	Surface Water	1
	Sediment	1
4.25	Soil Gas	TBD
	Soil	2
4.26	Soil Gas	TBD
	Soil	1
	Ground Water	3
	Sediment	~2
4.27	Soil	TBD
	Wipe	TBD
4.28	Soil Gas	TBD
	Soil	TBD
4.29	Soil Gas	TBD
	Soil	TBD
4.30	A plan for investigating the magazine area will be developed if it is determined that this area is a potential source area for contaminants.	

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TBD - To be determined based on dry wells identified as potential
contaminant sources

Radioactivity - Gross Alpha and Beta, any site-specific radio-nuclides.

Table 10. Sample Matrices, Malta Rocket Fuel Area Superfund Site, Towns of Malta and Stillwater, Saratoga County, New York.

RI Work Plan Task #	Matrix	# of Samples
4.31	Soil Gas	63
	Ground Water	5
--	Replicates	one per fifteen surface and ground water samples
	Field Blanks	1 per each day of split-spoon soil and wipe sampling*
--	Trip Blanks	1 per each shipment of samples except for soil gas
--	Mud Rotary Circulating Fluid	1

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USEPA TCL - United States Environmental Protection Agency
Target Compound List (Organic and Inorganic Parameters including Boron).

TBD - To be determined based on dry wells identified as potential
contaminant sources

Radioactivity - Gross Alpha and Beta, any site-specific radio-nuclides.

* Field blanks will not be obtained during sampling of ground-water, surface water,
surface soil, sediment, sludge and test pits since dedicated or disposable sampling
equipment will be used for collecting each sample. Soil-gas field blanks will be taken
after each substantially contaminated sample.

Table 11. Sample Containers and Preservation, Target Compound List (TCL) Parameters, Malta Rocket Fuel Area Superfund Site, Towns of Malta and Stillwater, Saratoge County, New York.

<u>Matrix</u>	<u>Parameter</u>	<u>Sample Container(s)</u>	<u>Preservative</u>
Water/Sludge	Volatile Organic Compounds	(3) 40 ml glass vials.	Hydrochloric acid.
Water/Sludge	Base Neutrals, Pesticides/PCBs	(3) 1 liter glass jars.	Unpreserved.
Water/Sludge	Metals including Boron	(1) 1 liter plastic jar.	Nitric acid.
Water/Sludge	Cyanide	(1) 1 liter plastic jar.	Sodium hydroxide and ascorbic acid.
Water/Sludge	Total Organic Carbon	(1) 1 liter plastic jar.	Sulfuric acid.
Soil/Sediment	Volatile Organic Compounds	(2) 40 ml glass vials.	Unpreserved.
Soil/Sediment	Base Neutrals, Pesticides/PCBs, Metals, Cyanide, Total Organic Carbon, TCLP.	(3) 250 ml soil jars.	Unpreserved.
Wipe	PCBs	(1) Silaneized wool (2) 40 ml glass vial of hexane	Hexane
Air	Metals, Particulates, Semivolatiles, Volatiles	(1) HiVol filter (1) PS-1 sample filter (1) Tenax tube	Unpreserved

Table 12. Current Occupational Airborne Contaminant Standards and Guidelines.

	<u>OSHA-PEL (PPM)</u>	<u>ACGIH (PPM)</u>
Carbon Tetrachloride	TWA-2	TWA-5, A2, Skin
Chloroform	2	TWA-10, A2
Trichloroethylene	TWA-50 STEL-200	TWA-50 STEL-200
Toluene	TWA-100 STEL-150	TWA-100 STEL-150

OSHA - Occupational Safety and Health Administration

PEL - Permissible Exposure Limit, 1989

ACGIH - American Conference of Governmental Industrial Hygienist

TLV - Threshold Limit Value

TWA - 8 Hour Time Weighted Average

STEL - 15 Minute Short Term Exposure Limit

PPM - Part Per Million

A(2) - Suspected Human Carcinogen

Skin - Absorbed through the Skin

Table 13. Contingency Plans for Potential Problems, Malta Rocket Fuel Area Site, Towns of Malta and Stillwater, Saratoga County, New York.

