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New York State Department of Environmental Conservation

MEMORANDUM

TO: Ajay Shah, RHWRE, Region 1 - Stony Brook
FROM: Marsden Chen, Bureau of Eastern Remedial Action
SUBJECT: Hooker Ruco Site ID No. 130004

DATE: January 2, 1996

Attached is a copy of the remedial design work plan for the Hooker Ruco site.

Please have staff review this document and provide your comments to Kamal Gupta, of my staff, by January 19, 1996.

If you have any questions, please contact him at (518) 457-3976.

Attachment

Marsden Chen

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HAZARDOUS WASTE REMEDIATION
REGION 1

Occidental Chemical Corporation

REMEDIAL DESIGN WORK PLAN FOR OPERABLE UNIT-1

REVISION 1

Hooker/Ruco Site
Hicksville, New York

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HAZ[illegible] WASTE REMEDIATION
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WASTE REMEDIATION

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Occidental Chemical Corporation

REMEDIAL DESIGN WORK PLAN FOR OPERABLE UNIT-1

REVISION 1

Hooker/Ruco Site
Hicksville, New York

OCTOBER 1995
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CONESTOGA-ROVERS & ASSOCIATES

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LIST OF ACRONYMS

1,2-DCE	cis-1,2-dichloroethylene
AGCs	Annual Guideline Concentrations
ARARs	Applicable or Relevant and Appropriate Requirements
bgs	Below Ground Surface
CERCLA	Comprehensive Environmental Response, Compensation and Liability Act
CLP	Contract Laboratory Protocols
CWA	Clean Water Act
DQOs	Data Quality Objectives
EPA	U.S. Environmental Protection Agency
FS	Feasibility Study
gpm	gallons per minute
HASCP	Health and Safety/Contingency Plan
KGD	Ketone, Glycol and Diol
LDR	Land Disposal Restrictions
NCDH	Nassau County Department of Health
NPDES	National Pollutant Discharge Elimination System
NYCRR	New York Compilation of Rules and Regulations
NYSDEC	New York State Department of Environmental Conservation
O&M	Operations and Maintenance
OU-1	Operable Unit - 1
OxyChem	Occidental Chemical Corporation
PCE	Perchloroethylene
PID	Photoionizaton Detector
QAPP	Quality Assurance Project Plan
RA	Remedial Action
RD	Remedial Design
RDWP	Remedial Design Work Plan
RI	Remedial Investigation
ROD	Record of Decision
RSCs	Ruco Site Chemicals
SAMP	Sampling, Analysis and Monitoring Plan
SGC's	Short Term Guideline Concentrations
SIP	State Implementation Program
Site	Hooker/Ruco Site
SMP	Site Management Plan
SOW	Statement of Work
SPDES	State Pollutant Discharge Elimination System
TBC	To Be Considered
TCE	Trichloroethylene
TICs	Tentatively Identified Compounds
TSWP	Treatability Study Work Plan
VOCs	Volatile Organic Compounds

1.0 INTRODUCTION

The purpose of this Remedial Design Work Plan (RDWP) is to describe the tasks which were to be completed for Operable Unit - 1 (OU-1) during the design process for the remedy for the Hooker/Ruco Site (Site) located in Hicksville, New York (see Figure 1.1). A Site plan is shown on Figure 1.2. The remedy was described in the Record of Decision (ROD) for the Site dated February 16, 1994. The major components of the remedy include:

i) installation and operation of a groundwater extraction system and treatment system to prevent further off-site migration, with on-site discharge to groundwater;
ii) treatability study for on-site groundwater;
iii) monitoring of the groundwater extraction system and the treatment system discharge;
iv) soil flushing in Sump 1;
v) excavation and off-site disposal of soils in the former drum storage area;
vi) further investigations of site soils in the vicinity of MW-E and in Sump 2; and
vii) institutional controls.

The ROD also included the following as components of the Remedial Action (RA);

i) additional analysis of tentatively identified compounds (TICs) in the soil and groundwater to identify the classes of compounds that comprise the TICs; and

ii) a treatability study for soil flushing.

Based on the review of the available information regarding TICs and the results of the testing method using samples from the Site, Occidental Chemical Corporation (Oxy Chem) believes that the TICs still unidentified represent a small component of the total TIC's. Thus, the TIC list is sufficiently complete and additional analysis is not required.

With respect to the soil treatability study, OxyChem believes that due to the high solubility of the majority of the TICs, these compounds will be readily removed from the soils and that a treatability test to evaluate the effectiveness of soil flushing is not required.

The remedy for the Site was based on a Feasibility Study (FS) prepared by OxyChem in August 1993 and the ROD dated January 1994. The Draft RDWP was submitted to the U.S. Environmental Protection Agency (EPA) in September 1994 and EPA comments were received on September 18, 1995. This document has been revised pursuant to the EPA comments and also to accommodate results of the Beyond the Ruco Property investigations which were presented in the report entitled,

"Interim Report
Groundwater Investigations Beyond
The Ruco Property
June 1995".

The groundwater component of the OU-1 remedy was focused on the removal and on-Site treatment of TICs by pumping groundwater from a depth of approximately 140 feet below ground surface (bgs) at the downgradient boundary of the Site.

Since submission of the RDWP, additional investigations have detected the presence of volatile organic compounds (VOCs), principally trichloroethylene (TCE), perchloroethylene (PCE), cis-1,2-dichloroethylene (1,2-DCE), and vinyl chloride in the groundwater at greater depths with the highest concentrations detected in the interval from 220± to 320±feet bgs.

Discussions held with the EPA subsequent to obtaining the additional data have revised the objective of the OU-1 remedy groundwater component to include the VOCs present at the greater depth. Thus, the purpose of this revised RDWP is to describe the tasks which will be completed for OU-1 based on the revised objective for the groundwater component.

The following sections present a summary of the activities which must be performed prior to completion of the Remedial Design (RD). The activities have been separated into three sections dealing with groundwater, bench-scale treatability studies, and further definition of Site soils. The tasks and the RD will be undertaken to comply with the intent of the ROD using appropriate EPA guidance documents. The design of the groundwater treatment system is dependent on the completion of bench-scale treatability studies. A Treatability Study Work Plan (TSWP) for conducting the bench-scale treatability studies is included as Appendix D. The other activities (further soil definition and groundwater testing) are presented in sufficient detail to permit the work to proceed upon approval of this document.

The results of the above predesign activities will be submitted to the EPA in the Remedial Design Investigation Report.

The RD tasks are presented to illustrate the items which will be addressed in the RD reports for the soil and groundwater.

1.1 FIELD ACTIVITIES

Field activities will be required to provide data to complete the designs for both the groundwater and soil remedies.

1.1.1 Groundwater Hydraulics

To determine the pumping rate required which will optimize hydraulic control and minimize the volume of water to be treated, it will be necessary to complete the following tasks:

i) install an extraction well;

ii) perform a variable rate pumping test; and
iii) perform a constant-rate pumping test.

These tasks will be completed before the on-Site treatment system is constructed and will be used to assist in the design of the treatment system.

The data obtained from the completion of these field activities will be used to verify the groundwater flow model results presented in Appendix C and to determine the pumping rate necessary to achieve the system objective of minimizing off-site migration of groundwater.

1.1.2 Treatability Studies

To design an effective groundwater treatment system for the compounds of concern, (i.e., TIC's, 1,2-DCE, TCE, PCE, and vinyl chloride) bench-scale treatability studies will be performed. Primary treatment process testing will review liquid phase carbon adsorption, ultra-violet (UV) light/chemical oxidation, air stripping, intrinsic bioattenuation, and any other suitable process retained through a screening process. Pre-treatment testing will also be carried out to address potential solids issues typically associated with air stripping. Alternate technologies to achieve the intent of the ROD will be evaluated during the design phase.

To assist in the design of the treatability studies, groundwater will be obtained from wells J1, J2, MW-50D1 and MW-50D2 and analyzed. Additional water will be obtained from J1, J2, MW-50D1 and MW-50D2 for use in performing the Treatability Study.

1.1.3 Delineation of Site Soils for Remediation

The following pre-design activities will be completed:

i) soil sampling and analysis in the vicinity of Test Boring 10 (TB-10) in the former drum storage area;
ii) soil sampling and analysis in the vicinity of MW-E; and
iii) soil sampling and analysis in Sump 2.

These tasks will be completed to provide data necessary to determine:

i) the location of the soil flushing system;
ii) the extent of soils in the former drum storage area to be excavated;
iii) the need for soil removal in the vicinity of MW-E, and, if necessary, the extent of soils to be excavated; and
iv) the proper disposal of excavated soils.

2.0 FIELD TASKS FOR GROUNDWATER HYDRAULICS

Field activities will consist of extraction well installation and pumping tests to establish hydrogeologic parameters and water-quality information. Each of these preliminary investigations are detailed in the following subsections.

The RA concept presented in the ROD was to control the off-site migration of TIC's detected in the Site soils and shallow groundwater (≤140 ft bgs). The subsequent detection of VOCs in the groundwater at greater depths, with the highest VOC concentrations detected in the interval from 220± to 320± feet bgs, resulted in the need to modify the ROD remedial objectives to address this chemical presence.

The revised objective of the groundwater extraction system includes the prevention of groundwater migration beyond the property boundary by extracting groundwater from these greater depths as well as from the shallower depths to address the TIC presence in the shallower groundwater. The results of the groundwater flow model presented in Appendix C show that these objectives may be achieved by pumping the deeper groundwater (180 to 400 ft bgs) at a rate of approximately 550 gpm (gallons per minute) from the location of well MW-50 and the shallower groundwater (90 to 150 ft bgs) at a rate of approximately 100 gpm in the southeast portion of the Site. The model was based on assumed aquifer coefficients described in Appendix C. Actual pumping rates will be determined based on the pumping test results and by field testing during the startup and optimization of the system.

The following elements will be completed as field tasks, and the results will be used for the bench-scale treatability studies and in the final design process.

2.1 WELL DESIGN

Based on water-quality data obtained from well MW-50 (see Table 2.1) and the results of the groundwater model presented in Appendix C, it is anticipated that two extraction wells will be required, one approximately screening the interval from 180 to 400 feet bgs, and the other screening the interval from approximately 70 to 150 ft bgs. Blank sections of pipe will be used adjacent to clay layers encountered during extraction well installation.

Optimal well screen design is normally developed by conducting sieve analyses of representative soil samples, and then designing the screen and associated gravel pack to retain a specific fraction of the formation. At the Site, however, the wells are not being designed to provide the maximum available water; they are being designed to yield only the amount of water necessary to capture the on-site groundwater.

As a field task, soil samples obtained during installation of well nest MW-52 will be submitted for sieve analysis. The samples will be collected at approximately 200, 250, 300, 350 and 400 feet bgs. The results will be used to verify the design for the deep well specified in this RDWP. Well design specifications are presented in Appendix A. During installation of the shallow well as part of the RA, samples will be collected at approximately 90 and 130 ft bgs from the shallow well borehole for sieve analysis to verify the design of the shallow well.

2.2 PUMPING TESTS

An extraction well will be installed in the vicinity of MW-50, per the drilling method and design presented in Appendix A. After the well has been developed to insure a clear discharge, a step-rate pumping test will be run on the well to determine its efficiency. Test specifications are presented in Appendix A.

Based on the results of the step-rate test, a pumping rate will be determined for a constant-rate test (see Appendix A). The purpose of the constant-rate pumping test will be to assess the response of the aquifer to a pumping stress. Results of the test analysis will be used to design the shallow well and to adjust the pumping rate of the deep well such that capture of the Site groundwater will be achieved. The test data will be analyzed using distance drawdown and time-drawdown relationships to arrive at Site-specific aquifer coefficients. These, in turn, will be incorporated into the groundwater model to refine its ability to predict zones of capture for various pumping rates.

Due to the anticipated high pumping rates of the step-test and constant rate pumping test (up to 600 gpm and 500 gpm, respectively), storage of the treated groundwater is not physically practical (e.g. the 72-hour constant rate pumping test would generate 2,160,000 gallons of extracted groundwater). Thus, direct discharge of the treated groundwater to recharge basins is required in order to perform the pumping tests.

The results of the groundwater treatability study are required prior to performing the pumping tests so that an appropriate temporary treatment system can be used to treat the extracted groundwater. In addition, an evaluation of the capacity of the existing sumps for recharge and the new recharge basin to be constructed in the western plant area will be performed. Prior to performing the evaluation of the new recharge basin, four 20-foot deep boreholes will be installed in the area of the proposed recharge basin to determine the soil conditions in this area. The design of the temporary treatment system and new recharge basin will be submitted to the EPA for approval prior to performing the pumping tests.

2.3 ANALYTICAL REQUIREMENTS

Prior to performance of the groundwater treatability study, wells J1, J2, MW-50D1, and MW-50D2 will be sampled and analyzed for the parameters shown on Tables 2.2, 2.3, 2.4 and 2.5 for characterization of the anticipated influent stream to the treatment system and to assist in finalizing the design of the treatability study. Additional water will be collected from wells J1, J2, MW-50D1, and MW-50D2 to perform the treatability study.

During the constant-rate pumping test, water samples will be obtained at 24, 48 and 72-hour intervals from both the influent to and effluent from the temporary treatment system for confirmation of the anticipated influent stream to the permanent treatment system and treatment efficiency of temporary treatment system. The samples will be analyzed for the parameters shown on Tables 2.2, 2.3, 2.4 and 2.5.

The selected chemical list on Tables 2.2, 2.3 and 2.4 will be analyzed using Contract Laboratory Protocols (CLP) - Statement of Work (SOW) 7/93, OLM 01.9 (7/93) for organics and ILM 03.0 (2/93) for inorganics except for hexavalent chromium which will be analyzed using SW-846 Method 7197 as shown in the Work/QA Plan Short Form included with Appendix E.

CLP methodology is not capable of identifying nor quantifying non-target compounds in the groundwater at the Site. OxyChem developed a list of Ruco Site Chemicals (RSCs) using the Remedial Investigation (RI) results, raw materials used at the facility, and past knowledge. The list is comprised of various ketone, glycol and diol compounds (Table 2.5). The RSC list of compounds is considered sufficiently complete and comprehensive. The analytical procedure for determination of the RSC's in soil and groundwater is presented in Appendix E and is called the KGD method. It is considered that the KGD method meets the data quality objectives (DQOs) of the program.

3.0 TREATABILITY STUDIES

Bench-scale treatability studies will be conducted for the groundwater using selected technology from the following list: metals pretreatment, UV light/chemical oxidation, carbon adsorption, air stripping, intrinsic bioattenuation, and/or any others that a search suggests are applicable. In each case, the treatability study will be designed to assess the effectiveness of removing the Site chemicals from the groundwater and to provide data and parameter values that will enable design of a full-scale treatment system. The influent, or raw, water for all treatability study tests will consist of water obtained from monitoring wells J1, J2, MW-50D1 and MW-50D2. The treatability studies will be used to evaluate preferred alternatives that will achieve the Remedial Action objectives of the ROD while minimizing the life-cycle costs and operation and maintenance costs of the system. A TSWP is submitted as Appendix D of this RDWP. Bench-scale testing will be implemented after approval of the RDWP.

Bench-scale treatability studies to determine the effectiveness of metals pretreatment technologies may include conventional precipitation, co-precipitation, or other technologies.

Primary treatment technologies to be tested at the bench scale may include UV light/chemical oxidation, air stripping and/or carbon polishing.

In all cases, OxyChem's objectives will be to meet the intent of the ROD while minimizing operational labor requirements, minimizing sludge generation and handling requirements, and minimizing life cycle costs. After the conclusion and evaluation of the bench-scale tests, scale- up calculations will be completed to identify full-scale operation requirements.

Based on the type of groundwater treatment technologies selected, it may be necessary to perform an air pathway analysis to evaluate the need for off-gas controls.

If required, an air pathway analysis will be conducted in accordance with EPA Air/Superfund National Technical Study Guidance Series methods to assess the potential maximum air emissions from the selected groundwater treatment system alternative.

The sources of air emissions may include an air stripper, aeration tanks, and other tanks or transfer vessels. The potential maximum air emissions from those sources will be estimated using a worst-case mass balance approach.

The estimated air emissions will be evaluated with respect to Applicable or Relevant and Appropriate Requirements (ARARs) (see Section 6.0), including potential emission control technology requirements.

The off-site impact of the estimated maximum actual emissions from the groundwater treatment system will be assessed using the EPA SCREEN2 screening air dispersion model to calculate the potential maximum ground level concentrations. The estimated ground level concentrations will be compared to applicable exposure criteria, including New York State Short Term Guideline Concentrations (SGCs) and Annual Guideline Concentrations (AGCs) and risk-based allowable exposure levels.

4.0 DESIGN TASKS FOR GROUNDWATER TREATMENT SYSTEM

Design tasks for the groundwater treatment system will be presented in the 30 percent design document to be submitted two months after completion of the bench-scale treatability study and pumping tests. Included in the 30 percent design document will be an evaluation of potential vapor phase treatment technologies to achieve compliance with the ARARs should the selected groundwater treatment technology generate an air discharge which requires treatment.

The following elements will be incorporated into the 30 percent Design document:

i) pipe sizes and materials of construction;
ii) trenches;
iii) concrete slabs, foundations and well vaults;
iv) electrical;
v) building construction;
vi) secondary containment;
vii) equalization tank;
viii) treatment processes;
ix) winterization;
x) discharge concentrations;
xi) discharge to groundwater;
xii) initial testing program;
xiii) long-term monitoring program;
xiv) operation and maintenance plan; and
xv) photographic documentation plan.

5.0 FIELD INVESTIGATIONS AND DESIGN CRITERIA FOR SITE SOILS

5.1 EXISTING DATA

The RI, combined with previous studies, has resulted in the characterization of the environmental condition of the Site. The EPA has identified the shallow (0 to 5 ft bgs) soils in the former drum storage area (TB-10), the vicinity of MW-E, and deeper (+10 ft bgs) soils in Sump 2 as possibly requiring remedial action. The results of the field investigation soil sampling will be used to determine if further action in any of the identified areas is warranted. These areas are shown on Figure 5.1.

5.2 SELECTED SOILS REMEDY

The major components of the selected remedy for the Site soils include:

i) excavation of the soils in the vicinity of TB-10 in the former drum storage area and shipment to an approved off-site disposal facility;

ii) if field testing results show PCE concentrations in the vicinity of MW-E at concentrations that are greater than the New York State Department of Environmental Conservation (NYSDEC) protection of groundwater quality guidelines, then excavation of impacted soils and shipment of the material to a proper off-site disposal facility; and

iii) if field testing of deep soils in Sump 2 show site chemicals present in the soils that are greater than the NYSDEC protection of groundwater quality guidelines, then the soils in Sump 2 will be addressed by soil flushing. The soils will be flushed with a portion of the discharge of treated groundwater. The method of discharging the treated water (and amount/volume) will be determined in the design phase.

5.3 FIELD INVESTIGATIONS OF SITE SOILS

The field investigations to assess the three identified areas will include shallow subsurface soil borings, split-spoon sampling, field screening, and analytical testing. Additional investigations of the shallow soil in the former drum storage area near TB-10 and the area around MW-E, and the deeper soils beneath Sump 2, will be completed as field tasks to determine which of the identified areas may require remedial measures for the protection of groundwater quality.

5.3.1 Former Drum Storage Area

The shallow (0 to 5 ft bgs) soil in the former drum storage area may be a potential source area of RSCs (see Table 2.5). The shallow soils in the vicinity of TB-10 contained RSCs at 1,600 mg/kg (milligrams per kilogram) in the 0 to 2-foot bgs sample, and at 2,400 mg/kg in the 3 to 5-foot bgs sample. Test borings in close proximity to TB-10 contained RSC concentrations less than 100 mg/kg. The shallow soils in the vicinity of TB-10 will be further investigated for the RSCs.

Four shallow (0 to 5 ft bgs) test borings will be drilled at locations 10 feet north, east, south and west of TB-10. Soil samples will be collected for analysis at a depth of 0 to 2 feet bgs and 3 to 5 feet bgs at each location. The soil samples will be analyzed for the RSCs.

5.3.2 MW-E

The shallow (0 to 5 ft bgs) soils in the vicinity of MW-E may contain PCE at concentrations that may be above the NYSDEC guideline of 1.4 mg/kg for the protection of groundwater quality. A soil sample obtained from 0.5 to 2.0 ft bgs in 1983 contained PCE at a concentration of 244 mg/kg. The soil samples collected from 5 ft bgs, 25 ft bgs and 50 ft bgs were below the to-be-considered (TBC) soil clean-up value for PCE (1.4 mg/kg).

The shallow soils in the vicinity of MW-E will be further investigated for selected organic compounds (Table 2.2).

A shallow (0 to 5 ft bgs) test boring will be drilled immediately adjacent and east (within 5 feet) of MW-E. Soil samples will be collected for analysis at a depth of 0 to 2 feet bgs and 3 to 5 feet bgs. The soil samples will be analyzed for selected organic compounds (Table 2.2) on a priority basis (verbal results within 48 to 72 hours). If, based on the priority results, PCE is detected at levels greater than the TBC soil clean-up value of 1.4 mg/kg, then additional shallow test borings (0 to 5 ft bgs) will be drilled 10 feet north, east and south of MW-E to define the extent of soil which may require remediation. The shed located immediately adjacent to MW-E prohibits drilling of exploratory test borings in a westerly direction. Soil samples in the expanded test boring pattern, if required, will be collected from 0 to 2 feet bgs and 3 to 5 feet bgs. The soil samples will be submitted for analysis of selected organic compounds (Table 2.2).

5.3.3 Sump 2

The deeper soils beneath Sump 2 (10 feet below the sump bottom) to the groundwater table; (approximately 35 ft below the sump bottom) is an area of the Site that requires further investigation. Analytical results of samples collected during the 1989 RI from Sump 2 showed low levels, less than 0.5 mg/kg, of PCE and the concentrations of PCE decreased with respect to increasing depth. The soil within the first 10 feet in Sump 2 was not identified as a potential source area and the concentration of PCE was below the TBC soil clean-up value for PCE. However, samples from an earlier test boring completed in Sump 2 during 1983 did contain elevated concentrations of PCE at depths greater than 10 feet below the base of Sump 2.

One test boring will be drilled in the center of Sump 2 and will extend from the base of the sump to the groundwater table (approximately 35 feet below the sump bottom). Soil samples will not be collected within 10 feet of the base of Sump 2 since these soils were assessed during the RI and found to be of acceptable quality. At least three soil samples will be collected between 10 ft bgs and the groundwater table. Samples selected for analysis will be based on the following:

i) three samples with the highest headspace screening readings will be selected for analysis;

ii) one of the three samples will be collected of the deep soils, 30 feet or deeper below the base of the sump; and

iii) one of the three samples collected will be a visibly stained sample (if available).

All soil samples collected from Sump 2 will be analyzed for selected organic compounds and RSCs (Tables 2.2 and 2.5).

5.3.4 Soil Sampling

All soil borings will be drilled using hollow-stem augers. Split-spoon sampling will be completed on a continuous basis from land surface to the completion depth of the boring. Selected samples will be submitted for chemical analysis. The remainder of the samples selected for chemical analysis and the other samples not selected for chemical analysis will be retained for geologic record. The split-spoon sampler will be a 3-inch diameter sampling device to ensure sufficient quantity of material for the requested analysis. A representative portion of each split-spoon sample will be placed in a labeled clean glass jar and be subjected to a headspace screening with a calibrated photoionization detector (PID). The daily calibration procedure for the PID and the headspace screening procedure are presented in Appendix A. All samples for analysis, other than volatile organics, will be homogenized in the field in accordance with procedures presented in Appendix A. The soil sampling equipment will be cleaned according to procedures presented in Appendix A.

Field blanks will be collected from the soil sampling equipment to demonstrate the effectiveness of the cleaning procedures. Field blanks will be collected by pouring demonstrated analyte-free deionized water through/over the sampling equipment, including the spoon and pan used for homogenization, and collecting the rinsate in appropriate laboratory containers. Field blanks will be collected from each piece of sampling equipment at the beginning of each work day that the equipment is used. Field blanks will be analyzed for the same parameters as samples collected that day.

5.3.5 Equipment Cleaning

All drilling equipment and monitoring well casings, risers, and screens will be cleaned using the protocols in Appendix A, Section 6.0.

5.3.6 Disposal of Drill Cuttings

Disposal of drill cuttings will be performed using the protocols in Appendix A, Section 7.0

5.4 TASK PLAN FOR THE REMEDIAL DESIGN/REMEDIAL ACTION OF SITE SOILS

The following section presents the basic strategies for implementing the selected remedy for the shallow and deep soil areas of the Site and the steps to be undertaken to satisfy the remedial goals and DQOs for the Site restoration. Further definition of the steps that will be taken for the shallow soils in the vicinity of MW-E and the deep soils beneath Sump 2 will be provided after completing the field investigation tasks. The RD report for Site soils will be submitted eight months after approval of this RDWP.

5.4.1 Mobilization

Mobilization of all required equipment, including excavation machines, storage facilities and a decontamination pad will be coordinated and assigned to specific areas of the Site selected for their proximity to the work areas and to minimize disruption of plant activities. During mobilization, specific site control measures will be used to limit access to the exclusion zones in the excavation areas. A pre-excavation meeting will be held to ensure that all personnel are familiar with the Health and Safety/Contingency Plan (HASCP) (see Appendix B) and are aware of their specific responsibilities and chain-of-command for field decisions.

5.4.2 Excavation

The former drum storage area and possibly the shallow soil in the vicinity of MW-E will require excavation. Each area that will require remediation will be staked out in the field. A site map showing the extent, both horizontally and vertically, will be prepared after completing the pre-design investigative tasks. The excavation of all shallow soil areas will be completed in the following manner:

i) Excavation by machine and/or hand will continue until the desired excavation depth is achieved. Desired excavation depths will be determined based upon the results of the pre-design investigation. The Ruco cooling water loop, a series of two 8-inch transite pipes extends along the properties eastern boundary near both the former drum storage area and MW-E. If necessary, extreme care will be taken when exposing these utilities, if they are expected to be within the excavation area. Hand digging, if required, will be employed to minimize physical damage to the utilities.

ii) Designated completion depths will be determined in the field by direct measurements.

iii) All soil excavated will be immediately transferred to containers for direct shipment off-site, with little or no storage of the soil on-site.

iv) Pre-excavation samples will be collected in accordance with procedures that will be outlined in the Sampling, Analysis and Monitoring Plan (SAMP) modified as required during the RD for the Site soils.

5.4.3 Shoring

Shoring requirements and volume calculations are the primary design components for the excavation of the former drum storage area. Shoring requirements (i.e., sidewall stability) will be determined using standard design criteria. The design requirements identified in this analysis will be presented to a shoring subcontractor and an appropriate type and quantity will be specified. Volume calculations for the soil removed during the excavation will be determined using the method of equal depth contours.

5.4.4 Erosion Control

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

5.4.5 Disposal

Off-site treatment and/or disposal of the excavated soil will comply with the ARARs. Notification prior to transport and disposal will include a written statement of the following:

i) name and location of the facility which will receive the soil;
ii) types and quantities of material;
iii) the expected shipping schedule; and
iv) method of transport.

5.4.6 Site Restoration

Restoration of any excavation will include regrading, and where necessary, backfilling and drainage to control storm-water runoff. Open excavations will be backfilled and compacted in appropriate lifts to provide acceptable stability. All restoration will be to pre-existing conditions.

5.5 CONTINGENCY PLAN

A contingency plan will be included in the RD report to respond to conditions, which if present, would require halting or revising the soils remediation.

5.6 FIELD SAMPLING

Based upon the data requirements and DQOs, a variety of samples will be collected during the soil remediation. The following subsections outline the sampling activities and define the rationale for each sampling program. Detailed field sampling procedures for the individual sampling programs will be outlined in the SAMP, modified as required during the RD.

5.6.1 Real-Time Monitoring

Site conditions will be monitored during the excavation and soil flushing activities. Air monitoring will be conducted for particulates, and volatile vapors during active excavation activities. Volatile vapor monitoring will be periodically performed during the implementation of the soil flushing program. The exact air monitoring locations will be determined in the field, but at a minimum, include one upwind and two downwind locations. Monitoring results will be used to evaluate on-site health and safety conditions. The monitoring locations and frequencies are presented in the HASCP (Appendix B).

5.6.2 Waste Characterization Samples

Representative samples of the soil that will be excavated will be collected in advance of the construction activities during the field investigation phase. The number and type (e.g., composite or grab) of samples collected will be representative of the area to be excavated and will be in accordance with the TSDF requirements. The samples will be analyzed for waste characterization requirements of 40 CFR 261 and 6NYCRR 371 to determine proper disposal of the excavated soil. If the soils are characterized as hazardous, the material will be disposed of at a RCRA "Subtitle C" landfill. If the soils fail RCRA characteristics for land disposal restrictions (LDR) (40 CFR 268), the soil will be pretreated prior to disposal to meet LDRs. If the material is characterized as non-hazardous, the soil will be properly disposed of off-site at a RCRA "Subtitle D" landfill.

5.6.3 Pre-Excavation Samples

Pre-excavation soil sampling will be completed in the field investigation phase to define the depth and lateral extent of the soils to be excavated and disposed off Site. The pre-excavation samples fulfill the need for confirmatory soil sampling and analysis. Pre-excavation samples will include two samples collected from beneath the target depth of each excavation. In the former drum storage area (TB-10), the pre-excavation samples will be compared to the TBC NYSDEC Technical Administrative Guidance Memorandum level of 50 mg/kg for each RSC. If the soil in the vicinity of MW-E requires remediation, the pre-excavation samples will be compared to the NYSDEC guidelines for the protection of groundwater quality for PCE of 1.4 mg/kg.

5.7 ANALYTICAL PROGRAM

Based upon the proposed sampling plan, analytical techniques will be required for two sample matrices. The types of samples requiring analysis include air and soil samples. Analytical methods for the soil sample matrix anticipated to be collected during the soil remediation are presented in the Work/QA Plan Short Form (Appendix E) and are discussed below.

5.7.1 Air Monitoring

Ambient 8-hour air monitoring samples will be analyzed for particulates. The requirements for this air monitoring are specified in the HASCP.

5.7.2 Soil Samples

5.7.2.1 Former Drum Storage Area Pre-Excavation Soil Samples

Soil samples collected during the pre-design phase in the former drum storage area will be analyzed for RSC organic compounds using the KGD method.

5.7.2.2 MW-E Pre-Excavation Soil Samples

Soil samples collected during the field investigation phase in the immediate vicinity of MW-E will be analyzed for selected TCL parameters (Table 2.2) using CLP methodologies as prescribed in the CLP SOW, 7/93 (OLM 01.9).

5.7.2.3 Sump 2 Soil Samples

Soil samples collected in Sump 2 will be analyzed for selected TCL parameters (Table 2.2) using CLP methodologies (SOW 7/93) and the RSC organics (Table 2.5) using the KGD method.

6.0 APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS (ARARS)

The ARARs governing the Remedial Action for groundwater and soil are shown on Tables 6.1 through 6.5.

7.0 SURVEYING

Land surveying will be required to establish existing grades, utility locations, and other nearby improvements for design and construction purposes. Following installation of the wells, the elevations of the ground surface and the tops of the riser pipes and security casings will be surveyed from Nassau County Benchmark (BM 14S07 G518) located along Oyster Bay Road. All soil sampling locations will be surveyed using the same benchmark and placed on a Site plan to use in delineating the soil areas which will require excavation. A temporary benchmark will be established on-site for use during implementation, unless a benchmark already exists on-site or within a reasonable distance off-site. A Licensed Land Surveyor (LLS) registered to practice in the State of New York will be retained to conduct all surveying activities. All surveying work will conform, at a minimum, to New York State's Code of Practice, 1986.

8.0 QUALITY ASSURANCE PROJECT PLAN (QAPP)

8.1 FIELD INVESTIGATION ACTIVITIES

The Quality Assurance Project Plan (QAPP) is included as Appendix E. It includes the KGD method and the selected laboratory's QAPP. Most of the samples obtained during the field activities will be analyzed by USEPA CLP SOWs OLM 01.9 (7/93) and ILM 03.0 (2/93), Standard Methods for the Examination of Water and Wastewater, Methods for Chemical Analysis of Water and Wastes, and/or the KGD method (for RSC organics). Samples for waste characterization will be analyzed during Test Methods for Evaluating Solid Waste, SW-846.

8.1.1 Groundwater

The minimum number of groundwater samples shown on Table 8.1 will be analyzed using the analytical procedures shown on Table 8.1. The total number of groundwater samples that will be analyzed cannot be determined due to the variable nature of the groundwater treatability study. An explanation of the variable number and type of analyses is provided in the TSWP (Appendix D).

8.1.2 Soils

The following minimum number of soil samples will be analyzed using the analytical procedures shown on Table 8.2:

i) two representative samples from the boring in the vicinity of MW-E;

ii) three representative samples from the boring beneath Sump 2; and

iii) two representative samples from the former drum storage area.

8.2 REMEDIAL PLAN IMPLEMENTATION

The QAPP for implementation, and subsequent operation of the system, will be prepared as part of the design documents, using the QAPP in Appendix E as the base document.

9.0 PERMITS AND REGULATORY REQUIREMENTS

The following section lists tentatively-identified permits and notification requirements which will be considered in conducting remedial activities at the Site. It is noted that the RD/RA is a CERCLA action and, therefore, is not subject to permitting requirements of State and Local jurisdictions for on-site actions. However, the substantive requirements of applicable air and water discharge permits and permits regulating construction and operation of containment structures will be met. The following subsections detail the relevant State and local regulatory framework and specify which permit requirements will be met.

9.1 FEDERAL PERMITS

New York State has a well developed State Implementation Program (SIP) for EPA promulgated regulations. Furthermore, Nassau County has NYSDEC approved air and water discharge programs in place. Accordingly, no Federal permits are required for the proposed action.

9.2 STATE PERMITS

Under its SIP filed with the EPA, New York State regulates discharges to local and regional water- and air-sheds and oversees the construction and operation of treatment plants. Furthermore, New York requires permits for groundwater recovery wells constructed on Long Island. Of these programs, New York relegates responsibility of discharges to local and regional airsheds to the County of Nassau. The following subsections detail the relevant environmental permitting requirements of the State of New York. Although no NYSDEC permits are required, the RA will meet the objectives of the permit framework in the following sections.

9.2.1 State Pollutant Discharge Elimination System

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

SPDES permits include provisions requiring compliance with:

i) technology-based and water-quality based effluent limitations as required by the CWA;
ii) standards of performance for new sources;
iii) toxic and pretreatment effluent standards;
iv) ocean discharge criteria adopted by the Federal government; and
v) any additional limitations necessary to ensure compliance with water-quality standards adopted pursuant to State law.

9.2.2 Well Construction

The installation of recovery wells is governed by a Long Island Well Construction Permit application under Title 6 New York Compilation of Rules and Regulations (NYCRR) Part 602. This is primarily a reporting requirement.

9.3 NASSAU COUNTY PERMITS

The Nassau County Department of Health (NCDH) is the NYSDEC's designated agent for administration of the Clean Air Act in the County of Nassau. Furthermore, the NCDH regulates the storage of certain hazardous materials under Article XI of the Nassau County Health Ordinance, as amended. The following subsections detail Nassau County permitting requirements. All County permit programs would only pertain to on-site actions, which are exempt from permitting requirements. Therefore, no County permits are required.

9.3.1 Air Emissions

The construction and operation of treatment plants require that a Permit Application to Construct and Operate a Process, Exhaust or Ventilation System be filed with the NCDH prior to construction to account for any potential fugitive emissions from the treatment plant. This permit process is regulated by the Nassau County Department of Health in accordance with requirements specified in Title 6 NYCRR Part 201, and guidelines presented in New York State AIR GUIDE-I. Air permits will not be required.

9.3.2 Article XI, Containment

The NCDH regulates the construction of structures containing hazardous materials under Article XI of the Nassau County Health Ordinance. These regulations dictate the manner in which facilities storing greater than 250 gallons (combined storage) of hazardous or toxic materials will be built, permitted and operated.

9.4 TOWN OF OYSTER BAY, BUILDING PERMIT

The Town of Oyster Bay building permit requirements will be met for the treatment enclosure and the extraction well vault.

10.0 ACCESS, EASEMENTS, RIGHTS-OF-WAY

OxyChem will obtain access to the plant through an agreement with Ruco Polymer Corporation.

11.0 HEALTH AND SAFETY REQUIREMENTS

The HASCP presented in Appendix B will be amended to cover all construction, chemical handling, and transportation activities. The HASCP attached as Appendix B covers all activities which will be undertaken during the field investigation phase of work.

12.0 SITE MANAGEMENT PLAN

The scope of the RD/RA necessitates the use of highly trained and skilled personnel. To this end, OxyChem will assemble a team with the proper qualifications to implement the RD/RA. A Site Management Plan (SMP) will be submitted within 45 days after approval of the Final RD.

The SMP for Remedial Construction will include the following items:

i) Identification of all off-site facilities proposed to be used to manage hazardous substances, or other materials from the Site resulting from the remedial construction work. For each facility, the proposed materials and methods of management shall be described.

ii) Discussion of the methods by which construction operations shall proceed. Discussion will include the following:

  a) Timing of and manner in which, remedial activities (e.g., decontamination, construction, monitoring, security measures, Site restoration) will be sequenced;

  b) Preparation of the Site including security, utilities, decontamination facilities, construction trailers, equipment storage and construction of roadways;

  c) Coordination of construction activities;

  d) Site inspections and maintenance during the Remedial Construction;

  e) Coordination with local authorities regarding contingency planning and potential traffic obstruction; and

f) Entry and access to the Site during the construction period(s) and periods of inactivity, including provisions for decontamination, erosion control, and dust control.

12.1 SUBCONTRACTORS

The scope of the RD/RA will require the following services:

i) Surveying;
ii) Drilling firms;
iii) Analytical laboratories; and
iv) Construction and Excavation Contractors.

Because of the undeveloped nature of the RD/RA, a full list of subcontractors will not be available until all bids are awarded.

13.0 MONITORING

13.1 SOIL SAMPLING

A soil monitoring plan will be prepared to evaluate the effectiveness of the soil flushing to be performed in Sump 1. The plan will specify the sampling frequency, parameters, location, depth, and protocols. The draft plan will be submitted with the 30% design document.

13.2 GROUNDWATER SAMPLING

A groundwater monitoring plan will be prepared to monitor the effectiveness of the overburden groundwater collection system. The draft groundwater monitoring plan will specify the sampling frequency, parameters, locations, and protocols and shall be submitted with the prefinal design document.

The RA shall provide for groundwater monitoring to be conducted for a period of five years after completion of construction. After the initial five-year period, an assessment of the groundwater monitoring program shall be performed to determine the suitability of the monitoring program and the need for modification.

A monitoring program for the on-Site groundwater treatment plant shall be developed and incorporated in the Operations and Maintenance (O&M) Manual for the plant. The program shall ensure the effluent from the groundwater treatment plant meets discharge criteria. The program shall specify sampling frequency, parameters, and protocols. The draft will be submitted with the 30% design document plan.

14.0 INSTITUTIONAL CONTROLS

The RA will provide for the appropriate deed restrictions on subsequent land and groundwater use. The objectives of institutional controls are to:

i) restrict the use of the Ruco property to industrial development only as long as chemicals above cleanup levels remain on the property and the treatment systems are in place; and

ii) restrict the use of groundwater to appropriate uses based on the concentration levels until such time as the groundwater beneath the Site has been determined to be remediated.

15.0 PROJECT SCHEDULES

The schedules presented consist of two concurrent time lines: one time line for soil activities and one time line for groundwater activities (Plan 1). These timelines present the gross overall schedule up to the conclusion of all construction activities for the groundwater treatment system and the removal of all soils. Long-term monitoring and O&M schedules are not presented because of their extended time periods and the preliminary nature of the treatment system. Long term monitoring, as stipulated under the CERCLA, requires the filing of annual monitoring reports and a review and report of the treatment progress every five years.

15.1 SCHEDULE FOR FIELD ACTIVITIES AND REMEDIAL DESIGN FOR SITE SOILS

Task	***Time from Approval of RDWP***
Soil borings and sampling	3 months
Sample analysis and validation	6 months
Soil Remedial Design report	8 months

15.2 SCHEDULE FOR FIELD ACTIVITIES AND REMEDIAL DESIGN FOR GROUNDWATER

15.2.1 Field Activities

Task	***Time from Approval of RDWP***
Sample and analyze J1, J2, MW-50D1, and MW-50D2	2 months
Extraction well, recharge basin, temporary treatment system and forcemain installation	6 months
Pumping tests, analysis, model simulation	8 months

15.2.2 Treatability Studies and Design Submittals

The following tasks are shown with their anticipated time frame for completion. Time for EPA review and comments, or for document review, cannot be anticipated at this time.

Task	*Time from Approval of RDWP*
Treatability studies (bench scale)	3 months
Extraction Well, Recharge Basin and Temporary Treatment System Design	3 months
Remedial Design report (30-percent complete)	9 months
Remedial Design report (100-percent complete)	15 months

The Groundwater Remedial Design report (100% complete) will present a construction schedule.