Potential Problem	Contingency Plan
Changes are made in program guidance.	Consult with EPA and incorporate appropriate new guidance into project deliverables.
Bad weather forces cancellation of scheduled sampling trip.	Reschedule CLP space and coordinate with EPA.
Scheduled work does not delineate extent of existing contamination.	Work with EPA to quickly scope alternative plan.
Soil gas survey is unreasonably extensive and does not delineate extent of existing contamination.	Work with EPA to quickly scope alternative plan.
CLP data are received late.	Work overtime when data are received to get back on schedule. Request preliminary data without review and do preliminary in-house QA/QC review. Adjust schedule if necessary.
Legal access or easements cannot be obtained.	Request assistance of EPA.
EPA deadlines move up.	Accelerate schedule with overtime, additional staff, dual tracking of project elements, or a combination of the three.
Data gathered in the remedial investigation provide unexpected results (contamination) much better or worse than expected, more contaminants detected, drums discovered, etc.	Schedule immediate review of facts with EPA and develop work plans amendment to cover changed scope of work and schedule.
Delay in procurement of subcontractor.	Accelerate schedule or extend deliverable schedule with overtime, additional drill rigs or select another bidder. Consult with EPA on schedule and adjustments.

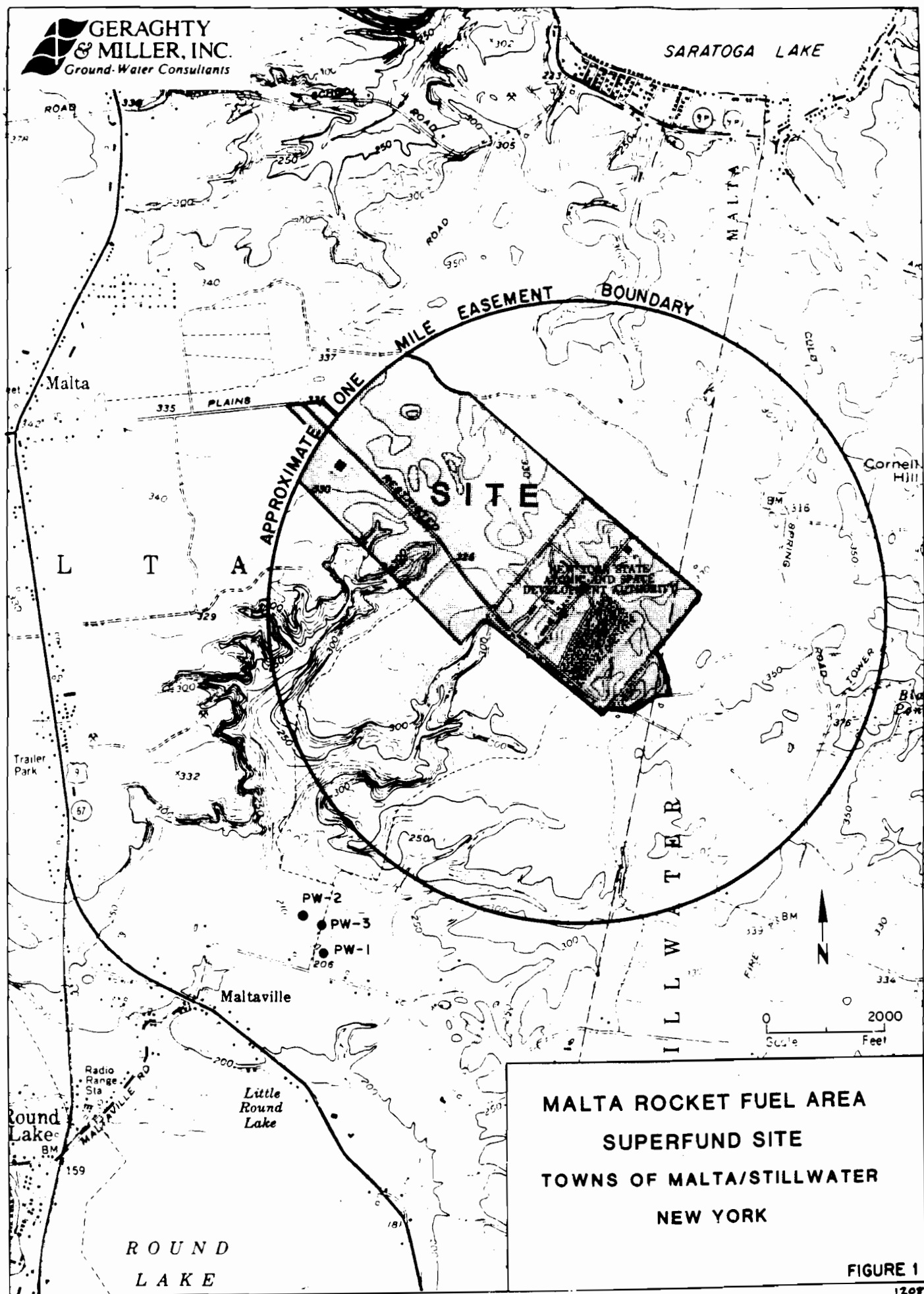
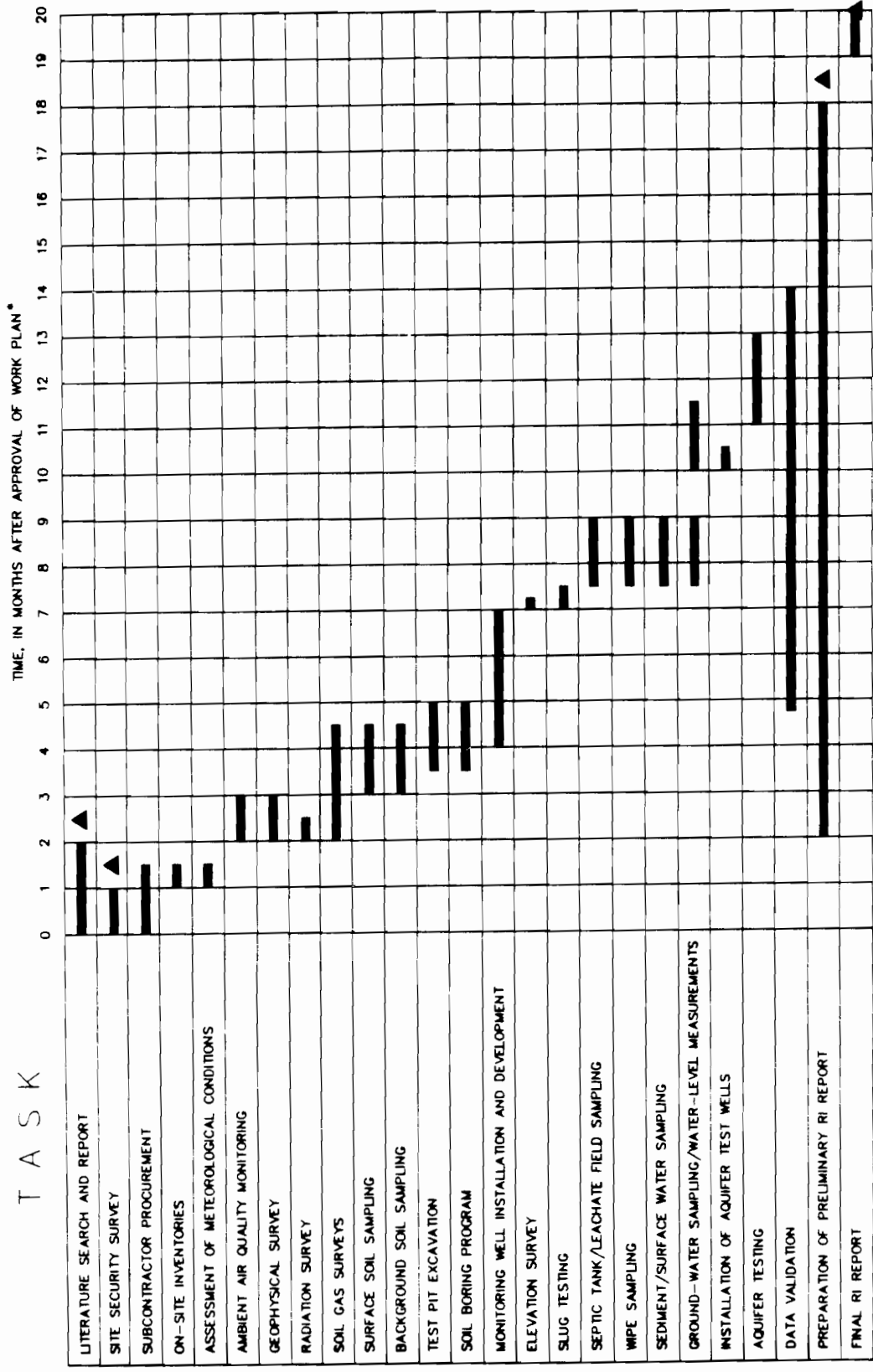