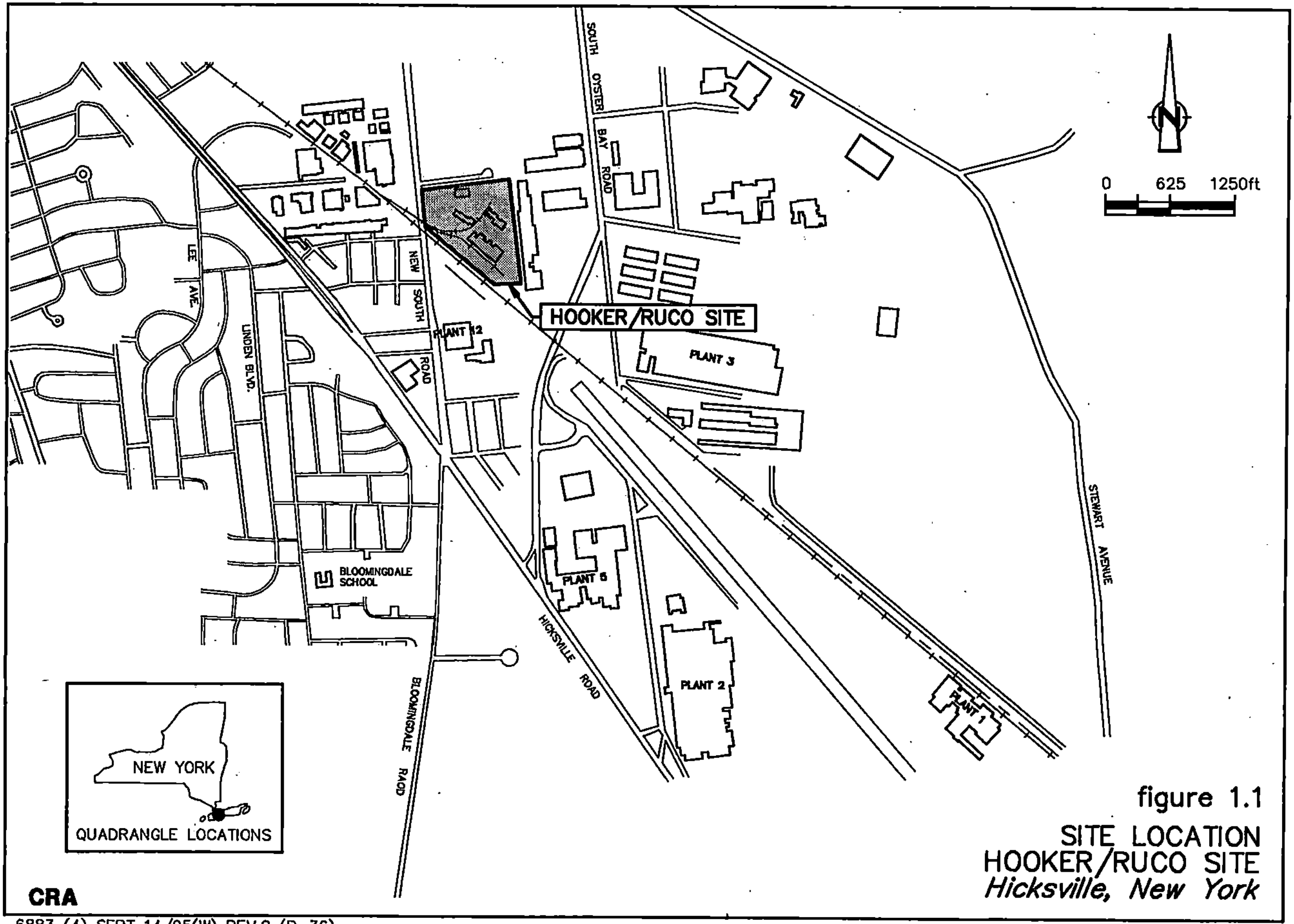


figure 1.1

SITE LOCATION
HOOKER/RUCO SITE
Hicksville, New York

6883 (4) SEPT 14/95(W) REV.0 (P-36)

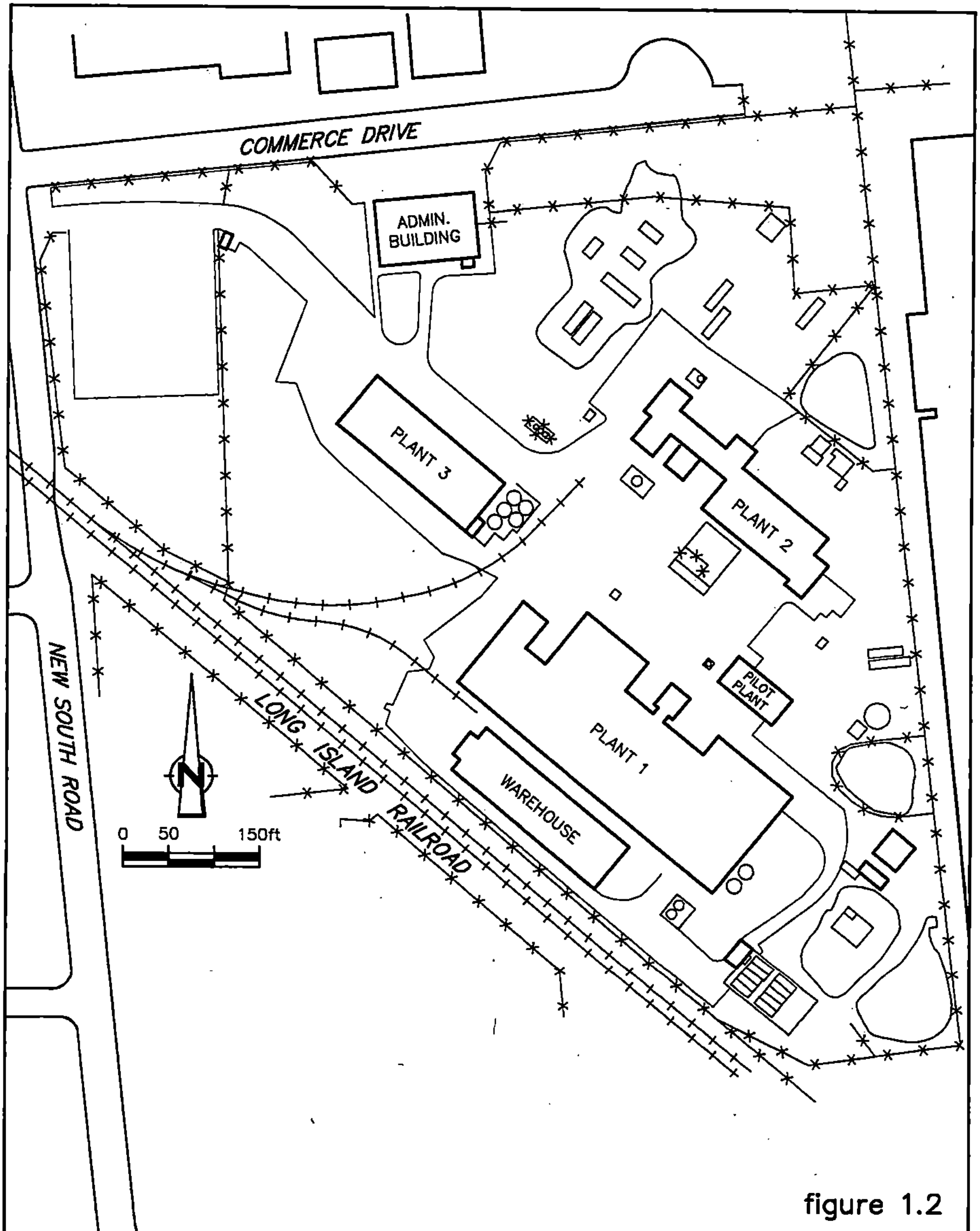


figure 1.2

SITE PLAN
HOOKER/RUCO SITE
Hicksville, New York

CRA

6883 (4) SEPT 15/95(W) REV.0 (P-39)

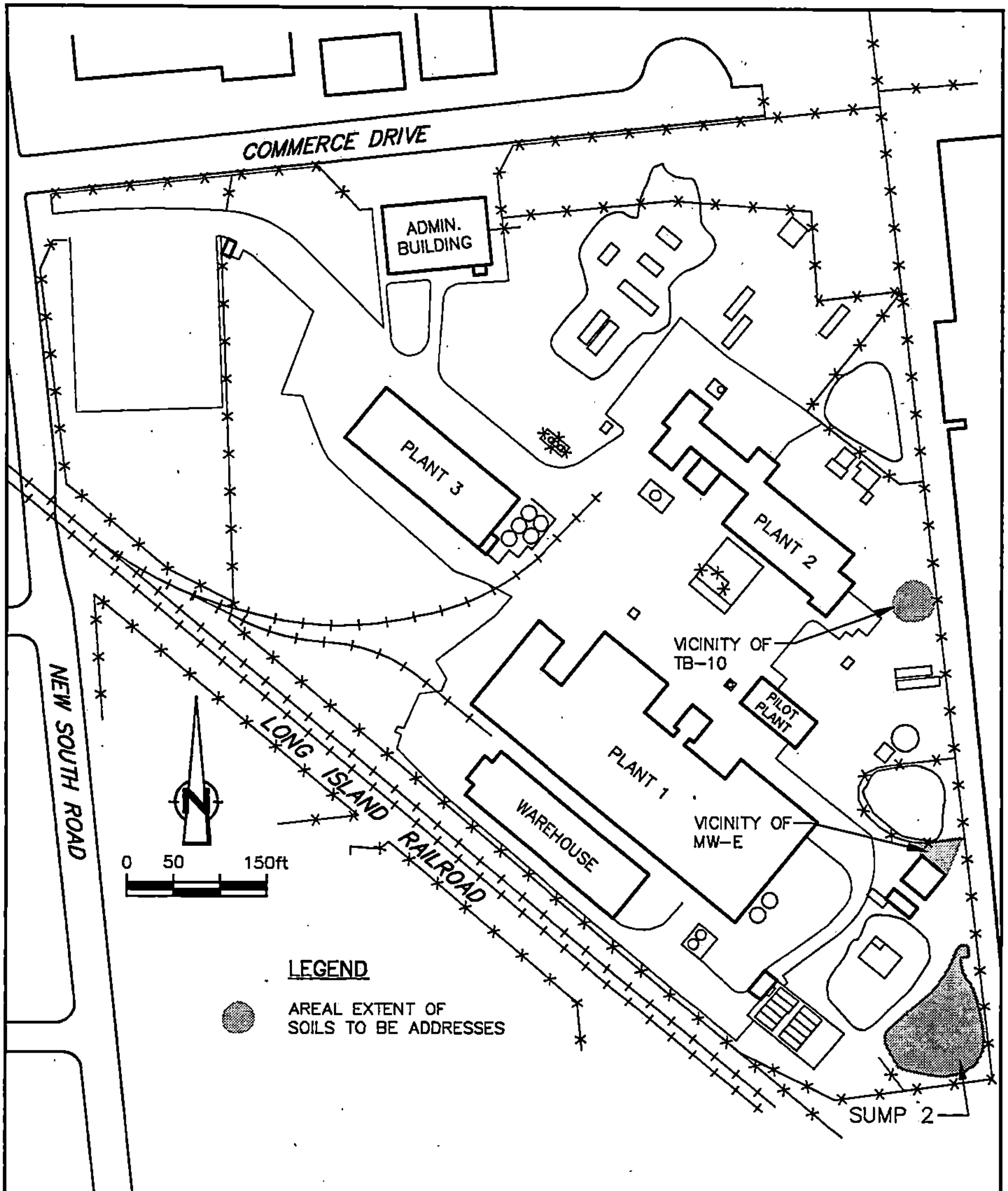
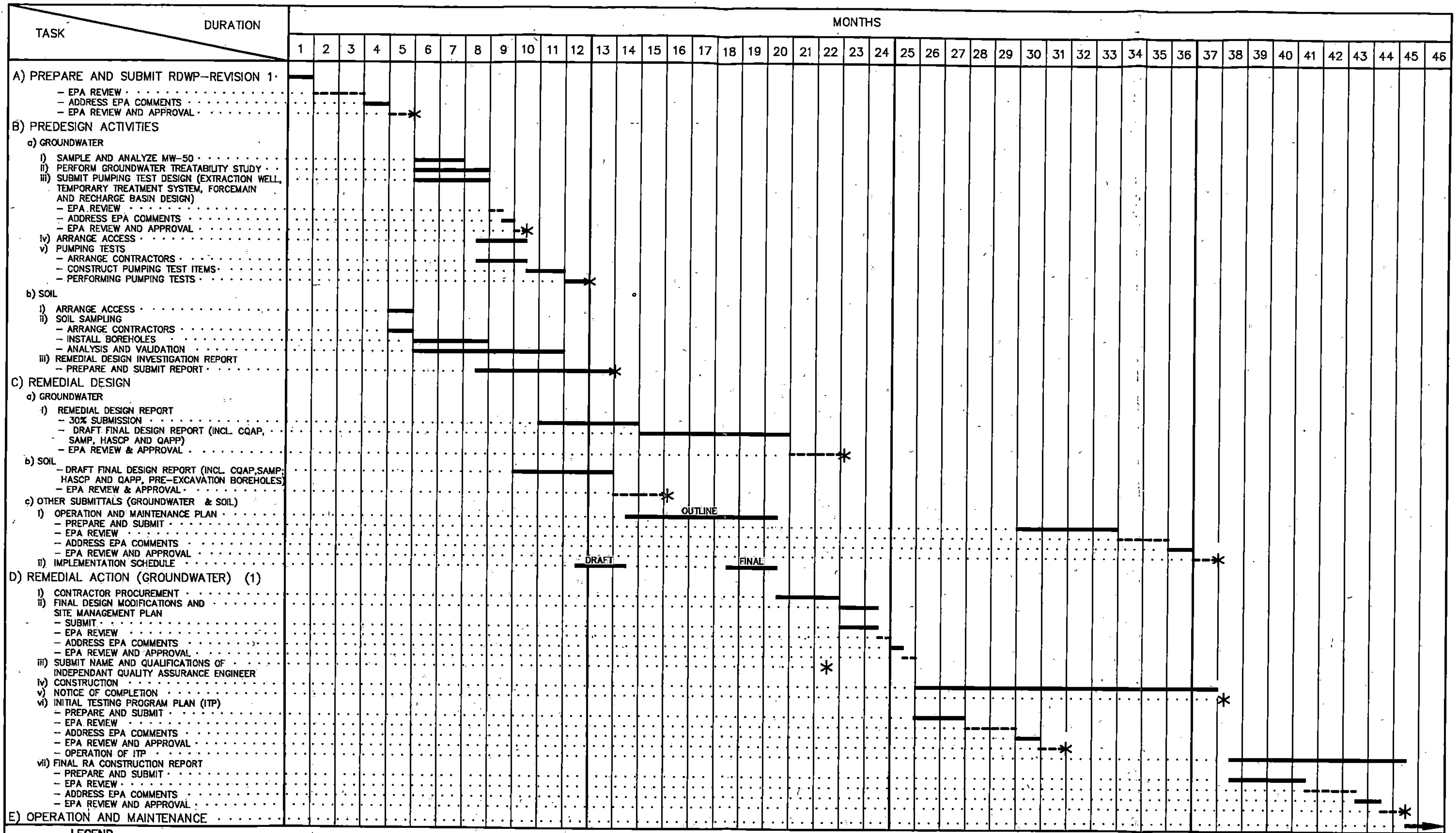


figure 5.1

AREAL EXTENT OF SOILS TO BE ADDRESSED
HOOKER/RUCO SITE
Hicksville, New York

CRA

6883 (4) SEPT 15/95(W) REV.0 (P-40)



LEGEND

━━━ ACTIVITY OF SPECIFIED DURATION

----- ACTIVITY OF UNSPECIFIED DURATION

* ONE TIME EVENT

(1) SIMILAR DOCUMENTATION AT AN ACCELERATED SCHEDULE WILL BE SUBMITTED FOR THE SOIL REMEDIATION.

CRA

figure 15.1

PRELIMINARY SCHEDULE OF RD/RA ACTIVITIES
RD WORK PLAN
PRELIMINARY RD/RA
Hooker/Ruco Site, Hicksville, New York

6883 (4) OCT 20/95(W) REV.0 (S-04)

TABLE 2.1

MW-50 HYDROPUNCH SAMPLES
ANALYTICAL RESULTS
HICKSVILLE, NEW YORK
OCCIDENTAL CHEMICAL CORPORATION
DECEMBER 1994
VOLATILES (µg/L)

Depth (feet)	*100*	*123*	*140*	*172*	*182*	*202*	*223*	*283*	*303*	*323*	*323 (Dup)*
Sample Date:	*12/07/94*	*12/07/94*	*12/08/94*	*12/09/94*	*12/12/94*	*12/13/94*	*12/14/94*	*12/20/94*	*12/21/94*	*12/21/94*	*12/21/94*
Parameter											
Bromodichloromethane	ND 1	ND 1	ND 1	ND 1	ND 1	ND 1	ND 5	ND 5	ND 10	ND 2	ND 2
Bromoform	ND 1	ND 1	ND 1	ND 1	ND 1	ND 1	ND 5	ND 5	ND 10	ND 2	ND 2
Bromomethane	ND 1	ND 1	ND 1	ND 1	ND 1	ND 1	ND 5	ND 5	ND 10	ND 2	ND 2
Carbon tetrachloride	ND 1	ND 1	ND 1	ND 1	ND 1	ND 1	ND 5	ND 5	ND 10	ND 2	ND 2
Chlorobenzene	2	ND 1	ND 1	ND 1	ND 1	ND 1	ND 5	ND 5	ND 10	ND 2	ND 2
Chloroethane	ND 1	ND 1	ND 1	ND 1	ND 1	ND 1	ND 5	ND 5	ND 10	ND 2	ND 2
2-Chloroethylvinyl ether	R	R	R	R	R	R	R	R	R	R	R
Chloroform	ND 1	ND 1	ND 1	ND 1	ND 1	ND 1	ND 5	ND 5	ND 10	ND 2	ND 2
Chloromethane	ND 1	ND 1	ND 1	ND 1	ND 1	ND 1	ND 5	ND 5	ND 10	ND 2	ND 2
Dibromochloromethane	ND 1	ND 1	ND 1	ND 1	ND 1	ND 1	ND 5	ND 5	ND 10	ND 2	ND 2
1,2-Dichlorobenzene	ND 1	ND 1	ND 1	ND 1	ND 1	ND 1	ND 5	ND 5	ND 10	ND 2	ND 2
1,3-Dichlorobenzene	ND 1	ND 1	ND 1	ND 1	ND 1	ND 1	ND 5	ND 5	ND 10	ND 2	ND 2
1,4-Dichlorobenzene	ND 1	ND 1	ND 1	ND 1	ND 1	ND 1	ND 5	ND 5	ND 10	ND 2	ND 2
Dichlorodifluoromethane	ND 1	ND 1	ND 1	ND 1	ND 1	ND 1	ND 5	ND 5	ND 10	ND 2	ND 2
1,1-Dichloroethane	ND 1	ND 1	ND 1	ND 1	ND 1	ND 1	ND 5	ND 5	ND 10	ND 2	ND 2
1,2-Dichloroethane	ND 1	ND 1	ND 1	ND 1	ND 1	ND 1	ND 5	ND 5	ND 10	ND 2	ND 2
1,1-Dichloroethene	ND 1	ND 1	ND 1	ND 1	ND 1	ND 1	ND 5	ND 5	ND 10	ND 2	ND 2
cis-1,2-Dichloroethene	ND 1	ND 1	ND 1	ND 1	3	13	ND 5	63J	43	16	21
trans-1,2-Dichlotoethene	ND 1	ND 1	ND 1	ND 1	ND 1	ND 1	ND 5	ND 5	ND 10	ND 2	ND 2
1,2-Dichloropropane	ND 1	ND 1	ND 1	ND 1	ND 1	ND 1	ND 5	ND 5	ND 10	ND 2	ND 2
cis-1,3-Dichloropropene	ND 1	ND 1	ND 1	ND 1	ND 1	ND 1	ND 5	ND 5	ND 10	ND 2	ND 2
trans-1,2-Dichloropropene	ND 1	ND 1	ND 1	ND 1	ND 1	ND 1	ND 5	ND 5	ND 10	ND 2	ND 2
Methylene chloride	ND 1	ND 1	ND 1	1	ND 1	ND 1	ND 5	ND 5	ND 10	ND 2	ND 2
1,1,2,2-Tetrachloroethane	ND 1	ND 1	ND 1	ND 1	ND 1	ND 1	ND 5	ND 5	ND 10	ND 2	ND 2
Tetrachloroethene	ND 1	ND 1	ND 1	16	99	110	39	110	150	48	69
1,1,1-Trichloroethane	ND 1	ND 1	ND 1	ND 1	ND 1	ND 1	ND 5	ND 5	ND 10	ND 2	ND 2
1,1,2-Trichloroethane	ND 1	ND 1	ND 1	ND 1	ND 1	ND 1	ND 5	ND 5	ND 10	ND 2	ND 2
Trichloroethene	ND 1	ND 1	ND 1	1	5	22	ND 5	450	460	160	220
Trichlorofluoromethane	ND 1	ND 1	ND 1	4	ND 1	ND 1	ND 5	ND 5	ND 10	ND 2	ND 2
Vinyl chloride	ND 1	ND 1	ND 1	ND 1	ND 1	ND 1	210	ND 5	ND 10	ND 2	ND 2

Notes:

NDx	Not-detected at or above x.
J	Associated value is estimated.
R	Rejected

TABLE 2.1

MW-50 HYDROPUNCH SAMPLES
ANALYTICAL RESULTS
HICKSVILLE, NY
OCCIDENTAL CHEMICAL CORPORATION
DECEMBER 1994
VOLATILES (µg/L)

Depth (feet)	*343*	*363*	*383*	*402*	*423*	*443*	*463*	*507*	*522*	*542*	*562*	*602*
Sample Date:	*12/22/94*	*12/23/95*	*12/28/94*	*12/30/94*	*01/13/95*	*01/17/95*	*01/18/95*	*01/25/95*	*01/26/95*	*01/26/95*	*01/30/95*	*02/01/95*
Parameter												
Bromodichloromethane	ND 2	ND 1	ND 1	ND 1	ND 1	ND 1	ND 1	ND 1	ND 1	ND 1	ND 1	ND 1
Bromoform	ND 2	ND 1	ND 1	ND 1	ND 1	ND 1	ND 1	ND 1	ND 1	ND 1	ND 1	ND 1
Bromomethane	ND 2	ND 1	ND 1	ND 1	ND 1	ND 1	ND 1	ND 1	ND 1	ND 1	ND 1	ND 1
Carbon tetrachloride	ND 2	ND 1	ND 1	ND 1	ND 1	ND 1	ND 1	ND 1	ND 1	ND 1	ND 1	ND 1
Chlorobenzene	ND 2	ND 1	ND 1	ND 1	ND 1	ND 1	ND 1	ND 1	ND 1	ND 1	ND 1	ND 1
Chloroethane	ND 2	ND 1	ND 1	ND 1	ND 1	ND 1	ND 1	ND 1	ND 1	ND 1	ND 1	ND 1
2-Chloroethylvinyl ether	R	R	R	R	R	R	R	R	R	R	R	R
Chloroform	ND 2	ND 1	1	ND 1	ND 1	ND 1	ND 1	ND 1	ND 1	ND 1	ND 1	ND 1
Chloromethane	ND 2	ND 1	ND 1	ND 1	ND 1	ND 1	ND 1	ND 1	ND 1	ND 1	ND 1	ND 1
Dibromochloromethane	ND 2	ND 1	ND 1	ND 1	ND 1	ND 1	ND 1	ND 1	ND 1	ND 1	ND 1	ND 1
1,2-Dichlorobenzene	ND 2	ND 1	ND 1	ND 1	ND 1	ND 1	ND 1	ND 1	ND 1	ND 1	ND 1	ND 1
1,3-Dichlorobenzene	ND 2	ND 1	ND 1	ND 1	ND 1	ND 1	ND 1	ND 1	ND 1	ND 1	ND 1	ND 1
1,4-Dichlorobenzene	ND 2	ND 1	ND 1	ND 1	ND 1	ND 1	ND 1	ND 1	ND 1	ND 1	ND 1	ND 1
Dichlorodifluoromethane	ND 2	ND 1	ND 1	ND 1	ND 1	ND 1	ND 1	ND 1	ND 1	ND 1	ND 1	ND 1
1,1-Dichloroethane	ND 2	3	ND 1	ND 1	ND 1	ND 1	ND 1	ND 1	ND 1	ND 1	ND 1	ND 1
1,2-Dichloroethane	ND 2	ND 1	ND 1	ND 1	ND 1	ND 1	ND 1	ND 1	ND 1	ND 1	ND 1	ND 1
1,1-Dichloroethene	ND 2	ND 1	ND 1	ND 1	ND 1	ND 1	ND 1	ND 1	ND 1	ND 1	ND 1	ND 1
cis-1,2-Dichloroethene	11	ND 1	ND 1	ND 1	ND 1	ND 1	ND 1	ND 1	ND 1	ND 1	ND 1	ND 1
trans-1,2-Dichlotoethene	ND 2	ND 1	ND 1	5J	ND 1	ND 1	ND 1	ND 1	ND 1	ND 1	ND 1	ND 1
1,2-Dichloropropane	ND 2	ND 1	ND 1	ND 1	ND 1	ND 1	ND 1	ND 1	ND 1	ND 1	ND 1	ND 1
cis-1,3-Dichloropropene	ND 2	ND 1	ND 1	ND 1	ND 1	ND 1	ND 1	ND 1	ND 1	ND 1	ND 1	ND 1
trans-1,2-Dichloropropene	ND 2	ND 1	ND 1	ND 1	ND 1	ND 1	ND 1	ND 1	ND 1	ND 1	ND 1	ND 1
Methylene chloride	ND 2	ND 1	ND 1	ND 1	ND 1	ND 1	ND 2	ND 1	ND 1	ND 1	ND 1	ND 3
1,1,2,2-Tetrachloroethane	ND 2	ND 1	ND 1	ND 1	ND 1	ND 1	ND 1	ND 1	ND 1	ND 1	ND 1	ND 1
Tetrachloroethene	32	5	4	ND 1	ND 1	ND 1	ND 1	ND 1	ND 1	ND 1	ND 1	ND 1
1,1,1-Trichloroethane	ND 2	4	ND 1	ND 1	ND 1	ND 1	ND 1	ND 1	ND 1	ND 1	ND 1	ND 1
1,1,2-Trichloroethane	ND 2	ND 1	ND 1	ND 1	ND 1	ND 1	ND 1	ND 1	ND 1	ND 1	ND 1	ND 1
Trichloroethene	83	5	7	ND 1	ND 1	ND 1	ND 1	ND 1	ND 1	ND 1	ND 1	ND 1
Trichlorofluoromethane	ND 2	ND 1	ND 1	ND 1	ND 1	ND 1	ND 1	ND 1	ND 1	ND 1	ND 1	ND 1
Vinyl chloride	ND 2	ND 1	ND 1	ND 1	ND 1	ND 1	ND 1	ND 1	ND 1	ND 1	ND 1	ND 1

Notes:

NDx	Not-detected at or above x.
J	Associated value is estimated.
R	Rejected

TABLE 2.2

OCCIDENTAL CHEMICAL CORPORATION
HOOKER/RUCO SITE
HICKSVILLE, NEW YORK

SELECTED ORGANIC COMPOUNDS

Carbon Disulfide

Chlorobenzene

Dichloroethylene (total)

Tetrachloroethylene

Trichloroethylene

Vinyl Chloride

Di N-Butyl Phthalate

4-Methyl-2-Pentanone

TABLE 2.3

OCCIDENTAL CHEMICAL CORPORATION
HOOKER/RUCO SITE
HICKSVILLE, NEW YORK

SELECTED TARGET ANALYTE LIST CONSTITUENTS

Chromium (hexavalent)(1)

Chromium (trivalent)

Iron

Manganese

Magnesium

Potassium

Sodium

Calcium

Cobalt

Lead

Nickel

Zinc

Note:

1) Hexavalent chromium will be analyzed according to SW-846, Method 7197.

TABLE 2.4

OCCIDENTAL CHEMICAL CORPORATION
HOOKER/RUCO SITE
HICKSVILLE, NEW YORK

Physicochemical Parameters for Groundwater Medium

Parameter	*Method*
pH	Method 423 (field measurement) (1)
Temperature	Method 212 (field measurement) (1)
Total Suspended Solids: TSS	Method 2540D (1)
Total Dissolved Solids: TDS	Method 2540C (1)
Biological Oxygen Demand: BOD	Method 5210B (1)
Chemical Oxygen Demand: COD	Method 5220B (1)
Hardness	Method 2340B (1)
Turbidity	Method 214 (field measurement) (1)
Conductivity	Method 205 (field measurement) (1)
Total Organic Carbon	Method 5310B (1)

Additional Parameters for Sampling of J1, J2, MW-50D1 and MW50D2 and 72-hour Pumping Test Sample

Alkalinity	EPA 310.1
Sulphate (SO4-2)	EPA 375.4
Ammonia (as N)	EPA 350.2
Fluoride	EPA 340.2
Nitrate (as N)	EPA 353.2
Nitrite (as N)	EPA 353.2
Total Organic Nitrogen (as N)	EPA 351.3
Oil and Grease	EPA 413.1
Total Phosphorus (as P)	EPA 365.2
Sulfide (as S)	EPA 376.1
Chloride	EPA 325

Notes:

1) "Standard Methods for the Examination of Water and Wastewater", 18th Edition, 1992 (including 1994 Addendum).
2) EPA - "Methods for Chemical Analysis of Water and Wastes", EPA 600/4-79-020, Revised March 1983.

TABLE 2.5

OCCIDENTAL CHEMICAL CORPORATION
HOOKER/RUCO SITE
HICKSVILLE, NEW YORK

RUCO SITE CHEMICALS

Compound	*Solubility (1)*
Ethylene Glycol	Completely miscible
Diethylene Glycol	Completely miscible
Triethylene Glycol	Completely miscible
Dipropylene Glycol	Completely miscible
2,2-Dimethyl-1,3-Propane Diol	Slightly miscible
2,6-Dimethyl-4-Heptanol	Not soluble
2,2,4-Trimethyl-1,3-Pentanediol	Slightly miscible
2-Ethylhexanoic Acid	Slightly miscible
Octanoic Acid	Slightly miscible (680 mg/kg water)
Hexanoic Acid	9700 mg/kg water

(1) Reference:

- Hawley's Condensed Chemical Dictionary, 12th edition, 1993.
- CRC Dictionary of Organic Chemicals
- CRC Handbook of Chemistry and Physics, 73rd edition, 1992/1993.

TABLE 6.1

LIST OF ARARs

1.0 Applicable or Relevant and Appropriate Requirements (ARARs)

1.1 ARARs for Groundwater Cleanup Criteria

1.1.1 Federal Regulations

The following sources of ARARs have been identified for site groundwater:

40 CFR	Part 141	National Primary Drinking Water Regulations
	Subpart B	Maximum Contaminant Levels
	Section 141.11	Maximum Contaminant Levels for Inorganic Chemicals
	Section 141.12	Maximum Contaminant Levels for Organic Chemicals
	Subpart F	Maximum Contaminant Level Goals
	Section 141.50	Maximum Contaminant Level Goals for Organic Contaminants
	Section 141.51	Maximum Contaminant Level Goals for Inorganic Contaminants
	Subpart G	National Revised Drinking Water Regulations: Maximum Contaminant Levels
	Section 141.61	Maximum Contaminant Levels for Organic Contaminants
40 CFR	Part 143	National Secondary Drinking Water Regulations
	Section 143.3	Secondary Maximum Contaminant Levels

1.1.2 New York Regulations

The following sources of ARARs have been identified for site groundwater:

6 NYCRR	Part 701	Classifications-Surface Waters and Ground Waters
	Section 701.15	Class GA Fresh Ground Waters
	Part 702	Derivation and Use of Standards and Guidance Values
	Section 702.1	Basis for Derivation of Water Quality Standards and Guidance Values
	Section 702.2	Standards and Guidance Values for Protection of Human Health and Sources of Potable Water Supplies
	Part 703	Surface Water and Ground Water Quality Standards and Ground Water Effluent Standards
	Section 703.5	Water Quality Standards for Taste, Color and Odor-Producing, Toxic and Other Deleterious Substances
10 NYCRR	Part 5	Drinking Water Supplies
	Subpart 5-1	Public Water Systems
	Section 5-1.51	Maximum Contaminant Levels
	Section 5-1.52	Tables: Table 1 - Inorganic Chemicals and Physical Characteristics Maximum Contaminant Level Determination; Table 3 - Organic Chemicals Maximum Contaminant Level Determination

1.1.3 Specific ARARs for Groundwater Cleanup Criteria

The specific ARARs for groundwater cleanup criteria are listed in Table 6.2.

TABLE 6.1

LIST OF ARARs

1.2 ARARs for Groundwater Discharge Criteria

1.2.1 Federal Regulations

The following sources of ARARs have been identified for site groundwater discharge:

40 CFR	Part 141	National Primary Drinking Water Regulations
	Subpart B	Maximum Contaminant Levels
	Section 141.11	Maximum Contaminant Levels for Inorganic Chemicals
	Section 141.12	Maximum Contaminant Levels for Organic Chemicals
	Subpart F	Maximum Contaminant Level Goals
	Section 141.50	Maximum Contaminant Level Goals for Organic Contaminants
	Section 141.51	Maximum Contaminant Level Goals for Inorganic Contaminants
	Subpart G	National Revised Drinking Water Regulations: Maximum Contaminant Levels
	Section 141.61	Maximum Contaminant Levels for Organic Contaminants
40 CFR	Part 143	National Secondary Drinking Water Regulations
	Section 143.3	Secondary Maximum Contaminant Levels

1.2.2 New York Regulations

The following sources of ARARs have been identified for site groundwater discharge:

6 NYCRR	Part 701	Classifications-Surface Waters and Ground Waters
	Section 701.15	Class GA Fresh Ground Waters
	Part 702	Derivation and Use of Standards and Guidance Values
	Section 702.1	Basis for Derivation of Water Quality Standards and Guidance Values
	Section 702.2	Standards and Guidance Values for Protection of Human Health and Sources of Potable Water Supplies
	Section 702.16	Derivation and Implementation of Effluent Limitations
	Section 702.18	More Stringent Groundwater Effluent Standards or Limitations
	Part 703	Surface Water and Ground Water Quality Standards and Ground Water Effluent Standards
	Section 703.5	Water Quality Standards for Taste, Color and Odor-Producing, Toxic and Other Deleterious Substances
	Section 703.6	Ground Water Effluent Standards and Limitations for Discharges to Class GA Waters
10 NYCRR	Part 5	Drinking Water Supplies
	Subpart 5-1	Public Water Systems
	Section 5-1.51	Maximum Contaminant Levels
	Section 5-1.52	Tables: Table 1 - Inorganic Chemicals and Physical Characteristics Maximum Contaminant Level Determination, Table 3 - Organic Chemicals Maximum Contaminant Level Determination

TABLE 6.1

LIST OF ARARs

1.2.3 Specific ARARs for Groundwater Discharge Criteria

The specific ARARs for groundwater discharge criteria are listed in Table 6.3. The substantive requirements of the State Pollutant Discharge Elimination System (SPDES) permit program shall be met for the discharge of treated groundwater at the Site. The final effluent standards for discharge are set through the SPDES process.

1.3 ARARs for Air Emission Discharge Criteria

1.3.1 Federal Regulations

The following sources of ARARs have been identified for site air emissions:

40 CFR	Part 50	National Ambient Air Quality Standards (NAAQS)
	Part 60	New Source Performance Standards (NSPS)
	Parts 61 and 63	National Emission Standards for Hazardous Air Pollutants (NESHAP) and Maximum Achievable Control Technology (MACT)
	Part 51	New Source Review (NSR), and Prevention of Significant Deterioration (PSD)
	Part 70	Operating Permit

The EPA has established guidance values on the control of air emissions through the Clean Air Act at CERCLA sites for groundwater treatment (EPA, 1989). This guidance indicates that the sources most in need of controls are those with an actual emission rate in excess of 3 lbs/hr or 15 lbs/day, or a calculated annual rate of 10 tons/year of total VOCs. The calculated annual rate assumes 24-hour operation, 365 days per year.

RCRA regulations outlined in 10 CFR Parts 264 and 265, Subpart AA-Air Emission Standards for Process Vents and Subpart BB - Air Emission Standards for Equipment Leaks are potential ARARs. These standards, applicable to wastestreams with organic concentrations of at least 10 ppmw (parts per million by weight), require that the total organic emissions from all effected processes be reduced below 3 lbs/hr and 3.1 tons/yr or reduction of total organic emissions by 95 percent weight.

1.3.2 New York Guidelines

The following sources of New York State ARARs have been identified for air emissions:

6 NYCRR	Part 200	General Provisions
	Part 201	Permits and Certificates
	Part 202	Emissions Testing, Sampling and Analytical Determinations
	Part 231	New Source Review in Non-Attainment Areas
	Part 257	Air Quality Standards

The New York State DEC Division of Air Resources has issued draft guidelines for the control of toxic ambient air contaminants in New York State. These guidelines are presented in the New York State Air Guide-1. State guidance values pertaining to potential air emissions from groundwater treatment equipment to be used at the Hooker/Ruco site are listed in Table 6.5.

TABLE 6.1

LIST OF ARARs

1.4 ARARs for Transport and Disposal of Hazardous Byproduct Wastes

1.4.1 Federal Regulations

The following sources of ARARs have been identified for treatment, transportation and disposal of hazardous byproducts:

40 CFR	Part 261	Identification and Listing of Hazardous Waste
	Part 262	Standards Applicable to Generators of Hazardous Waste
	Part 263	Standards Applicable to Transporters of Hazardous Waste
	Part 264	Standards for Owners and Operators of Hazardous Waste Treatment, Storage and Disposal Facilities
	Subpart B	General Facility Standards
	Subpart E	Manifest System, Recordkeeping and Reporting
	Subpart N	Landfills
	Subpart O	Incinerators
	Part 265	Interim Status Standards for Owners and Operators of Hazardous Waste Treatment, Storage and Disposal Facilities
	Subpart B	General Facility Standards
	Subpart E	Manifest System, Recordkeeping and Reporting
	Subpart N	Landfills
	Subpart O	Incinerators
	Subpart P	Thermal Treatment
	Subpart Q	Chemical, Physical and Biological Treatment
	Part 268	Land Disposal Restrictions
49 CFR	Part 172	Hazardous Material Regulations of the Department of Transportation, Hazardous Materials Tables and Hazardous Communication Requirements and Emergency Response Information Requirements
	Part 173	Hazardous Material Regulations of the Department of Transportation, Shippers, General Requirements for Shipping and Packaging
	Part 178	Hazardous Material Regulations of the Department of Transportation, Shipping Container Specifications
	Part 179	Hazardous Material Regulations of the Department of Transportation, Specifications for Tank Cars

1.4.2 New York Regulations

TABLE 6.1

LIST OF ARARs

The following sources of ARARs have been identified for treatment, transportation and disposal of hazardous byproducts:

6 NYCRR	Part 360	Solid Waste Management Facilities
	Part 370	Hazardous Waste Management System - General
	Part 371	Identification and Listing of Hazardous Waste
	Part 372	Hazardous Waste Manifest System and Related Standards for Generators, Transporters and Facilities
	Part 373	Hazardous Waste Management Facilities
	Subpart 373.1	Hazardous Waste Treatment, Storage and Disposal Facility Permitting Requirements
	Subpart 373.2	Final Status Standards for Owners and Operators of Hazardous Waste Treatment, Storage and Disposal Facilities
	Part 376	Land Disposal Restrictions

TABLE 6.2

CHEMICAL-SPECIFIC ARARS FOR GROUNDWATER CLEANUP CRITERIA(1)
OCCIDENTAL CHEMICAL CORPORATION
HOOKER/RUCO SITE
HICKSVILLE, NEW YORK

	Federal Standards			*State Standards*		*Minimum ARAR-Based Groundwater Cleanup Criteria*
Compound	*MCL* (2)	*MCLGs* (3)	*SMCLs* (4)	*Groundwater Quality Standards* (5)	*Drinking Water Standards* (6)	
Acetone	NR	NR	NR	NR	50U	50
Benzene	5	0*	NR	0.7	5P	0.7
Bis (2-ethylhexyl) phthalate	NR	NR	NR	50	50U	50
2-Butanone	NR	NR	NR	NR	50U	50
Carbon disulfide	NR	NR	NR	NR	50U	50
Chlorobenzene	NR	NR	NR	5	5P	5
Chloroform	100	NR	NR	7	100	7
Chloromethane	NR	NR	NR	NR	5P	5
Dieldrin	NR	NR	NR	ND 2.5	50U	ND 2.5
1,2-Dichloroethylene total	70	70	NR	5	5P	5
Di-n-butyl-phthalate	NR	NR	NR	NR	50U	50
Di-n-octyl-phthalate	NR	NR	NR	NR	50U	50
Ethylbenzene	700	700	NR	5	5P	5
Heptachlor epoxide	NR	0*	NR	ND 2.2	50U	ND 2.2
4-Methyl-2-pentanone	NR	NR	NR	NR	50U	50
Naphthalene	NR	NR	NR	NR	50U	50
Tetrachloroethylene	5	0*	NR	5	5P	5
Trichloroethylene	5	0*	NR	5	5P	5
Vinyl chloride	2	0*	NR	2	2	2
Xylenes	10,000	10,000	NR	5	5P	5
TICs	NR	NR	NR	NR	50U	50
Aluminum	NR	NR	50	NR	NR	NR
Antimony	6	3	NR	NR	NR	6
Arsenic	50	NR	NR	25	50	25
Barium	1,000	2,000	NR	1,000	1,000	1,000
Beryllium	1	0*	NR	NR	NR	1
Cadmium	10	5	NR	10	10	5
Calcium	NR	NR	NR	NR	NR	NR
Chromium III	NR	NR	NR	50	50	50
Chromium VI	50	100	NR	50	50	50
Cobalt	NR	NR	NR	NR	NR	NR
Copper	NR	1,300	1,000	200	1,000	200
Iron	NR	NR	300	300**	300**	300
Lead	15	0*	NR	25	50	15
Magnesium	NR	NR	NR	NR	NR	NR
Manganese	NR	NR	50	300**	300**	300

TABLE 6.2

CHEMICAL-SPECIFIC ARARS FOR GROUNDWATER CLEANUP CRITERIA(1)
OCCIDENTAL CHEMICAL CORPORATION
HOOKER/RUCO SITE
HICKSVILLE, NEW YORK

	Federal Standards			*State Standards*		*Minimum ARAR-Based Groundwater Cleanup*
Compound	*MCL* (2)	*MCLGs* (3)	*SMCLs* (4)	*Groundwater Quality Standards* (5)	*Drinking Water Standards* (6)	*Criteria*
Nickel	NR	NR	NR	NR	NR	NR
Potassium	NR	NR	NR	NR	NR	NR
Selenium	10	NR	NR	10	10	10
Silver	50	NR	NR	50	50	50
Sodium	NR	NR	NR	20,000	NR	20,000
Vanadium	NR	NR	NR	NR	NR	NR
Zinc	NR	NR	5,000	300	5,000	300

Notes:

(1) Micrograms per liter.
(2) 40 CFR 141.11, 141.12, 141.61.
(3) 40 CFR 141.50, 141.51.
(4) 40 CFR 143.3.
(5) 6 NYCRR 703.5.
(6) 10 NYCRR 5-1.52.
NR - Not regulated.
P - Principle Organic Compound; each cannot exceed 5 μg/L.
U - Unspecified Organic Compound; each cannot exceed 50 μg/L.
ND (x) - Not detected at or above x.

* The EPA believes that an MCLG of zero is not an appropriate setting for cleanup levels, and the corresponding MCL will be the potentially relevant and appropriate requirement (EPA, 1990).

** The total of iron and manganese cannot exceed 500 μg/L.

TABLE 6.3

CHEMICAL-SPECIFIC ARARs FOR GROUNDWATER DISCHARGE CRITERIA (1)
OCCIDENTAL CHEMICAL CORPORATION
HOOKER/RUCO SITE
HICKSVILLE, NEW YORK

	Federal Standards			*State Standards*			
Compound	***MCL*** (2)	***MCLGs*** (3)	***SMCLs*** (4)	***Groundwater Quality Standards*** (5)	***Drinking Water Standards*** (6)	***Groundwater Effluent Standards Class GA*** (7)	***ARAR-Based Groundwater Discharge Criteria*** (8)
Acetone	NR	NR	NR	NR	50U	NR	50
Benzene	5	0*	NR	0.7	5P	0.7	0.7
Bis(2-ethylhexyl)phthalate	NR	NR	NR	50	50U	4,200	50
2-Butanone	NR	NR	NR	NR	50U	NR	50
Carbon disulfide	NR	NR	NR	NR	50U	NR	50
Chlorobenzene	NR	NR	NR	5	5P	NR	5
Chloroform	100	NR	NR	7	100	7	7
Chloromethane	NR	NR	NR	NR	5P	NR	5
Dieldrin	NR	NR	NR	ND	50U	ND	ND 2.5
1,2-Dichloroethylene total(2)	70	70	NR	5	5P	NR	5
Di-n-butyl-phthalate	NR	NR	NR	NR	50U	770	50
Di-n-octyl-phthalate	NR	NR	NR	NR	50U	NR	50
Ethylbenzene	700	700	NR	5	5P	NR	5
Heptachlor epoxide	NR	0*	NR	ND	50U	ND	ND 2.2
4-Methyl-2-pentanone	NR	NR	NR	NR	50U	NR	50
Naphthalene	NR	NR	NR	NR	50U	NR	50
Tetrachloroethylene	5	0*	NR	5	5P	NR	5
Trichloroethylene	5	0*	NR	5	5P	10	5
Vinyl Chloride	2	0*	NR	2	2	5	2
Xylenes	10,000	10,000	NR	5	5P	NR	5
TICs	NR	NR	NR	NR	50U	NR	50††

TABLE 6.3

CHEMICAL-SPECIFIC ARARs FOR GROUNDWATER DISCHARGE CRITERIA (1)
OCCIDENTAL CHEMICAL CORPORATION
HOOKER/RUCO SITE
HICKSVILLE, NEW YORK

	Federal Standards			*State Standards*			
Compound	*MCL* (2)	*MCLGs* (3)	*SMCLs* (4)	*Groundwater Quality Standards* (5)	*Drinking Water Standards* (6)	*Groundwater Effluent Standards Class GA* (7)	*ARAR-Based Groundwater Discharge Criteria* (8)
Aluminum	NR	NR	50	NR	NR	2,000	2,000
Antimony	6	3	NR	NR	NR	NR	6
Arsenic	50	NR	NR	25	50	50	25
Barium	1,000	2,000	NR	1,000	1,000	2,000	1,000
Beryllium	1	0*	NR	NR	NR	NR	1
Cadmium	10	5	NR	10	10	20	10
Calcium	NR	NR	NR	NR	NR	NR	NR
Chromium III	NR	NR	NR	50	50	NR	50
Chromium VI	50	100	NR	50	50	100	50
Cobalt	NR	NR	NR	NR	NR	NR	NR
Copper	NR	1,300	1,000	200	1,000	1,000	1,000
Iron	NR	NR	30	300†	300†	600‡	600‡
Lead	50	0*	NR	25	50	50	25
Magnesium	NR	NR	NR	NR	NR	NR	NR
Manganese	NR	NR	50	300†	300†	600‡	600‡
Nickel	NR	NR	NR	NR	NR	2,000	2,000
Potassium	NR	NR	NR	NR	NR	NR	NR
Selenium	10	NR	NR	10	10	40	10

TABLE 6.3

CHEMICAL-SPECIFIC ARARs FOR GROUNDWATER DISCHARGE CRITERIA (1)
OCCIDENTAL CHEMICAL CORPORATION
HOOKER/RUCO SITE
HICKSVILLE, NEW YORK

	Federal Standards			*State Standards*			
Compound	*MCL* (2)	*MCLGs* (3)	*SMCLs* (4)	*Groundwater Quality Standards* (5)	*Drinking Water Standards* (6)	*Groundwater Effluent Standards Class GA* (7)	*ARAR-Based Groundwater Discharge Criteria* (8)
Silver	50	NR	NR	50	50	100	100
Sodium	NR	NR	NR	20,000	NR	NR	20,000
Vanadium	NR	NR	NR	NR	NR	NR	NR
Zinc	NR	NR	5,000	300	5,000	5,000	5,000

Notes:

1. Micrograms per liter.
2. 40 CFR 141.11, 141.12, 141.61.
3. 40 CFR 141.50, 141.51.
4. 40 CFR 143.3.
5. 6 NYCRR 703.5.
6. 10 NYCRR 5-1.52.
7. 6 NYCRR 703.6.
8. 6 NYCRR 702.16.

NR Not regulated.

P Principle Organic Compound; each cannot exceed 5 µg/L.
U Unspecified Organic Compound; each cannot exceed 50 µg/L.
NDx Not Detected at or above x.
* The EPA believes that an MCLG of zero is not an appropriate setting for cleanup levels, and the corresponding MCL will be the potentially relevant and appropriate requirement (EPA, 1990).
†† Applies to each individual compound.
† The total of iron and manganese cannot exceed 500 µg/L.
‡ Combined concentration of iron and manganese shall not exceed 1,000 µg/L.

TABLE 6.4

SPECIFIC TBC SOIL CLEANUP CRITERIA TO PROTECT GROUNDWATER QUALITY(1)
OCCIDENTAL CHEMICAL CORPORATION
HOOKER/RUCO SITE
HICKSVILLE, NEW YORK

Compound	*Solubility S (mg/L)*	*Partition Coefficient Koc (ml/g)*	*Groundwater Standards Criteria Cw (µg/L)*	*Allowable Soil Concentration (2) Cs (ppm)*	*Soil Cleanup Objectives To Protect Groundwater Quality (3) (ppm)*	*Recommended Soil Cleanup Objective (4) (ppm)*	*Background (5,6,7) (ppm)*	*TBC Soil Cleanup Criteria To Protect Groundwater Quality (ppm)*
Volatile Organics								
Benzene	1,750	83	0.7	0.0006	0.06	0.06	NA	0.06
Xylenes	198	240	5	0.012	1.2	1.2	NA	1.2
Ethylbenzene	152	1,100	5	0.055	5.5	5.5	NA	5.5
Toluene	535	300	5	0.015	1.5	1.5	NA	1.5
Tetrachloroethylene	150	277	5	0.014	1.4	1.4	NA	1.4
Trichloroethylene	1,100	126	5	0.007	0.7	0.7	NA	0.7
Methylene chloride	16,700	21	5	0.001	0.1	0.1	NA	0.1
Acetone	1,000,000	2.2	50	0.0011	0.11	0.2	NA	0.2
2-Butanone	268,000	4.5*	50	0.003	0.3	0.3	NA	0.3
4-Methyl-2-Pentanone	19,100	19*	50	0.01	1.0	1.0	NA	1.0
1,1-Dichloroethane	5,500	30	5	0.002	0.2	0.2	NA	0.2
1,2-Dichloroethane	8,520	14	5	0.001	0.1	0.1	NA	0.1
1,1,1-Trichloroethane	1,500	152	5	0.0076	0.76	0.8	NA	0.8
1,1,2,2-Tetrachloroethane	2,900	118	5	0.006	0.6	0.6	NA	0.6
1,1-Dichloroethane	2,250	65	5	0.004	0.4	0.4	NA	0.4
1,2-Dichloroethene (trans)	6,300	59	5	0.003	0.3	0.3	NA	0.3
Chlorobenzene	466	330	5	0.017	1.7	1.7	NA	1.7
Chloroethane	5,740	37*	50	0.019	1.9	1.9	NA	1.9
1,2-Dichlorobenzene	100	1,700	4.7	0.079	7.9	7.9	NA	7.9
1,3-Dichlorobenzene	123	310*	5	0.0155	1.55	1.6	NA	1.6
1,4-Dichlorobenzene	79	1,700	5	0.085	8.5	8.5	NA	8.5
1,2,4-Trichlorobenzene	30	670*	5	0.034	3.4	3.4	NA	3.4
Vinyl chloride	2,670	57	2	0.0012	0.12	0.2	NA	0.2
1,2,3-Trichloropropane	1,900	68	5	0.0034	0.34	0.4	NA	0.4
1,3-Dichloropropane	2,700	51	5	0.003	0.3	0.3	NA	0.3
Dibromochloromethane	N/A	N/A	50	N/A	N/A	N/A	NA	N/A
Chloroform	8,200	31	7	0.003	0.3	0.3	NA	0.3

TABLE 6.4

SPECIFIC TBC SOIL CLEANUP CRITERIA TO PROTECT GROUNDWATER QUALITY(1)
OCCIDENTAL CHEMICAL CORPORATION
HOOKER/RUCO SITE
HICKSVILLE, NEW YORK

Compound	*Solubility S (mg/L)*	*Partition Coefficient Koc (ml/g)*	*Groundwater Standards Criteria Cw (µg/L)*	*Allowable Soil Concentration (2) C_s (ppm)*	*Soil Cleanup Objectives To Protect Groundwater Quality (3) (ppm)*	*Recommended Soil Cleanup Objective (4) (ppm)*	*Background (5,6,7) (ppm)*	*TBC Soil Cleanup Criteria To Protect Groundwater Quality (ppm)*
Carbon Tetrachloride	757	110*	5	0.006	0.6	0.6	NA	0.6
Benzoic Acid	2,900	54*	50	0.027	2.7	2.7	NA	2.7
Carbon Disulfide	2,940	54*	50	0.027	2.7	2.7	NA	2.7
Semi-Volatile Organics								
Benzo(b)fluoranthene	0.014	550,000	0.002	0.011	1.1	1.1	NA	1.1
Benzo(k)fluoranthene	0.0043	550,000	0.002	0.011	1.1	1.1	NA	1.1
Phenanthrene	1	4,365*	50	2.20	220	50.0	NA	50.0
Fluoranthene	0.206	38,000	50	19	1,900	50.0	NA	50.0
Pyrene	0.132	13,295*	50	6.65	665	50.0	NA	50.0
Benzo(a)pyrene	0.0012	5,500,000	0.002 (ND)	0.110	11.0	0.061 or MDL	NA	11.0
Indeno(1,2,3-cd)pyrene	0.0005	1,600,000	0.002	0.032	3.2	3.2	NA	3.2
2-Methylphenol	31,000	15	5	0.001	0.1	0.100 or MDL	NA	0.100 or MDL
4-Methylphenol	24,000	17	50	0.009	0.9	0.9	NA	0.9
Fluorene	1.7	7,300	50	3.5	350.0	50.0	NA	50.0
Dibenzofuran	10	1,230*	5	0.062	6.2	6.2	NA	6.2
Acenaphthene	3.42	4,600	20	0.9	90.0	50.0	NA	50.0
Acenaphthylene	3.93	2,056*	20	0.41	41.0	41.0	NA	41.0
Napthalene	31.7	1,300	10	0.130	13.0	13.0	NA	13.0
2-Methylnaphthalene	26	727*	50	0.364	36.4	36.4	NA	36.4
Anthracene	0.045	14,000	50	7.00	700.0	50.0	NA	50.0
bis(2-ethylhexyl)phthalate	0.285	8,706*	50	4.35	435.0	50.0	NA	50.0
Dimethylphthlate	5,000	40	50	0.020	2.0	2.0	NA	2.0
Diethylphthlate	896	142	50	0.071	7.1	7.1	NA	7.1
Butybenzylphthlate	2.9	2,430	50	1.215	122.0	50.0	NA	50.0
Di-n-butyl phthalate	400	162*	50	0.081	8.1	8.1	NA	8.1
Di-n-octyl phthalate	3	2,346*	50	1.2	120.0	50.0	NA	50.0
Chrysene	0.0018	200,000	0.002	0.004	0.4	0.4	NA	0.4
Benzo(a)anthracene	0.0057	1,380,000	0.002	0.03	3.0	0.220 or MDL	NA	3.0
Benzo(g,h,i)perylene	0.0007	1,600,000	5	8.0	800	50.0	NA	50.0
2,4-Dichlorophenol	4,600	380	1	0.004	0.4	0.4	NA	0.4

TABLE 6.4

SPECIFIC TBC SOIL CLEANUP CRITERIA TO PROTECT GROUNDWATER QUALITY(1)
OCCIDENTAL CHEMICAL CORPORATION
HOOKER/RUCO SITE
HICKSVILLE, NEW YORK

Compound	*Solubility S (mg/L)*	*Partition Coefficient Koc (ml/g)*	*Groundwater Standards Criteria Cw (µg/L)*	*Allowable Soil Concentration (2) C_s (ppm)*	*Soil Cleanup Objectives To Protect Groundwater Quality (3) (ppm)*	*Recommended Soil Cleanup Objective (4) (ppm)*	*Background (5,6,7) (ppm)*	*TBC Soil Cleanup Criteria To Protect Groundwater Quality (ppm)*
2,4,5-Trichlorophenol	1,190	89*	1	0.001	0.1	0.1	NA	0.1
Dibenzo(a,h)anthracene	0.0005	33,000,000	50	1,650	165,000	0.014 or MDL	NA	165,000
3,3'-Dichlorobenzidine	N/A	N/A	N/A	N/A	N/A	N/A	NA	N/A
Hexachlorobenzene	0.006	3,900	0.35	0.014	1.4	0.41	NA	1.4
Phenol	82,000	27	1	0.0003	0.03	0.03 or MDL	NA	0.03 or MDL
Pentachlorophenol	14.00	1,022	1	0.01	1	1 or MDL	NA	1 or MDL
Nitrobenzene	1,900	36	5	0.002	0.2	0.200 or MDL	NA	0.200 or MDL
4-Chloro-3-methylphenol	3,850	47	5	0.0024	0.24	0.240 or MDL	NA	0.240 or MDL
2,4-Dinitrophenol	5,600	38	5	0.002	0.2	0.200 or MDL	NA	0.200 or MDL
4-Nitrophenol	16,000	21	5	0.001	0.1	0.100 or MDL	NA	0.100 or MDL
2-Nitrophenol	2,100	65	5	0.0033	0.33	0.330 or MDL	NA	0.330 or MDL
2-Chlorophenol	28,500	15*	50	0.008	0.8	0.8	NA	0.8
Aniline	35,000	13.8	5	0.001	0.1	0.1	NA	0.1
2-Nitroaniline	1,260	86	5	0.0043	0.43	0.430 or MDL	NA	0.430 or MDL
3-Nitroaniline	1,100	93	5	0.005	0.5	0.500 or MDL	NA	0.500 or MDL
4-Chloroaniline	--	43	5	0.0022	0.22	0.220 or MDL	NA	0.220 or MDL
2,6-Dinitrotoluene	277.0	198*	5	0.01	1.0	1.0	NA	1.0
Organic Pesticides/Herbicides and PCBs								
4,4'-DDD	0.16	770,000*	ND(<0.01)	0.077	7.7	2.9	NA	7.7
4,4'-DDE	0.04	440,000*	ND(<0.01)	0.044	4.4	2.1	NA	4.4
4,4'-DDT	0.005	243,000*	ND(<0.01)	0.025	2.5	2.1	NA	2.5
Dieldrin	0.195	10,700*	ND(<0.01)	0.001	0.1	0.044	NA	0.1
Endrin	0.26	9,157*	ND(<0.01)	0.001	0.1	0.10	NA	0.1
Aldrin	0.017	96,000	ND(<0.01)	0.005	0.5	0.041	NA	0.5
Endosulfan I	0.32	8,168*	0.1	0.009	0.9	0.9	NA	0.9
Endosulfan II	0.33	8,031*	0.1	0.009	0.9	0.9	NA	0.9
Endosulfan Sulfate	0.22	10,038*	0.1	0.01	1.0	1.0	NA	1.0
Heptachlor	0.18	12,000	ND(<0.01)	0.001	0.1	0.10	NA	0.1
Heptachlor epoxide	0.35	220	ND(<0.01)	0.0002	0.02	0.02	NA	0.02
Chlordane	0.056	21,305*	0.1	0.02	2.0	0.54	NA	2.0

TABLE 6.4

SPECIFIC TBC SOIL CLEANUP CRITERIA TO PROTECT GROUNDWATER QUALITY(1)
OCCIDENTAL CHEMICAL CORPORATION
HOOKER/RUCO SITE
HICKSVILLE, NEW YORK

Compound	*Solubility S (mg/L)*	*Partition Coefficient Koc (ml/g)*	*Groundwater Standards Criteria Cw (µg/L)*	*Allowable Soil Concentration (2) C_s (ppm)*	*Soil Cleanup Objectives To Protect Groundwater Quality (3) (ppm)*	*Recommended Soil Cleanup Objective (4) (ppm)*	*Background (5,6,7) (ppm)*	*TBC Soil Cleanup Criteria To Protect Groundwater Quality (ppm)*
2,4-D	890	104*	4.4	0.005	0.5	0.5	NA	0.5
2,4,5-T	238	53	35	0.109	1.9	1.9	NA	1.9
Silvex	140	2,600	0.26	0.007	0.7	0.7	NA	0.7
PCBs	0.08	17,510*	0.1	0.1	10	1.0 (surface) 10.0 (subsurface)	NA	10.0
Polychlorinated dibenzofurans (PCDF)	N/A	N/A	N/A	N/A	N/A	N/A	NA	N/A
Dibenzo-P-dioxins (PCDD) 2,3,7,8 TCDD	0.0000193	1,709,800	0.000035	0.0006	0.06	N/A	NA	N/A
alpha-BHC	1.63	3,800	ND(<0.05)	0.002	0.2	0.11	NA	0.2
beta-BHC	0.24	3,800	ND(<0.05)	0.002	0.2	0.2	NA	0.2
delta-BHC	3.14	6,600	ND(<0.05)	0.003	0.3	0.3	NA	0.3
gamma-BHC (Lindane)	7.0	1,080	ND(<0.05)	0.0006	0.06	0.06	NA	0.06
Parathion	24.0	760	1.5	0.012	1.2	1.2	NA	1.2
Mitotane	N/A	N/A	N/A	N/A	N/A	N/A	NA	N/A
Methoxychlor	0.040	25,637	35.0	9.0	900	10.0	NA	900
Endrin ketone	N/A	N/A	N/A	N/A	N/A	N/A	NA	N/A
gamma-chlordane	0.56	140,000	0.1	0.14	14.0	0.54	NA	14.0
Inorganics								
Aluminum					N/A	SB	246-25,000	25,000
Antimony					N/A	SB	<3-18	18
Arsenic					N/A	7.5 or SB	0.44-21	21
Barium					N/A	300 or SB	2.3-1,600	1,600
Beryllium					N/A	1.0 or SB	0-7	7
Cadmium					N/A	1 or SB	0.01-2	2
Calcium					N/A	SB	<15-35,000	35,000
Copper					N/A	25 or SB	1.7 - 31	31
Chromium					N/A	10 or SB	1.1 - 4	40
Cobalt					N/A	30 or SB	<0.48-60	60
Cyanide					N/A	N/A	<2.9	<2.9
Iron					N/A	2,000 or SB	901-16,000	16,000
Lead					N/A	30 or SB	0.68-240	240

TABLE 6.4

SPECIFIC TBC SOIL CLEANUP CRITERIA TO PROTECT GROUNDWATER QUALITY(1)
OCCIDENTAL CHEMICAL CORPORATION
HOOKER/RUCO SITE
HICKSVILLE, NEW YORK

Compound	*Solubility S (mg/L)*	*Partition Coefficient Koc (ml/g)*	*Groundwater Standards Criteria Cw (µg/L)*	*Allowable Soil Concentration (2) Cs (ppm)*	*Soil Cleanup Objectives To Protect Groundwater Quality (3) (ppm)*	*Recommended Soil Cleanup Objective (4) (ppm)*	*Background (5,6,7) (ppm)*	*TBC Soil Cleanup Criteria To Protect Groundwater Quality (ppm)*
Magnesium					N/A	SB	<12.1-9,700	9,700
Manganese					N/A	SB	<3.4-5,000	5,000
Mercury					N/A	0.1	<0.07-0.33	0.33
Nickel					N/A	13 or SB	0.5-34	34
Potassium					N/A	SB	56-43,000	43,000
Silver					N/A	SB	<0.15-24.3	24.3
Selenium					N/A	2 or SB	0.1-3.9	3.9
Sodium					N/A	SB	10.7-50,000	50,000
Thallium					N/A	SB	<0.17-0.55	0.55
Vanadium					N/A	150 or SB	1-300	300
Zinc					N/A	20 or SB	<1.7-110	110

Notes:

(1) NYSDEC TAGM 4046, "Determination of Soil Cleanup Objectives and Cleanup Levels", 1994.
(2) Allowable soil concentration Cs = f*Cw*Koc (f=0.01).
(3) Soil Cleanup Objective = Cs*100 (correction factor).
(4) As per proposed TAGM, total VOCs ≤10 ppm, total semi-VOCs ≤500 ppm and total pesticides ≤10 ppm.
(5) McGovern, E., "Background Concentrations of 20 Elements in Soil with Special Regard for New York State".
(6) Geraghty & Miller, Inc. "Data Report, Phase I Remedial Investigation, Grumman Aerospace Corporation, Bethpage, New York (1992)"; Inorganic Soil Concentrations from GMS-1S, GMS-1I, GMS-2I, and GMS-3I.
(7) Inroganic soil concentrations from baseline borings Pilot Hole G, Pilot Hole S, and Well Q-1 installed during the 1989 RI.
NA - Not applicable.
* Log Koc = -0.55 log S + 3.64. Other values are experimental values.
N/A Not available.
MDL Method Detection Limit.

TABLE 6.5

CHEMICAL-SPECIFIC ARARs FOR AIR DISCHARGE CRITERIA
OCCIDENTAL CHEMICAL CORPORATION
HOOKER/RUCO SITE
HICKSVILLE, NEW YORK

Compound	*Toxicity Rating*	*SGC ($\mu g/m^3$)*	*AGC ($\mu g/m^3$)*
Acetone	Low	140,000	14,000
Benzene	High	30	1.2×10^{-1}
2-Butanone	Moderate	140,000	300
Chlorobenzene	Moderate	11,000	20
Chloroform	Moderate	980	23
Chloromethane	Moderate	22,000	770
1,2-Dichloroethylene (cis)	Moderate	190,000	1,900
Ethylbenzene	Moderate	100,000	1,000
4-Methyl-2-Pentanone	Moderate	83,000	830
Tetrachloroethylene	Moderate	81,000	7.5×10^{-2}
Trichloroethylene	Moderate	33,000	4.5×10^{-1}
Vinyl Chloride	High	1,300	2.0×10^{-2}
Xylenes	Moderate	100,000	300

Notes:

(1) Short-Term Guideline Concentrations (SGC) and Annual Guideline Air Concentrations (AGC), New York State Air Guide.

TABLE 8.1

SUMMARY OF GROUNDWATER ANALYSES
OCCIDENTAL CHEMICAL CORPORATION
HOOKER/RUCO SITE
HICKSVILLE, NEW YORK

Activity	*No. of Samples*	*Parameters*	*Analytical Methods*
Pumping test	6	Tables 2.2, 2.3, 2.4 and 2.5	CLP, SW846-7197, and KGD methods
QA/QC Samples for Pumping test			
Field blank	1/day	Tables 2.2, 2.3, 2.4 and 2.5	CLP, SW846-7197, and KGD methods
Trip blank	1/day	TCL VOAs	CLP SOW 7/93
MS/MSD/Dup	1/1	Tables 2.2, 2.3, 2.4 and 2.5	CLP, SW846-7197, and KGD methods
Sampling Wells J1, J2, MW-50D1, and MW-50D2	4	Tables 2.2, 2.3, 2.4 and 2.5	CLP, SW846-7197, and KGD methods

TABLE 8.2

SOIL SAMPLING SUMMARY
OCCIDENTAL CHEMICAL CORPORATION
HOOKER/RUCO SITE
HICKSVILLE, NEW YORK

Soil Boring Locations	*Number of Test Borings*	*Number of Soil Samples (1)*	*Analysis (2)*
Former drum storage area	4	8	Table 2.5 - RSCs
MW-E	1 (a)	2 (b)	Table 2.2 - Selected Organics
Sump 2	1	3	Tables 2.2 and 2.5 Selected Organics and RSCs
TOTAL	**6 (a)**	**13 (b)**	

(1) Number of soil samples for analytical testing.
(2) Analytical testing:
RSCs: Analysis for semivolatiles by KGD method.
Selected Organics: Analysis of selected TCL compounds by CLP methodologies.
(a) The number of test borings may increase by 3 based upon priority testing results from the initial test boring.
(b) The number of soil samples may increase by 6 based upon priority testing results from the initial test boring.

Note:

The following Quality Control samples will be submitted for specified analyses:

field blanks:	one per day of sampling - selected TLP compounds and RSCs.
trip blanks (1):	one per day of sampling - selected TLP VOAs
duplicates:	at a rate of 10 percent - selected TLP compounds and RSCs.
matrix spike/matrix spike duplicates:	one per batch of 10 samples (1 minimum) - selected TLP compounds and RSCs.

(1) Only to be analyzed if constituents of concern are detected in the field blank.

APPENDIX A

SAMPLING, ANALYSIS AND MONITORING PLAN

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1.0 INTRODUCTION

The Sampling, Analysis, and Monitoring Plan (SAMP) has been developed to provide a detailed description of the investigation methodologies and protocols to perform the pre-design field activities required to provide the data necessary to complete the Remedial Design (RD) for the Hooker/Ruco Site (Site) located in Hicksville, New York.

2.0 EXTRACTION WELL INSTALLATION

The groundwater extraction well will be installed using the protocols presented below.

2.1 MOBILIZATION

The Contractor will supply all equipment and materials sufficient to complete the extraction well installation in a timely manner and without undo delays. A staging area will be provided on the plant site which will be used throughout the project. Contractor will be responsible for setting up decontamination equipment of sufficient size to accommodate the drill end of the rig, including the turntable, mast, platform and rear wheels, as well as drill rods and bits.

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

The Contractor will coordinate at all times with OxyChem's representative and personnel of Ruco Polymer Corporation to insure that there is minimal disruption to plant activities. The Contractor will check in with security every time personnel or equipment enter or leave the plant property. The Contractor will have available for immediate use Level C procedure equipment, and all personnel will have been properly trained in its use.

2.2 DRILLING PROCEDURES

A 18-inch borehole will be drilled to 400 feet in depth using the mud-rotary method. The drilling fluid will be bentonite and water. All drill cuttings and drilling mud must be containerized and transported to a designated area on site for disposal.

Formation sampling for geologic characterization, using a split-spoon sampler, will be conducted at 10-foot intervals and at the discretion of the supervising hydrogeologist. Split-spoon contents will be disposed of on site with the drill cuttings.

OxyChem's site representative will monitor the work space breathing zone using a photoionization detector. Based on organic vapor levels, as specified in the site Health and Safety/Contingency Plan (HASCP) (see Appendix B), the site safety officer may require that Level C personal protection be employed.

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

At the conclusion of the drilling, a geophysical (gamma-ray) log for further geologic characterization will be performed.

Upon completion of the log, the final screen setting will be selected with EPA concurrence.

2.3 WELL CONSTRUCTION

The well will be constructed of 12-inch (pipe size) diameter, 20-slot, wirewound stainless-steel screen, Johnson or equivalent. The screen length and setting will be selected in the field by the on-site hydrogeologist.

The screen will be attached to 12-inch low-carbon steel casing, sufficient in length to complete the well to 0.5 ft bgs (foot below grade). Centralizers will be affixed to the casing to insure placement of a uniform thickness of gravel pack. Prior to installation, the well screen and casing will be cleaned using the procedures presented in Section 6.0.

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

Morie No. 1 gravel pack (or equivalent) will be introduced around the well screen using a Tremie pipe. A weighted steel tape will be used to periodically check the level of the gravel pack. The gravel pack will extend to approximately 175 feet below ground surface. A five-foot thick layer of fine sand overlain by a 5-foot bentonite seal will be installed on the gravel pack. The remainder of the annular space will be filled with a 6 percent bentonite/94 percent cement slurry using a tremie pipe.

Prior to surface completion, the well will be developed using a surge block and pumping. All development water will be containerized for disposal in Sump 1. Development will continue until the discharge is less than 5 NTUs (nepheolometric turbidity units).

The well will be completed at the surface with a pitless adapter. The wellhead will be covered with a standard steel cap with compression fittings to keep out surface water. A square or diameter round manhole and gate box will be cemented in place.

Typical extraction well construction details are shown in Figure A.1.

Following installation of the well, the elevations of the ground surface and the top of the riser pipe will be surveyed from Nassau County Benchmark (BM 14S07 G518) located along Oyster Bay Road.

3.0 MONITORING WELL INSTALLATION

OxyChem believes that sufficient wells exist to monitor the constant-rate pumping test. Should additional monitoring wells need to be installed in the future for some other purpose, the following procedures will be used.

3.1 MOBILIZATION

The mobilization procedures are presented in Section 2.1.

3.2 DRILLING PROCEDURES

Monitoring wells may be installed either as single wells or as well nests. They may also be shallow wells or deep wells.

3.2.1 Shallow Wells

Shallow wells (less than or equal to 130 feet below ground surface) will be installed using 8-inch outside diameter (4 1/4-inch inside diameter) hollow stem augers to the desired depth. For a single well, or the deepest well in a well nest, split-spoon sampling using a 3-inch diameter carbon steel split-spoon will be used at 5-foot intervals to obtain the stratigraphic information necessary to determine the screened interval for the well(s). Split-spoon contents will be disposed of on Site with the drill cuttings. Since split-spoon sampling will be performed, gamma-ray logging is not necessary. If a clay layer over 1-foot thick is detected in the screened interval, the first 10 feet of sand below the clay will be screened. Groundwater table wells will have a 15-foot screen extending from approximately 5 feet above the groundwater table to 10 feet below it. The final screen setting will be selected with EPA concurrence.

Air monitoring and investigation derived wastes will be handled as described in Section 2.2.

3.2.2 Deep Wells

Deep wells (greater than 130 feet bgs) will be installed using the mud rotary drilling method presented in Section 2.2 with the exception that the borehole will be 6-inch diameter. For a single well or the deepest well in a well nest, split-spoon sampling and gamma-ray logging will be performed. The final screen setting will be selected with EPA concurrence.

Air monitoring and investigation derived wastes will be handled as described in Section 2.2.

3.3 WELL CONSTRUCTION

Monitoring wells will be constructed of either precleaned 2-inch diameter stainless steel or PVC with the following properties:

i) Stainless Steel - 10-slot, wire-wound screen, Johnson or equivalent, 10 to 20 feet in length with flush-joint threads and Schedule 304 riser pipe;

ii) PVC - 10-slot screen, 10 to 20 feet in length with flush-joint threads and Schedule 80 riser pipe.

The screen will be set at least 1 foot from the bottom of the borehole with sufficient riser pipe to extend from the top of the screen to approximately 2 feet above the ground surface.

The annular space will be filled from the bottom of the well to at least 2 feet above the top of the screen with clean Morie No. 1 gravel pack (or equivalent). A weighted steel tape will periodically be placed down to annulus to ensure the gravel pack comes at least 2 feet above the screen. A minimum 2-foot layer of fine sand overlain by bentonite seal at least 2 feet thick will be placed above the gravel pack and the remaining annular space will be filled with a 6 percent bentonite-cement slurry using a tremie pipe.

A security casing with locking cap will be installed for each well.

A 3 to 4-foot diameter cement pad will be constructed around the security casing and mounded in such a way as to direct surface runoff from the casing. The security casing will be locked. Typical monitoring well construction details are shown in Figure A.2.

The wells will be developed by pumping and surging. The surging may be done by periodically pumping, or with a surge block. The site geologist will monitor pumping rates, water color, turbidity, pH, and conductivity with instruments calibrated pursuant to the manufacturers specifications to determine the effectiveness of the development. Well development will be considered complete when turbidity measurements indicate that the discharge has 50 NTU's. All development water will be discharged into Sump 1 allowing the water to return where it originated.

Following installation of the wells, the elevations of the ground surface and the tops of the riser pipes and security casings will be surveyed from Nassau County Benchmark (BM 14S07 G518) located along Oyster Bay Road.

4.0 FORMATION SAMPLING

The split-spoon sampler will be a 3-inch diameter, rust-free carbon steel Lynex, or equivalent, sampling device. A representative portion of each split-spoon sample will be placed in a labeled clean glass jar and analyzed by a HNU photoionization detector or equivalent, calibrated daily according to Attachment 1, by the head-space analysis described in Attachment 2. If a 5-ppm (parts per million) concentration results from the headspace analysis of a split-spoon sample or visual observations of stained soils are made, the samples and drill spoil will be containerized and characterized for disposal purposes. All samples for characterization analysis will be homogenized in the field as specified in Attachment 3, except for the volatiles portion. A determination of sample disposition will be made within 5 minutes, during which time the split spoon will be kept closed. The soil samples described above for analytical testing will be analyzed to comply with the requirements of the TSDF.

The soil sampling equipment including homogenizing tools will be cleaned with procedures outlined in Attachment 4. Field blanks will be collected from the soil sampling equipment to ensure that cleaning procedures have been adequately completed. Field blanks will consist of pouring demonstrated analyte-free deionized water through the sampling equipment and collecting the runoff in appropriate laboratory containers. Field blanks will be collected from each piece of sampling equipment; split spoons, pans and spatulas used for sample homogenization, and will be collected at the beginning of each work day that the equipment is used. Field blanks will be analyzed for the same parameters as the samples collected that day. The field blanks will be sent for laboratory analysis with the samples collected that day.

5.0 SUBSURFACE SAMPLING (SHALLOW BORINGS)

Shallow subsurface soil borings will be drilled at the locations shown on Figure A.3 using 8-inch outside diameter hollow stem augers. The borings will vary in depth from 5 to approximately 35 feet. Figure A.3 also shows the number of samples (zero, two or three) to be obtained for analysis at each location. A summary of the investigative soil samples to be collected, parameters to be analyzed, and analytical protocols are presented in the Work/QA Plan Short Form included in Appendix E. The soil samples will be collected according to the protocol outlined in Attachment 3 with the sampling equipment cleaned according to the protocol outlined in Attachment 4. Soil sample duplicates will be collected at a rate of 10 percent. All test borings will be backfilled with a bentonite cement grout (6 percent - 94 percent) and sealed with a cement cap.

In each shallow boring continuous split-spoon samples will be taken and subjected to a head-space analysis and the readings recorded. Selected samples will be submitted for chemical analysis except from the borings installed in the area of the proposed recharge basin. The remainder of the samples selected for chemical analysis and the other split-spoon samples not selected for chemical analysis shall be retained for geologic record.

The following paragraphs describe the samples to be taken at each boring location.

5.1 FORMER DRUM STORAGE AREA

Four shallow (0 to 5 ft bgs) test borings will be drilled at locations 10 feet north, east, south and west of TB-10. Soil samples will be collected for analysis at a depth of 0 to 2 feet bgs and 3 to 5 feet bgs at each location. The soil samples will be analyzed for the RSCs (see Table 2.5 in the RDWP).

5.2 MW-3

A shallow (0 to 5 ft bgs) test boring will be drilled immediately adjacent and east (within 5 feet) of MW-E. Soil samples will be collected for analysis at a depth of 0 to 2 feet bgs and 3 to 5 feet bgs. The soil samples will be analyzed for selected organic compounds (see Table 2.2 in the RDWP) on a priority basis (verbal results within 48 to 72 hours). If, based on the priority results, PCE is detected at levels greater than the TBC soil clean-up value of 1.4 mg/kg, then additional shallow test borings (0 to 5 ft bgs) will be drilled 10 feet north, east and south of MW-E to define the extent of soil which may require remediation. The shed located immediately adjacent to MW-E prohibits drilling of exploratory test borings in a westerly direction. Soil samples in the expanded test boring pattern, if required, will be collected from 0 to 2 feet bgs and 3 to 5 feet bgs. The soil samples will be submitted for analysis of selected organic compounds (RDWP Table 2.2).

5.3 SUMP 2

One test boring will be drilled in the center of Sump 2 and will extend from the base of the sump to the groundwater table (approximately 35 feet below the sump bottom). Soil samples will not be collected within 10 feet of the base of Sump 2 since these soils were assessed during the RI and found to be of acceptable quality. At least three soil samples will be collected between 10 ft bgs and the groundwater table. Samples selected for analysis will be based on the following:

i) three samples with the highest headspace screening readings will be selected for analysis;

ii) one of the three samples will be collected of the deep soils, 30 feet or deeper below the base of the sump; and

iii) one of the three samples collected will be a visibly stained sample (if available).

All soil samples collected from Sump 2 will be analyzed for selected organic compounds and RSCs (RDWP Tables 2.2 and 2.5, respectively).

The boring in the base of Sump 2 will be backfilled with 6% bentonite/cement grout using a Tremie pipe to ensure complete sealing of the test boring.

5.4 PROPOSED RECHARGE BASIN

Four test borings will be drilled at the locations shown on Figure A.3 to a depth of approximately 20 feet bgs. The purpose of these borings is to determine the hydraulic characteristics of the soils and the suitability of the area as a recharge basin. Up to four soil samples will be selected for grain size analysis. It is expected that the samples will be selected from those intervals with the finer grain materials. The soils will be logged using the Unified Soil Classification System.

6.0 EQUIPMENT CLEANING

6.1 CONSTRUCTION EQUIPMENT

All of the drilling equipment that comes in contact with the boring will be steam-cleaned between each boring. Well casings and screens will be steam cleaned prior to installation to ensure that all oils, grease, and waxes from manufacturing have been removed. A cleaning area will be set up in a central location and used throughout the pre-design investigation. The cleaning area will be lined with polyethylene sheeting and bermed to collect the runoff. All cleaning water will be collected and staged on-site in 55-gallon drums. The cleaning water will be analyzed to determine proper disposal.

6.2 SAMPLE COLLECTION AND MONITORING EQUIPMENT

Soil sample and groundwater sample collection equipment will be cleaned using the protocol presented in Attachments 4 and 6, respectively.

Downhole equipment for the gamma log and water level monitoring equipment will be cleaned with low phosphate soap and water with a final rinse with deionized water.

7.0 DISPOSAL OF DRILL CUTTINGS

Split-spoon samples will be field screened in accordance with procedures presented in Attachment 2. Any split-spoon sample that has a PID reading of 5 ppm (parts per million) or greater from the headspace will require the containerization of drill cuttings. The drill cuttings will be contained in 17-H 55-gallon drums until a split-spoon sample has a concentration less than 5 ppm. If headspace results do not exceed 5 ppm, the drill cuttings will be distributed evenly around the surface of the boring.

8.0 GEOPHYSICAL LOGGING

When deep borings (greater than 140 feet bgs) for monitoring or extraction wells are drilled to the proposed depths, each borehole will be geophysically logged by the gamma method. The gamma log measures the radiation of gamma rays from certain radioactive elements that occur naturally in subsurface clay formations. Low intensity gamma-ray activity indicates a sand layer. Prior to and between uses, the downhole equipment will be cleaned using the procedures described in Section 6.2.

9.0 WATER-LEVEL MEASUREMENTS

Water-level measurements will be taken from the new and previously installed wells on a bimonthly basis for the duration of the field investigation. Prior to and between uses, the downhole equipment will be cleaned using the procedures described in Section 6.2.

10.0 GROUNDWATER SAMPLING

Groundwater samples will be analyzed for selected TCL/TAL parameters using CLP methodology, except for hexavalent chromium and for TIC's. Hexavalent chromium will be analyzed using SW846 Method 7197 and the TICs will be analyzed using the KGD method. Non-filtered samples from monitoring wells will be collected using the procedures in Attachment 5. Filtered samples will be collected for metals analysis if the groundwater contains observable sediment. These will be analyzed at the discretion of OxyChem. The procedure to collect filtered metal samples from monitoring wells is presented in Attachment 5. Groundwater samples collected from the long-term pumping test will be obtained from sample ports located in the pump discharge line and in the discharge line from the temporary treatment plant. The flow rate from the sample ports will be adjusted to prevent aeration during the collection of groundwater samples for VOC analysis. A summary of the investigative groundwater samples to be collected parameters to be analyzed, and analytical protocols are presented in the Work/QA Plan Short Form included in Appendix E.

Field measurements will be made for pH, specific conductance, turbidity, and temperature with instruments calibrated pursuant to manufacturers specifications. All wells will be allowed to stabilize from time of installation for a minimum of two weeks prior to sampling. The wells will be sampled according to the protocol outlined in Attachment 5.

10.1 FIELD QA/QC

Replicate groundwater samples will be collected at a rate of 10 percent.

Trip blanks, consisting of demonstrated analyte-free water and sealed in 40 mL septum vials will be transported into the field where sampling for volatile organics in an aqueous matrix occurs. Trip blanks will be collected at a frequency of one per day of sampling.

The sampling equipment will be cleaned according to the protocol outlined in Attachment 6. Field blanks will be collected from the sampling pump to assure that the cleaning procedures have been adequately completed. The field blank will consist of inserting the cleaned sample pump into a section of dedicated 2-inch diameter stainless steel casing with a bottom plug. After the pump has been installed into the casing, the casing will be filled with demonstrated analyte-free deionized water and the pump will then be turned on. The field blank will be collected from the pump's discharge and placed in appropriate laboratory containers. Field blanks will be collected each day that the groundwater sampling equipment is used. Field blanks will be sent for laboratory analysis with the samples collected that day. The field blanks will be analyzed for the same parameters as the collected sample.

The purged water from all of the wells will be discharged to the ground surface in Sump 1 and allowed to return to the water table where it originated.

11.0 PROCEDURES FOR RUNNING A STEP-RATE PUMPING TEST

11.1 PURPOSES OF THE TEST

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

11.2 SETTING UP THE TEST

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

A pump with the full range of capacities (up to 600 gpm) required for the testing will be installed. The depth of the pump intake will be sufficient to insure that the anticipated drawdown will not dewater the pump. Reaction of the well during development should provide a good indication of expected drawdowns.

Install a flow measuring device which has an accuracy of at least 90 percent of the true flow (± 10 percent). Use of an orifice plate and manometer is recommended, though not always possible. If the rates are low, a graduated container or 55-gallon drum is sufficiently accurate.

If a flow meter is to be used, it must be capable of providing rapid data, either through a volume/time measurement or through a totalizer which can be accurately read over a short period of time, such as one minute. All meters will be calibrated prior to running a test. Details regarding the type of meter to be used and its calibration procedure will be submitted to the EPA upon selection and prior to initiation of the test.

Water levels will be obtained by transducers and the data stored on a logger, follow the standard operating procedure for the use of the equipment model. The transducer will have the correct pressure range for the anticipated drawdowns.

A temporary groundwater treatment system will be mobilized to the Site. The technology to be implemented for treating the extracted groundwater will be determined after the bench-scale testing has been completed. The discharge of treated water from the step-rate test will be directed to Sumps 1, 2 and Sump 3 as required. It may be necessary to construct additional recharge basins to perform the pumping tests. Details regarding the temporary treatment facility and recharge basin requirements will be submitted to the EPA for approval prior to initiating the pumping tests.

11.3 TEST PROCEDURES

Four steps will be run for one hour each or until the rate of groundwater level decline in the pumped well has stabilized (less than 0.1 feet/minute) whichever is shorter, without recovery periods between steps. The test rates will be 150, 300, 450, and 600 gpm. This will result in 90,000 gallons of water requiring treatment prior to discharge if each step is performed for one hour.

Immediately before start-up a static water level will be obtained. Turn the pump on at the desired rate and rapidly adjust it to correct flow. Set the datalogger to record measurement at 10-second intervals for the first 1 to 10 minutes, and at 5-minute intervals for the remainder of the step.

Manual measurements will be taken at 20 minute intervals during the test as a check of the equipment performance and accuracy. Repeat this procedure for each additional step. At the end of the last step shut the pump off and measure water-level recovery using the same frequency of measurements as above.

11.4 DATA ANALYSIS

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

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

12.0 PROCEDURES FOR RUNNING A CONSTANT-RATE PUMPING TEST

12.1 PURPOSE OF THE TEST

A constant-rate pumping test will be used to determine the transmissivity and storativity of the Magothy aquifer. These will be used to refine the flow component of the computer model presented in Appendix C so that it will more accurately simulate aquifer responses to pumping.

The test will also be used to determine the pumping rate necessary to achieve the system objective of minimizing off-Site migration of groundwater.

12.2 SETTING UP THE TEST

In order to establish antecedent trends in the levels of the potentiometric surface, water levels will be obtained for 96 hours prior to the test in the pumping well from all observation wells which will be monitored during the test, and a background well, located well beyond the anticipated influence of the pumping test response. A list of wells is shown on Table A.2. Measurements should be a minimum of four hours apart. Two hours prior to start-up of the test, the frequency of measurements will be increased to hourly. All readings will be taken from the same point throughout the test, usually a well marked point on the top of the casing.

A rain gage and barometer will be set up 96 hours prior to the test and readings will be taken daily on both instruments, with barometric changes obtained more frequently during the actual test.

It is expected that the pump and flow measuring device installed for the step-test will be used for the constant-rate test.

Water levels will be obtained by transducers and the data stored on a logger, follow the standard operating procedure for the use of the equipment model. The transducer will have the correct pressure range for the anticipated drawdowns.

The technology to be implemented for treating the groundwater extracted during the test will be determined after bench-scale testing has been completed. The anticipated pumping rate is 500 gpm for a 24-hour period, which will result in 720,000 gallons of water requiring treatment. The actual pumping rate will be determined after review of the step-test results.

Discharge of the treated water will be directed to the new recharge basin to be constructed in the western plant area. An evaluation of recharge basin requirements will be submitted to the EPA prior to starting the pumping tests.

12.3 TEST PROCEDURES

Immediately before start-up, static water levels will be obtained in the pumping well. Turn the pump on at the desired rate and rapidly adjust it to the current flow. Set the datalogger to record measurements at 10-second intervals for the first minute, 1-minute intervals from 1 to 10 minutes, and at 5-minute intervals for the first hour. Hourly measurements should be obtained until the end of the test. Manual measurements will be obtained at 8-hour intervals during the test as a check of the equipment performance and accuracy.

Water-level measurements will be obtained in the observation wells at the frequency shown on Table A.1.

Samples from the pumping well and from the temporary treatment facility for water-quality analyses will be obtained after 24 hours and 48 hours of the test, and just before the well is turned off. Sampling and analytical protocols are presented in the Quality Assurance Project Plan.

At the end of the test, the pump will be shut down and water levels will be obtained during the recovery period at the same frequency as during start-up. The length of the recovery period will be determined in the field.

12.4 DATA ANALYSIS

The data will be converted to drawdown readings by subtracting the depth to the static water level from the pumping water level.

Drawdown data will be plotted on semilogarithimic format with time on the x-axis and drawdown on the y-axis for all wells. The Jacob Method will be used to arrive at transmissivity and storage coefficient values.

Plot final drawdowns from all wells on a semilogarithmic format with distance from the pumping well on the x-axis and drawdown on the y-axis. The Theis Method will be used for determining transmissivity and storage coefficients.