FIGURE 1

T A S K



* INCLUDES LABORATORY TURNAROUND TIME BUT DOES NOT SHOW TIME FOR AGENCY REVIEW

▲ DELIVERABLE

SCALE

TIME IN MONTHS AFTER APPROVAL



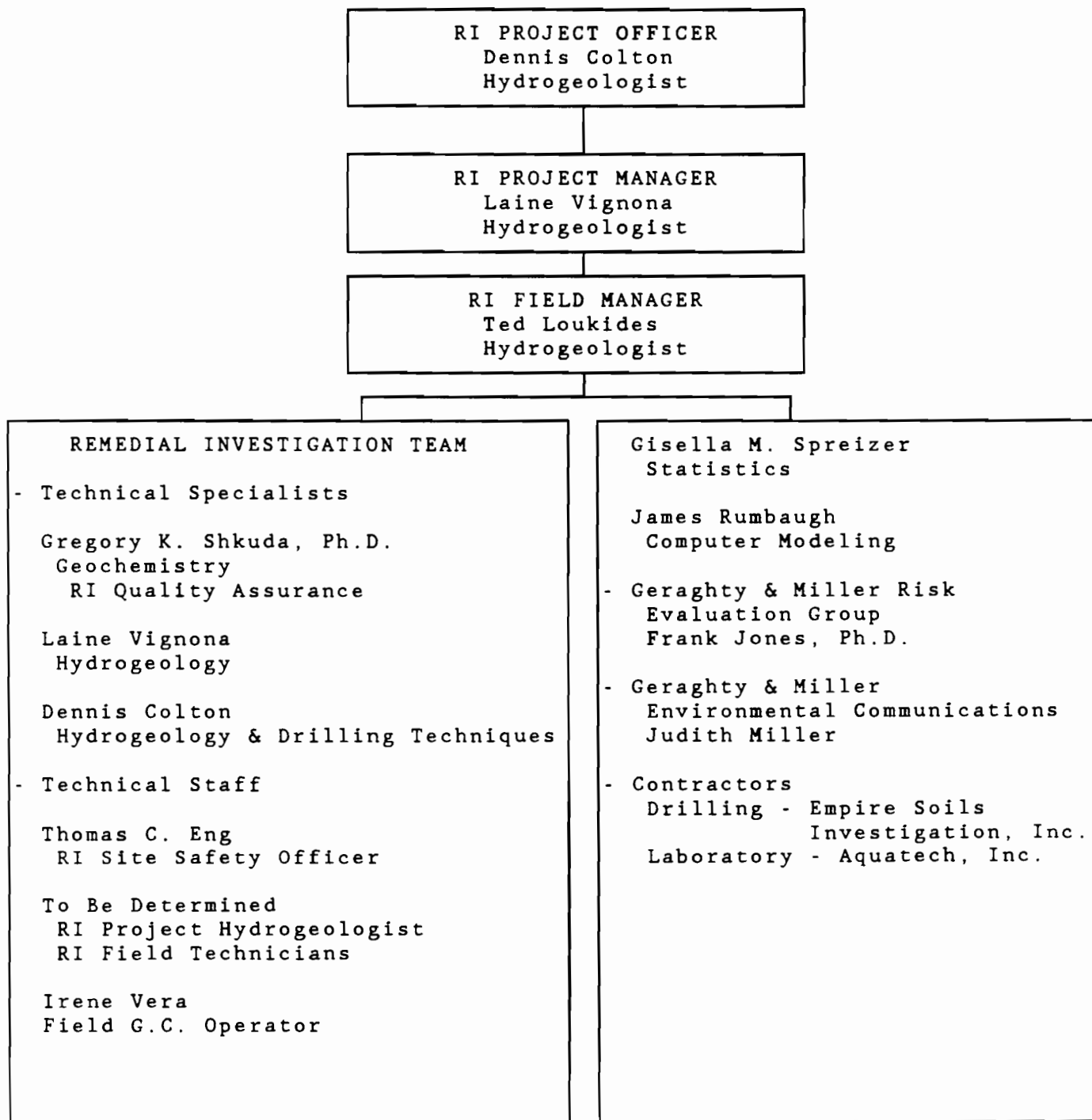
PROPOSED SCHEDULE OF REMEDIAL INVESTIGATION ACTIVITIES