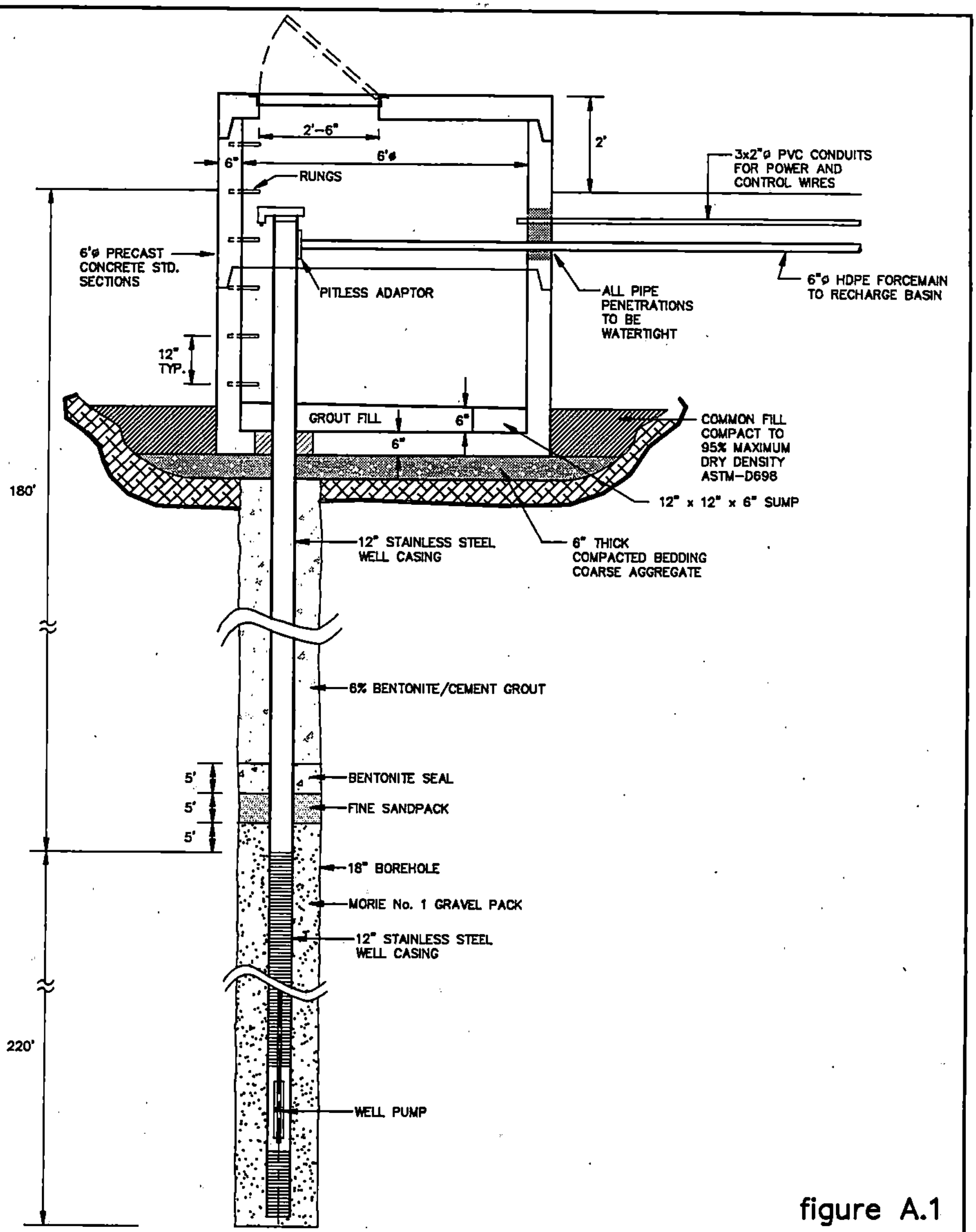

figure A.1

TYPICAL EXTRACTION WELL CONSTRUCTION DETAILS
RD WORK PLAN
HOOKER/RUCO SITE
Hicksville, New York

CRA

6883 (4) OCT 18/95(W) REV.0 (D-09)

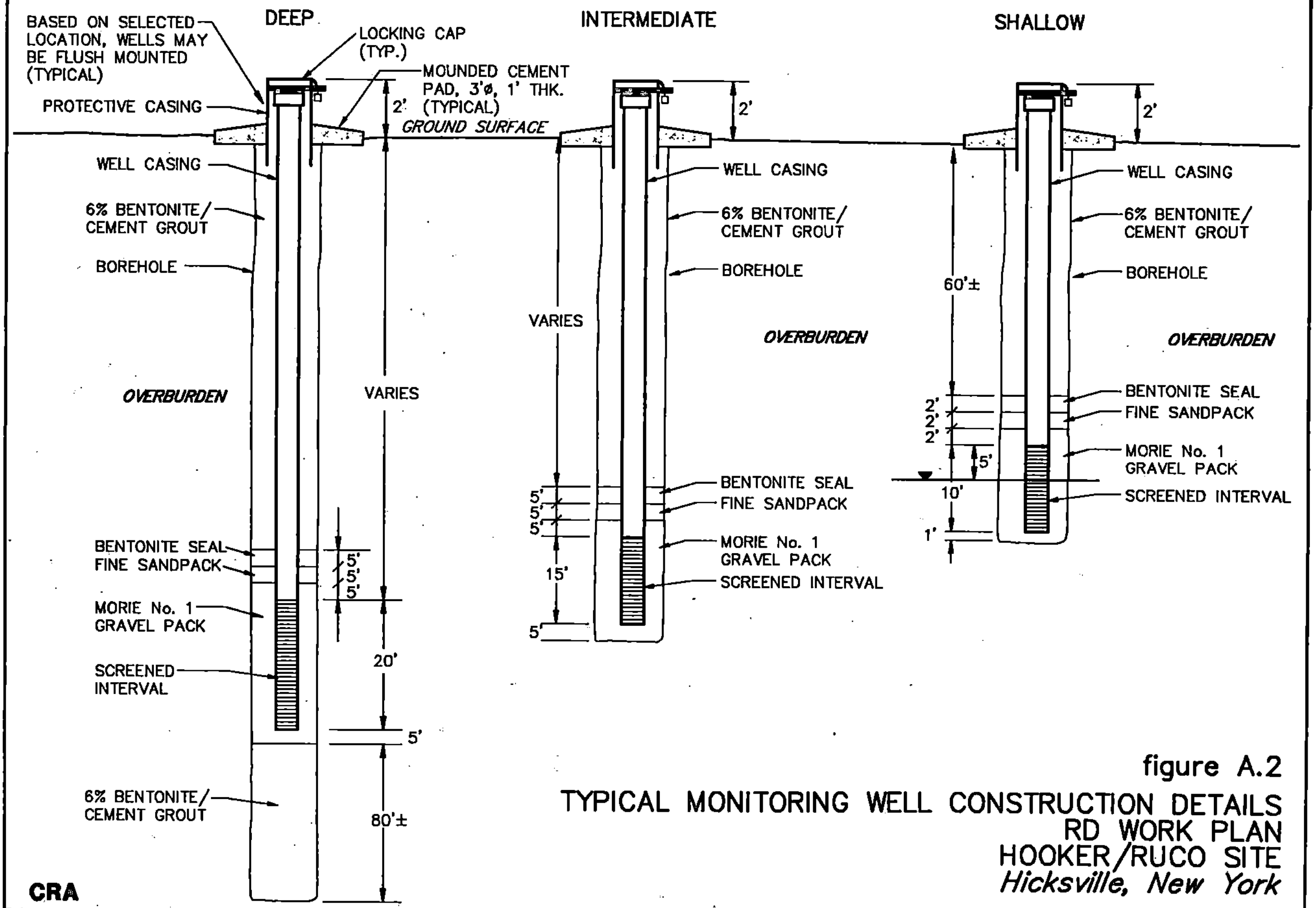

figure A.2

TYPICAL MONITORING WELL CONSTRUCTION DETAILS
RD WORK PLAN
HOOKER/RUCO SITE
Hicksville, New York

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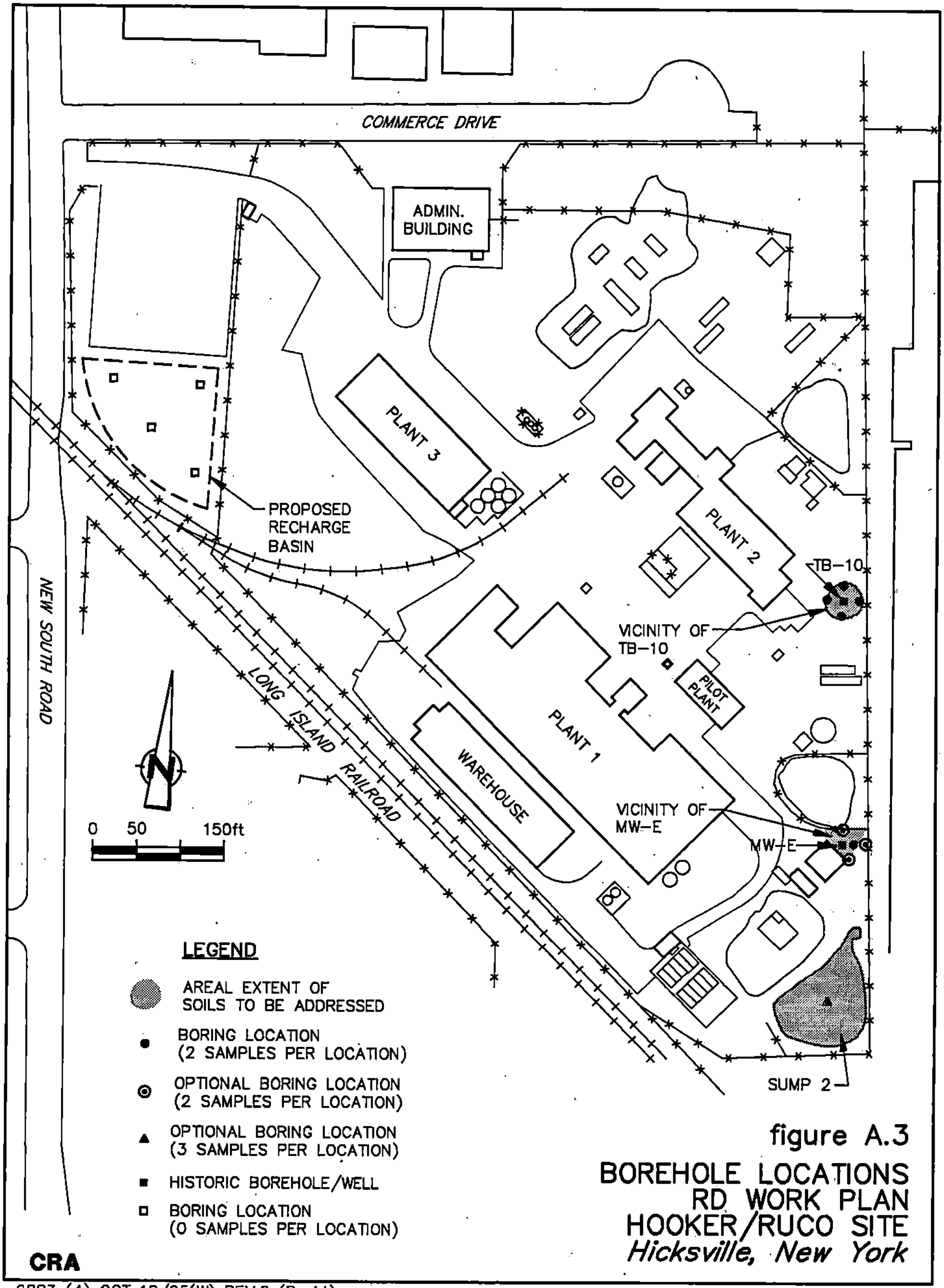

figure A.3

BOREHOLE LOCATIONS
RD WORK PLAN
HOOKER/RUCO SITE
Hicksville, New York

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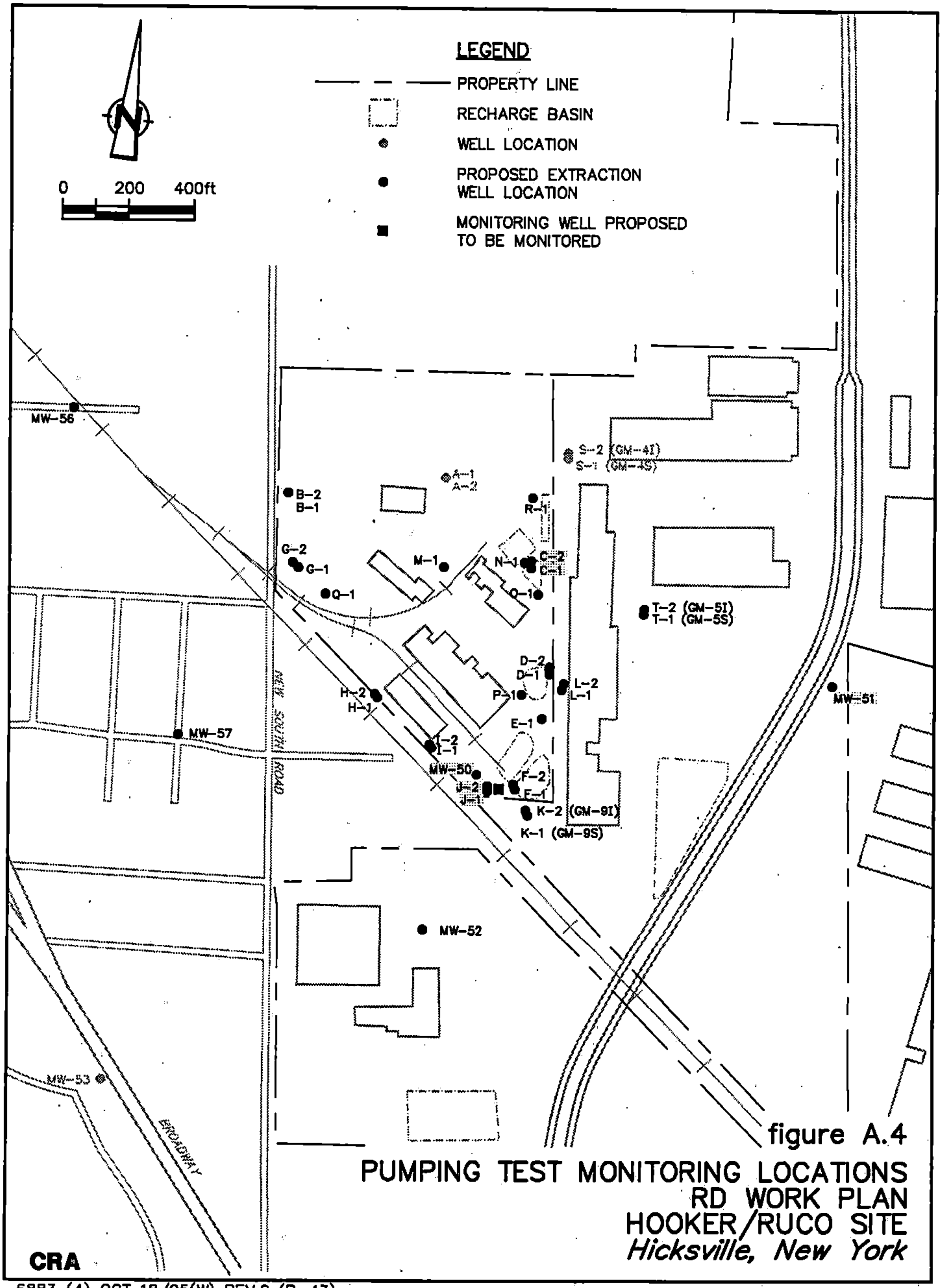

figure A.4

PUMPING TEST MONITORING LOCATIONS
RD WORK PLAN
HOOKER/RUCO SITE
Hicksville, New York

6883 (4) OCT 18/95(W) REV.0 (P-43)

TABLE A.1

CONSTANT-RATE PUMPING TEST MONITORING WELLS
HOOKER/RUCO SITE
HICKSVILLE, NEW YORK

Well ID	*Ground Elevation (ft amsl)*	*Top of Casing Elevation (ft amsl)*	*Casing Diameter (inches)*	*Screen Diameter (inches)*	*Depth To Top of Screen (ft bgs)*	*Depth to Bottom of Screen (ft bgs)*	*Monitoring Group(1)*
B-1	130.5	132.65	2	2	49	69	3
B-2	130.5	132.64	2	2	86	104	3
C-1	133.3	135.62	2	2	50	70	2
C-2	133.3	135.60	2	2	114	124	2
D-1	130.1	132.37	2	2	45	65	3
D-2	130.1	132.32	2	2	86	91	3
E-1	129.3	131.96	2	2	46	66	2
E-2	129.3	131.68	2	2	75	90	2
F-1	129.8	131.79	2	2	47.5	67.5	1
F-2	129.8	131.56	2	2	90	110	1
G-1	128.9	130.56	2	2	55	70	2
G-2	128.9	130.73	2	2	120.2	130.2	2
H-1	130.8	131.10	2	2	54.4	69.4	3
H-2	130.8	131.27	2	2	120.2	130.2	3
I-1	130.3	129.95	2	2	55	70	3
I-2	130.3	129.90	2	2	119.5	129.5	3
J-1	129.4	132.38	2	2	53	68	1
J-2	129.4	132.38	2	2	129	139	1
K-1 (GM-9S)	128.6	130.75	2	2	53	68	2
K-2 (GM-9I)	128.6	130.54	2	2	120.6	130.6	2
L-1	129.8	131.54	2	2	53.3	68.3	2
L-2	129.8	131.65	2	2	120.2	130.2	2
M-1	133.0	135.64	2	2	55	70	3
O-1	132.8	134.80	2	2	52	67	2
P-1	130.0	132.37	2	2	53	68	2
Q-1	130.5	132.67	2	2	53	68	2
R-1	134.0	136.11	2	2	53	68	3
T-1	131.6	131.15	2	2	53.0	68.0	3
T-2	131.6	131.31	2	2	119.1	129.1	3
MW-50D1	(2)	132.63	2	2	285	305	1
MW-50D2	(2)	132.03	2	2	415	435	1
N10593	-	128.50	2	2	72	77	2
MW-51D1	(2)	(2)	2	2	(2)	(2)	3
MW-51D2	(2)	(2)	2	2	(2)	(2)	3
MW-52D1	(2)	(2)	2	2	(2)	(2)	3

TABLE A.1

CONSTANT-RATE PUMPING TEST MONITORING WELLS
HOOKER/RUCO SITE
HICKSVILLE, NEW YORK

Well ID	*Ground Elevation (ft amsl)*	*Top of Casing Elevation (ft amsl)*	*Casing Diameter (inches)*	*Screen Diameter (inches)*	*Depth To Top of Screen (ft bgs)*	*Depth to Bottom of Screen (ft bgs)*	*Monitoring Group(1)*
MW-52D2	(2)	(2)	2	2	(2)	(2)	3
MW-56D1	(2)	(2)	2	2	(2)	(2)	3
MW-56D2	(2)	(2)	2	2	(2)	(2)	3
MW-57D1	(2)	(2)	2	2	(2)	(2)	3
MW-57D2	(2)	(2)	2	2	(2)	(2)	3

Notes:

(1) Monitoring Frequency
Groundwater levels will be monitored at the following frequency:

Group 1:
- every minute for the first 10 minutes
- every 10 minutes for the remainder of the first hour
- hourly until the end of the test

Group 2:
- every 10 minutes for the first hour
- hourly for the next five hours
- once every two hours until the end of the test

Group 3:
- every 30 minutes for the first hour
- hourly for the next five hours
- once every four hours until the end of the test

(2) To be supplied when wells are installed.

ATTACHMENT 1

HNU MODEL P1-101 PHOTOIONIZATION ANALYZER SPECIFICATIONS AND CALIBRATION

Application:	Detection of trace volatile organic vapors in ambient air
Method Detection:	Photoionization
Ranges:	0-20, 0-200 and 0-2,000 ppm (benzene referred)
Sensitivity:	0.1 ppm
Repeatability:	±1% of full scale
Operational Temperature:	greater than 32°F
Response Time:	Less than 3 seconds to 90% of full scale
Dimensions:	Probe - 2-1/2" dia. x 11-1/4" long Unit - 8-1/4" w. x 6-1/2" h. x 5-3/16" d.
Power:	Internal rechargeable battery - 12 VDC
Maximum Continuous Operation:	10 hours on fully charged battery
Outputs:	Analog meter; 0-20, 0-200 and 0-2,000 ppm Signal output for recorder; 0-5 VDC
Alarms:	Audible and visual alarm to be set at 5 ppm.

STANDARD OPERATING PROCEDURE
HNU MODEL HW-101
PHOTOIONIZATION DETECTOR

Meter Use

1. Unclamp the cover from the main readout assembly and connect the probe cable to the 12 pin keyed connector on the readout assembly panel.
2. Screen the filter nozzle securely into the probe end cap.
3. Check the battery operation. Turn the function switch to the BATT position. If the battery is fully charged, the needle should move to the right and go into the green zone of the scale. If the needle is below the green zone or if the low battery indicator comes on, the batteries must be recharged.
4. Check the zero adjustment. Turn the function switch to the STANDBY position. The needle should align with the zero position on the scale. If this does not occur, then adjust the needle until a zero reading is achieved using the zero adjustment.
5. Select an appropriate operating range using the function switch. It is recommended that the user start with a 0 to 2,000 position and switch to a more sensitive range as required. Once the appropriate operating range has been selected, the instrument is now operational and ready for use.

Calibration Procedure

1. Attach the regulator to the calibration cylinder which has a mixture of 100 ppm isobutylene in pure air. Attach the analyzer directly to the output of the regulator using a short piece (butt connected) of flexible tubing.
2. Open the regulator and allow the calibrant gas to flow directly from the cylinder to the analyzer.
3. Unlock the span control knob on the main readout assembly by turning the locking mechanism counter-clockwise. Adjust the span control knob to read the required setting shown on the calibrant cylinder. (Note, the span knob should be set at 9.8 and the needle should read 57 ppm when the function switch is positioned on the 0 to

200 scale, using a 10.2eV lamp and 100 ppm isobutylene calibrant gas.) After setting the span knob to the correct setting, relock the knob by turning the locking mechanism clockwise.

4. After adjusting the span knob, set the function switch back to STANDBY position and recheck the zero setting. If the zero setting requires adjustment, complete the adjustment and recalibrate the span setting using the calibrant gas.

5. If the span setting is less than 9.0, after zero readjustments, or calibration cannot be achieved, then the lamp bulb must be cleaned.

Lamp Cleaning

1. The function switch must be in the off position prior to disassembling the instrument.

2. Disassemble the probe following directions outlined in Paragraph 6. 2-1 of the operation manual.

3. Clean the lamp bulb with a mild detergent, rinse with deionized water and wipe dry with lens paper.

4. If rigorous cleaning of the lamp bulb is required, clean the lamp with special HNU cleaning compound supplied by the manufacturer.

5. Reassemble the probe and recheck the calibration of the analyzer.

ATTACHMENT 2

PROTOCOL FOR SCREENING SOIL SAMPLES FOR VOLATILE ORGANIC COMPOUNDS

Equipment

PID

Sample jars with lids (approximately 40 milliliter)

Aluminum foil

Rubber band

Procedure

1. Transfer a representative portion of the sample into the sample jar. Close the split spoon to minimize volatilization.
2. Seal the jar with a piece of the aluminum foil and secure it with a rubber band.
3. Store the sample in a warm area (25°C minimum).
4. In order to take a measurement, push the intake probe of the instrument through the aluminum foil, taking care not to allow soil or water to enter the intake.
5. Record the highest reading, which usually occurs within 5 seconds of puncturing the seal. Record measurement on log. Allow meter to return to zero before next measurement.

ATTACHMENT 3

PROTOCOL FOR SOIL SAMPLING

Equipment

Split-spoon samplers

Polyethylene sheeting

Table (optional)

Surgical gloves (or equivalent) and Solvex gloves

Spatula and mixing bowl (stainless steel)

Procedure

1. Assemble the 3-inch diameter rust-free carbon steel Lynex, or equivalent, split-spoon sampler when all parts have been cleaned.
2. Transfer the sampler to the driller (or helper); be sure that this person has clean gloves on.
3. The sample will then be collected by the driller using the standard penetration test.
4. Obtain the sampler from the driller and place it on polyethylene sheeting.
5. Unscrew the end cap and break the spoon open to expose the sample.
6. Using only the spatula, cut off the top 2 to 3 inches of sample and discard, and transfer an appropriate portion to the sample container for volatile organic analysis. The sample portion for volatile organic analysis will be placed into the VOA vials immediately upon opening the split-spoons and prior to screening. The sample portion for volatile organic analysis will not be homogenized. Fill the vial as completely as possible. If the sample is from a predetermined depth requiring analysis, homogenize the remainder of the sample using a stainless steel pan and a stainless steel spatula. Where appropriate, because of sample cohesiveness, use the coning and quartering method of homogenization. Put the sample in the appropriate containers. If the sample is to be screened for volatile organics, remove a small portion and conduct the screening as specified in the Protocol for Screening Soil Samples for Volatile Analysis, making sure the split-spoon is closed. If the sample is selected for chemical analysis, homogenize the remainder and put it in the

appropriate containers. Only those filled VOA vials which have been selected for chemical analysis will be submitted. The contents of the filled VOA vials not selected for chemical analysis will be placed with the drill cuttings and the emptied vials disposed as sanitary waste.

7. Fill out the sample label (project, location, depth, date, etc.) and cover with transparent tape. Place the container in a cooler with ice.

8. Fill out sample/core log and chain-of-custody form.

ATTACHMENT 4

PROTOCOL FOR CLEANING SOIL SAMPLING EQUIPMENT

1. With a dedicated wire brush, clean out any solid material remaining in or on the sampling equipment.

2. Place all sampling equipment on a grate with a catchment drum beneath it.

3. Wash with low phosphate detergent and tap water.

4. Rinse with tap water.

5. Rinse with 10 percent HNO_3, ultrapure (or 1 percent HNO, if the sampling equipment is made of carbon steel) if used for metal sampling.

6. Rinse with tap water.

7. Rinse with acetone (or methanol, followed by hexane). Solvents will be pesticide grade or better.

8. Rinse with deionized water. The deionized water will be demonstrated analyte free. Copies of the laboratory analysis will be kept on site for inspections during EPA audit.

9. Air dry.

10. Reassemble all sampling equipment with gloved hands.

11. Wrap in aluminum foil, shiny side out.

ATTACHMENT 5

PROTOCOLS FOR SAMPLING GROUNDWATER BY BLADDER PUMP

Equipment

Bladder
Air compressor
Cycle controller
Teflon-lined polyethylene tubing
Measuring tape and chalk (M-scope)
Sample bottles
0.45 um filters
Graduated bucket
Distilled water
Rags
Alconox™ laboratory cleaner
Sample containers
Polyethylene sheeting
pH meter and buffers
Test tube or vials
Conductivity meter and standard
Gloves (Latex, Nitrile, or equivalent)
Thermometer
Turbidity meter

Procedure

1. Unlock the well and measure the depth to water with a chalked tape or M-scope to the hundredth of a foot. Calculate the amount of water standing in the well.

2. Lower the clean bladder pump with dedicated Teflon-lined discharge tubing down the well and secure the pump directly below the measured water surface. Attach air source to bladder pump.

3. Periodically measure the flow rate using a graduated bucket. Operate the pump in a continuous manner to avoid aerating the samples. When collecting samples for volatile organics, TOX and TOC, pumping rates will not exceed 100 milliliters per minute. Record pumping rates on sampling log. The pump will

be lowered as required, to account for drawdown in the well and to ensure that all standing water has been removed.

4. Pump three times the amount of standing water from the well before sampling. Put on protective gloves.

5. While the well is being evacuated, the pH, conductivity, turbidity, and temperature will be monitored to confirm that formation water is being sampled.

6. If dissolved metals sampling is to be performed, attach an in-line 0.45 micron filter with cellulose acetate filter media and either polypropylene or polyethylene housing, or performance equivalent to the discharge tube and direct sample to container. Add preservatives as required.

7. Fill containers and place all filled containers in cooler with ice. The bladder pump will be operated in a continuous manner so that it does not pulsate, which may cause aeration in the return tube or discharge. Note: Do not rinse bottle with sample water before filling. Volatile vials are to be filled first.

8. Complete water sampling log and chain-of-custody form.

9. Lock well and deliver samples to the shipping courier. Place airbill number and signature on chain-of-custody. Samples will be sent via overnight courier to the laboratory.

ATTACHMENT 6

PROTOCOL FOR CLEANING GROUNDWATER SAMPLING EQUIPMENT

1. Remove dedicated Teflon-lined polyethylene tubing, wipe it down with tape water and store in a plastic bag.

2. Remove the dedicated Teflon bladder and store it with the tubing.

3. The only parts of the pump having contact with the sample are the pump barrel exterior, the bottom check valve, and the tubing connector on top. These three items will be cleaned as follows.

4. Wash with low phosphate detergent followed by a tap water rinse.

5. Rinse with 10 percent HNO_3, ultrapure, followed by a trap water rinse, (only if metals are being tested).

6. Rinse with acetone (or methanol followed by hexane) followed by a deionized water rinse. Solvents will be pesticide grade or better. The deionized water will be demonstrated analyte free. Copies of the laboratory analysis will be kept on Site for inspection during EPA audit.

7. Air dry.

8. Reassemble with new dedicated bladder and tubing.

9. Wrap with aluminum foil, shiny side out.

APPENDIX B

HEALTH AND SAFETY PLAN/CONTINGENCY PLAN

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(Following Report)

LIST OF TABLES
(Following Report)

LIST OF APPENDICES

1.0 INTRODUCTION

The Health and Safety/Contingency Plan (HASCP) presented herein describes the health and safety procedures and emergency response guidelines to be implemented during the Remedial Design/Remedial Action activities at the Hooker/Ruco Site (Site) in Hicksville, New York. Figure B1.1 presents a layout of the Site.

The activities to be completed at the Site include the following:

i) mobilization and demobilization of labor, materials, and equipment to the Site;
ii) installation of soil borings;
iii) installation of a groundwater extraction well;
iv) pump testing activities;
v) soil sampling activities;
vi) groundwater monitoring activities;
vii) completion of treatability studies;
viii) soil excavation activities;
ix) installation of a groundwater treatment system; and
x) decontamination activities.

During project activities personnel may come in contact with soils, sediments, groundwater, and waste materials which potentially contains hazardous substances. This HASCP has been developed to ensure the following:

i) that Site personnel are not adversely exposed to the compounds of concern;

ii) that public health and the environment are not adversely impacted by contaminated materials which may potentially migrate off-Site during work activities at the Site;

iii) compliance with applicable governmental and non-governmental (American Conference of Governmental Industrial Hygienists [ACGIH]) regulations and guidelines. In particular, the amended rules of the Occupational Safety and Health Act (OSHA) for Subpart H of Part 1910 (Title 29 Code of Federal Regulations (CFR) Part 1910.120) will be implemented for all Site work; and

iv) initiation of proper emergency response procedures to minimize the potential for any adverse impact to Site workers, Ruco Polymer Corporation employees, the general public or the environment.

For the purpose of this HASCP, all project activities performed on Site involving contact with potentially contaminated materials will be considered contaminated operations requiring personal protective equipment (PPE). A detailed description of the PPE required is presented in Section B6.1.

The applicability of this HASCP extends to all personnel who will be on-Site, including the on-Site Engineer or Geologist, Ruco Polymer Corporation employees, contractors, subcontractors, and visitors to the Site. Contractors who will be conducting project activities at the Site will be responsible for the health and safety of their own personnel and the implementation of their own HASCP. A copy of the Contractor's HASCP and employer-specific Standard Operating Procedures (SOPs) will be maintained on-Site whenever project activities are in progress.

1.1 PROJECT ORGANIZATION

The project activities will be organized as follows: A Project Manager will direct the project and an environmental contractor(s) will conduct the field investigation activities.

Site personnel will include an on-Site Engineer and/or Geologist who will be responsible for ensuring that Contract Specifications will be met, including those related to Site health and safety. The environmental contractor will provide the necessary support personnel to complete the project activities. This will include a supervisor and an individual who will serve as the Health and Safety Officer (HSO) and a field crew of equipment operators, drillers, and laborers. On-Site personnel may serve in more than one job function as long as they are qualified to do so.

The Ruco Polymer Corporation property is an active industrial facility with inherent conditions not related to the planned project activities. The Ruco Plant HSO, Mr. Steven Bates, will be consulted prior to on-Site activity on the property to determine if any safety precautions should be taken in addition to those mentioned herein.

2.0 SITE CHARACTERIZATION AND POTENTIALLY HAZARDOUS COMPOUNDS

Table B2.1 presents a list of chemical compounds which have been previously detected at the Site in soils, sediments and groundwater. The exposure routes and Time Weighted Average (TWA) exposure levels for the various chemical compounds are listed in Table B2.2. These levels are set to protect the health of workers.

In addition to the chemical compounds which are presented in Table B2.1, a list of Tentatively Identified Compounds (TICs) has been compiled for the Site. These compounds have also been identified in the Site soils and represent raw materials or incomplete products associated with the manufacturing process at the Site. Table B2.3 presents a listing of the TICs.

3.0 BASIS FOR DESIGN

Regulations set forth by OSHA in Title 29, Code of Federal Regulations, Parts 1910 and 1926 (29 CFR 1910 and 1926) form the basis of this HASCP. Emphasis is placed on Sections 1910.120 (Hazardous Waste Operations and Emergency Response), 1910 Subpart I (Personal Protective Equipment), and 1910 Subpart Z (Toxic and Hazardous Substances). In addition, current Threshold Limit Values (TLVs) formulated by the ACGIH have been considered in the development of the selection of PPE. Some of the specifications within this section are in addition to the OSHA regulations, and reflect the positions of the United States Environmental Protection Agency (USEPA), the National Institute for Occupational Safety and Health (NIOSH), and the United States Coast Guard (USCG) regarding safe operating procedures at hazardous waste sites.

The health and safety of the Ruco Polymer Corporation employees, the public, Site personnel, and the protection of the environment will take precedence over cost and scheduling considerations for all project work. It is intended that this HASCP will be used in conjunction with the on-Site contractor's employer specific SOPs.

4.0 RESPONSIBILITIES AND ADMINISTRATION

4.1 PROJECT MANAGER

The Project Manager will be responsible for the overall implementation and monitoring of the health and safety program by:

i) ensuring appropriate protective equipment is available and properly used by all personnel, in accordance with the HASCP;

ii) ensuring personnel health and safety awareness by providing them with proper training and familiarity with procedures and contingency plans;

iii) ensuring all personnel are aware of potential hazards associated with the Site conditions and operations;

iv) supervising and monitoring the safety performance of all personnel to ensure their work practices are conducted in accordance with the HASCP;

v) correcting any work practices or conditions that would expose personnel to possible injury or hazardous condition;

vi) communications with the on-Site HSO; and

vii) promptly initiating emergency alerts.

4.2 HSO

The on-Site HSO shall be responsible for all decisions regarding operations and work stoppage due to health and safety considerations. The HSO will have prior experience in working at hazardous waste sites.

The on-Site HSO responsibilities include:

i) supervision and enforcement of safety equipment usage, including the required use of extra equipment if appropriate;

ii) supervision and inspection of equipment cleaning;

iii) supervision of decontamination;

iv) conduct the on-Site personnel safety indoctrination session in potential hazards, personal hygiene principles, safety equipment usage, the project specific Hazard Communication Program, pertinent Ruco Polymer Corporation contractor requirements, confined space entry procedures, and emergency procedures;

v) maintain Exclusion Zone (EZ) and Contaminant Reduction Zone (CRZ) work area;

vi) review and modify the HASCP as more information becomes available or conditions warrant;

vii) authority to suspend work activity due to unsafe working conditions;

viii) issue confined space entry permits as required;

ix) coordination of emergency procedures; and

x) ensure that all on-Site personnel have obtained the required medical examination prior to arrival at the Site and have met the OSHA training requirements.

5.0 WORKER TRAINING AND EDUCATION

Prior to commencing Site activities, a Health and Safety/Site Indoctrination Session will be presented. Attendance is mandatory for all personnel who will be or are expected to be involved with the program at the Site.

The training program will stress the importance that each attendee understands the basic principles of personnel protection and safety, be able to perform their assigned job tasks in a safe and environmentally responsible manner and be prepared to respond in an appropriate manner to any emergency which may arise. Background information of the Site will be included and the various components of the project HASCP will be presented followed by an opportunity to ask questions to ensure that each attendee understands the HASCP. Personnel not successfully completing this training program will not be permitted to enter or work in potentially contaminated areas of the Site. Personnel successfully completing this training program shall sign an acknowledgment form, a copy of which is presented in Appendix B.1.

This training will be given in addition to the basic training required under OSHA and is not intended to meet the requirements of 29 CFR 1910.120. Prior to working in or entering an EZ environment (as defined in Section B6.5), all personnel will be required to provide documentation to the HSO indicating successful completion of the training requirements of 29 CFR 1910.120.

6.0 PERSONAL PROTECTIVE EQUIPMENT (PPE)

This section of the HASCP describes the requirements for PPE and the specific levels of protection required for each work task to be conducted at the Site during project activities. The basic Ruco Polymer Corporation plant PPE requirements for all personnel on Site but not in an active work zone include:

i) full length pants;
ii) safety footwear;
iii) safety glasses with side shields;
iv) hard hats; and
v) longsleeve shirts.

6.1 PROTECTION LEVELS

Personnel will wear protective equipment when project activities involve potential exposure to Site contaminants or when direct contact with potentially hazardous substances may occur. Chemical resistant clothing protects the skin from contact with skin-destructive and absorbable contaminants. Respirators protect lungs, the gastrointestinal tract, and if a full-face respirator is worn, the eyes, against airborne toxicants. Respiratory protection levels will be based on the potential presence of the chemical compounds previously detected at the Site.

The specific protection levels to be employed at the Site for each work task are listed in Table B6.1. All project activities conducted at the Site will require the use of one of the following levels of PPE.

Level B:

i) supplied air respirator (MSHA/NIOSH approved). Respirators may be positive pressure-demand, self-contained breathing apparatus (SCBA) or positive pressure-demand airline respirator (with escape bottle for

Immediate Danger to Life and Health (IDLH) or potential for IDLH atmosphere);

ii) polycoated tyvek® or saranex® coveralls;
iii) steel toe work boots and disposable boot covers or rubber boots;
iv) disposable inner gloves - chemical resistant;
v) outer work gloves - chemical resistant; and
vi) hard hat.

Level C:

i) polycoated tyvek® or saranex® coveralls;
ii) steel toe work boots and disposable boot covers or rubber boots;
iii) disposable inner gloves - chemical resistant;
iv) outer work gloves - chemical resistant;
v) full-face air purifying respirator (APR), equipped with combination cartridges for organic vapors/acid gases and particulates; and
vi) hard hat.

Modified Level D:

i) polycoated tyvek® or saranex® coveralls;
ii) steel toe work boots;
iii) disposable inner gloves - chemical resistant;
iv) outer work gloves - chemical resistant;
v) safety glasses;
vi) splash shields as necessary; and
vii) hard hat.

Level D:

i) standard work uniform or coveralls;
ii) steel toe work boots;
iii) gloves as necessary;
iv) safety glasses with side shields;
v) splash shield as needed; and

vi) hard hat.

PPE will be maintained in a clean sanitary condition and ready for use. Disposable coveralls shall be discarded when torn and as personnel leave the contaminated work zone. Hard hats shall be thoroughly cleaned after leaving the contaminated work zone. Respirators shall be cleaned after each day's use and cartridges discarded. A sufficient quantity of potable water shall be supplied for washing, cleaning PPE and drinking. A potable water supply for washing and cleaning PPE will be maintained adjacent to the decontamination area described in Section B8.0. Fresh potable water for drinking will be supplied on a daily basis and be maintained at a location removed from the active work area. Protection levels provided by PPE selection shall be upgraded or downgraded based upon a change in Site conditions.

All proposed changes to protection levels and PPE requirements will be reviewed and approved prior to their implementation by the HSO and on-Site Engineer or Geologist.

6.2 DURATION OF WORK TASKS

The duration of project activities involving the usage of PPE will be established by the HSO based upon ambient temperature and weather conditions, the capacity of personnel to work in the designated level of PPE (heat stress, see Section B12.3 Environmental Control), and limitations of the protective equipment (i.e. ensemble permeation rates, life expectancy of air-purifying respirator cartridges, etc.). As a minimum, rest breaks will be observed at the following intervals:

i) 15 minutes midway between shift startup and lunch;
ii) one-half to one hour for lunch; and
iii) 15 minutes in the afternoon, between lunch and shift end.

All rest breaks will be taken in a clean area (e.g., support zone) after full decontamination and PPE removal. Additional rest breaks will be observed, based upon the heat stress monitoring guidelines presented in Appendix B.2.

6.3 LIMITATIONS OF PROTECTIVE CLOTHING

PPE ensembles designated for use during project activities have been selected to provide protection against the known or suspected contaminants in the soil and groundwater. No protective garment, glove or boot is chemical-proof, nor will it afford protection against all chemical types. Permeation of a given chemical through PPE is a complex process governed by contaminant concentrations, environmental conditions, physical condition of the protection garment, and the resistance of a garment to a specific contaminant; chemical permeation may continue even after the source of contamination has been removed from the garment.

In order to obtain optimum usage from PPE, the following procedures are to be followed by all Site personnel using PPE:

i) when using disposable coveralls, don a new clean garment after each rest break or at the beginning of each shift;

ii) inspect all clothing, gloves and boots both prior to and during use for:
   a) imperfect seams,
   b) non-uniform coatings,
   c) tears,
   d) poorly functioning closures,

iii) inspect reusable garments, boots and gloves both prior to and during use for:
   a) visible signs of chemical permeation,
   b) swelling,
   c) discoloration,
   d) stiffness,
   e) brittleness,
   f) cracks,

g) any sign of puncture, and
h) any sign of abrasion.

Reusable gloves, boots or coveralls exhibiting any of the characteristics listed above will be discarded.

Additional PPE usage guidelines are as follows:

i) ankles/wrists will be secured tightly with the use of duct tape;

ii) prescription eyewear used on Site shall be safety glasses equipped with side shields when full-face respirators are not required. Contact lenses shall not be used;

iii) all EZ workers will have received training in the usage of full-face air purifying respirators and supplied air respiratory protection equipment; and

iv) steel toe leather footwear shall be covered with neoprene overboots prior to entering the EZ and immediately upon entering the CRZ.

EZ personnel also carry certain responsibilities for their own health and safety, and are required to observe the following safe work practices:

i) familiarize themselves with this HASCP;

ii) use the "buddy system" when working in a contaminated operation;

iii) use the safety equipment in accordance with training received, labeling instructions and common sense;

iv) maintain safety equipment in good condition and proper working order;

v) refrain from activities that would create additional hazards (i.e. smoking, eating, etc., in restricted areas, leaning against dirty, contaminated surfaces);

vi) smoking and eating will be prohibited except in designated areas. These designated areas may change during the duration of the project to maintain adequate separation from the active work area(s). Designation of these areas will be the responsibility of the HSO; and

vii) soiled disposable outerwear shall be cleaned, removed, and either left in a safe place until reuse or placed into a covered container prior to washing hands and face, eating, using lavatory facilities or leaving the Site.

6.4 RESPIRATORY PROTECTION PROGRAM

Prior to arriving at the Site, all on-Site personnel will have received training in the use of, and have been fit tested for a full-facepiece respirator. All on-Site personnel will be required to comply with their employer specific written respiratory protection program developed in accordance with OSHA 29 CFR 1910.134.

Respiratory protection may be required during some of the project activities. This is to ensure worker protection from potentially contaminated particulates, vapors, and/or fumes. A photoionization detector (PID) will be available at the Site and used by the HSO. The action level to determine the level of respiratory protection necessary during project activities is based on the known concentrations of Site contaminants measured within worker breathing zones. The action levels and appropriate respiratory protection for project activities are as follows:

Sustained Organic Vapor Reading Above Background within Worker Breathing Zone in Parts Per Million (ppm)	*Action Taken*
0 or background	Full-face respirator available
1-250	Wear full-face respirator
>250	Shutdown operations implement engineering controls, upgrade to supplied air respiratory protection

The appropriate air purifying respirator cartridge to be used at the Site is a combination organic vapor/acid gases and particulate filter cartridge. The cartridge used must be of the same manufacturer as the respiratory face piece.

6.5 SITE CONTROL

Designated work areas will be set up as appropriate during project activities, as required. The purpose of these procedures is to limit access to potentially contaminated areas, and prevent the migration of potentially hazardous materials into adjacent non-contaminated areas. These areas are described in the following.

i) The Exclusion Zone (EZ) is the area immediately surrounding the active work area. Sufficient area will be provided for efficient movement of personnel and equipment as well as contaminant control. Boundaries are modifiable depending on operational requirements. The HSO will be responsible for maintaining the boundaries of this area. Personnel entering this area are required to wear the PPE as defined previously. A wind direction indication device (i.e. flagging, windsock, etc.) will be mounted in the area of any EZ during Site activities.

   All personnel (including visitors) entering the EZ or CRZ using respiratory protection must have successfully passed a qualitative respirator FIT test in accordance with OSHA 29 CFR 1910.134. Documentation of FIT testing is the responsibility of each employer.

In the event that unauthorized personnel enter the EZ, work will stop. Work will not resume until the unauthorized personnel have been removed from the EZ or have been moved to an acceptable on-Site area. A log of all visitors to the Site, including those entering the EZ, will be maintained.

ii) The Contaminant Reduction Zone (CRZ) will provide a location for removal of contaminated PPE and final removal and decontamination of personnel and equipment. Supplemental safety equipment, such as fire extinguishers, portable eyewash and extra quantities of PPE may be stored in this area. The order in which safety equipment is to be donned is as follows:

a) polycoated tyvek® or saranex®;
b) rubber boot;
c) gloves;
d) respirator (if required); and
e) hard hat.

The following order applies when removing safety equipment:

a) wash off boots, and outer gloves prior to removal;
b) polycoated tyvek® or saranex®;
c) hard hat;
d) respirator; and
e) inner gloves.

iii) The Support Zone (SZ) is situated in clean areas where there is a minimal risk of encountering hazardous materials or conditions. PPE beyond the basic requirements is therefore not required.

7.0 ACTIVITY HAZARD/RISK ANALYSIS

This section identifies the general hazards associated with specific project activities and presents the documented or potential health and safety hazards that exist at the Site. Every effort will be made to reduce or eliminate these hazards. Those which cannot be eliminated must be guarded against by use of engineering controls and/or PPE. Table B7.1 presents the anticipated hazards/risks and appropriate precautions.

In addition to the chemical hazards presented in Section B2.0 of this HASCP, physical hazards including trip and fall hazards, slippery surfaces, the use of heavy equipment and drilling equipment, potential confined space entry, the use of decontamination equipment, and potential heat and cold stress exist at the Site. It will be the responsibility of each on-Site contractor and their personnel to identify the physical hazards posed by the various Site project activities and implement preventative and corrective action.

7.1 CHEMICAL EXPOSURE

Preventing exposure to toxic chemicals is a primary concern. Chemical substances can enter the unprotected body by inhalation, skin absorption, and ingestion. A contaminant can cause damage at the point of contact or can act systemically, causing a toxic effect at a part of the body distant from the point of initial contact.

Chemical exposures are generally divided into two categories: acute and chronic. Symptoms resulting from acute exposures usually occur during or shortly after exposure to a sufficiently high concentration of a contaminant. The concentration required to produce such effects varies widely from chemical to chemical. The term "chronic exposure" generally refers to exposures to "low" concentrations of a contaminant over a long period of time. The "low" concentrations required to produce symptoms of chronic exposure depend upon the chemical, the duration of each exposure, and the number of exposures. For a given contaminant, the symptoms of an acute exposure may be completely different from those resulting from chronic exposure.

For either chronic or acute exposure, the toxic effect may be temporary and reversible, or may be permanent (disability or death). Some chemicals may cause obvious symptoms such as burning, coughing, nausea, tearing eyes, or rashes. Other chemicals may cause health damage without any such warning signs (this is a particular concern for chronic exposures to low concentrations). Health effects such as cancer or respiratory disease may not become manifest for several years or decades after exposure. In addition, some toxic chemicals may be colorless and/or odorless, may dull the sense of smell, or may not produce any immediate or obvious physiological sensations. Thus, a worker's senses or feelings cannot be relied upon in all cases to warn of potential toxic exposure.

The effects of exposure not only depend on the chemical, its concentration, route of entry, and duration of exposure, but may also be influenced by personal factors such as the individual's smoking habits, alcohol consumption, medication use, nutrition, age, and sex.

An important exposure route of concern at the Site is inhalation. The lungs are extremely vulnerable to chemical agents. Even substances that do not directly affect the lungs may pass through lung tissue into the bloodstream, where they are transported to other vulnerable areas of the body. Some toxic chemicals present in the atmosphere may not be detected by human senses (i.e. they may be colorless, odorless, and their toxic effects may not produce any immediate symptoms). Respiratory protection is therefore extremely important if there is a possibility that the work site atmosphere may contain such hazardous substances. Chemicals can also enter the respiratory tract through punctured eardrums. Where this is a hazard, individuals with punctured eardrums should be medically evaluated specifically to determine if such a condition would place them at an unacceptable risk and preclude their working at the task in question.

Direct contact of the skin and eyes by hazardous substances is another important route of exposure. Some chemicals directly injure the skin. Some pass through the skin into the bloodstream where they are transported to vulnerable organs. Skin absorption is enhanced by abrasions, cuts, heat, and moisture. The eye is particularly vulnerable because airborne chemicals can dissolve in its moist surface and be carried to the rest of the body through the bloodstream (capillaries are very close to the surface of the eye). Wearing protective equipment, not using contact lenses in contaminated atmospheres (since they may trap chemicals against the eye surface), keeping hands away from the face, and minimizing contact with liquid and solid chemicals can help protect against skin and eye contact.

Although ingestion should be the least significant route of exposure at the Site, it is important to be aware of how this type of exposure can occur. Deliberate ingestion of chemicals is unlikely, however, personal habits such as chewing gum or tobacco, drinking, eating, smoking cigarettes, and applying cosmetics at the Site may provide a route of entry for chemicals.

8.0 AIR MONITORING

During the progress of project activities, periodic real-time monitoring of particulate levels and organic vapors levels will be taken by the HSO. The following air monitoring instrumentation will be used for this purpose:

i) a photoionization detector equipped with an 11.7 eV lamp; and
ii) a realtime digital particulate monitor (respirable fraction).

All monitoring equipment will be calibrated on a daily basis in accordance with the manufacturer's guidelines, and such calibrations will be recorded in the Site daily log book. Results of all daily air monitoring also will be recorded in the Site daily log book and copies are to be given to the Site Engineer or Geologist.

Air monitoring will be conducted in the breathing zone of workers in the EZ and at the downwind perimeter of the Site on an hourly basis or as deemed necessary by the HSO based on Site-specific conditions. Background measurements immediately upwind of the EZ will be taken before activities commence. Work activities generating particulate levels in excess of 150 micrograms per cubic meter ($\mu g/m^3$) (based on a 15-minute average) or organic vapor levels greater than 5 ppm above background at the downwind perimeter of the Site, will temporarily be halted until alternate work methods or engineering controls are in place to maintain particulate levels below 150 $\mu g/m^3$ and organic vapor levels below 5 ppm above background at the downwind perimeter of the Site.

Respiratory action levels for organic vapors are discussed in Section B6.4.

Immediately upon identifying sustained elevated levels of organic vapors (greater than 250 parts per million (ppm) within the Work Zone, the air monitoring results will be reported to the Site Engineer or Geologist and work activities will be shutdown. The HSO will determine the cause of the sustained elevated levels of organic vapors and alternate work methods or engineering controls will be implemented to rectify the release of elevated concentrations of organic vapors, or upgrade levels of PPE as required.

In addition to the real time air monitoring, integrated sampling for total nuisance dust at the Site perimeter (one upwind and two downwind) will be conducted weekly. When soil excavation, staging and removal activities are taking place. Total nuisance dust will be collected using a PVC collection filter and an air sampling pump. The collected samples will be analyzed gravimetrically according to NIOSH Method 0500. The purpose of this monitoring is to document the actual nuisance dust levels that existed during the soil handling activities.

9.0 DECONTAMINATION PROCEDURES

In general, everything that enters the EZ at this Site must either be decontaminated or properly discarded upon exit from the EZ. All personnel, including any State and local officials must enter and exit the EZ through the decontamination area. Prior to demobilization, potentially contaminated equipment will be decontaminated and inspected by the HSO before it is moved into the clean zone. Any material that is generated by decontamination procedures will be stored in a designated area in the EZ until disposal arrangements are made.

The type of decontamination solution to be used is dependent on the type of chemical hazards. The decontamination solution for this Site is Alconox (soap) for equipment and for any reusable PPE. The Material Safety Data Sheet (MSDS) for Alconox is presented in Appendix B.3.

9.1 EQUIPMENT DECONTAMINATION PROCEDURES

All equipment must be decontaminated within the CRZ by a high pressure water cleaner upon exit from the EZ. Decontamination procedures should include: knocking soil/mud from machines; water rinsing using a solution of water and Alconox; and a final water rinse. Final decontamination of equipment, upon completion of activities, will take place on a temporary decontamination wash pad which will be constructed at the Site. Figure B9.1 presents a typical medium duty decontamination pad. Personnel shall wear the personal protection specified in Table B6.1 when decontaminating equipment. Runoff will be collected and stored until appropriate disposal arrangements are made. Following decontamination and prior to exit from the EZ, the HSO shall be responsible for ensuring that the item has been sufficiently decontaminated. This inspection shall be included in the Site log.

9.2 PERSONNEL DECONTAMINATION PROCEDURES

The following describes the procedures to be followed by all personnel when leaving the EZ.

Station 1: Equipment Drop

Deposit equipment used on-Site (tools, sampling devices and monitoring instruments, radios, etc.) on plastic drop cloths. These items must be decontaminated or discarded as waste prior to removal from the EZ.

Station 2: Outer Boot and Outer Glove Wash and Rinse

Scrub outer boots, outer gloves and/or splash suit with decontamination solution or detergent wash. Rinse off using water.

Station 3: Outer Boot and Glove Removal

Remove outer boots and gloves. If outer boots are disposable, deposit in a covered container. If non-disposable, store in a clean dry place.

Station 4: Outer Garment Removal

Remove outer garments and deposit in a covered container. Decontaminate or dispose of splash suits as necessary.

Station 5: Respiratory Protection Removal

Remove hard hat and facepiece, and deposit on a clean surface. Air purifying respirator cartridges will be discarded as appropriate. Wash and rinse respirator at least daily. Wipe off and store respiratory gear in a clean, dry location.

Station 6: Inner Glove Removal

Remove inner gloves. Deposit in a covered container for disposal.

Station 7: Field Wash

Thoroughly wash hands and face with soap and water.

10.0 GENERAL SAFETY AND PERSONAL HYGIENE

1. Eating at the Site is prohibited except in specifically designated areas. Designation of eating areas will be the responsibility of the HSO. The location of these areas may change during the duration of the project to maintain adequate separation from the active work area(s).

2. Smoking at the Site is prohibited except in specifically designated areas.

3. Individuals getting wet to the skin with effluent from the washing operation must wash the affected area immediately. If clothes in contact with skin are wet, then these must be changed.

4. Hands must be washed with soap and water before eating, drinking, smoking and before using toilets at the facilities provided.

5. Waste will be properly stored until such time that it is disposed of during completion of project activities.

11.0 MEDICAL SURVEILLANCE

In accordance with the requirements detailed in 29 CFR 1910.120 and 29 CFR 1910.134, all Site personnel who will come in contact with potentially contaminated materials will have received medical surveillance by a licensed physician or physician's group.

Medical records for all on-Site personnel will be maintained by their respective employers. The medical records will detail the tests that were taken and will include a copy of the consulting physician's statement regarding the tests and the employee's suitability for work.

The medical records will be available to the employee or his designated representative upon written request, as outlined in 29 CFR 1910.20.

Each employer will provide certifications to the HSO that its' personnel involved in Site activities will have all necessary medical examinations prior to commencing work which requires respiratory protection or potential exposure to hazardous materials. Personnel not obtaining medical certification will not perform work within contaminated areas.

Interim medical surveillance will be completed if an individual exhibits poor health or high stress responses due to any Site activity or when accidental exposure to elevated concentrations of contaminants occur.

12.0 ENVIRONMENTAL CONTROL PROGRAM

This section of the HASCP outlines measures to be implemented at the Site to prevent hazards associated with environmental conditions.

12.1 WEATHER MONITORING

The HSO will be responsible for checking weather forecasts for the next day and week of work to provide advance notification of any severe weather conditions. Severe weather conditions (e.g., heavy rain) may cause unsafe conditions at the Site and in some situations work may have to be stopped.

12.2 RAIN

Excessive amounts of precipitation may cause potential safety hazards for all work tasks. The hazards would be most commonly associated with slipping, tripping or falling due to slippery surfaces and further hazards are detailed by work task (Table B7.1).

Severe weather conditions will result in work stoppage and the implementation of further emergency measures, as described in Appendix B.4 of the HASCP.

12.3 TEMPERATURE

The project activities are expected to be conducted year round. Low and high temperatures may be experienced which require measures to be implemented to prevent health and safety hazards from occurring. The potential hazards arising from temperature extremes are heat and cold exposure.

The potential hazard due to worker heat stress is particularly important if high protection levels of PPE are in use (e.g., respirators). A detailed monitoring program and prevention measures to implement to reduce heat stress are detailed in Appendix B.2. It is the responsibility of the HSO to determine which measures are appropriate to implement to prevent heat stress; these will depend largely on daily Site conditions.

Exposure to cold is similar to heat stress in that the HSO must determine the appropriate preventative measures to implement. Some of the measures which may be implemented include: more frequent breaks, additional clothing and partial enclosure of work areas. Detailed cold exposure prevention measures are also included in Appendix B.2.

12.4 WIND

High winds may be encountered at the Site and these can cause hazards that may affect Site personnel health and safety. Preventative measures that will be implemented if necessary are as follows:

i) restricted Site activity;
ii) battening down light equipment or building materials;
iii) partially enclosing work areas; and
iv) reduction or stoppage of work activities.

13.0 CONFINED SPACE ENTRY PROCEDURE

A confined space provides the potential for unusually high concentrations of contaminants, explosive atmospheres, oxygen deficient atmospheres, limited visibility and restricted movement. This section establishes requirements for safe entry into, continued work in, and safe exit from confined spaces. Additional information regarding confined space entry can be found in 29 CFR 1926.21, 29 CFR 1910.146 and NIOSH-106. At this Site, confined spaces may be encountered during excavation activities or during installation of the groundwater treatment system. Entry into a confined space will only be undertaken after remote methods have been tried and found not to be successful. If confined space entry is required, such work will only be undertaken following the guidelines presented in this section.

13.1 DEFINITIONS

Confined Space is a space or work area not designed or intended for normal human occupancy, having limited means of egress and poor natural ventilation; and/or any structure, including buildings or rooms, which have limited means of egress.

Confined Space Entry Permit (CSEP) is a document to be initiated by the supervisor or personnel who are to enter into or work in a confined space. The CSEP will be completed by the personnel involved in the entry and approved by the HSO before personnel will be permitted to enter the confined space. The CSEP shall be valid only for the performance of the work identified on the permit and for the location and time specified on the permit. The beginning of a new shift with change of personnel will require the issuance of a new CSEP. A copy of the CSEP is provided in Appendix B.5.

Confined Space Observer is an individual assigned to monitor the activities of personnel working within a confined space. The confined space observer monitors and provides external assistance to those inside the confined space. The confined space observer summons rescue personnel in the event of emergency and assists the rescue team.

13.2 GENERAL PROVISIONS

The following general provisions will apply to confined space entry:

i) when possible, confined spaces should be identified with a posted sign which reads: Caution - Confined Space;

ii) only personnel trained and knowledgeable of the requirements of these confined space entry procedures will be authorized to enter a confined space or be a confined space observer;

iii) a CSEP must be issued prior to the performance of any work within a confined space. The CSEP will become a part of the permanent and official health and safety record for the Site;

iv) natural ventilation shall be provided for the confined space prior to initial entry and for the duration of the CSEP. Positive/forced mechanical ventilation may be required. However, care should be taken to not spread contamination outside of the enclosed area;

v) if flammable liquids are anticipated to be within the confined space, explosion proof equipment will be used. All equipment shall be positively grounded;

vi) the contents of any confined space shall, where necessary and where possible, be removed prior to entry. All sources of ignition must be disconnected and/or removed prior to entry;

vii) hand tools used in confined spaces shall be in good repair, explosion proof and spark proof, and selected according to intended use. Where possible, pneumatic power tools are to be used;

viii) hand-held lights and other illumination utilized in confined spaces shall be equipped with guards to prevent contact with the bulb and must be explosion proof;

ix) compressed gas cylinders, except cylinders used for SCBA shall not be taken into confined spaces. Gas hoses shall be removed from the space and the supply turned off at the cylinder valve when personnel exit from the confined space;

x) if a confined space requires respiratory equipment or where rescue may be difficult, safety belts, body harnesses, extraction equipment and lifelines will be used. The outside observer shall be provided with the same equipment as those working within the confined space;

xi) a ladder or extraction device is required in all confined spaces deeper than the employee's shoulders. The ladder shall be secured and not removed until all personnel have exited the confined space;

xii) only SCBA or NIOSH-approved airline respirators equipped with a 5-minute emergency air supply (egress bottle) shall be used in untested spaces or in any confined space with conditions determined immediately dangerous to life and health;

xiii) where air-moving equipment is used to provide ventilation, chemicals shall be removed from the vicinity to prevent their introduction into the confined space;

xiv) vehicles shall not be left running near confined space work or near air-moving equipment being used for confined space ventilation;

xv) smoking in confined spaces will be prohibited at all times; and

xvi) any deviation from these confined space entry procedures requires the prior permission of the HSO.

13.3 PROCEDURE FOR CONFINED SPACE ENTRY

The HSO and confined space entry personnel shall adhere to the following confined space entry procedures:

i) evaluate the job to be done and identify the potential hazards before a job in a confined space is scheduled;

ii) initiate a CSEP in concurrence with the HSO or designated alternative;

iii) ensure that the confined space is ventilated before starting work in the confined space and for the duration of the time that the work is to be performed in the confined space;

iv) ensure that the personnel who enter the confined space and the confined space observer helper are familiar with the contents and requirements of this instruction and the CSEP; and

v) ensure remote atmospheric testing of the confined space prior to and during employee entry and before validation/revalidation of a CSEP to ensure the following requirements:

  a) oxygen content between 19.5 percent and 23.0 percent,
  b) no concentration of combustible gas in the space. Sampling will be done throughout the confined space and specifically at the lowest point in the space,
  c) the absence of other atmospheric contaminants if the space has previously contained toxic, corrosive or irritant material, and
  d) if remote testing is not possible, Level B PPE is required for confined space entry.

The CSEP shall be considered void if work in the confined space does not start within one hour after the tests in Item v) above are performed or if significant changes within the confined space atmosphere or job scope occurs.

The CSEP posted at the work Site shall be removed at the completion of the job or the end of the shift, whichever is first.

13.4 CONFINED SPACE OBSERVER

The duties of the confined space observer are as follows:

i) while personnel are inside the confined space, a confined space observer will monitor the activities and provide external assistance to those in the confined space. The observer will not have other duties which may take his attention away from the work or require him to leave the vicinity of the confined space at any time while personnel are in the confined space;

ii) the confined space observer shall maintain at least voice contact with all personnel in the confined space. Visual contact is preferred, if possible;

iii) the confined space observer shall be instructed by his supervisor or the HSO in the method for contacting rescue personnel in the event of an emergency;

iv) if irregularities within the confined space are detected by the observer, personnel within the confined space will be ordered to exit;

v) in the event of an emergency, the confined space observer must not enter the confined space prior to contacting and receiving assistance from a helper. Prior to this time, he should attempt to remove personnel with the lifeline and to perform all other rescue functions from outside the space; and

vi) a helper shall be designated to provide assistance to the confined space observer in case the observer must enter the confined space to retrieve personnel.

14.0 EMERGENCY CONTINGENCIES

It is essential that Site personnel be prepared in the event of an emergency. Emergencies can take many forms; illnesses or injuries, chemical exposure, fires, explosions, spills, leaks, releases of harmful contaminants, or sudden changes in the weather. The following sections outline the general procedures for emergencies. Emergency information should be posted as appropriate. It should be noted that the Ruco Polymer Corporation plant has an emergency plan which will be implemented by Ruco Polymer Corporation personnel. In the absence of Ruco Polymer Corporation participation in an emergency situation, the following responsibilities and procedures shall be implemented.

14.1 EMERGENCY CONTACTS

Fire:	911
Police:	911
Ambulance:	911
Hospital:	Central General Hospital (516) 681-8900 Ext. 2335 - Emergency Room
Directions to Hospital:	Follow the route which is outlined on Figure B14.1.

13.2 ADDITIONAL EMERGENCY NUMBERS

Ruco Polymer Corporation (Mr. Steve Bates)	516-931-8104 (Ext. 77 or 79)
Occidental Chemical Corporation (Dr. Alan Weston)	716-286-3607
United States Environmental Protection Agency (Mr. Dale Carpenter)	212-264-8742
United States Environmental Protection Agency (Hotline)	800-424-9346
National Response Center	800-424-8802
Hicksville Fire Department	516-931-0026

Nassau County Police 8th Precinct	516-535-6800
Nassau County Poison Control	516-542-2323
Nassau County Department of Health	516-535-3410 (day hours)
Primary Hospital/Central General Hospital	516-681-8900 (Ext. 2335)
New York State Department of Environmental Conservation (Albany)	800-457-7362

14.3 EMERGENCY EQUIPMENT AVAILABLE ON SITE

Equipment	*Location*
Communication	CRZ. Emergency Alarms/Horns.
Medical	OSHA approved first aid kit sized for a minimum of five people. Portable emergency eyewash and shower.
Fire Fighting	One 20-pound ABC type dry chemical fire extinguisher in the CRZ. One 20-pound ABC type dry chemical fire extinguisher on each piece of equipment.

14.4 PROJECT PERSONNEL RESPONSIBILITIESDURING EMERGENCIES

HEALTH AND SAFETY OFFICER (HSO)

As the administrator of the project, the HSO has primary responsibility for responding to and correcting emergency situations. The HSO will:

i) take appropriate measures to protect personnel including: withdrawal from the EZ, total evacuation and securing of the Site, or upgrading or down-grading the level of protective clothing and respiratory protection;

ii) take appropriate measures to protect the public and the environment including isolating and securing the Site, preventing runoff to surface waters, and ending or controlling the emergency to the extent possible;

iii) ensure that appropriate Plant, Federal, State and local agencies are informed, and emergency response plans are coordinated. In the event of fire or explosion, the local fire department should be summoned immediately. In the event of an air release of toxic materials, the local authorities should be informed in order to assess the need for evacuation;

iv) ensure that appropriate decontaminatio,n treatment, or testing for exposed or injured personnel is obtained;

v) determine the cause of the incident and make recommendations to prevent the recurrence; and

vi) ensure that all required reports have been prepared.

14.5 MEDICAL EMERGENCIES

Any person who becomes ill or injured in the EZ must be decontaminated to the maximum extent possible. If the injury or illness is minor, full decontamination should be completed and first aid administered prior to transport. If the patient's condition is serious, at least partial decontamination should be completed as much as possible without causing further harm to the patient. First aid should be administered while awaiting an ambulance or paramedics. All injuries and illnesses must immediately be reported to the HSO.

Any vehicle used to transport contaminated personnel, will be cleaned or decontaminated as necessary.

14.6 FIRE OR EXPLOSION

In the event of a fire or explosion, the local fire department should be summoned immediately. Upon their arrival, the HSO or designated alternate will advise the fire commander of the location, nature, and identification of the hazardous materials on Site.

If it is safe to do so, Site personnel may:

i) if hazardous, report to the Agency On-Scene Coordinator and/or Project Manager;
ii) use fire fighting equipment available on Site; or
iii) remove or isolate flammable or other hazardous materials which may contribute to the fire.

14.7 SPILL CONTROL AND RESPONSE PLAN

During all active work at the Site involving the transport and handling of excavated soils, an on-Site and off-Site Spill Control and Response Plan will be in effect. This plan, as presented herein, will provide contingency measures for potential releases of material from excavated soils handled on-Site.

The following equipment will be available on-Site and used for any unexpected spills:

i) sand, clean fill or other non-combustible absorbent;
ii) 55-gallon DOT-approved drums;
iii) front-end loader and/or backhoe; and
iv) shovels.

Hand tools which are used will generally be discarded with the waste material unless it is determined appropriate to decontaminate the tools. If tools are decontaminated, they will receive a detergent wash in addition to steam cleaning or hot water cleaning.

14.7.1 On-Site Contingency Plan

In the event that a release of a hazardous substance occurs beyond the limit of excavations and working areas, the following protocols will be implemented:

i) notification of release: if human health or the environment are threatened, then the National Response Centre (NRC) and United States Environmental Protection Agency (EPA) will be notified as soon as possible. Appropriate local authorities (police, fire department, traffic control, etc.) will also be notified. NRC will be notified of any release of reportable quantities including all releases which threaten human health or the environment. EPA will determine if other releases require notification to the NRC. In any event, the on-Site EPA representative will receive the initial notification of a hazardous materials release;

ii) decontamination procedures: decontamination procedures may be required after cleanup to eliminate traces of the substance spilled or to reduce it to an acceptable level. Complete cleanup may require removal of affected soils. Personnel decontamination may include showers and cleansing or disposing of clothing and equipment as appropriate. All contaminated materials including equipment, clothes and other materials that cannot be decontaminated will be properly containerized, labeled and placed in the staging area for proper disposal; and

iii) a release report will be submitted to the EPA, within 24 hours of the release, summarizing the release and response action.

If a major release of material stored in a tank or container occurs on-Site, the following actions will immediately be taken:

i) notify the Engineer and on-Site HSO;

ii) take immediate measures to control and contain the release within the Site boundaries;
iii) keep unnecessary personnel away; isolate the area of release and deny entry;
iv) do not allow anyone to touch released material;
v) stay upwind; keep out of low areas; and
vi) keep combustibles away from the released materials.

An employee alarm system to signify a major release or an emergency will consist of three short blasts using an air horn. An air horn will always be maintained at the staging area and at active excavation areas during active work hours.

Upon implementing these procedures, air monitoring, to identify the level of protection required, will be performed following the procedures for a spill.

In the event that excavated soils are spilled on-Site outside of the excavation area, field personnel will immediately respond to the spill. The spilled soils will be confined to the immediate area of the spill. The visibly affected soil will be excavated to limits based on a visual determination of spill contamination with the concurrence of the EPA on-Site representative.

14.7.2 Off-Site Contingency Plan

Only authorized transporters will be used for the transportation of hazardous materials. If a release of material from a transport vehicle occurs while in transit, the following actions will be taken to reduce potential migration of the waste material:

i) immediately notify the Contractor, who will in turn notify the Engineer and the EPA;

ii) take immediate measures within the capabilities of the transportor to control the release, if necessary;

iii) contain and eliminate the release, if possible;

iv) stay within a safe distance of the vehicle and keep unnecessary people away, isolate the area of release and deny entry to unauthorized personnel;

v) stay upwind, keeping out of low areas and do not allow contact with the released material;

vi) contact the appropriate local authorities (police, fire department, traffic control, railroad carrier, etc.) and local hazardous materials response unit; and

vii) other actions, as advised by the spill response team, which may include evacuation within 200 feet downwind of the incident.

15.0 RECORDKEEPING

The HSO shall establish and maintain records of all necessary and prudent monitoring activities as described below:

- i) name and job classification of the employees involved on specific tasks;
- ii) records of qualitative fit testing and physical examination results for Site personnel;
- iii) records of all OSHA training certification for Site personnel;
- iv) records of training acknowledgment forms; and
- v) emergency report sheets describing any incidents or accidents.

FIGURES

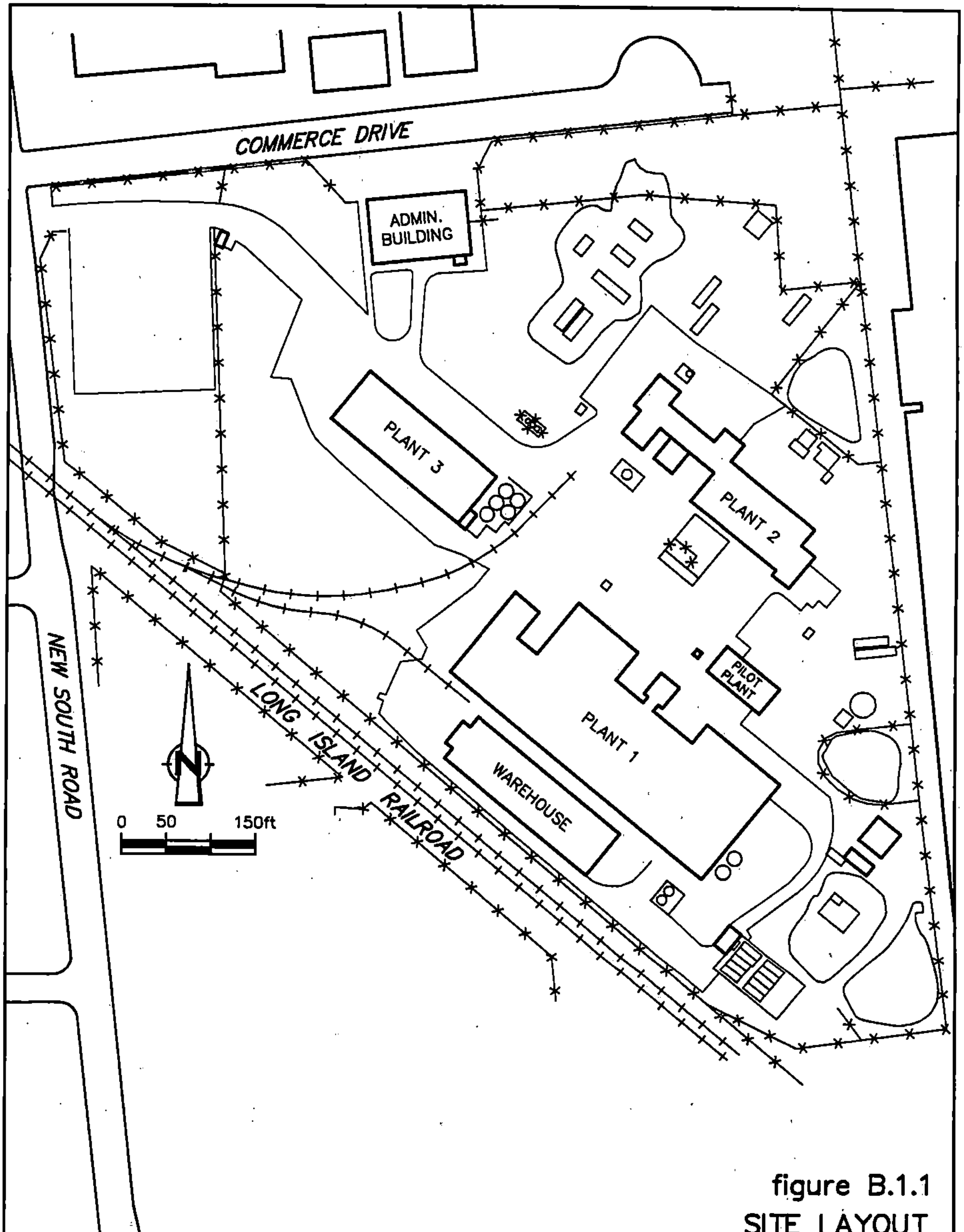

figure B.1.1

SITE LAYOUT
HOOKER/RUCO SITE
Hicksville, New York

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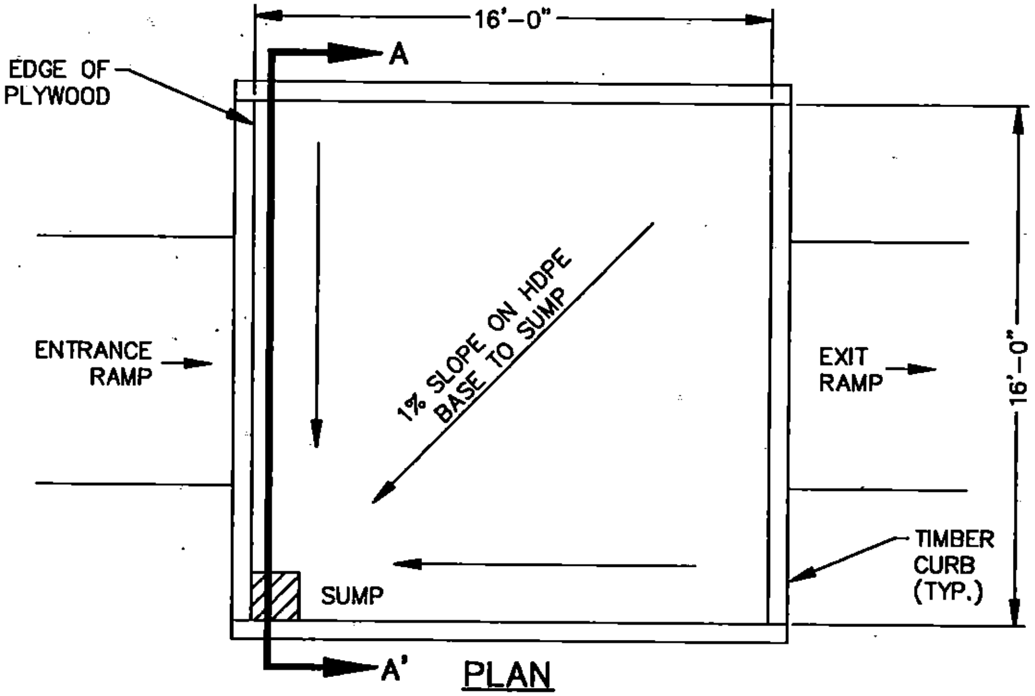
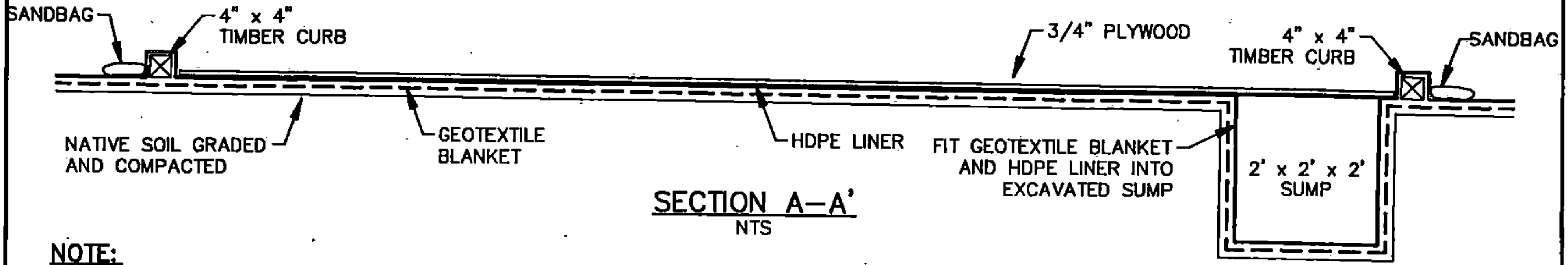
6883 (4) SEPT 15/95(W) REV.0 (P-41)



PLAN
NTS



SECTION A–A'
NTS

NOTE:

THE PAD SHOWN IS A TEMPORARY (I.E. SHORT TERM) MEDIUM DUTY USE DESIGN.

figure B.9.1

TYPICAL DECONTAMINATION AREA
HOOKER/RUCO SITE
Hicksville, New York

CRA

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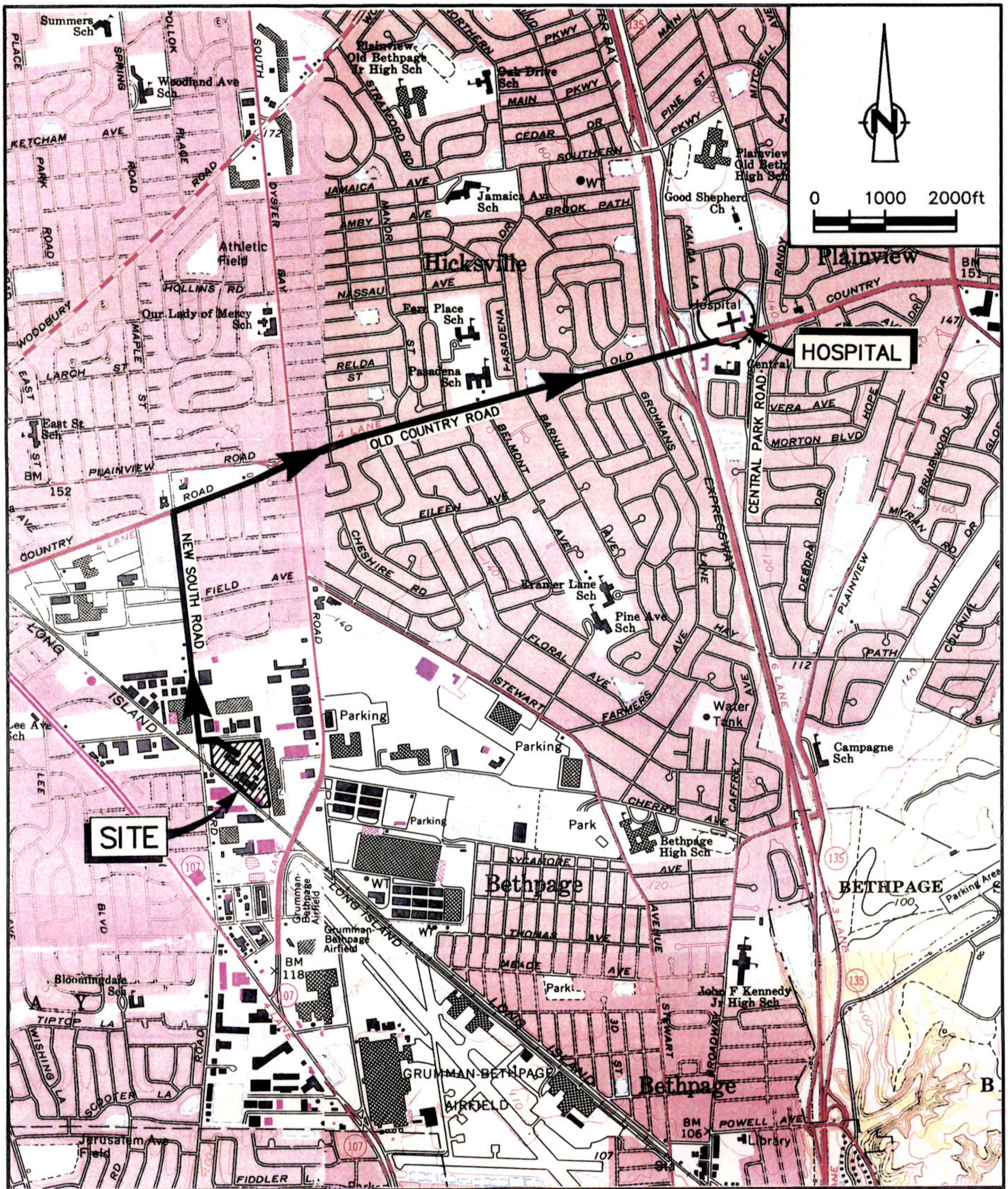


SOURCE: USGS QUADRANGLE MAPS;
AMITYVILLE, FREEPORT, HICKSVILLE AND HUNTINGTON, N.Y.

figure B.14.1

EMERGENCY HOSPITAL ROUTE
HOOKER/RUCO SITE
Hicksville, New York

CRA

6883 (4) SEPT 15/95 (W) REV.0

TABLES

TABLE B2.1

CHEMICAL COMPOUNDS PREVIOUSLY DETECTED AT THE SITE IN SOILS, SEDIMENTS AND GROUNDWATER
RUCO POLYMER CORPORATION
HICKSVILLE, NEW YORK

Trichloroethene
Perchloroethylene
Ethylbenzene
Toluene
Xylene
Phenol
1,2-Dichloroethene
Chloroform
Chlorobenzene
Styrene
1,1-Dichloroethene
Chloroethylenes
Di-n-octyl phthalate
Di-n-butyl phthalate
Bis(2-ethylhexyl)phthalate
Fluoranthene
Pyrene
Chyrsene
Phenanthrene
Benzoic Acid
Hexachlorocyclohexane
Methylene Ethyl Ketone
4-Methylphenol
Dibenzofuran
Naphthalene
2-Methylnaphthalene
Carbon Tetrachloride

Notes:
The following inorganics have been listed due to their presence above background levels.

Cadmium
Lead
Mercury

TABLE B2.2

EXPOSURE ROUTES AND EXPOSURE LEVELS FOR THE IDENTIFIED CHEMICALS AT RUCO POLYMER CORPORATION HICKSVILLE, NEW YORK

Chemical Compound	*Ionization Potential*	*Exposure Routes*	*Acceptable Exposure Levels in Air*
Trichloroethene	9.5	Inhalation, Ingestion	50 ppm (1) 1000 ppm (2)
Perchloroethylene	9.3	Inhalation, Ingestion Animal Carcinogen	25 ppm (1) 500 ppm (2)
Ethylbenzene	8.8	Inhalation, Ingestion	100 ppm (1) 2000 ppm (2)
Toluene	8.8	Inhalation, Ingestion Skin Absorption	50 ppm (1) 2000 ppm (2)
Xylene	8.5	Inhalation, Ingestion	100 ppm (1) 1000 ppm (2)
Phenol	8.5	Inhalation, Ingestion Skin Absorption	5 ppm (1) 100 ppm (2)
1,2-Dichloroethene	9.7	Inhalation, Ingestion	200 ppm (1) 4000 ppm (2)
Chloroform	11.4	Inhalation, Ingestion Possible Human Carcinogen	10 ppm (1) 1000 ppm (2)
Chlorobenzene	9.1	Inhalation, Ingestion	10 ppm (1) 2400 ppm (2)
Styrene	8.4	Inhalation, Ingestion Skin Absorption	50 ppm (1) 5000 ppm (2)
1,1-Dichloroethene	11.2	Inhalation, Ingestion	5 ppm (1)
Chloroethylene	10.0	Inhalation, Ingestion Human Carcinogen	5 ppm (1)
Di-n-octyl phthalate	-	Inhalation, Ingestion	-
Di-n-butyl phthalate	-	Inhalation, Ingestion	5 mg/m3 (1)
Bis(2-ethylhexyl phthalate)	-	Inhalation, Ingestion	-
Flouranthene	-	Inhalation, Ingestion	-

TABLE B2.2

EXPOSURE ROUTES AND EXPOSURE LEVELS FOR THE IDENTIFIED CHEMICALS AT RUCO POLYMER CORPORATION HICKSVILLE, NEW YORK

Chemical Compound	*Ionization Potential*	*Exposure Routes*	*Acceptable Exposure Levels in Air*
Pyrene	-	Inhalation, Ingestion	-
Chrysene	7.8	Inhalation, Ingestion Human Carcingen	0.2 mg/m3 (1)
Phenanthrene	-	Inhalation, Ingestion	-
Benzoic Acid	-	Inhalation, Ingestion	-
Hexachlorocyclohexane	-	Inhalation, Ingestion	-
Methyl Ethyl Ketone	9.5	Inhalation, Ingestion	200 ppm (1)
4-Methphenol	-	Inhalation, Ingestion	-
Dibenzofuran	-	Inhalation, Ingestion	-
Naphthalene	8.1	Inhalation, Ingestion	10 ppm (1)
2-Methylnaphthalene	-	Inhalation, Ingestion	-
Carbon Tetrachloride	11.5	Inhalation, Ingestion Skin Absorption, Animal Carcinogen	5 ppm (1) 300 ppm (2)
Cadmium	-	Inhalation, Ingestion Possible Human Carcinogen	0.002 mg/mg3 (1)
Lead	-	Inhalation, Ingestion	0.15 mg/mg3 (1)
Mercury	-	Inhalation, Ingestion Skin Absorption	0.01 mg/m3 (1) 10 mg/m3 (2)

Notes:

(1)	1994-1995 Values, American Conference of Governmental Industrial Hygienists (ACGIH) Threshold Limit Values (TLVs).
(2)	Immediately Dangerous to Life and Health.
mg/mg3	Milligram per cubic meter.
ppm	Parts Per Million.

TABLE B2.3

TENTATIVELY IDENTIFIED COMPOUNDS (TICs)
RUCO POLYMER CORPORATION
HICKSVILLE, NEW YORK

Ethylene Glycol
Diethylene Glycol
Triethylene Glycol
Dipropylene Glcyol
2,2-Dimethyl-1,3-Propane Diol
2,6-Dimethyl-4-Heptanol
2,2,4-Trimethyl-1,3-Pentanediol
2-Ethylhexanoic Acid
Octonoic Acid
Hexonoic Acid

Notes:
TICs represent materials or incomplete products associated with the manufacturing process at the Site.