MALTA ROCKET FUEL AREA
SUPERFUND SITE

FIGURE

6

Figure 7. Malta Rocket Fuel Area Project Organization



DRAFTER: GS

MGR.: LV

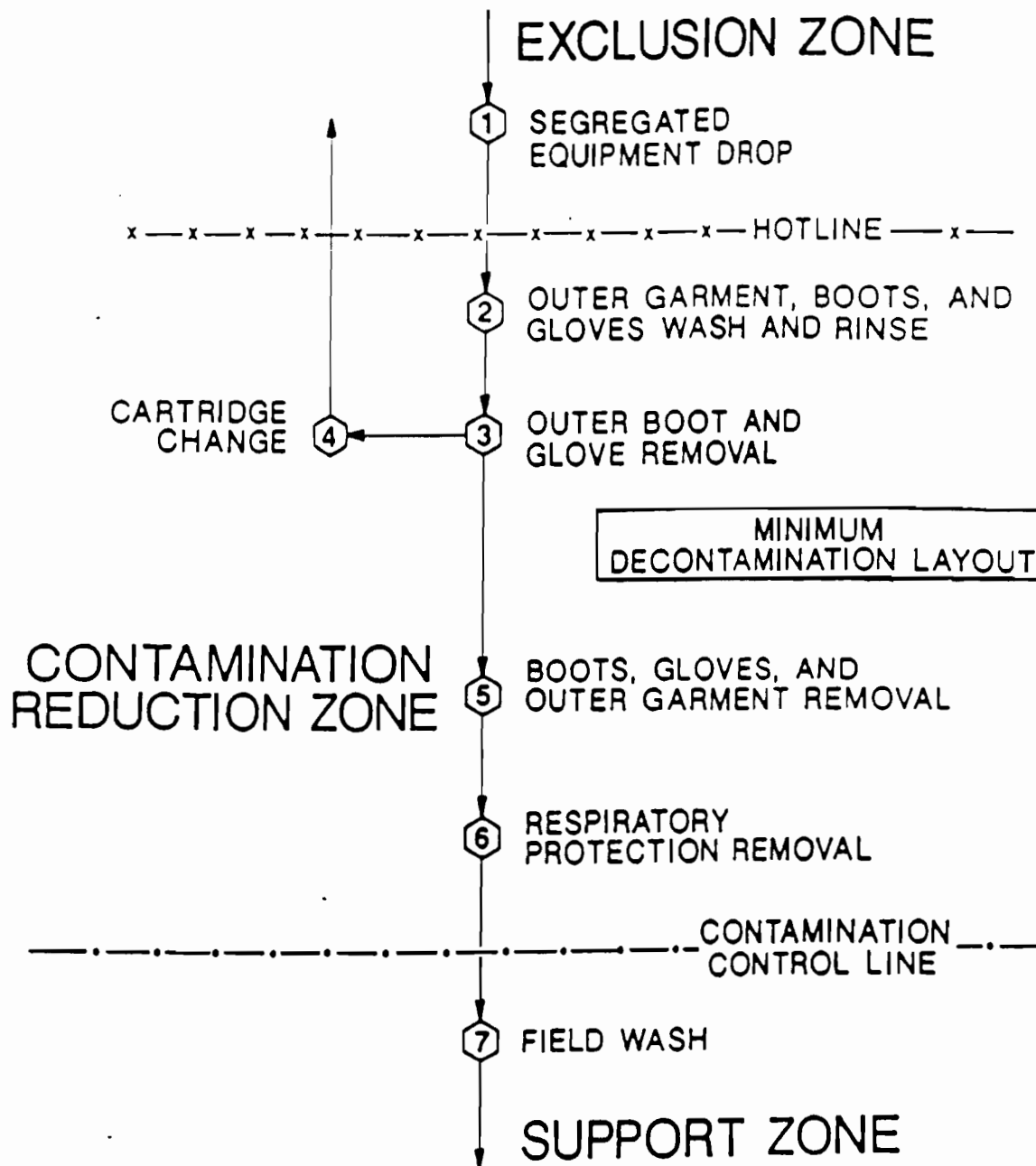
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CAD FILE: NON-CAD