TABLE B6.1

SPECIFIC PERSONAL PROTECTION LEVELS
RUCO POLYMER CORPORATION
HICKSVILLE, NEW YORK

Work Task	*Maximum Protection Level (1)*	*Alternate Protection Level (2)*
Mobilization and Demobilization of Labor, Materials and Equipment to and from the Site	Modified D	D
Installation of Soil Borings	Level C	Modified D
Installation of Groundwater Monitoring Wells	Level C	Modified D
Pump Testing Activities	Level C	Modified D
Soil Sampling Activities	Level C	Modified D
Groundwater Monitoring Activities	Level C	Modified D
Completion of Treatability Studies	Level C	Modified D
Soil Excavation Activities	Level C (3)	Modified D
Installation of Groundwater Treatment System	Level C (3)	Modified D
Decontamination Activities	Level C	Modified D

Notes:
Specific requirements of protection levels are detailed in Section B6.1.

(1) Level C: To be worn when the criterion for using air-purifying respirators (APRs) are met and a lesser level of skin protection is needed.
Modified Level D: To be worn when dermal protection is required, however, no respiratory hazards are present. It provides minimal protection against chemical hazards.

(2) Alternate protection levels will be used if monitoring indicates that conditions are appropriate or the HSO and Site Engineer agree that there is a reduced potential of exposure.

(3) May require upgrade in protection level of additional personal protection equipment based on job task (see Confined Space Entry Permit) or results of air monitoring during performance of a particular activity.

TABLE B7.1

ANTICIPATED HAZARDS/RISKS AND APPROPRIATE PRECAUTIONS
RUCO POLYMER CORPORATION
HICKSVILLE, NEW YORK

Activity	*Anticipated Hazards/Risks*	*Appropriate Precautions*
1. Mobilization and Demobilization Activities	• slip/trip/fall hazards • potential back injuries from lifting heavy objects • potential heat or cold stress • severe weather • electrical hazards from power sources • moving or backing vehicles	• Modified D or Level D personal protection • practice safe lifting techniques • participate in on-Site training programs • practice good personal hygiene principles • use a spotter around moving or backing equipment • work activities will be reduced or suspended during severe weather conditions • ground surface interrupters should be used to reduce the hazard of electrical shock. Do not stand in water when handling equipment. Electrical equipment will be approved. • keep first aid supplies readily available
2. Installation of Soil Borings, Installation of Groundwater Monitoring Wells, Pump Testing Activities, Soil Sampling Activities, Groundwater Monitoring Activities, Completion of Treatability Studies, Soil Excavation Activities, Installation of Groundwater Treatment System and Decontamination Activities	• slip/trip/fall hazards • potential back injuries from lifting heavy objects • potential heat or cold stress • severe weather • electrical hazards from power sources • moving or backing vehicles and equipment • personnel injuries from sharp objects, falling debris or pinch points • direct contact with potentially contaminated soils, groundwater and sediments. • hazards presented by the use of drilling and heavy equipment	• Level B, Level C, or Modified Level D, based on actual field activities, specific work areas, and/or established protection levels (see Table B6.1) • practice safe lifting techniques • participate in all on-Site training programs • be trained with all appropriate equipment standard operating procedures • practice good personal hygiene principles • take proper precautions in unsafe areas • use the "Buddy System" • use confined space entry permits where appropriate

TABLE B7.1

ANTICIPATED HAZARDS/RISKS AND APPROPRIATE PRECAUTIONS
RUCO POLYMER CORPORATION
HICKSVILLE, NEW YORK

Activity	*Anticipated Hazards/Risks*	*Appropriate Precautions*
Continued...	• hazards presented by confined spaces (i.e., cave-ins, falling debris, oxygen deficiency, etc.) • overhead hazards (e.g., electrical lines) and underground utilities • potential burns from hot equipment • hazards presented by the use of specialized equipment (e.g., decontamination equipment) • reduced field of vision from wearing full-face respirators	• only essential personnel allowed in work area • perform an underground utility location survey • use a spotter around moving or backing equipment • identify all high temperature objects or equipment • work activities will be reduced or suspended during severe weather conditions • grounded plugs should be used to reduce the hazard of electrical shock. Do not stand in water when handling equipment. Electrical equipment will be approved. • keep first aid supplies readily available

APPENDIX B.1

TRAINING ACKNOWLEDGMENT FORM

TRAINING ACKNOWLEDGEMENT FORM

Please Print:

NAME: ______________________

ADDRESS: ______________________

SOCIAL SECURITY NUMBER: ______________________

EMPLOYER: ______________________

JOB SITE: Ruco Polymer Corporation
Hicksville, New York

I have attended and understood the mandatory Site-specific initiation session for the above referenced job site. This program referenced the following topics:

i) known potential hazards on-Site;

ii) level of personal protection equipment required;

iii) emergency procedures for the Site; and

iv) the basics of the Site-specific Health and Safety Plan.

I further confirm that I have the required 40 hours of training to comply with 29 CFR 1910.120, have a respirator for which I have been fit tested and have been thoroughly trained on the standard operating procedures of equipment I will be operating or procedures (e.g., confined space) which I will be participating in.

______________________ (Date)

______________________ (Signature)

APPENDIX B.2

HEAT STRESS PREVENTION AND MONITORING

HEAT STRESS PREVENTION AND MONITORING(1)

Heat stress may occur at any time work is being performed at elevated temperatures. Wearing of chemical protective clothing, which may result in decreasing natural body ventilation, increases the risk of heat stress.

If the body's physiological processes fail to maintain a normal body temperature because of excessive heat, a number of physical reactions can occur, ranging from mild (such as fatigue, irritability, anxiety, and decreased concentration, dexterity movement) to fatal. Because heat stress is one of the most common and potentially serious illnesses at hazardous waste sites, regular monitoring and other preventative measures are vital.

Site workers must learn to recognize and treat the various forms of heat stress. The best approach is preventative heat stress management. In general, if possible:

1. have workers drink 16 ounces of water before beginning work, such as in the morning or after lunch. Provide disposable 4-ounce cups, and water that is maintained at 50 to 60°F. Urge workers to drink one to two of these cups of water every 20 minutes for a total of one to two gallons per day. Provide a cool area for rest breaks. Discourage the intake of coffee during working hours. Monitor for signs of heat stress;

2. acclimate workers to Site work conditions by slowly increasing workloads (e.g., do not begin Site work activities with extremely demanding activities);

3. provide cooling devices to aid natural body ventilation. These devices, however, add weight and their use should be balanced against worker efficiency. An example of a cooling aid is long cotton underwear which acts as a wick to absorb moisture and protect the skin from direct contact with heat-absorbing protective clothing;

---

(1) Sources: (USEPA, 1985) 29 United States Code of Federal Regulations, 1910.29

4. in extremely hot weather, conduct field activities in the early morning and evening;

5. ensure that adequate shelter is available to protect personnel against heat as well as cold, rain, snow, etc., which can decrease physical efficiency and increase the probability of both heat and cold stress. If possible, set up the command post in the shade;

6. in hot weather, rotate shifts of workers wearing impervious clothing; and

7. good hygienic standards must be maintained by frequent changes of clothing and showering. Clothing should be permitted to dry during rest periods. Persons who notice skin problems should immediately consult medical personnel.

The following is a discussion of specific results of heat stress.

Heat Stroke

Heat stroke is an acute and dangerous reaction to heat stress caused by failure of heat regulating mechanisms of the body; the individual's temperature control system that causes sweating stops working correctly. Body temperature rises so high that brain damage and death will result if the person is not cooled quickly.

- Symptoms - Red, hot, dry skin, although person may have been sweating earlier; nausea; dizziness; confusion; extremely high body temperature; rapid respiratory and pulse rate; unconsciousness or coma.

- Treatment - Cool the victim quickly. If the body temperature is not brought down fast, permanent brain damage or death will result. Soak the victim in cool, but not cold water; sponge the body with cool water or pour water on the body to reduce the temperature to a safe level (102°F). Observe the victim and obtain medical help. Do not give coffee, tea or alcoholic beverages.

Heat Exhaustion

Heat exhaustion is a state of every definite weakness or exhaustion caused by the loss of fluids from the body. The condition is much less dangerous than heat stroke, but it nonetheless must be treated.

- Symptoms - Pale, clammy, moist skin; profuse perspiration and extreme weakness. Body temperature is normal, pulse is weak and rapid, breathing is shallow. The person may have a headache, may vomit and may be dizzy.

- Treatment - Remove the person to a cool, air conditioned place, loosen clothing, place in a head-low position and provide bed rest. Consult physician, especially in severe cases. The normal thirst mechanism is not sensitive enough to ensure body fluid replacement. Have patient drink one to two cups of water immediately, and every 20 minutes thereafter until symptoms subside. Total water consumption should be about one to two gallons per day.

Heat Cramps

Heat cramps are caused by perspiration that is not balanced by adequate fluid intake. Heat cramps are often the first sign of a condition that can lead to heat stroke.

- Symptoms - Acute painful spasms of voluntary muscles (e.g., abdomen and extremities).
- Treatment - Remove victim to cool area and loosen clothing. Have patient drink one to two cups of water immediately and every 20 minutes thereafter until symptoms subside. Total water consumption should be one to two gallons per day.

Heat Rash

Heat rash is caused by continuous exposure to heat and humid air and is aggravated by chafing clothes. The condition decreases ability to tolerate heat.

- Symptoms - Mild red rash, especially in areas of the body that come into contact with protective gear.
- Treatment - Decrease amount of time in protective gear and provide powder to help absorb moisture and decrease chafing.

Heat Stress Monitoring and Work Cycle Management

For strenuous field activities that are part of on-going Site work activities in hot weather, the following procedures shall be used to monitor the body's physiological response to heat, and to manage the work cycle, even if workers are not wearing impervious clothing. These procedures are to be instituted when the temperature exceeds 70°F. If possible these measures will be supplemented by the use of automatic monitoring equipment which can be worn by the workers under their PPE.

- Measure Heart Rate - Heart rate (HR) should be measured by the radial pulse for 30 seconds as early as possible in the resting period. The HR at the beginning of the rest period should not exceed 110 beats/minute. If the HR is higher, the next work period should be shortened by 33 percent, while the length of the rest period stays the same. If the pulse rate still exceeds 110 beats/minute at the beginning of the next rest period, the following work cycle should be further shortened by 33 percent. The procedure is continued until the rate is maintained below 110 beats/minute.

- Measure Body Temperature - When ambient temperature is over 90°F, body temperatures should be measured with a clinical thermometer as early as possible in the resting period. If oral temperature (OT) at the beginning of the rest period exceeds 99.6°F, the next work period should be shortened by 33 percent, while the length of the rest period stays the same. If the OT exceeds 99.6°F at the beginning of the next rest period, the following work cycle should be further shortened by 33 percent. The procedure is continued until the body temperature is maintained below 99.6°F.

- Physiological Monitoring Schedule - The following Suggested Frequency of Physiological Monitoring Schedule for Fit and Acclimated Workers shall be used as a guideline.

Temperature (Adjusted)	***(Level D)***	***(Level C)***
90°F (32.2°C) or above	After each 45 minutes of work	After each 15 minutes of work
87.5°F (30.8°-32.2°C)	After each 60 minutes of work	After each 30 minutes of work
82.5°-87.5°F (28.1°-32.2°C)	After each 90 minutes of work	After each 60 minutes of work
77.5°-82.5°F (25.3°-28.1°C)	After each 120 minutes of work	After each 90 minutes of work
72.5°-77.5°F (22.5°-25.3°C)	After each 150 minutes of work	After each 120 minutes of work

Measure the air temperature with a standard thermometer. Estimate the fraction of sunshine by judging what percent of the sun is out.

100% sunshine = no cloud cover = 1.0
50% sunshine - 50% cloud cover = 0.5
0% sunshine - full cloud cover = 0.0
Adjusted temp. = actual temp. + 13 x (% sunshine factor).

The length of work period is governed by Frequency of Physiological Monitoring. The length of the rest period is governed by physiological parameters (heart rate and oral temperature). For example, if an individual's heart rate exceeds 110 beats/minute at the beginning of the rest period, that individual will remain on rest-time until his/her heart rate drops well below 110 beats/minute and their next work period (= duration of time before suggested physiological monitoring) is decreased by 33 percent.

COLD STRESS PREVENTION AND MONITORING

Persons working outdoors in low temperatures, especially at or below freezing are subject to cold stress. Exposure to extreme cold for a short time causes severe injury to the surface of the body, or results in profound generalized cooling, causing death. Areas of the body which have a high surface area-to-volume ratio such as fingers, toes, and ears, are the most susceptible.

Chemical protective clothing generally does not afford protection against cold stress. In many instances, it increases susceptibility. Hazardous waste Site workers must learn to dress carefully to provide chemical protection and thermal insulation while not dressing so warmly that exercise or strenuous activity will result in heat stress.

Provisions must also be made for the fact that after physical activity and accumulation of body heat, sudden chilling during decontamination and rest breaks may increase susceptibility to colds, etc.

Two factors influence the development of a cold injury: ambient temperature and the velocity of the wind. Wind Chill Indices describe the chilling effect of moving air in combination with low temperature.

As a general rule, the greatest incremental increase in wind chill occurs with a wind of 5 miles per hour (mph). Additionally, 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.

Frostbite

Local injury resulting from cold is included in the generic term frostbite. Frostbite of the extremities can be categorized into:

1. frost nip or incipient frostbite is characterized by sudden blanching or whitening of skin;
2. superficial frostbite is characterized by skin with a waxy or white appearance and is firm to the touch, but tissue beneath is resilient; and
3. deep frostbite is characterized by tissues that are cold, pale and solid.

To administer first aid for frostbite:

1. take the victim indoors and rewarm the areas quickly in water that is between 39°C and 41°C (102°F to 105°F);
2. give a warm drink - water or juices, no coffee, tea or alcohol. The victim must not smoke;
3. keep the frozen parts in warm water or covered with warm clothes for 30 minutes even though the tissue will be very painful as it thaws;
4. then elevate the injured area and protect it from injury;
5. do not allow blisters to be broken;
6. use sterile, soft, dry material to cover the injured areas; and
7. keep victim warm and get immediate medical care.

After thawing, the victim should try to move the injured areas a little, but no more than can be done alone, without help. Seek medical attention as soon as possible.

Note:

1. Do not rub the frostbitten part (this may cause gangrene).
2. Do not use ice, snow, gasoline or anything cold on the frostbitten area.
3. Do not use heat lamps or hot water bottles to rewarm the part.
4. Do not place the part near a hot stove.

Hypothermia

Systemic hypothermia is caused by exposure to freezing or rapidly dropping temperature. Its symptoms are usually exhibited in five stages:

1. shivering;
2. apathy, listlessness, sleepiness;
3. (sometimes) rapid cooling of the body to less than 95°F;
4. unconsciousness, glassy stare, slow pulse, slow respiration; and
5. death.

If hypothermia is suspected in any field personnel, move person to a warmer location until symptoms recede.

APPENDIX B.3

MATERIAL SAFETY DATA SHEET

04 332 16 AC+E

Material Safety Data Sheet

May be used to comply with
HA's Hazard Communication Standard,
CFR 1910.1200. Standard must be
consulted for specific requirements.

U.S. Department of Labor
Occupational Safety and Health Administration
(Non-Mandatory Form)
Form Approved
OMB No. 1218-0072

IDENTITY *(As Used on Label and List)* DETERGENT 8	*Note: Blank spaces are not permitted. If any item is not applicable, or no information is available, the space must be marked to indicate that*

Section I

Manufacturer's Name ALCONOX, INC.	Emergency Telephone Number (212) 473-1300
Address *(Number, Street, City, State, and ZIP Code)* 215 PARK AVENUE SOUTH	Telephone Number for Information (212) 473-1300
NEW YORK, N.Y. 10003	Date Prepared JULY 1, 1989
	Signature of Preparer *(optional)*

Section II — Hazardous Ingredients/Identity Information

Hazardous Components (Specific Chemical Identity; Common Name(s))	OSHA PEL	ACGIH TLV	Other Limits Recommended	% *(optional)*
ETHYLENE GLYCOL MONOBUTYL ETHER	50 PPM	25 PPM		
DIPROPYLENE GLYCOL METHYL ETHER	100 PPM	100 PPM		

NO OTHER INGREDIENTS IN DETERGENT 8 APPEARED ON THE OSHA STANDARD 29 CFR 1910 SUBPART Z.

Section III — Physical/Chemical Characteristics

Boiling Point	235°F	Specific Gravity (H_2O = 1)	.994
Vapor Pressure (mm Hg.)	NO DATA	Melting Point	N.A.
Vapor Density (AIR = 1)	NO DATA	Evaporation Rate (Butyl Acetate = 1)	NO DATA

Solubility in Water
COMPLETE

Appearance and Odor
CLEAR LIQUID-SLIGHT AMMONIA ODOR

Section IV — Fire and Explosion Hazard Data

Flash Point (Method Used) 191°F (OPEN CUP)	Flammable Limits	LEL NO DATA	UEL NO DATA

Extinguishing Media
ALCOHOL FOAM, CO_2, DRY CHEMICAL, WATER FOG

Special Fire Fighting Procedures
FOR FIRES INVOLVING THIS MATERIAL DO NOT ENTER WITHOUT PROTECTIVE EQUIPMENT AND SELF CONTAINED BREATHING APPARATUS.

Unusual Fire and Explosion Hazards
NONE

(Reproduce locally)

Section V — Reactivity Data

Stability	Unstable		Conditions to Avoid NONE
	Stable	XX	

Incompatibility (*Materials to Avoid*) STRONG ACIDS, OXIDIZERS

Hazardous Decomposition or Byproducts THERMAL DECOMPOSITION MAY RELEASE NITROUS OXIDES

Hazardous Polymerization	May Occur		Conditions to Avoid NONE
	Will Not Occur	XX	

Section VI — Health Hazard Data

Route(s) of Entry:	Inhalation? YES	Skin? YES	Ingestion? YES

Health Hazards (*Acute and Chronic*) INHALATION OF VAPORS MAY PROVE LOCALLY IRRITATING. SKIN CONTACT MAY PROVE LOCALLY IRRITATING. INGESTION MAY CAUSE DISCOMFORT AND/OR NAUSEA.

Carcinogenicity:	NTP? NO	IARC Monographs? NO	OSHA Regulated? NO

Signs and Symptoms of Exposure INHALATION MAY CAUSE DROWSINESS IN POORLY VENTILLATED AREAS. SKIN CONTACT MAY PROVE LOCALLY IRRITATING.

Medical Conditions Generally Aggravated by Exposure PREEXISTING SKIN DISORDERS MAY BE AGGRAVATED UPON EXPOSURE.

Emergency and First Aid Procedures
EYES-FLUSH WITH PLENTY OF WATER FOR 15 MINUTES.SEEK MEDICAL ATTENTION. SK
FLUSH WITH PLENTY OF WATER. INGESTION-GIVE WATER.DO NOT INDUCE VOMITING.IF VOMITING OCCURS READMINISTER FLUIDS. SEE A PHYSICIAN.

Section VII — Precautions for Safe Handling and Use

Steps to Be Taken in Case Material Is Released or Spilled USE ABSORBENT MATERIAL AND REMOVE WITH A SHOVEL. RINSE REMAINDER TO SEWER. MATERIAL IS COMPLETELY BIODEGRADABLE.

Waste Disposal Method SMALL QUANTITIES MAY BE DISPOSED OF IN SEWER. LARGE QUANTITIES SHOULD BE DISPOSED OF ACCORDING TO LOCAL REQUIREMENTS FOR ALKALINE LIQUID.

Precautions to Be Taken in Handling and Storing NO SPECIAL PRECAUTIONS IN STORING. OPEN CONTAINER SLOWLY TO RELEASE PRESSURE BUILD-UP.

Other Precautions USE PROTECTIVE EQUIPMENT WHEN HANDLING UNDILUTE MATERIAL. AVOID SPLASHING AND SPRAYING UNDILUTE MATI

Section VIII — Control Measures

Respiratory Protection (*Specify Type*) NOT REQUIRED

Ventilation	Local Exhaust NORMAL	Special N.A.
	Mechanical (*General*) N.A.	Other N.A.

Protective Gloves REQUIRED	Eye Protection RECOMMENDED

Other Protective Clothing or Equipment EYE WASH STATION SHOULD BE AVAILABLE.

Work/Hygienic Practices
USE GOOD INDUSTRIAL HYGIENE AND SAFETY PRACTICES EMPLOYED WITH ANY INDUSTRIAL CHEMICAL

• U.S.G.P.O.: 1986-491-529/45775

APPENDIX B.4

SEVERE WEATHER PROCEDURES

SEVERE WEATHER

When projects are conducted outside, the potential for severe weather must be considered. Thunderstorms, tornadoes and winter storms can develop quickly, jeopardizing Site safety. The following emergency procedures are to be followed in the event of severe weather.

Thunderstorms and Lightning

1. Monitor weather conditions at all times while working. At a sign of an impending storm - increased cloudiness, darkened skies, increased wind listen to a radio for the latest weather information.

2. When a thunderstorm accompanied by lightning is in the project area, reduce activities or cease work immediately.

3. Perform decontamination as quickly and orderly as possible, if work stoppage is necessary.

4. Seek shelter inside nearest building or Site trailer.

5. If you are caught in an open area and you feel your hair stand on end, lightning may be about to strike you. Drop to your knees and bend forward, putting your hands on your knees. DO NOT LIE FLAT ON THE GROUND.

6. If someone has been struck by lightning, monitor life signs and begin administering mouth-to-mouth resuscitation or cardiopulmonary resuscitation as needed. Send for help.

7. Check conscious victims for burns, especially at the fingers and toes and next to buckles and jewelry. Administer first aid for shock. Do not let the victim walk around.

Tornadoes

1. Tornadoes usually develop from thunderstorms and normally occur at the trailing edge of the storm. Most tornadoes occur in the months of April, May, June and July in the late afternoon and early evening hours.

2. When storms are predicted for the project area, monitor weather conditions on a radio. A tornado watch is issued when favorable conditions exist for the development of a tornado. A tornado warning is issued by the local weather service office whenever a tornado has actually been sighted or is strongly indicated by radar.

3. If a tornado warning is issued, seek shelter immediately.

4. If a tornado warning is issued and you are in a vehicle or a Site trailer, leave and go to the nearest building.

5. Once a tornado has passed the Site, Site personnel are to assemble at the designated SZ area to determine if anyone is missing. Administer first aid and seek medical attention as needed.

Winter Storms

1. When snow or ice storms are predicted for the project area, Site personnel should monitor weather conditions on a radio. A winter storm watch is issued when a storm has formed and is approaching the area. A winter storm warning is issued when a storm is imminent and immediate action is to be taken.

2. When a storm watch is issued, monitor weather conditions and be prepared to halt Site activities. Seek shelter in Site buildings or the Site trailer.

APPENDIX B.5

CONFINED SPACE ENTRY PERMIT

CONFINED SPACE ENTRY PERMIT

SITE NAME/LOCATION/REF. NO.: Ruco Polymer Corporation
Hicksville, New York
Reference No. 6883

WORK ACTIVITY:

Duration:________ Issue Date: ________ Time:________ Filled Out by:________

POTENTIAL HAZARDS:
(System Generated)

(Work Generated)

CONFINED SPACE ENTRY PERMIT

AIR MONITORING: PRE-ENTRY__________ PERIODIC__________ CONTINUOUS__________

DATE/TIME	*BY (INIT)*	*%O_2*	*ppm CO*	*% LEL*	*OTHER TEST*	
					TYPE	*RESULT*

ISOLATION:

Purging Required: YES ☐ NO ☐ PURGING CONFIRMED:

Safety Tags Required: YES ☐ NO ☐

VENTILATION REQUIRED: YES ☐ NO ☐

CONTINUOUS __________ OTHER __________

EMERGENCY RESCUE EQUIPMENT REQUIRED:

__________Communications Device
__________First Aid Kit
__________Stretcher/Backboard
__________Fire Extinguisher
__________SCBA
__________Other ____________________

__________Winch/Hoist
__________Harness with Lifeline (type)
__________PPE (type)
__________Lighting (type)

CONFINED SPACE ENTRY PERMIT

PERSONAL PROTECTIVE EQUIPMENT REQUIRED:

____________ Hardhat
____________ Safety Glasses
____________ Face Shield
____________ Ear Plugs/Muff
____________ Emergency Escape Pack
____________ Lanyards
____________ Gloves (type) ____________
____________ Harnesses (type) ____________
____________ Other ____________

____________ Respiratory Protection (type)
____________ Coveralls
Chemical Suits
____________ Rain Suits
____________ Lifelines

ADDITIONAL WORK INSTRUCTIONS:

EMERGENCY CONTACT PHONE NO. ____________

PERSONS ENTERING CONFINED SPACE (PRINT NAME)

STANDBY PERSON REQUIRED: YES ☐ NO ☐ (PRINT NAMES)

6883 (4)

CONFINED SPACE ENTRY PERMIT

I have reviewed and met the requirements of this permit and expect that this work shall be done safely. Entrants have been instructed on the proper confined space entry procedures, requirements and conditions.

ENTRY AUTHORIZED BY: ______________________________ DATE: __________________

All work under this permit has been completed and all materials and entrants have been withdrawn from the confined space.

______________________________ ______________________________

Attendant or Entrant Date

APPENDIX C

GROUNDWATER FLOW MODEL SIMULATIONS

TABLE OF CONTENTS

1.0 INTRODUCTION

The remedial action concept presented in the Record of Decision (ROD) was to control the off-site migration of tentatively identified compounds (TICs) detected in the Hooker/Ruco Site (Site) soils and shallow (≤140 feet below ground surface (bgs)) groundwater. The subsequent detection of volatile organic compounds (VOCs) in the groundwater at greater depths, with the highest VOC concentrations detected in the interval from 220± to 320± feet bgs, resulted in the need to modify the ROD remedial objective to address this chemical presence.

The evaluation presented below uses the calibrated Geraghty & Miller (G&M) groundwater and chemical transport model as provided by G&M to Occidental Chemical Corporation (OxyChem).

The G&M groundwater flow model was developed for Grumman Aerospace Corporation (Grumman) using the three-dimensional finite difference groundwater flow model MODFLOW developed by the U.S. Geological Survey. To date, complete model documentation detailing the use of observed data, assumptions, conceptualization, construction, calibration and results of the groundwater flow model has not been provided by G&M. The model was calibrated to average groundwater flow conditions observed over the time period from 1991 to 1993. The computer files associated with the calibrated model were provided to OxyChem on June 9, 1995. Strictly on the basis of these computer files, OxyChem is able to conduct groundwater flow simulations using MODFLOW and the computer files associated with G&M's calibrated model.

A brief description of the G&M groundwater flow model is provided herein. It must be emphasized that, without G&M's formal model documentation, OxyChem is unable to judge the reasonableness of any assumptions that may have been applied by G&M to develop the calibrated model.

The model domain consists of a rectangular area extending approximately 21,200 ft in the east-west direction and 32,600 ft in the north-south direction centered about the Grumman facility. The model consists of eight layers. The vertical location of each layer in the vicinity of MW-50 located in the southern portion of the Site is shown in Table 1. Elevated chemical presence was detected in the approximate depth interval of 200 to 320 ft bgs.

Table 1

Approximate Vertical Location of Model Layers in the Vicinity of MW-50

Model	*Elevation (ft amsl)*		*Depth Below Ground Surface (ft bgs)*	
Layer	*layer top*	*layer bottom*	*layer top*	*layer bottom*
1	130	40	0	90
2	40	25	90	105
3	25	-50	105	180
4	-50	-140	180	270
5	-140	-235	270	365
6	-235	-365	365	495
7	-365	-480	495	610
8	-480	-550	610	680

The top layer is simulated as unconfined with a calibrated precipitation recharge rate of 26.9 in./yr. The top two layers appear to represent the upper aquifer which consists of stratified glacial outwash sand and gravel deposits with discontinuous silty clay layers. The lower layers represent the Magothy Aquifer consisting of stratified fluvial deposits of primarily fine sand, silt and clay with some discontinuous lenses of coarse sand and gravel. The bottom of layer 8 is represented as an impermeable boundary corresponding to the upper clay unit of the Raritan Formation. A constant hydraulic head boundary is applied around the entire perimeter of the model domain. The calibrated hydraulic conductivities determined by G&M for each model layer in the vicinity of the Site are shown in Table 2. Each layer was considered to be horizontally isotropic and vertically anisotropic. The ratio of the horizontal to vertical hydraulic conductivities in each layer are shown in Table 2. Presumably, the vertical anisotropy was applied to represent the stratified nature of the deposits and the intermittent clay lenses present in each deposit.

Table 2

G&M Calibrated Hydraulic Conductivity in the Vicinity of the Site

Model Layer	*Horizontal Hydraulic Conductivity, K_H (ft/day)*	*Horizontal Hydraulic Conductivity, K_V (ft/day)*	$K_{H/} K_V$
1	200	15	13.3
2	200	15	13.3
3	120	5	24
4	30	2	15
5	30	2	15
6	30	2	15
7	30	2	15
8	60	1.2	50

2.0 GRUMMAN INTERIM REMEDIAL MEASURE

Grumman initially proposed an Interim Remedial Measure (IRM) to address adversely impacted groundwater from the Grumman site. The IRM consisted of seven wells at the pumping rates listed in Table 3. The areas and rates of recharge are also listed to provide a complete description of Grumman's IRM.

Table 3

Pumpage and Recharge for the Grumman IRM

Pumping		*Recharge*		
Extraction Well	*Pumping Rate (gpm)*	*Recharge From*	*Recharge Rate (gpm)*	*Recharge Sump Location*
GP-1	1086	Plant 3	50.0	Northeast of Grumman plant 3
GP-11	540	Plant 2	978	Southeast of Grumman plant 2
GP-13	608	Plant 5	1036	South of Grumman plant 5
GP-16	765	Plant 12	47	Southeast of Grumman plant 12
ONCT-1D	1000	Plant 26	525	Northeast of Grumman plant 3
ONCT-2D	1000	ONCT-1D	1000	Southeast of Grumman plant 2
		ONCT-2D	1000	Southeast of Grumman plant 2

In a letter dated June 21, 1995 to the New York State Department of Environmental Conservation (NYSDEC) G&M described the application of their groundwater flow model to address the U.S. Environmental Protection Agency's (EPA) Record of Decision (ROD) pertaining to the Site. The ROD requires that groundwater emanating from the Site be prevented from migrating off site. G&M used their model to conduct particle tracking simulations which demonstrated that containment of the Site could be achieved for steady-state conditions resulting from pumping the Grumman production wells GP-6 and GP-14 at 1000 gpm each while pumping occurs for Grumman's proposed IRM (see Table 3). The additional groundwater withdrawn by GP-6 was discharged to the sump located to the northeast of Grumman plant 3. The additional groundwater withdrawn by GP-14 was discharged to the sump located to the south of Grumman plant 5. The particle tracking simulation was performed using the U.S. Geological Survey's particle tracking program MODPATH. To conduct the particle tracking simulations, G&M applied a porosity value of 0.3 in each layer which is typical of a sand and gravel deposit. Particles were released in four groups around the perimeter of the Site boundary near the bottom of model layer 3, at the midpoint of model layers 4 and 5, and near the top of model layer 6. The model layers are primarily level around the Site and Table 1 shows that these particles were released at approximate depths of 175, 225, 318 and 370 ft bgs, respectively. All particles were captured by GP-14 showing containment over the vertical interval ranging from approximately 175 to 370 ft bgs. Based upon this observation, G&M demonstrated that pumping GP-6 and GP-14 appears to satisfy the ROD for the Site.

In a G&M letter dated July 19, 1995 Grumman revised their proposed IRM by shifting ONCT-2D to the east and adding the additional extraction well ONCT-3D at the previous location of ONCT-2D. The proposed pumping rates at ONCT-2D and ONCT-3D were 700 and 600 gpm, respectively. All other pumping and recharge rates remain as indicated in Table 3 with the exception the recharge rate to the sump located southeast of Grumman plant 2 was increased by 300 gpm. G&M did not provide a particle tracking analysis to demonstrate that containment of the Site could be achieved by pumping GP-6 and GP-14 while pumping occurs for Grumman's modified IRM.

3.0 EVALUATION OF PUMPING OF GP-6 AND GP-14 WHILE PUMPING OCCURS FOR GRUMMAN'S MODIFIED IRM

OxyChem has used G&M's calibrated model to conduct a particle tracking analysis similar to that presented in the June 21 G&M letter to evaluate Site containment with GP-6 and GP-14 pumping at 1000 gpm each while pumping occurs for Grumman's modified IRM. The steady-state hydraulic head distribution for these pumping and recharge conditions was used with the particle tracking program PATH3D developed by S.S. Papadopulos & Associates Ltd. A porosity value of 0.3 was used in all layers. The pumping rates at all other industrial and municipal wells within the model domain remained the same as those set in the G&M calibrated model. Four groups of particles were released around the Site perimeter at the same depth intervals indicated in the G&M June 21 letter.

The results of this particle tracking analysis are presented on Figures 1 to 4. These figures display a 10,000 ft^2 area of the G&M groundwater flow model domain centered about the Grumman Site. The pumping wells and their associated rates within this area are shown on each figure along with the model layer from which the pumping rate was simulated. The locations of the active recharge sumps are also indicated. The figures present the calculated pathways of the particles in each of the four groups over a 50-year time period along with the simulated steady-state hydraulic head distribution within the layer where the particle group was released. The particle pathways cross several model layers over the 50-year time period. The pathway of each particle in a particular model layer is colored according to the legend shown on the figures.

The particle tracking results shown on Figures 1 to 4 are consistent with those presented in the June 21 G&M letter. The particles released in all four groups are captured by GP-14. This evaluation demonstrates that containment of the Site may be achieved over the depth interval from approximately 175 to 370 ft bgs by pumping GP-6 and GP-14 while pumping occurs for Gumman's modified IRM.

4.0 OXYCHEM PROPOSED ROD MEASURE

The following presents an evaluation of an on-Site pumping scenario to address the ROD. The scenario consists of pumping an extraction well in the vicinity of MW-50 at a rate of 550 gpm and pumping an extraction well located at the southeast corner of the Site (arbitrarily labeled MW-A) at a rate of 100 gpm. The scenario simulates the discharge of treated groundwater at a rate of 125 gpm to sump 1 located in the southeast corner of the Site and discharge of the remaining treated groundwater (525 gpm) to a new sump proposed on the west side of the Site, south of the existing parking lot. The pumping rate from the extraction well in the vicinity of MW-50 was simulated from model layer 6 which corresponds to the lowest model layer where chemical presence was observed beneath the Site. The pumping rate from MW-A was simulated from model layer 2. It should be noted that MODFLOW assumes that a well fully penetrates the model layer in which it is placed. Thus, using the G&M groundwater flow model, Table 1 shows that the MW-50 and MW-A extraction wells are simulated with screened intervals from 90 to 105 ft bgs and 270 to 365 ft bgs, respectively. The pumping and recharge rates for Grumman's modified IRM were included in the simulation. The pumping rates at all other municipal and industrial wells within the model domain remained the same as those set in the G&M calibrated model.

To evaluate Site containment, particles were released at the location of the two sumps and around the Site perimeter. The particles at both sumps were released in model layer 1 at a depth of 70 ft bgs corresponding to the approximate location of the watertable beneath the Site. The particles around the Site perimeter were released at the top of layer 2, middle of layers 3, 4 and 5 and at the top of layer 6. From Table 1, the particle release locations correspond to approximately depths of 95, 143, 225, 318 and 370 ft. bgs, respectively.

The particle tracking results over a 50-year time period for OxyChem's ROD measure are presented on Figures 5 to 11.

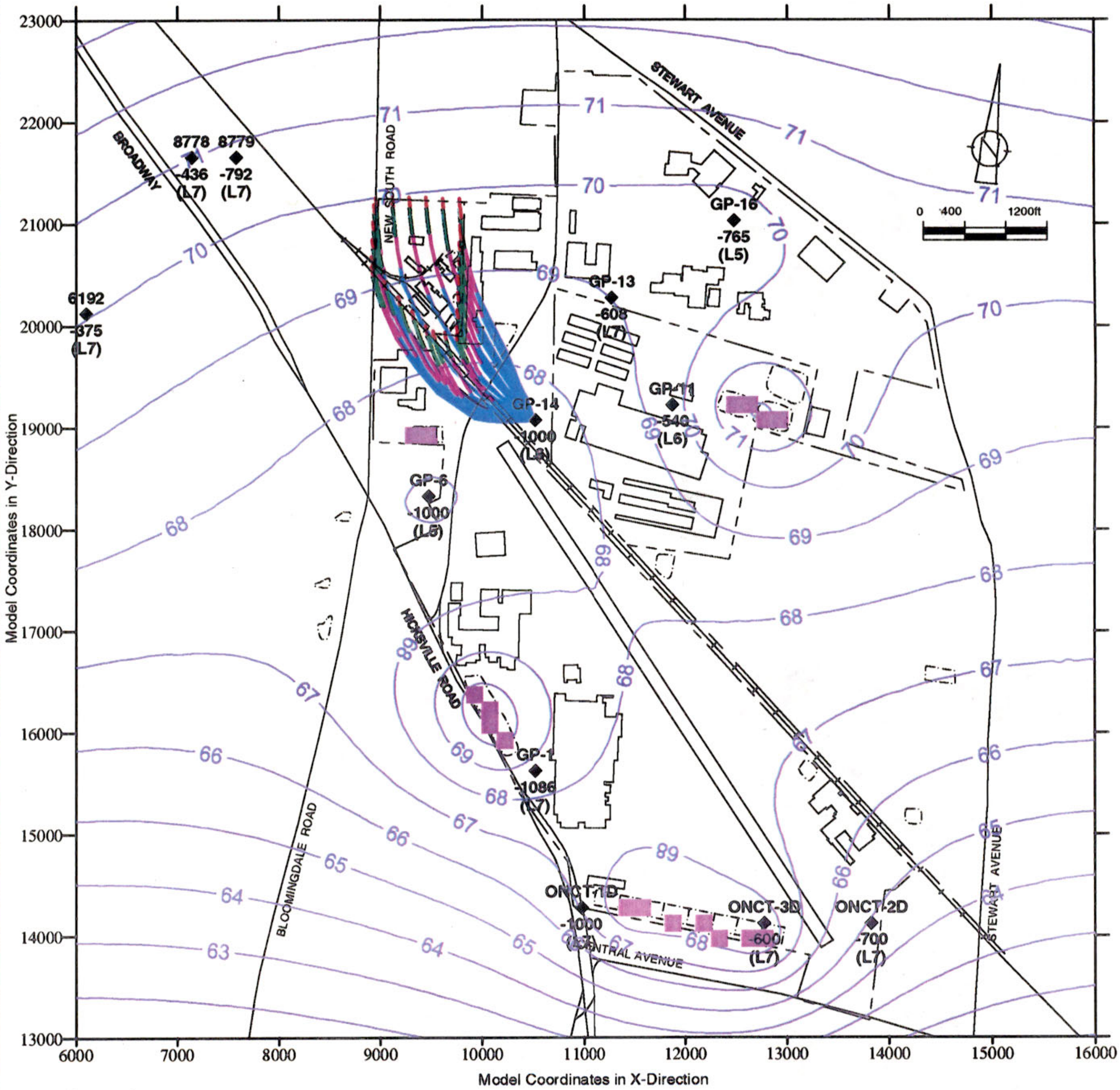
An elevated chemical presence has been identified in the surficial soils within sump 1. The discharge of treated groundwater to sump 1 is proposed to flush out these surficial soils. As a result, the water discharged to sump 1 must be contained. Simulation of pumping at MW-50 without pumping at MW-A showed that the particles released at sump 1 move off-Site to the southeast the direction of the simulated groundwater flow. The pumping at MW-50 draws water from depth and the discharge to sump 1 does not reach significant depths until it has moved off-Site where, at this point, the discharge water is beyond the zone of capture for MW-50. Thus, pumping at MW-A is required. Figure 5 shows that the majority of the particles released at sump 1 are captured by MW-A. However, some particles released at sump 1 are not captured by MW-A and move off Site in a southeast direction. As these particles move off Site, they are also being drawn vertically downwards by the pumping at MW-50. Once reaching model layer 5, the particles are drawn back toward MW-50 and are captured. Capture is demonstrated by the magenta colored particle pathways in layer 5 which lay beneath the particle pathways in the more shallow layers shown on Figure 5. This simulation demonstrates that the water discharged to sump 1 is contained by the combined pumping at MW-A and MW-50.

Figure 6 shows the simulated pathways for the particles released at the new sump located south of the parking lot. All but two of the released particles are captured by the pumping at MW-50. One of the released particles moves off-Site in the southeast direction and vertically downward to model layer 7. A second particle moves off-Site initially to the east and then moves to the south while obtaining progressively greater depths. Since a chemical presence has not been detected at the location of the new sump, the loss of some of the treated groundwater discharged to this sump is not considered a significant threat to the groundwater quality in the surrounding area.

The particle tracking results for the particles released around the Site perimeter are shown on Figures 7 to 11. All of the particles released at the top of layer 2 and at the middle of layers 3, 4 and 5 are captured by the pumping at MW-50. Figure 11 shows that all but two of the particles released at the top of layer 6 are captured by MW-50 in the 50-year time period that the particle tracking was conducted. Two particles released at the northwest corner of the Site move off Site in a southwest direction and vertically downward until the influence of the MW-50 pumping draws the particles toward MW-50.

5.0 SUMMARY

The above evaluation demonstrates that pumping on the order of 550 gpm in the vicinity of well MW-50 at a depth on the order of 270 to 367 ft bgs and pumping on the order of 100 gpm to the southeast of sump 1 at a depth on the order of 90 to 105 ft bgs is sufficient to contain groundwater emanating from the Site. The containment of all treated groundwater discharged to sump 1 is achieved by the combined pumping at the shallow and deep intervals.



Legend

🟪 Active recharge basin/sump location.

GP-1
◆
-1086
(L7)
Extraction well location and pumping rate in gpm from model layer ( ).

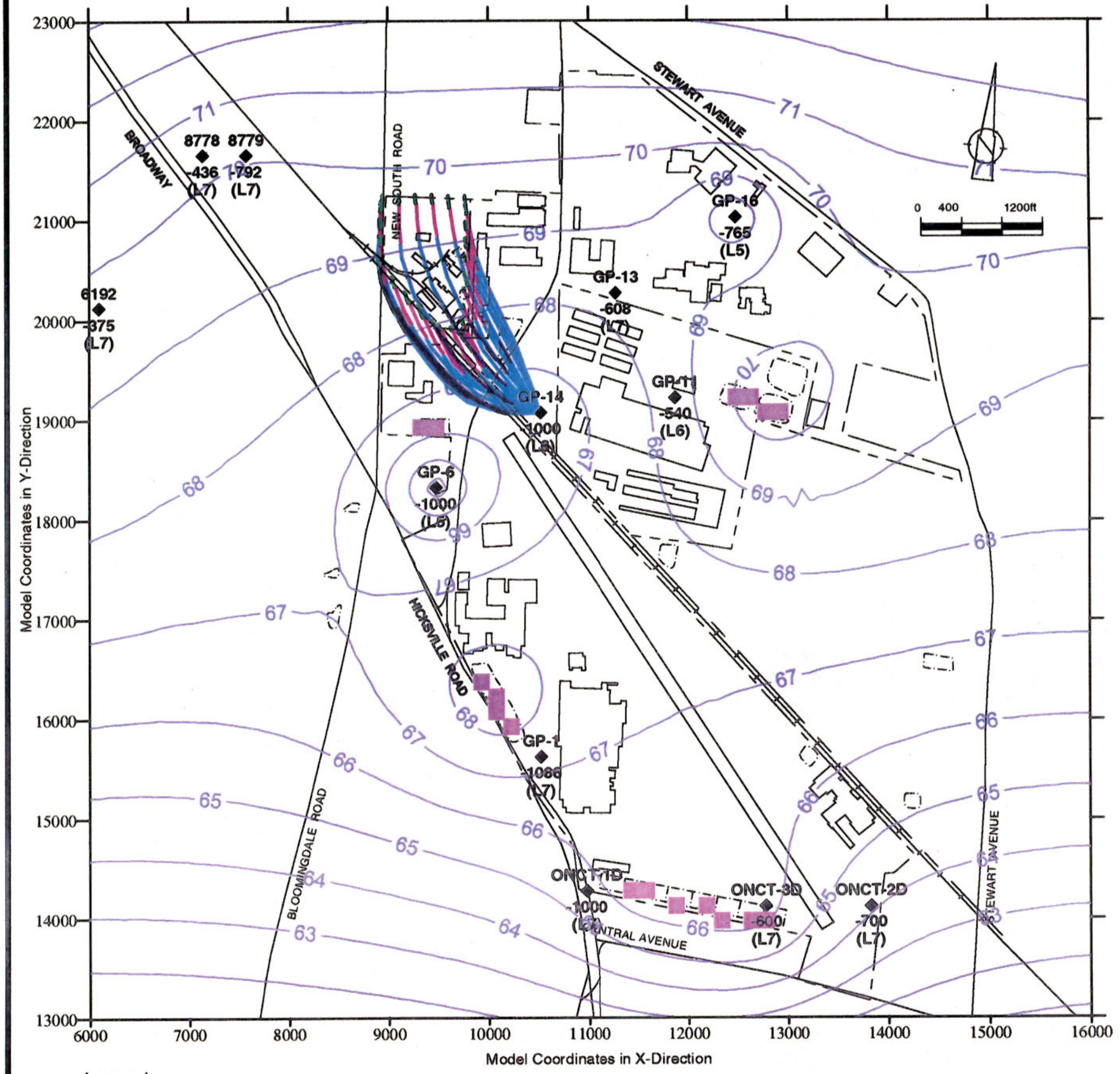
—68— Simulated hydraulic head in layer 3 (ft. amsl).