FILE NO.: 1208

PRJCT. NO.: NYO4605

DATE: 3-7-91



SCALE



**GERAGHTY
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SITE WORK ZONES AND DECONTAMINATION PROCEDURE

GE

FIGURE

8

DRAFTER: GS

MGR.: LV

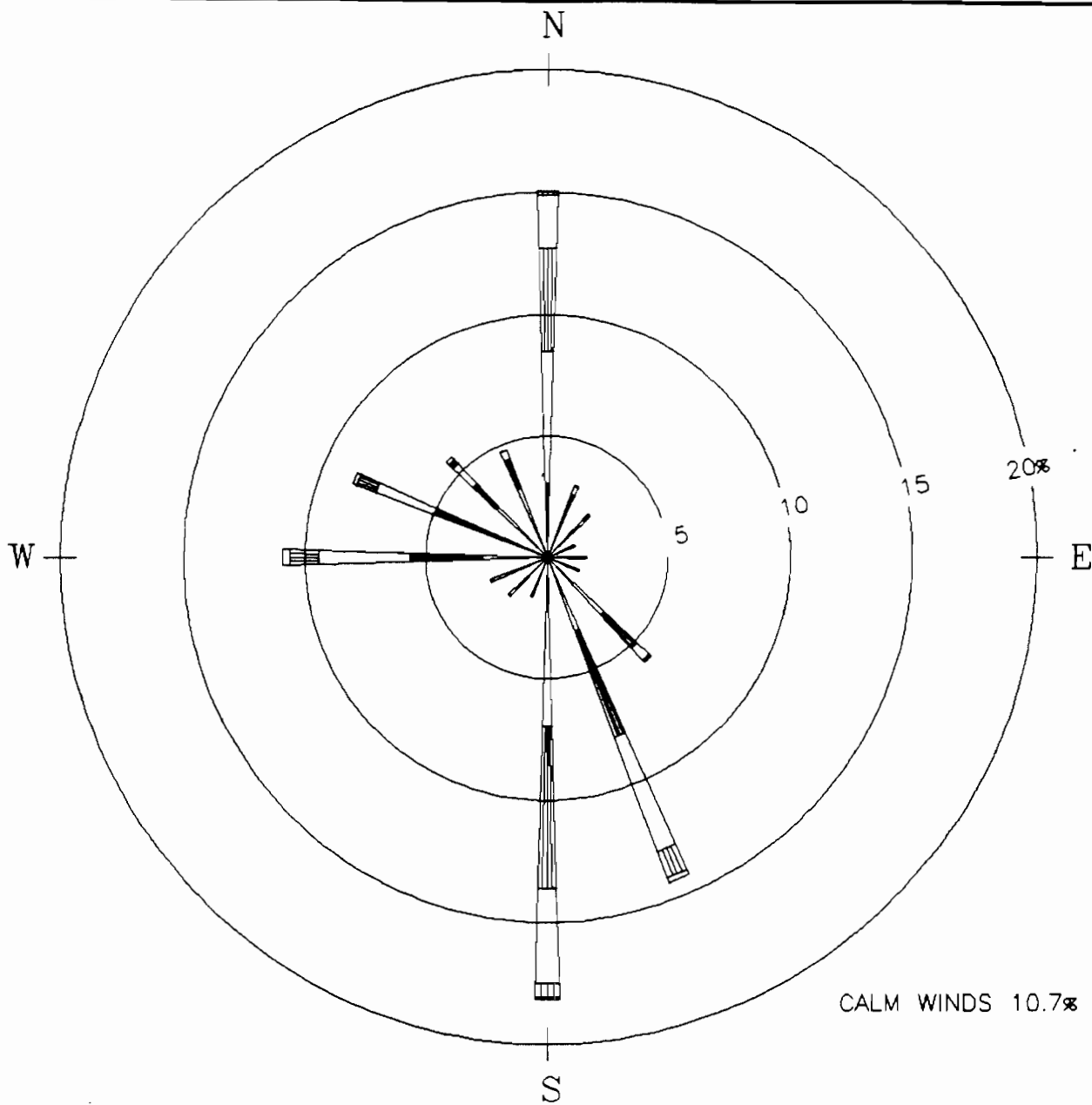
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FILE NO.: 1208

PRJCT. NO.: NY04605

DATE: 3-7-91



CALM WINDS 10.7%

WIND SPEED CLASS BOUNDARIES
(MILES/HOUR)

NOTES:

DIAGRAM OF THE FREQUENCY OF OCCURRENCE FOR EACH WIND DIRECTION. WIND DIRECTION IS THE DIRECTION FROM WHICH THE WIND IS BLOWING. EXAMPLE - WIND IS BLOWING FROM THE NORTH 15.1 PERCENT OF THE TIME.

SCALE



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WINDROSE DIAGRAM FOR 1989 AT STATION
NUMBER 14735, ALBANY, NEW YORK

GE

FIGURE

9