50-year pathways for particles released in Layer 3:

- Particle pathway in Layer 3.
- Particle pathway in Layer 4.
- Particle pathway in Layer 5.
- Particle pathway in Layer 6.
- Particle pathway in Layer 7.
- Particle pathway in Layer 8.

figure 1
Grumman Modified IRM with GP-6 & GP-14
Simulated Hydraulic in Layer 3 and 50-Year Pathways for
Particles Released at Site Boundary in Bottom of Layer 3 (175 ft bgs)
HOOKER/RUCO SITE
Hicksville, New York

CRA



Legend

■ Active recharge basin/sump location.

GP-1 ◆ -1086 (L7) Extraction well location and pumping rate in gpm from model layer ( ).

—68— Simulated hydraulic head in layer 4 (ft. amsl).

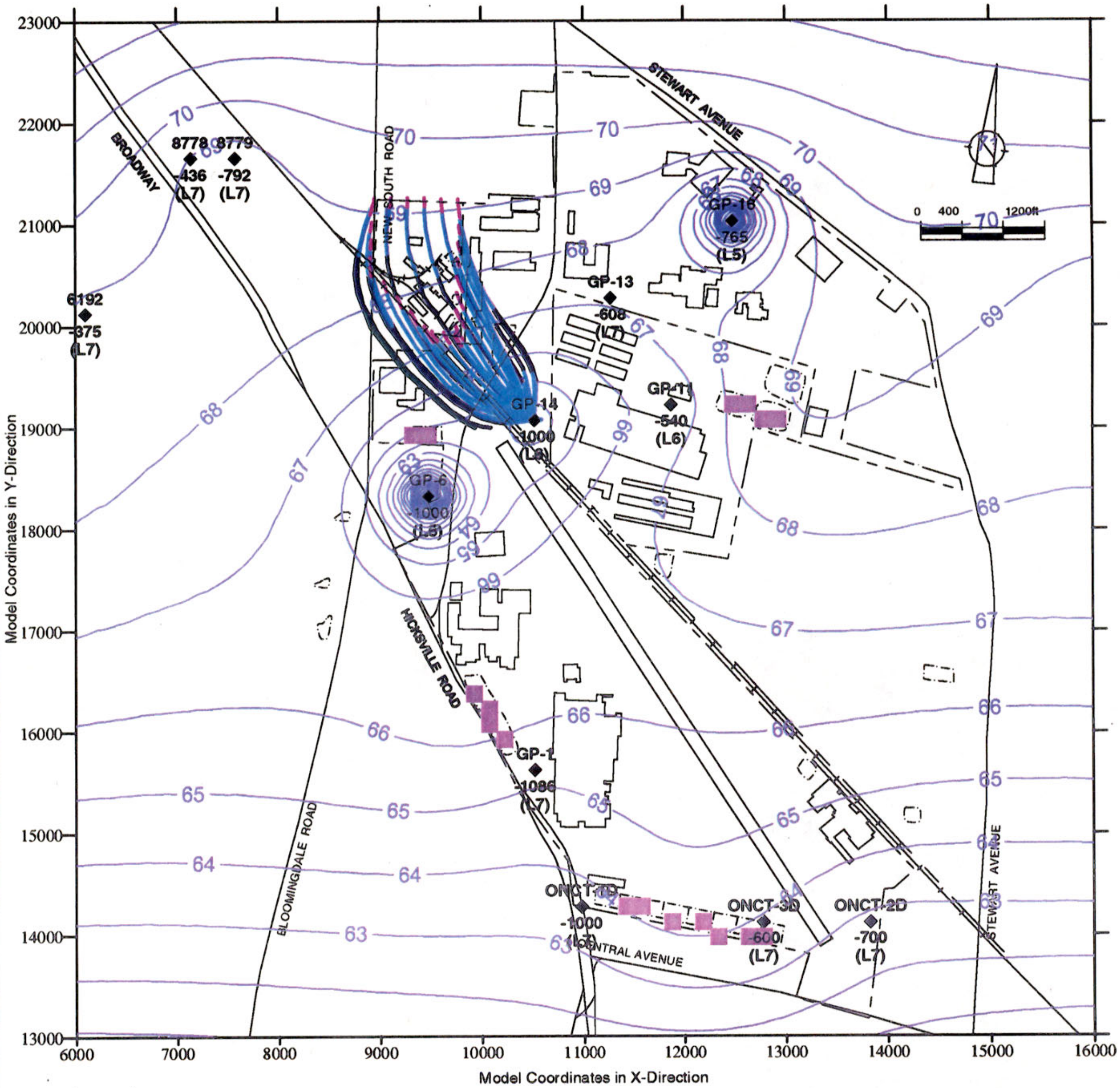
50-year pathways for particles released in Layer 4:

- Particle pathway in Layer 3.
- Particle pathway in Layer 4.
- Particle pathway in Layer 5.
- Particle pathway in Layer 6.
- Particle pathway in Layer 7.
- Particle pathway in Layer 8.

figure 2
Grumman Modified IRM with GP-6 & GP-14
Simulated Hydraulic in Layer 4 and 50-Year Pathways for
Particles Released at Site Boundary in Middle of Layer 4 (225 ft bgs)
HOOKER/RUCO SITE
Hicksville, New York

CRA

6833 (4) Oct. 18/95 HYD-W. REV.0 (n:/hg/6883/irm/mirm4h.srf)



Legend

■	Active recharge basin/sump location.
GP-1 ◆ -1086 (L7)	Extraction well location and pumping rate in gpm from model layer ( ).
—68—	Simulated hydraulic head in layer 5 (ft. amsl).

50-year pathways for particles released in Layer 5:

- Particle pathway in Layer 3.
- Particle pathway in Layer 4.
- Particle pathway in Layer 5.
- Particle pathway in Layer 6.
- Particle pathway in Layer 7.
- Particle pathway in Layer 8.

figure 3

Grumman Modified IRM with GP-6 & GP-14

Simulated Hydraulic in Layer 5 and 50-Year Pathways for

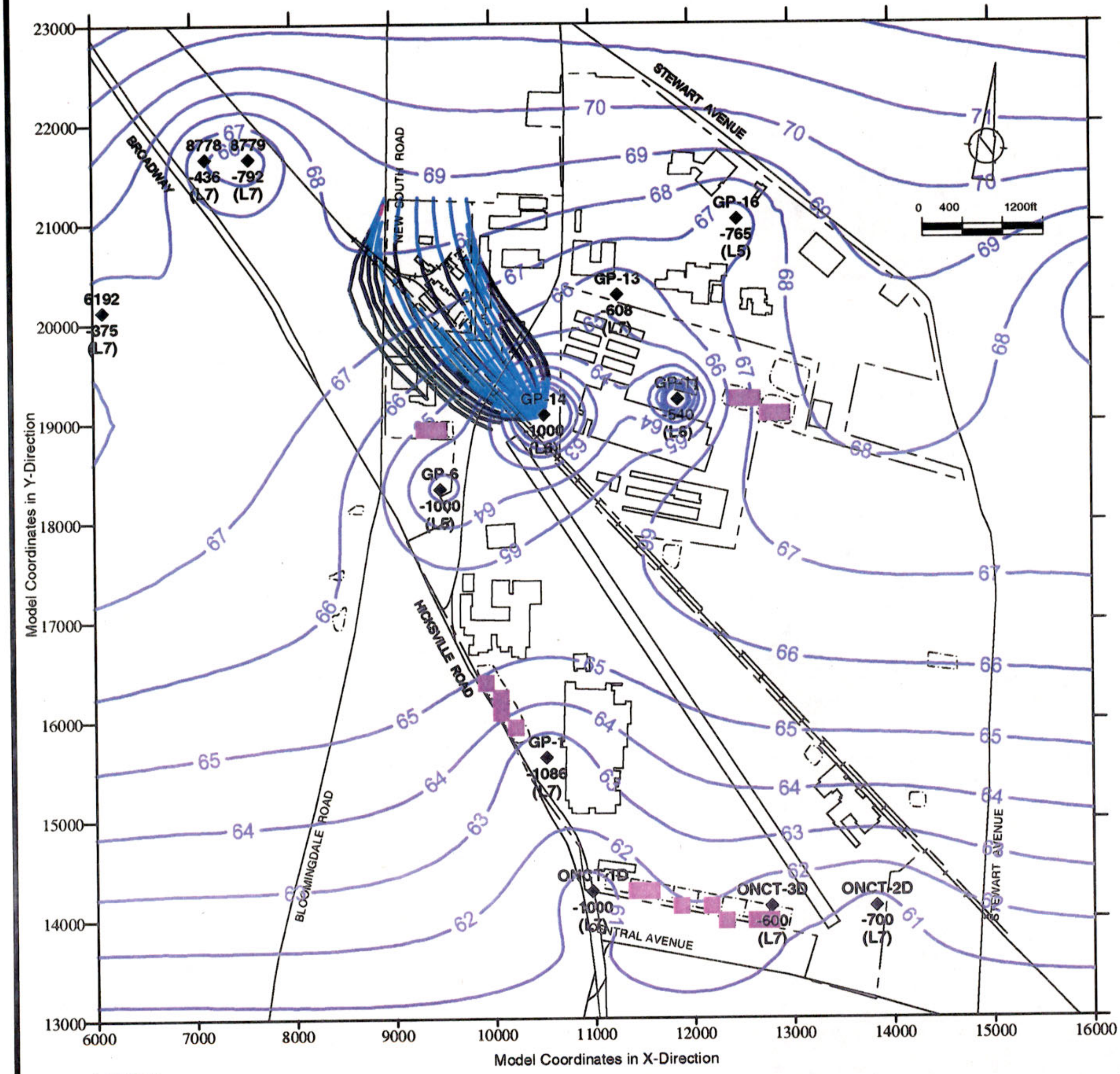
Particles Released at Site Boundary in Middle of Layer 5 (318 ft bgs)

HOOKER/RUCO SITE

Hicksville, New York

CRA

6833 (4) Oct. 18/95 HYD-W. REV.0 (n:/hg/6883/irm/mirm5h.srf)



Legend

■ Active recharge basin/sump location.

GP-1 ◆ -1086 (L7) Extraction well location and pumping rate in gpm from model layer ( ).

—68— Simulated hydraulic head in layer 6 (ft. amsl).

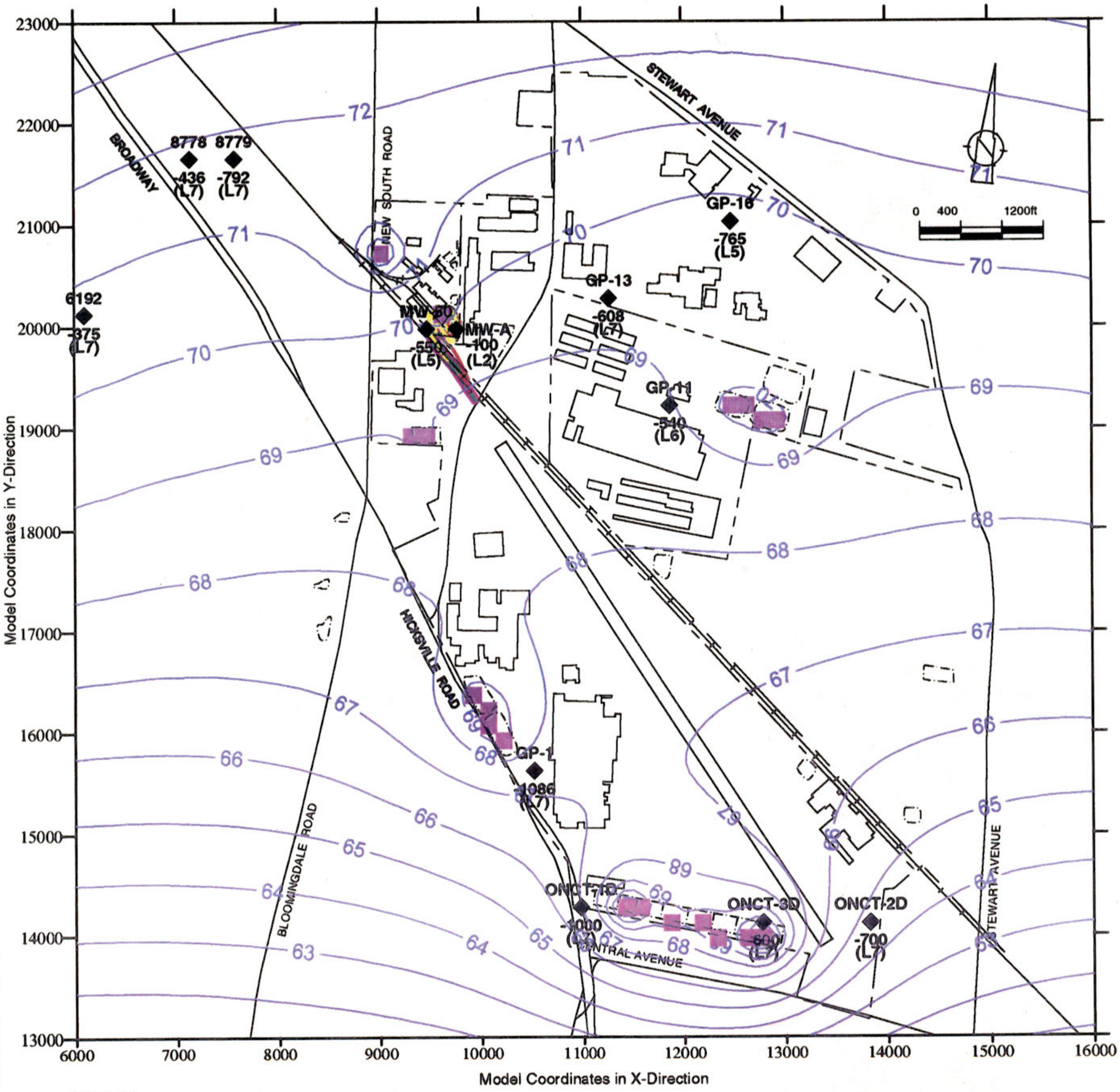
50-year pathways for particles released in Layer 6:

— Particle pathway in Layer 3.
— Particle pathway in Layer 4.
— Particle pathway in Layer 5.
— Particle pathway in Layer 6.
— Particle pathway in Layer 7.
— Particle pathway in Layer 8.

figure 4

Grumman Modified IRM with GP-6 & GP-14
Simulated Hydraulic in Layer 6 and 50-Year Pathways for
Particles Released at Site Boundary in Top of Layer 6 (370 ft bgs)
HOOKER/RUCO SITE
Hicksville, New York

CRA



Legend

■ Discharge basin/sump location.

GP-1 ◆ -1086 (L7) Extraction well location and pumping rate in gpm from model layer ( ).

—68— Simulated hydraulic head in layer 1 (ft. amsl).

50-year pathways for particles released in Layer 1:

— Particle pathway in Layer 1.
— Particle pathway in Layer 2.
— Particle pathway in Layer 3.
— Particle pathway in Layer 4.
— Particle pathway in Layer 5. .
— Particle pathway in Layer 6.
— Particle pathway in Layer 7.
— Particle pathway in Layer 8.

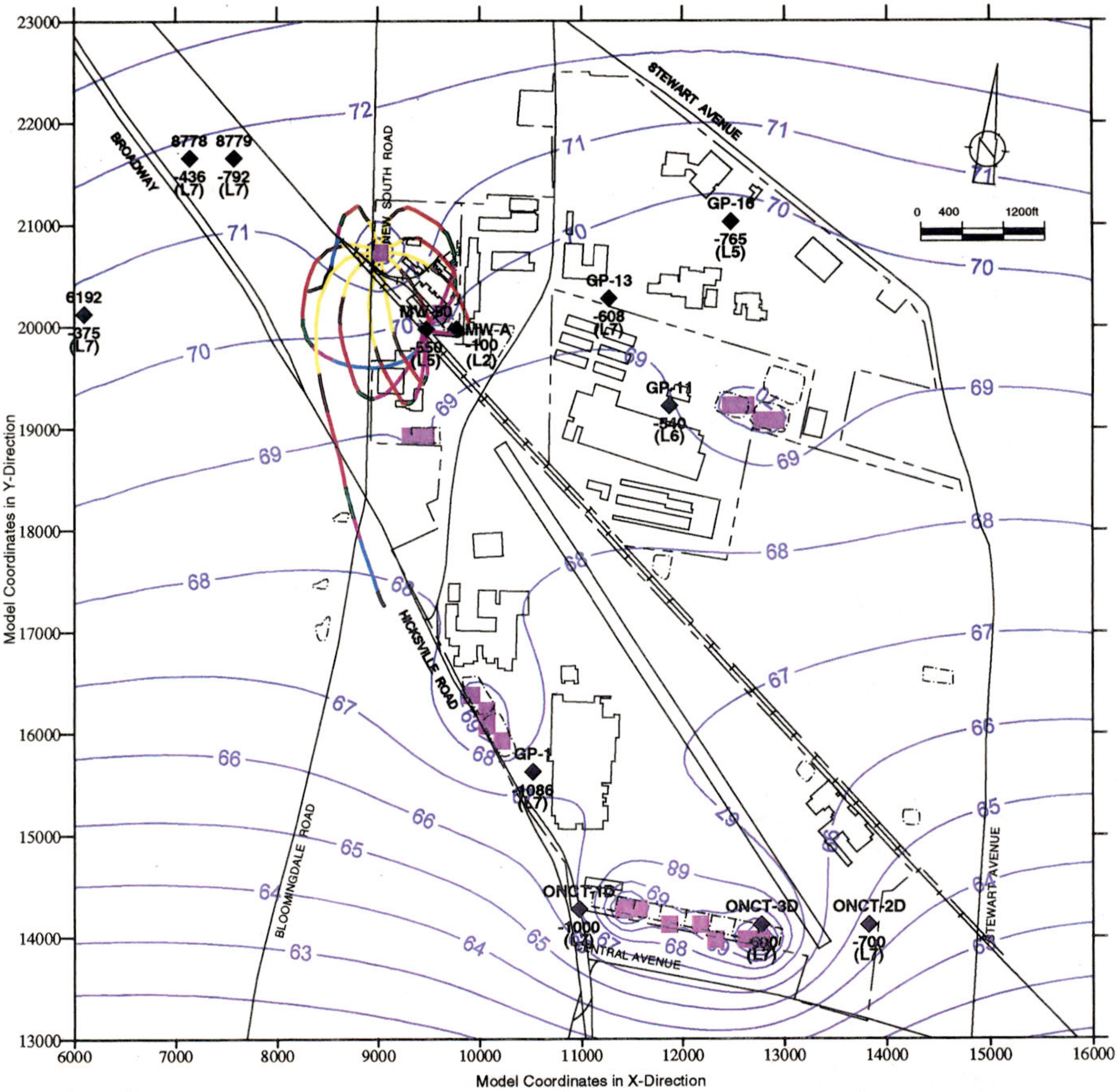
figure 5

Grumman Modified IRM with OxyChem ROD Measure Simulated Hydraulic in Layer 1 and 50-Year Pathways for Particles Released at Sump 1 in Layer 1 at Watertable (70 ft bgs)

HOOKER/RUCO SITE

Hicksville, New York

CRA



Legend

■ Discharge basin/sump location.

GP-1
◆
-1086
(L7)
Extraction well location and pumping rate in gpm from model layer ( ).

—68— Simulated hydraulic head in layer 1 (ft. amsl).

50-year pathways for particles released in Layer 1:

— Particle pathway in Layer 1.
— Particle pathway in Layer 2.
— Particle pathway in Layer 3.
— Particle pathway in Layer 4.
— Particle pathway in Layer 5.
— Particle pathway in Layer 6.
— Particle pathway in Layer 7.
— Particle pathway in Layer 8.

figure 6

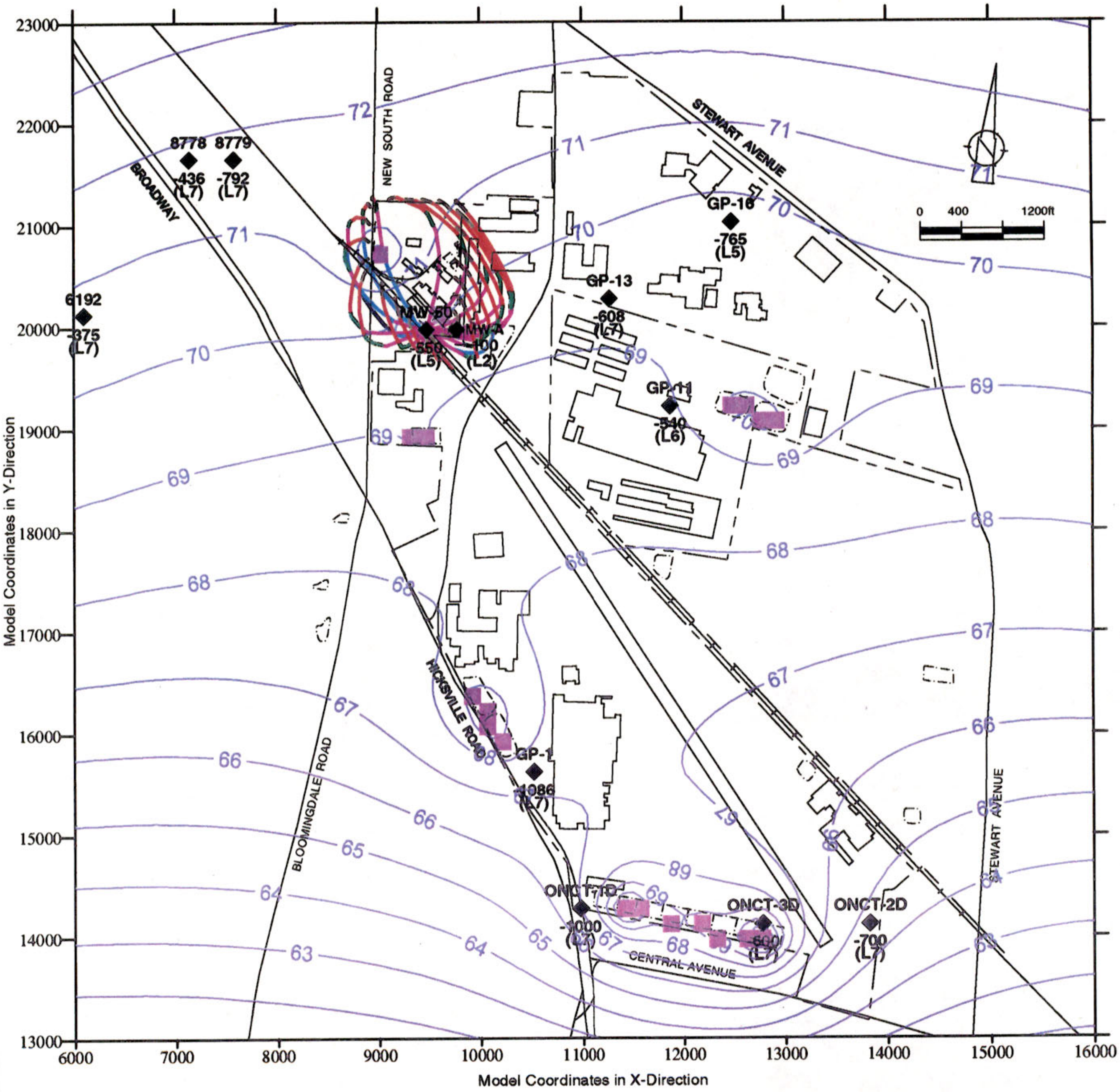
Grumman Modified IRM with OxyChem ROD Measure Simulated Hydraulic in Layer 1 and 50-Year Pathways for Particles Released at the New Sump South of Parking Lot in Layer 1 at Watertable (70 ft bgs)

HOOKER/RUCO SITE

Hicksville, New York

CRA

6833 (4) Oct. 17/95 HYD-W. REV.0 (n:/hg/6883/irm/mirmr112.srf)



Legend

■ Discharge basin/sump location.

GP-1 ◆ -1086 (L7) Extraction well location and pumping rate in gpm from model layer ( ).

—68— Simulated hydraulic head in layer 2 (ft. amsl).

50-year pathways for particles released in Layer 2:

— Particle pathway in Layer 1.
— Particle pathway in Layer 2.
— Particle pathway in Layer 3.
— Particle pathway in Layer 4.
— Particle pathway in Layer 5.
— Particle pathway in Layer 6.
— Particle pathway in Layer 7.
— Particle pathway in Layer 8.

figure 7

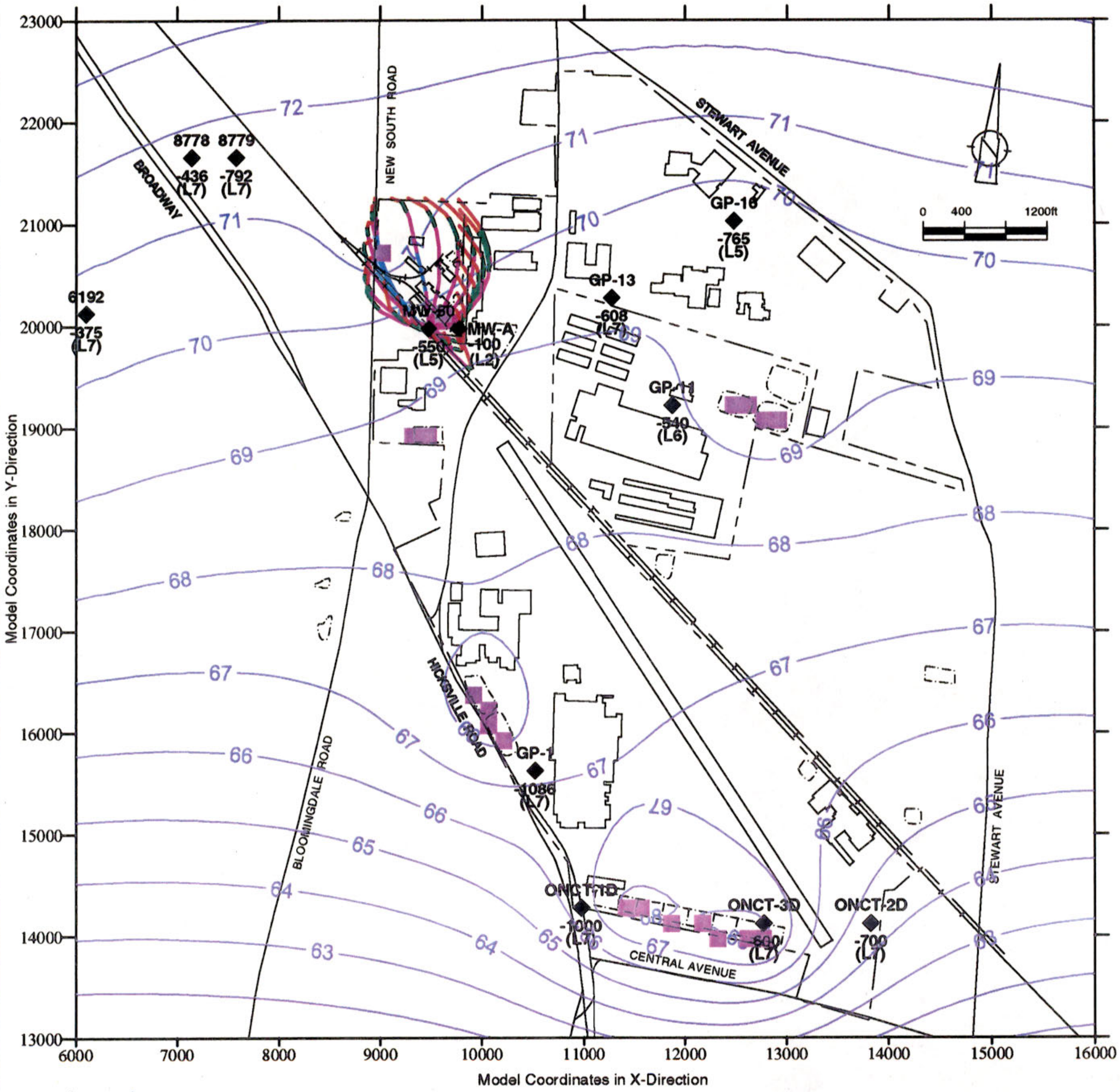
Grumman Modified IRM with OxyChem ROD Measure Simulated Hydraulic in Layer 2 and 50-Year Pathways for Particles Released at Site Boundary in Top of Layer 2 (95 ft bgs)

HOOKER/RUCO SITE

Hicksville, New York

CRA

6833 (4) Oct. 17/95 HYD-W. REV.0 (n:/hg/6883/irm/mirmr12h.srf)



Legend

■ Discharge basin/sump location.

GP-1 ◆ -1086 (L7) Extraction well location and pumping rate in gpm from model layer ( ).

—68— Simulated hydraulic head in layer 3 (ft. amsl).

50-year pathways for particles released in Layer 3:

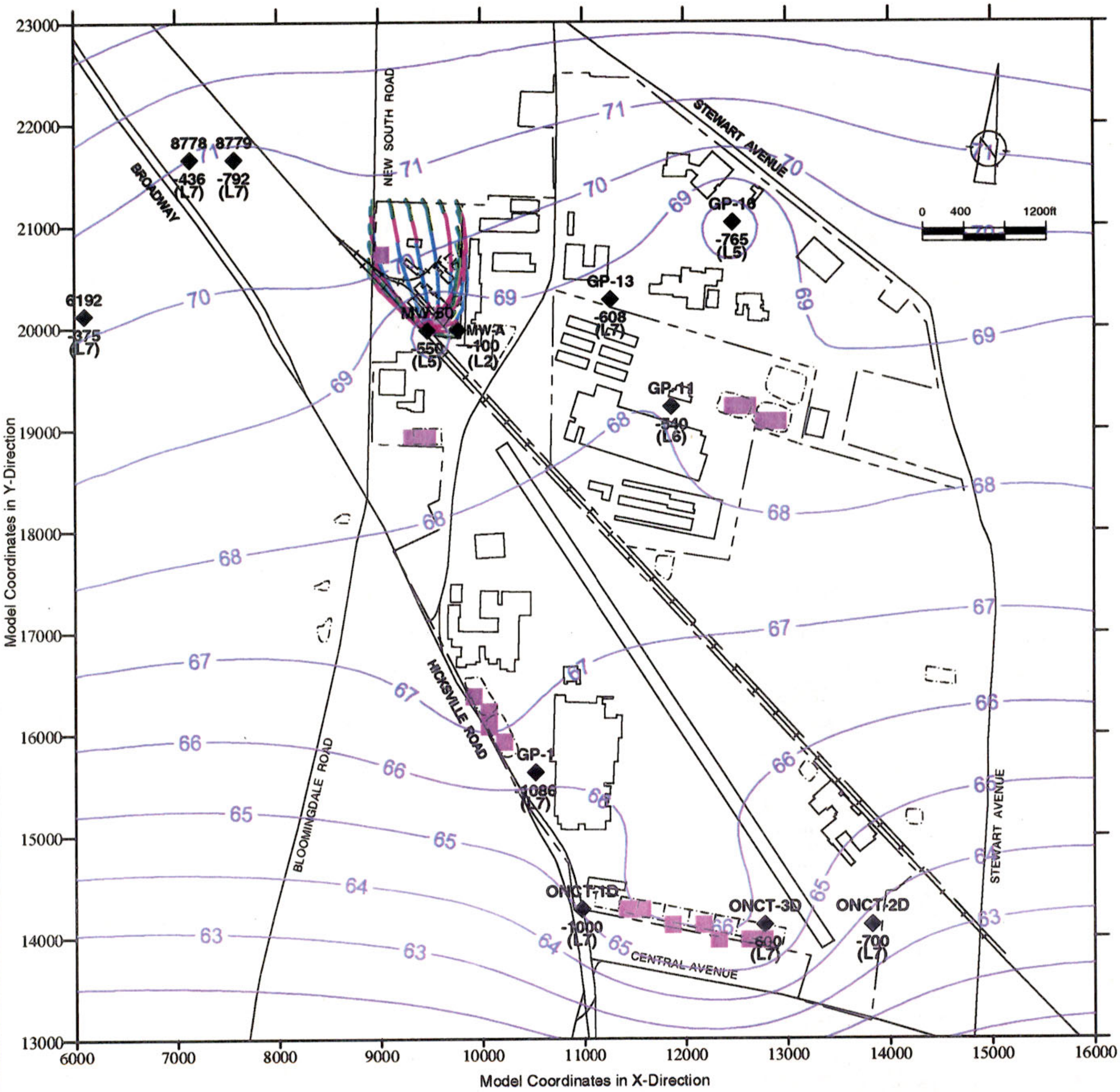
— Particle pathway in Layer 1.
— Particle pathway in Layer 2.
— Particle pathway in Layer 3.
— Particle pathway in Layer 4.
— Particle pathway in Layer 5.
— Particle pathway in Layer 6.
— Particle pathway in Layer 7.
— Particle pathway in Layer 8.

figure 8

Grumman Modified IRM with OxyChem ROD Measure
Simulated Hydraulic in Layer 3 and 50-Year Pathways for Particles Released at Site Boundary in Middle of Layer 3 (143 ft bgs)
HOOKER/RUCO SITE
Hicksville, New York

CRA

6833 (4) Oct. 17/95 HYD-W. REV.0 (n:/hg/6883/irm/mirmr13h.srf)



Legend

▪ Discharge basin/sump location.

GP-1 ◆ -1086 (L7) Extraction well location and pumping rate in gpm from model layer ( ).

—68— Simulated hydraulic head in layer 4 (ft. amsl).

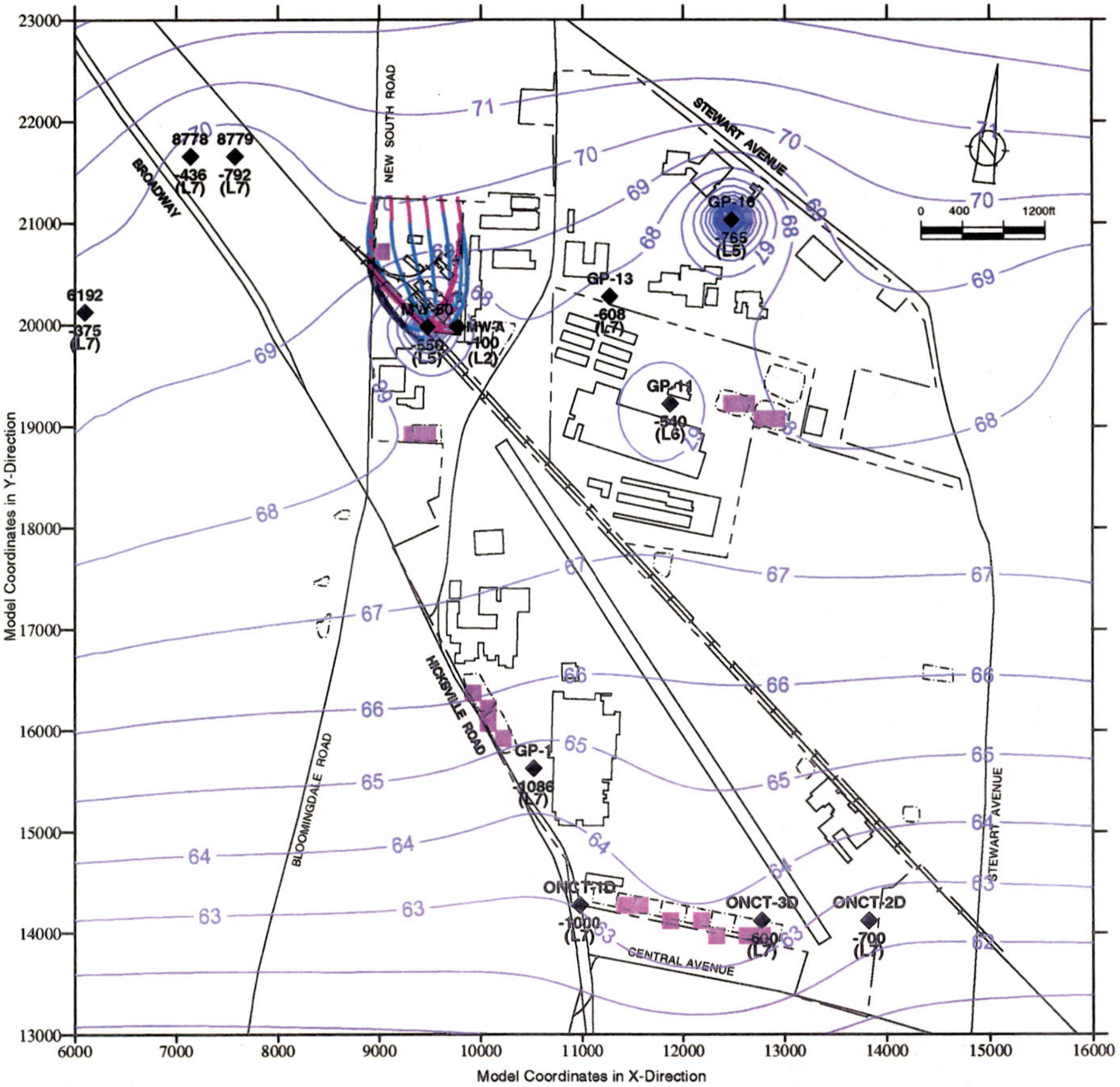
50-year pathways for particles released in Layer 4:

— Particle pathway in Layer 1.
— Particle pathway in Layer 2.
— Particle pathway in Layer 3.
— Particle pathway in Layer 4.
— Particle pathway in Layer 5.
— Particle pathway in Layer 6.
— Particle pathway in Layer 7.
— Particle pathway in Layer 8.

figure 9

Grumman Modified IRM with OxyChem ROD Measure
Simulated Hydraulic in Layer 4 and 50-Year Pathways for Particles
Released at Site Boundary in Middle of Layer 4 (225 ft bgs)
HOOKER/RUCO SITE
Hicksville, New York

CRA



Legend

■ Discharge basin/sump location.

GP-1 ◆ -1086 (L7) Extraction well location and pumping rate in gpm from model layer ( ).

—68— Simulated hydraulic head in layer 5 (ft. amsl).

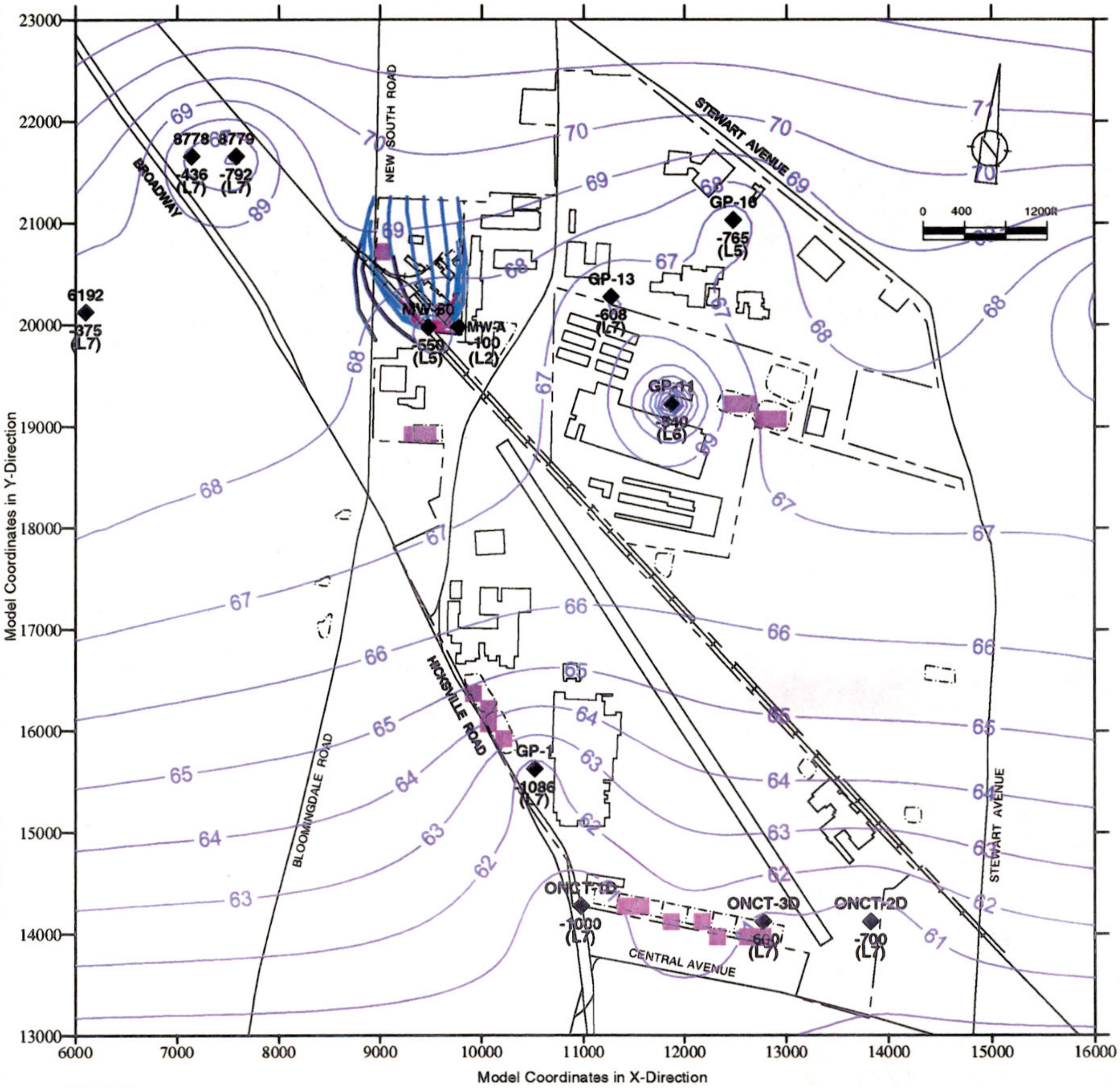
50-year pathways for particles released in Layer 5:

— Particle pathway in Layer 1.
— Particle pathway in Layer 2.
— Particle pathway in Layer 3.
— Particle pathway in Layer 4.
— Particle pathway in Layer 5.
— Particle pathway in Layer 6.
— Particle pathway in Layer 7.
— Particle pathway in Layer 8.

figure 10

Grumman Modified IRM with OxyChem ROD Measure
Simulated Hydraulic in Layer 5 and 50-Year Pathways for Particles
Released at Site Boundary in Middle of Layer 5 (318 ft bgs)
HOOKER/RUCO SITE
Hicksville, New York

CRA



Legend

▪ Discharge basin/sump location.

◆ GP-1 -1086 (L7) Extraction well location and pumping rate in gpm from model layer ( ).

—68— Simulated hydraulic head in layer 6 (ft. amsl).

50-year pathways for particles released in Layer 6:

— Particle pathway in Layer 1.
— Particle pathway in Layer 2.
— Particle pathway in Layer 3.
— Particle pathway in Layer 4.
— Particle pathway in Layer 5.
— Particle pathway in Layer 6.
— Particle pathway in Layer 7.
— Particle pathway in Layer 8.

figure 11

Grumman Modified IRM with OxyChem ROD Measure
Simulated Hydraulic in Layer 6 and 50-Year Pathways for Particles
Released at Site Boundary in Top of Layer 6 (370 ft bgs)
HOOKER/RUCO SITE
Hicksville, New York

CRA

6833 (4) Oct. 17/95 HYD-W. REV.0 (n:/hg/6883/irm/mirmr16h.srf)

APPENDIX D

GROUNDWATER TREATABILITY STUDY WORK PLAN

TABLE OF CONTENTS

LIST OF TABLES

1.0 INTRODUCTION

The Hooker/Ruco Site (Site) is located in Hicksville, New York. The Site history is described in the Remedial Design Work Plan (RDWP). The groundwater at the Site contains volatile organic compounds (VOCs), principally trichloroethylene (TCE), perchloroethylene (PCE), cis-1,2-dichloroethylene (1,2-DCE), and vinyl chloride (VC). Some semi-volatile organic compounds (SVOCs) are also present in the groundwater. They have been identified as Ruco Site Chemicals (RSCs) and include: ethylene glycol, diethylene glycol, triethylene glycol, dipropylene glycol, 2,2-dimethyl-1,3-propane diol, 2,6-dimethyl-4-heptanol, 2,2,4-trimethyl-1,3-pentanediol, 2-ethylhexanoic acid, octanoic acid, and hexanoic acid.

A groundwater treatability study will be conducted as part of the RDWP activities. The purpose of the study is to determine the treatability of the water with respect to removal of VOCs and RSCs. Water samples for the study will be taken from wells J1, J2, MW-50D1, and MW-50D2 at the Site.

2.0 DESCRIPTION OF POTENTIAL REMEDIAL TECHNOLOGIES

Several remedial technologies are being considered and will be evaluated in the treatability study. These technologies are described in the following sections.

2.1 AIR STRIPPING

Air stripping is a proven method for the removal of VOCs from water or aqueous waste streams. Air stripping has found its widest application in the remediation of aquifers containing dissolved solvents. A properly designed and operated air stripping system can achieve greater than 99 percent removal of VOCs from water. Residuals from an air stripping process include the treated water; often suitable for re-use, discharge to surface water bodies, or reinjection; and the stripping tower off gas.

In air stripping, the moving gas is air, usually at ambient temperature and pressure, and the governing equilibrium relationship is Henry's Law. VOCs having Henry's law constants above 10 atm are readily air-strippable at ambient temperatures. These include certain chlorinated solvents, aromatic solvents, and various trihalomethanes. Suspended and dissolved solids in the waste stream can create precipitation and clogging problems and may require pretreatment of the water prior to feeding into the air stripping process.

There are many different types of air stripping processes. They include aerated tanks, packed towers, and tray separation units. The most common are packed towers with countercurrent flow of air and water. Water is pumped to the top of the tower and distributed uniformly across the packing. It flows downward in a film layer along the packing surfaces. Air is blown into the base of the tower and flows upward, contacting the water. Packed-tower operation provides a high level of turbulence and a very large surface area for mass transfer. VOCs are transferred from the water to the air and carried out the top of the column.

The key design variables in air stripping are the liquid loading rate, the air-to-water ratio, the packing height or number of trays, and the characteristics of the tower packing or trays. Several numerical simulation models with the appropriate data base of chemical properties are now available for determining proper air stripping tower or tray design. A treatability study specific to air stripping performance is typically not necessary, unless chemical properties are not available for the target compounds. However, treatability studies for evaluating solids formation/removal during air stripping are usually recommended.

2.2 ULTRAVIOLET LIGHT/CHEMICAL OXIDATION

Ultraviolet (UV) light/chemical oxidation is a process whereby organics are destroyed upon the application of a high energy UV light in combination with a strong oxidant such as hydrogen peroxide (H_2O_2) or ozone. The UV radiation catalyzes the chemical oxidation of the organics in the water, where they undergo a change in their chemical structure or simply become more reactive. Additionally, UV light at a wavelength less than 400 Newton-meters (Nm) reacts with H_2O_2 molecules to form hydroxyl radicals (OH^-), which in turn react aggressively with any oxidizable organics in solution. The ultimate end products of this reaction are dependent on the particular organics in the water being treated. In the case of simple organics (comprised only of carbon and hydrogen) such as benzene, the end products would be carbon dioxide and water. In the presence of chlorine molecules, as is the case of TCE and PCE, the reacted chlorine would be oxidized to chloride ions (Cl^-). No sludges are produced from such organic reactions. However, if inorganic constituents are present in the influent, such as ferrous and manganous ions, these may be oxidized to form sludge that will require separation and removal.

Like most other chemical oxidation reactions, the UV/oxidation process is dependent upon a number of reaction conditions which can affect both performance and cost. Some of these include the amount of UV and H_2O_2 applied, water retention time in the UV reactor, the temperature and the pH under which the system is operated, mixing efficiency, and the usage of other catalysts. Operational costs associated with the enhanced oxidation process are primarily related to the rate of primary oxidant used, UV lamp replacement and the electrical power required to operate a specific system design.

A bench-scale treatability study is typically necessary to determine the feasibility of using UV/oxidation and the appropriate design parameters. Additionally, a pre-treatment study is required for evaluating solids removal options to minimize UV reactor fouling.

2.3 GRANULAR ACTIVATED CARBON (GAC) ADSORPTION

The process of adsorption onto activated carbon involves contacting the water with GAC, usually through a series of contactors or adsorbers operated in series. GAC adsorbs organic constituents in the water by surface/pore diffusion where organic molecules are entrapped in the pores of the carbon granules. Adsorption potential and efficiency depends on such factors as polarity of the adsorbate, molecular weight, type and characteristics of the adsorbent, and pH of the solution.

The activated carbon is considered saturated with the organic when the effluent organic concentration equals the influent concentrations. This is sometimes called theoretical "breakthrough" or carbon exhaustion. The carbon's breakthrough capacity is specific to the properties of the organic being treated and can be predicted through the use of adsorption isotherms. Once the carbon is saturated with organics, it must be replaced with either virgin carbon or regenerated carbon.

GAC adsorption isotherms can be determined in a laboratory treatability study using batch adsorption vials.

2.4 INTRINSIC BIOATTENUATION

Intrinsic bioattenuation (or passive in situ bioremediation) is a plume management strategy by which the natural assimilation processes are monitored and used to limit and reduce the adverse impacts of certain chemical compounds in groundwater. These intrinsic processes include biological, physical, and chemical.

The RSCs are potential compounds for applying intrinsic bioattenuation. Table D2.1 is a summary of available data on the aerobic and anaerobic biodegradation potential for the RSCs.

Evidence for intrinsic bioattenuation can be gathered by comparing certain chemical and microbial parameters at the plume versus an upgradient "clean" background location. These parameters are summarized below:

Evidence for Anaerobic Conditions in the Plume Area

- lower oxygen levels;
- lower nitrate levels;
- lower sulfate levels;
- higher ferrous iron levels;
- higher methane levels;
- lower nutrients and total organic carbon content;
- redox potential at -100 mVolt or less; and
- higher anaerobic microbial population.

Evidence for Aerobic Conditions in the Plume Area

- no significant difference in nitrate levels;
- no significant difference in sulfate levels;
- higher ferric iron content;
- no significant increase in dissolved methane concentration;
- lower nutrients and total organic carbon content;
- redox potential between 0 and +100 mVolt; and
- higher aerobic microbial population.

3.0 TEST OBJECTIVES

The purpose of the groundwater treatability study is to i) provide data to establish whether air stripping, UV/oxidation, GAC adsorption, and/or intrinsic bioattenuation are feasible technologies for the removal of VOCs and RSCs from the Site groundwater, and ii) examine the fouling potential of influent water on the air stripping and/or UV/oxidation systems.

The groundwater treatability study will be conducted using water from monitoring wells J1, J2, MW-50D1, and MW-50D2. Approximately 70 gallons (total) of the groundwater will be taken, characterized, and shipped to the appropriate laboratories for treatability testing as described in the following sections. One background sample will be taken for characterization from GM-4S for baseline comparison.

The groundwater treatability study is divided into the following tasks:

TASK 1: Groundwater Characterization
Samples from J1, J2, MW-50D1, and MW-50D2 plus one background well sample (GM-4S) will be taken and characterized. The results will be used to assist in the performance of the treatability studies (Tasks 2 to 6).

TASK 2: Laboratory Jar Test for Pretreatment Evaluation
Jar tests will be carried out to address the potential for solids formation during aeration and/or UV/oxidation treatment. Pretreatment options such as pH adjustment, chemical coagulation, and filtration will be evaluated.

TASK 3: Air Stripping Numerical Modeling
The Packed Stripping Tower Design Model™ and the Shallow Tray™ Proprietary Stripping Model will be used to determine the appropriate size and operating parameters for air stripping the VOCs.

TASK 4: UV/Oxidation Tests

Bench-scale tests will be performed by Vulcan Peroxidation Systems, Inc. (Tucson, Arizona) to evaluate the feasibility and design parameters for UV/oxidation treatment of VOCs and RSCs.

TASK 5: GAC Adsorption Isotherm Tests

GAC adsorption isotherms will be generated for the RSCs only. Isotherms for the VOCs are readily available from the literature, GAC vendors, and other projects.

TASK 6: Intrinsic Bioattenuation

Chemical and microbial characteristics from MW-50 will be compared against background well GM-4S to assess evidence of intrinsic bioattenuation of the RSCs.

The principal objective of the overall groundwater treatability study is to obtain quantitative performance, design, operations, and cost data to be used in the implementation of the appropriate remedial technologies. Another objective of the overall study is to evaluate the need for pretreatment of the groundwater, for removal of metals and solids, prior to air stripping, UV/oxidation, or GAC.

The objectives of individual lab and bench-scale tests are described in Section 4.1.

4.0 EXPERIMENTAL DESIGN AND PROCEDURE

The scope of work for the groundwater treatability study will include numerical simulation and laboratory-scale testing. The laboratory-scale testing will be performed in fixed base laboratories. Task 1 (Groundwater Characterization) will be performed by IEA Laboratory (Monroe, Connecticut). Task 4 (UV/oxidation) will be carried out at the Vulcan Peroxidation System, Inc. (VPS) Laboratory in Tucson, Arizona. The remaining tasks will be done at the TreaTek-CRA Company Laboratory in Niagara Falls, New York.

4.1 TREATABILITY TESTING METHODOLOGY

4.1.1 Task 1 - Groundwater Characterization

Samples from J1, J2, MW-50D1, and MW-50D2 and one sample from GM-4S will be characterized for the following:

TCL Metals
RSCs
TDS
Alkalinity
TOC
Redox Potential
Sulfate
Ammonia
Phosphorus
Selected TCL - Organics
TSS
Chloride
Hardness
COD
Nitrate
Reduced Iron (ferric and ferrous)
Nitrogen
Turbidity

4.1.2 Task 2 - Laboratory Jar Tests for Pretreatment Evaluation

The objective of these tests will be to determine which solids pretreatment technologies are appropriate for the extracted groundwater in the event that pretreatment is found to be necessary based on solids formation under aeration/oxidation conditions.

A 10-gallon sample of the groundwater will be collected from each of MW-50D1 and MW-50D2 and combined into one 20-gallon sample. The sample will be tested in the field for pH, conductivity and turbidity.

The test methods (e.g. strength of titrant) described herein may be modified when the tests are conducted depending on the water sample characteristics (from Task 1).

Test 1: Laboratory-Scale Jar Test to Evaluate Solids Precipitation Resulting from Aeration

Laboratory-scale aeration tests will be performed to assess the potentials for inorganic precipitate formation during air stripping. The procedures to be implemented for conducting the laboratory-scale aeration tests are as follows:

Equipment

- three 1 liter aeration beakers
- magnetic stirrer apparatus
- pH meter
- glass thermometer
- 750 mL glass Erlenmeyer flasks
- 1 liter glass graduated cylinders
- air compressor
- filtration kit

Procedure

1. Fill three nominal 1 liter glass beakers with groundwater. Record pH and temperature.
2. Aerate one beaker for one hour, aerate the second beaker for two hours, or longer if necessary, and maintain one beaker as a control.
3. Inspect beakers for signs of precipitates.

4. Measure final pH and temperature.
5. Decant the supernatant solutions into clean glass vessels and analyze for TSS and TDS.

Test 2: Laboratory-Scale Jar Tests to Evaluate Solid Precipitation Resulting from pH Adjustment

A pH adjustment test will be performed to determine the effect, if any, of increasing the initial pH of the extracted groundwater on the potential for solids precipitation. This test is proposed since pH adjustment may ultimately be included as part of a pretreatment system. During the pH adjustment tests, the following variables shall be controlled:

- temperature of the jar contents;
- chemical strength of the alkaline solution for pH adjustment;
- method of adding the alkaline solution;
- duration and intensity of mixing the alkaline solution into the groundwater test sample; and
- method of sample decantation for evaluating solids formation.

Equipment

- Five 1 liter glass beakers
- A stock solution of sodium hydroxide (1 N)
- 10 mL glass pipette for NaOH addition
- Magnetic stirrer apparatus and teflon coated magnetic bars
- pH meter
- glass thermometer
- Five 750 mL glass Erlenmeyer flasks
- Five 1 liter glass graduated cylinders
- Magnetic Rod

Procedure

1. Fill five 1 liter clean glass beakers with a groundwater sample from the 20-gallon sample.

2. Place the five beakers on the magnetic stirrer apparatus.

3. Record pH and temperature and determine turbidity in accordance with Standard Methods. (Methods for Examination of Water and Wastewater, 1989, 17th Edition).

4. Prepare a 1 N NaOH solution in accordance with Standard Methods.

5. Turn the stirrer on at zero rotation. Adjust the magnetic stirrer to allow slow mixing during NaOH addition.

6. Measure and record the pH of the control sample (Beaker #1) using a calibrated pH meter.

7. Adjust the pH in Beaker #2 slowly adding prepared NaOH solution. Add NaOH solution drop wise using a 5 mL pipette. Continue to add the NaOH solution dropwise until the final pH reading is approximately one unit (plus or minus 0.1) higher than the pH reading of the control beaker. Record the final pH reading and the volume of the NaOH solution added to raise pH to selected value. Remove magnetic bar carefully from the beaker.

8. Repeat step 7 above in beaker #3. Add the NaOH solution until the final pH reading is one unit higher than that recorded for Beaker #2. Ensure that mixing is continued throughout the NaOH addition. Record the final pH and volume of the NaOH added. Repeat this step for Beaker #4 by raising the pH by approximately one unit higher than Beaker #3.

9. Repeat Step 8 above for beaker #5 by raising the pH by one unit higher than Beaker #4.

10. When the pH in all the beakers has been adjusted to the selected pH, turn the stirrer off and remove the magnet rod from the sample. Measure the final pH and temperature and determine the turbidity for

the four beakers according to the Standard Method for the Examination of Water and Wastewater, 17th Edition.

11. Inspect beakers visually for signs of precipitation. Record nature of precipitate (color, visual density, approximate depth of the precipitate layer).

12. Remove beakers from the magnetic stirrer apparatus slowly so as not to disturb the precipitate. Carefully decant the sample from each beaker into five 1 liter graduated cylinders. Record amount of liquid decanted to each graduated cylinder.

13. Analyze the supernatant solution for TSS and TDS.

Test 3: Laboratory-Scale Jar Test for Treatment by Chemical Coagulation for Solid Precipitation

The precipitation of suspended solids in groundwater can be achieved by the use of chemical coagulants.

The following test will be performed to determine the effectiveness of several concentrations of alum (aluminum potassium sulphate) on suspended solid precipitation from Hooker/Ruco groundwater.

Equipment and Reagents

- Six 2 liter glass beakers
- Six 2 liter glass measuring cylinders
- 100 mL measuring cylinder
- pH meter
- Thermometer
- Magnetic stirrer apparatus and teflon-coated magnetic bars
- Magnetic rod
- Two 100 mL glasses
- 1N sodium hydroxide solution

- A stock of alum solution prepared by dissolving 100 g alum, (Al)K(SO4). $12H_2O$ in a liter of distilled water.

Method

1. Fill one glass burette with 1 N sulfuric acid solution.

2. Fill one glass burette with 1 N sodium hydroxide solution.

3. Pour 1000 cc of groundwater in each of the six glass beakers.

4. Place the six beakers on the stirring apparatus.

5. Record the pH and temperature of the groundwater, also record visual observation of the color and turbidity of the samples.

6. Introduce a magnetic bar to each beaker and turn the stirrers on a slow rate.

7. Adjust pH in all beakers to between 5.5 and 6.5. Using 1N solution of sulfuric acid or sodium hydroxide slowly add the solution dropwise using a 10 ml pipette. Adjust the final pH in the six beakers to within ±0.1 pH units.

8. Increase the stirring rate to approximately 100 rpm and recheck the pH to see whether further adjustment is requirement.

9. Turn the stirrer off and allow five minutes before the addition of the alum solution.

10. Add 10 ml of alum solution to Beaker #2, 20 ml to Beaker #3, 30 ml to Beaker #4, 40 ml to Beaker #5 and 50 ml to Beaker #6.

11. Turn stirrer on at 100 rpm for one minute.

12. Reduce the speed of the stirrer to 30 rpm for a period of 20 minutes. Record your observation on the color, consistency, visual observation on the density and size of floc particles.

13. Turn the stirrer off, remove the magnetic bars from the beakers. Transfer the liquid in each beaker into a clean glass measuring cylinder.

14. Leave the solutions in the measuring cylinder undisturbed for 30 minutes to settle, then record observations on the settleability of the floc, e.g., floc depth, color, etc.

15. Decant the clear supernatant solutions into clean glass bottle and analyze it for TSS and TDS.

Test 4: Bench-Scale Manganese Green Sand Filtration to Evaluate Clarification and Solids

The need to conduct a bench-scale green sand filtration test will be based on the results of the lab testing and whether or not elevated levels of insoluble solids are generated by aeration and/or pH adjustment based on visual observations of the amount of settled material and the clarity of the water. If it is determined that bench-scale tests are required, an additional combined 20 gallon sample will be collected from MW-50. The water will be pretreated by either aeration or pH adjustment. After settling, the water will be passed through a conditioned bed of green sand media at a hydraulic loading rate of approximately 1 to 2 gallons per minute per square foot of the filter bed (gpm/ft^2). The bench-scale green sand filter will consist of a 60-inch long by 3-inch diameter column, packed with 6 inches of pea gravel, 30 inches of manganese green sand and 12 inches of anthracite. Influent and effluent samples will be collected directly into sample containers from sampling ports and analyzed for total dissolved solids and total suspended solids. The final duration of the green sand filtration test will be established based on the results of the initial lab testing and based on observations made during the running of the filtration test.

Test 5: Bench-Scale Multi-Media Filtration to Evaluate Clarification and Solids/Metal Removal

The need to conduct a bench-scale multi-media filtration test will be based on the results of lab testing and the presence of suspended solid materials. If it is determined that bench-scale tests are required, additional samples will be collected and pretreated as described above for Test 4. The pretreated and settled water will be passed through a conditioned filter bed at a hydraulic loading rate of 5 gpm/ft^2. The filter will consist of a 60-inch long by 3-inch diameter column, packed with 4 inches of pea gravel, 4 inches of garnet sand, 4 inches of filter sand and 12 inches of anthracite. Influent and effluent samples will be collected and analyzed for total dissolved solids and total suspended solids.

4.1.3 Task 3 - Air Stripping Numerical Modeling

Numerical simulation of air stripping will be carried out using the Packed Stripping Tower Design Model™ and the Shallow Tray™ Proprietary Stripping Model. Influent concentrations of VOCs will be based on previous groundwater sampling results and results from Task 1.

4.1.3 Task 4 - UV/Oxidation Treatability Study

The following UV/oxidation testing protocol has been developed in consultation with Vulcan Peroxidation Systems, Inc. (VPS). Approximately 40 gallons of groundwater will be taken from J1, J2, MW-50D1, and MW-50D2 (10 gallons each) and combined into two 20-gallons samples (J1 and J2 being one sample, and MW-50D1 and MW-50D2 being the other) for the tests. The testing protocol described below may be adjusted based on characterization results from Task 1.

Tests 1-12: UV/Oxidation Testing Procedure

The UV/oxidation study will consist of a series of tests, which are designed to evaluate a variety of treatment parameters. These parameters include UV intensity and dose, H_2O_2 dose, pH, catalyst type and dosage, pretreatment and oxidation time required to destroy the target compounds (VOCs and RSCs) to less than the specified limit.

The procedures to be implemented for conducting these tests are as follows:

Equipment and Reagents

The groundwater will be tested in a VPS perox-pure™ bench-scale system. The closed batch-operated system will consist of an oxidation chamber housing a high intensity UV lamp, a recirculation reservoir and pump, a heat exchanger for solution temperature control, and an oxidant feed system. The bench-scale equipment used by VPS is identical in UV dosage, UV emission characteristics, and power factor to the full-scale perox-pure equipment. This means that there is no scale-up factor applied in translating the bench-scale oxidation time.

All materials in contact with the solution are either 316 stainless steel, glass, quartz, or teflon. Before each testing study the system shall be acid washed and rinsed several times with tap water followed by a final rinse with distilled water.

The H_2O_2 used in the test is Technical Grade. The use of this grade H_2O_2 assures consistency and repeatability of test results.

Other reagents which may be used during testing include sulfuric acid and sodium hydroxide for pH control. In addition, VPS proprietary catalysts may be used to increase the production of hydroxyl radicals in the advanced oxidation process.

Method

The following test plan is tentatively proposed based upon previous information on the groundwater quality. Additional information will be gathered from characterization and analysis of the water sample provided for testing (Task 1). The test plan and chemical dosages will be finalized at that time. The number of tests which will be performed will depend upon the number of variables investigated. For example, pH adjustment may be evaluated if the alkalinity level in the groundwater is low.

Test	*UV Light Intensity*	*H2O2 Dosage*	*Initial pH*	*Oxidation Time (minutes)*
1	A	A	A	A
2	A	A	A	B
3	A	B	A	A
4	A	B	A	B
5	A	C	A	A
6	A	C	A	B
7	B	A	A	A
8	B	A	A	B
9	B	B	A	A
10	B	B	A	B
11	B	C	A	A
12	B	C	A	B

Note:
A, B, and C are different conditions.

4.1.5 Task 5 - GAC Adsorption Isotherm Tests

GAC adsorption isotherms will be determined for the RSCs. Approximately 10 gallons of groundwater will be taken from J1 and J2 (5 gallons each) which should have higher RSC concentrations than

MW-50D1 and MW-50D2. If the characterization samples show similar concentrations, 2.5 gallons will be collected from each of the four wells. Isotherm testing will be performed for RSCs only. The sample will be prepared by pretreating the water with 60 minutes of aeration to remove any VOCs. The procedure for the GAC isotherm test is as follows:

Equipment and Reagents

- activated carbon - virgin granular activated carbon (8 x 30 mesh)
- distilled water
- 40 ml glass bottles with teflon caps
- lab shaker

Procedure

1. Add measured amounts of activated carbon to each of the glass bottles depending on groundwater chemistry (e.g. 0.0, 5.0, 15.0, 30.0, 60.0, and 100.0 mg). Also add a glass bead to each vial and then fill the bottles to the brim with groundwater.

2. Rotate the bottle overnight on the shaker.

3. Separate the carbon by centrifugation, and analyze the supernatant for RSCs.

4. Calculate Fruendlich isotherm for the total and specific RSCs as shown below.

$$q = x/m = k_d c_e^{1/n}$$

where: x = weight of analyte adsorbed (mg)
= $(c_i - c_e)(V/1000)$
V = volume of groundwater used (ml)
c_i = initial concentration of analyte (mg/L)
c_e = equilibrium concentration of analyte (mg/L)
m = weight of carbon (g)

k_d, n = empirical constant

The Fruendlich equation parameters and 1/n are determined by applying regression to logarithmic form of the equation, where log q is taken as the dependent variable and log c_e as the independent variable. The slope of the plot gives the value of 1/n and its intercept with the log q axis yields the value of log k_d.

5. Estimate carbon consumption rate in pounds per 1000 gallons of groundwater based on the result of the isotherm.

4.1.6 Task 6 - Intrinsic Bioattenuation Assessment

The potential for intrinsic bioattenuation of the RSCs will be assessed by comparing various chemical and microbial parameters in the plume area (J1, J2, MW-50D1, and MW-50D2) versus background (GM-4S). These parameters include dissolved oxygen, nitrate, sulfate, ferrous and ferric iron, redox potential, and microbial content.

5.0 SAMPLING AND ANALYSIS

Table D5.1 contains a summary of the sampling and analysis required for the treatability study. The Quality Assurance (QA) objectives for measurement data in terms of precision, accuracy, completeness, representativeness and comparability will be consistent with the RDWP-QAPP (Appendix E). Sample collection, packaging, and shipping will be performed in conformance with the RDWP-SAMP (Appendix A) and RDWP-QAPP (Appendix E).

The QA/QC procedures to be followed for the development of all measurement data will be consistent with the procedures outlined in the RDWP-QAPP. The elements that will be included as part of the QA/QC procedures are as follows:

1) **Sample Custody and Document Control** including field and laboratory chain-of-custody procedures, storage of samples and file custody procedures;

2) **Calibration Procedures and Frequency** including field and laboratory instruments;

3) **Internal Quality Control Checks and Frequency** including field QC and laboratory QC (calibration checks, internal standards performance, method blank samples, matrix spike/matrix spike duplicates, surrogates, laboratory duplicate analysis, blind check samples and trip blank samples);

4) **Data Reduction, Validation and Reporting;**

5) **Performance and System Audits** including field audits and laboratory audits;

6) **Preventive Maintenance;**

7) **Specific Routine Procedures Used to Assess Data Precision, Accuracy and Completeness** including field measurements, laboratory data (precision, accuracy, completeness, sensitivity), statistical evaluations;

8) **Corrective Action**; and

9) **Quality Assurance Report to Management.**

6.0 DATA MANAGEMENT

Data management refers to the procedures for recording observations and raw data in the field or laboratory, including the use of bound notebooks, data collection sheets, and photographs. Data management for the performance of the groundwater treatability testing will be consistent with the procedures outlined in Section 5.0.

7.0 DATA ANALYSIS AND INTERPRETATION

7.1 GENERAL

Raw data collected for the groundwater treatability testing will be reviewed (tabulation and validation) and analyzed (e.g. statistical evaluation) and presented (tabular or graphical) in conformance with guidelines outlined in Section 5.0.

7.2 DATA ANALYSIS AND INTERPRETATION

Data from lab and bench scale testing will be presented in tabular form and an assessment made of the validity of each process operation for the treatment of the Site groundwater.

Inorganics, VOCs and RSCs data from the pretreatment, UV/oxidation, and carbon isotherm tests will be assessed for precision, accuracy, and completeness. Treatment performance data will be presented as a function of the various design variables.

8.0 HEALTH AND SAFETY

Laboratory work related to the groundwater treatability testing will be performed in accordance with the specific laboratory Chemical Hygiene Plan which is required by OSHA (Standard 29 CFR 1910.1450). Any Site-related activities (e.g. sampling) will adhere to the procedures outlined in the RDWP-HASP (Appendix B).

9.0 RESIDUALS MANAGEMENT

Residuals resulting from the performance of the groundwater treatability testing may include groundwater, spent carbon, and precipitated solids from the jar tests. These materials will be disposed of in accordance with Federal and State requirements.

10.0 REPORTING

Results of the groundwater treatability testing will be reported in the Remedial Design Investigation Report as outlined in the RDWP.

11.0 MANAGEMENT AND STAFFING

The overall management of the project is being provided by OxyChem. The management and staffing of the treatability study will be conducted by TreaTek-CRA. The approval and oversight of the project will be conducted by USEPA.

TABLE D2.1

BIODEGRADATION POTENTIAL OF RUCO SITE CHEMICALS
OCCIDENTAL CHEMICAL CORPORATION
HOOKER/RUCO SITE
HICKSVILLE, NEW YORK

Chemical	*Biodegradation* *Aerobic (half life)*	*Biodegradation* *Anaerobic (half life)*
2,2-Dimethyl-1,3-propane diol	Yes (N/A)	Yes (2-3 months)
2,6-Dimethyl-4-heptanol	NA	NA
Dipropylene glycol	Yes (7-28 days)	Yes (1-2 months)
Diethylene glycol	Yes (7-28 days)	Yes (1-2 months)
2,2,4-Trimethyl-1,3-pentane diol	NA	NA
Triethylene glycol	Yes (7-28 days)	Yes (1-2 months)
Octanoic acid	NA	A
Ethylene glycol	Yes (2-12 days)	Yes (7-48 days)

Notes:

NA Data not available

Source:

1. Evans and David, Biodegradation of Mono-, Di, and Triethylene Glycols in River Water Under Controlled Laboratory Condition, 1973.
2. Hinchee et. al., Microbial Processes for Bioremediation, 1995.
3. Howard et. al., Handbook of Environmental Degradation Rates, 1991.

TABLE D5.1

SAMPLING AND ANALYSIS SUMMARY
GROUNDWATER TREATABILITY STUDY
OCCIDENTAL CHEMICAL CORPORATION
HOOKER/RUCO SITE
HICKSVILLE, NEW YORK

Tasks	*Number of Samples*	*Parameter*	*Method*
1	5	Selected TCL Metals	CLP ILM03.0 (2/93)
	5	RSCs	KGD Method (1)
	5	TSS	SM 212
	5	TDS	SM 209C
	5	Chloride	EPA 325
	5	Alkalinity	EPA 310.1
	5	Hardness	SM 314B
	5	TOC	SM 505
	5	COD	SM 508
	5	pH	EPA 150.1
	5	Redox potential (eH)	-
	5	Dissolved oxygen	EPA 360.2
	5	Nitrate (as N)	EPA 353.2
	5	Sulfate	EPA 375.4
	5	Reduced iron (ferric, ferrous)	
	5	Ammonia (as N)	EPA 350.2
	5	Total Phosphorus (as P)	EPA 365.2
	5	Turbidity	EPA 180.1
	5	Selected TCL Organics	CLP OLM01.9 (7/93)
	5	di-n-butylphthalate	CLP OLM01.9 (7/93)
2	14	TSS	SM212
	14	TDS	SM209C
4	24 (2)	RSCs	KGD Method
	24 (2)	Selected TCL Organics	CLP OLM 01.9 (7/93)
5	6	RSCs	KGD Method

Notes:

(1)	Method developed by Occidental Chemical Corporation for Groundwater and Soil analysis of Site-specific compounds. Method referenced from OxyChem letter to USEPA dated May 13, 1992.
COD	Chemical Oxygen Demand.
RSCs	Ruco Site Chemicals.
TCL	Target Compound List.
TDS	Total Dissolved Solid.
TOC	Total Organic Carbon.
TSS	Total Suspended Solid.
(2)	May be reduced to 12 if RSC concentrations in shallow and deep wells are similar.

APPENDIX E

QUALITY ASSURANCE PROJECT PLAN

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(Following Appendix)

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(Following Appendix)

LIST OF ATTACHMENTS
(Following Appendix)

1.0 QUALITY ASSURANCE PROJECT PLAN (QAPP)

1.1 INTRODUCTION

The Quality Assurance Project Plan (QAPP) defines all Quality Assurance/Quality Control (QA/QC) procedures which will be used during the analysis of samples from Operable Unit 1 of the Hooker/Ruco Site (Site) during the Remedial Design/Remedial Action (RD/RA). The QAPP has been prepared following specifications and definitions described in "Test Methods for Evaluating Solid Wastes" (SW-846), November 1986, revised September 1994; and Region II CERCLA Quality Assurance Manual (October 1989), Guidance for Preparation of Combined Work/Quality Assurance Project Plans for Environmental Monitoring, Office of Water Regulations and Standards, United States Environmental Protection Agency (EPA), May 1988.

Analytical testing of solid and liquid media, as detailed in this Plan, will be completed in accordance with the following specifications:

i) "Test Methods for Evaluating Solid Wastes" (SW-846), November 1986, revised September 1994;

ii) "Standard Methods for Evaluating Water and Wastewater" (SM), 18th Edition, 1992 (including 1994 Addendum);

iii) USEPA Contract Laboratory Protocols (CLP), Statement of Work, March 1990 for "Organic Analysis, Multi-Media, Multi-Concentration" OLM 01.9 (7/93) and for "Inorganic Analysis, Multi-Media, Multi-Concentration" ILM 03.0 (2/93);

iv) Ketone, Glycols and Diol (KGD) method; and

v) "Methods for Chemical Analysis of Water and Wastes", March 1983, 600-4-79-020 (600 Series).

1.2 PROJECT DESCRIPTION

A comprehensive description of the Remedial Design project is contained in Sections 2.0 and 5.0 of the Remedial Design Work Plan (RDWP).

1.3 PROJECT ORGANIZATION AND RESPONSIBILITY

1.3.1 Project Organization, Remedial Design Implementation

Project Coordinator	Dr. Alan Weston (OxyChem)
Project Manager	Jim Havas (OxyChem)
Project Engineer	Jim Kay (CRA)
Remedial Leader	Tony Ying (TreaTek-CRA)
Health and Safety Officer	Craig Gebhardt (CRA)
QA/QC Officer	Patrick Garrity (OxyChem)
External Laboratory Coordinator (ELC)	Michael Bonomo (IEA)
Sampling Coordinator	Patrick Garrity (OxyChem)

1.4 DEFINITION OF RESPONSIBILITIES

a. The QA/QC Officer (QAO) is responsible for the following:
   - selecting and reviewing all sampling and analytical protocols required for measuring and monitoring;
   - selecting analytical laboratories;
   - directing the activities of the external analytical laboratory used for the project;
   - reviewing all QA/QC results;
   - has overall responsibility for management of the analytical program and the validity of all data;
   - reviewing and advising on all aspects of QA/QC;
   - making QC evaluations to assist in reviewing QA/QC procedures, and, if problems are detected, making recommendations to the ELC to rectify the problem;

- evaluating and recommending corrections to sample custody procedures;
- informing the Project Manager that appropriate QA/QC procedures have been established and are being implemented by the proper personnel; and
- evaluating and recommending corrections in sampling and/or analytical techniques.

b. The ELC is responsible for the following:

- the laboratory's activities;
- training and qualifying personnel in specified laboratory QC and analytical procedures, prior to receiving samples;
- informing the QAO if any review of data quality appears to warrant repeat analysis of some or all samples;
- receiving samples from the field and verifying that incoming samples correspond to the packing list or Chain of Custody sheet;
- maintaining records of all incoming samples, tracking those samples through subsequent processing, analysis and ultimately, appropriate disposal of those samples at the conclusion of the project;
- preparing QC samples for analysis prior to and during the program;
- preparing QC and sample data for review by the QAO;
- review of raw data with laboratory chemists against calibration and QC records;
- approval of finished data; and
- preparing QC and sample data for transmission to the QAO.

c. Sampling Coordinator

The sampling coordinator is responsible for the following:

- coordinating field activities and delivery of samples to the analytical laboratory;
- determining appropriate sampling equipment and sample containers to minimize contamination;
- training and qualifying field personnel in sampling procedures and field analytical procedures prior to sampling;
- ensuring that samples are collected, labeled, preserved, stored,

transported, and, when necessary, filtered as specified in the procedures or protocols;

- checking that all sample documentation is correct and transmitted with the samples to the analytical laboratory and the QAO;
- verifying that field analytical QC procedures are being followed as specified in the QA/QC protocol and prepares QC for review by the QAO; and
- participating in field analytical/sampling quality audits with the QAO.

1.5 QUALITY ASSURANCE OBJECTIVES

The overall QA objective is to develop and implement procedures for field sampling, Chain of Custody, laboratory analyses and reporting that will provide accurate data. Specific procedures to be used for Chain of Custody, calibration, laboratory analysis, reporting, QC, audits, preventive maintenance and corrective actions are presented in other sections of this QAPP. Procedures relative to sampling are presented in Sections 2.0 and 5.0 of the Work Plan and Section 1.6 of the QAPP.

Data quality objectives (DQOs) have been established in accordance with the USEPA guidance document entitled "Data Quality Objectives for the RI/FS Process", dated March 1987. DQOs have been established to ensure that the database developed during the field tasks for groundwater hydraulics and field investigations for site soils meets the objectives and quality necessary for its intended use. Table E-1 presents the analytical programs and DQOs for each analysis. Targeted detection limits will be consistent with the analytical methods used.

The purpose of this section is to define the goals for the level of QA effort. Objectives for accuracy, precision, sensitivity, completeness, representativeness and comparability of measurement data from the analytical laboratory will be identified. In addition, QA objectives for field measurements will be defined.

1.6 SAMPLING PROCEDURES

A comprehensive description of the field sampling procedures for the design tasks of the Remedial Action is contained in Section 2.3 Analytical Requirements, and Section 5.3.4 Soil Sampling of the RDWP. Groundwater samples will be collected to achieve two objectives; characterize anticipated influent groundwater and provide sufficient volume of raw material for treatability studies. Soil samples will be collected to achieve two objectives; delineate the extent of soil requiring cleanup and to characterize soils requiring excavation. Analytical results from the groundwater sampling will be used to design the groundwater treatment system and to determine the efficiency of the selected system under bench-scale treatability studies. Analytical results from soil samples collected in the former drum storage area, in the vicinity of MW-E, and in the base of Sump 2 will be used to delineate the extent of Ruco Site Chemicals (RSCs) and selected organic compounds and determine if these areas will require cleanup. Analytical results of the waste characterization samples from areas requiring excavation will be used for transport and disposal purposes. During all sample activities, split samples will be supplied upon request to the EPA representative. A copy of the sample analysis program is presented in Table E-2.

1.7 SAMPLE CUSTODY PROCEDURES

It will be the responsibility of the Sampling Coordinator to maintain and document sample handling. This will be completed using a Chain of Custody form. The ELC will provide documentation that the samples have been properly disposed after completing the analyses.

1.7.1 Sample Collection and Transport Chain of Custody

The designated laboratory will provide sample Chain of Custody as prescribed by CLP. Sample custody procedures will be followed for all samples. At a minimum, the record will contain the following types of information:

- i) sample number;
- ii) signature of collector;
- iii) date and time of collection;
- iv) sample matrix (e.g., soil, air);
- v) identification of sample location;
- vi) number of containers;
- vii) parameters requested for analysis;
- viii) signature of person(s) involved in the chain of possession; and
- ix) inclusive dates of possession.

A copy of the Chain of Custody form is included as Figure E-1. To prevent misidentification of samples, legible labels will be affixed to each sample container. The labels will be sufficiently waterproof and durable to remain legible even when wet and will contain the following information:

- i) sample identification number;
- ii) name of collector;
- iii) date and time of collection;
- iv) place of collection; and
- v) parameter(s) requested (if space permits).

In cases where samples may leave the site Project Coordinator's immediate control, such as shipment to laboratory by a common carrier, a seal will be provided on the shipping container or individual sample bottles to ensure that the samples have not been disturbed during transportation.

Sample tags will be filled out for each sample and kept on file at the laboratory. The sample tags will be sequentially numbered.

1.7.2 Field Lab Book Documentation

In the field, the sampler will record the following information in the field log book (bound) for each sample collected. All entries will be dated, initialed, and legible.

i) project number;
ii) sample matrix;
iii) name of sampler;
iv) sample source;
v) time and date;
vi) pertinent data (i.e., depth, water surface elevation, pumping method);
vii) analysis to be conducted;
viii) sampling method (i.e., pump type);
ix) appearance of each sample (i.e., color, turbidity, evidence of soil staining);
x) preservative added, if any;
xi) number of sample bottles collected;
xii) field analytical equipment;
xiii) other equipment used to make field measurements;
xiv) calculations;
xv) results; and
xvi) calibration data for equipment.

1.7.3 Laboratory Chain of Custody Documentation

Each sample or group of samples shipped to the laboratory for analysis will be given a unique identification number. The laboratory Sample Custodian will record the client name, number of samples, and date of receipt of samples in the Sample Control Log Book. The temperature of one sample/cooler will be measured and recorded on the Chain of Custody. Samples removed from storage for analyses will be documented in the Sample Control Log Book.

The laboratory will be responsible for maintaining analytical log books and laboratory data as well as a sample (on hand) inventory for submittal to OxyChem on an "as required" basis. Raw laboratory data produced from the analysis of samples submitted for this program will be inventoried and maintained by the laboratory for a period of five years at which time OxyChem will advise the laboratory regarding the need for additional storage.

1.8 SAMPLE STORAGE PROCEDURES AND HOLDING TIMES

Sample size, storage, preservation techniques, and holding times, are presented in Table E-3. Samples will be transported in coolers using sufficient ice to maintain a temperature of 4°C (±2°C) during transport. Shipping containers shall also be secured by nylon strapping tape to ensure samples are not disturbed during transport. Samples shall be transported to the lab within 24 hours of collection.

All aqueous volatile organic samples and trip blanks will be preserved as follows:

i) adjust the pH of the sample to ≤2 by carefully adding 1:1 HCl drop by drop to the required two (40 ml) sample vials. The number of drops of 1:1 HCl required shall be determined on a third portion of sample water of equal volume; and

ii) if acidification causes effervescence, the sample shall be submitted without acid preservation. This sample property shall be appropriately noted when present.

1.9 SAMPLE PREPARATION METHODS

Sample preparation methods for groundwater and soil samples for RSCs are addressed in the KGD method presented in Attachment E-1. Copies of the method startup and MDL studies are included as Attachments E-2 and E-3; a copy of the QA/QC review of these studies is provided in Attachment E-4. Sample preparation methods for selected target compounds will be completed according to procedures presented in CLP. Sample preparation methods for selected physicochemical parameters in groundwater samples will be completed according to procedures presented in SM and EPA 600 Series methods. Waste characterization samples will be completed according to procedures presented in SW-846, and the September 25, 1990 procedures for toxicity characteristics in accordance with 40 CFR 261, Appendix II.

1.10 ANALYTICAL PROCEDURES

1.10.1 Groundwater Samples

The KGD method will be used in the analysis of all water samples for RSC parameters. CLP will be used in the analysis of all water samples for selected TCL/TAL parameters. SM and EPA 600 Series methods will be used in the analysis of selected physicochemical parameters. Groundwater samples will be analyzed by IEA Laboratories (Monroe, Connecticut).

1.10.2 Soil Samples

The KGD method will be used in the analysis of all soil samples for RSC parameters. CLP will be used in the analysis of all soil samples for selected TCL parameters. Soil samples will be analyzed by IEA Laboratories (Monroe, Connecticut or Billerica, MA).

1.10.3 Waste Characterization Samples

The waste characterization samples will be analyzed for ignitability, reactivity, corrosivity and toxicity by IEA Laboratories (Monroe, Connecticut). Testing parameters and regulatory levels applicable to the disposal of the waste material will be completed pursuant to 40 CFR 261.24.

1.11 CALIBRATION PROCEDURES AND FREQUENCY

All calibration procedures and their frequency shall be followed as described in the specified analytical methods. All standards used for quantitation must be traceable to an EPA EMSL standard whenever possible, and if not, to a verified standard. This is a compound whose purity has been determined by at least two different analytical procedures. Linearity of detector response for each parameter must be demonstrated by generation of a calibration curve containing five concentrations of that parameter. All method-specified calibration criteria must be met prior to sample analyses. All calibrations must be performed using either average response factors or first-order linear regression (with a correlation coefficient requirement of ≥0.995). Higher order fits are not acceptable.

All sample calculations must be made from responses which fall within this linearity range. During the course of the analysis, standards must be interspersed at frequent intervals to check the calibration as specified in the analytical methods. The preparation of all standards, including purity verification, dilutions, linearities, etc., must be recorded in a bound notebook with each page or work unit signed and dated by the analyst.

1.12 DATA REDUCTION, VALIDATION AND REPORTING

All raw data will be examined, evaluated and then reduced to final results by the Data Validator. A copy of the Data Validator's curriculum vitae is provided as Attachment E-5. The final results will be expressed in units of measurement that permit comparison with data generated from similar projects and analyses performed pursuant to the remediation at the referenced site.

All raw data shall be reviewed and validated against calibration and QC records to ensure that data are reliable, and that the data are in compliance with the QA/QC objectives. Any data determined to be invalid shall not be used in the final reporting, however, will be made available to EPA upon request. However, the fact that data have been invalidated and the reasons for the invalidation will be reported to the following people in the following order:

i) QAO;
ii) Site Coordinator; and
iii) USEPA.

The report format will include at least the following:

i) sample ID number or code;
ii) place of collection;
iii) date sampled; and
iv) date analyzed.

Analytical procedures for samples analyzed for selected organic and inorganic compounds will be performed using CLP methods. Data from samples analyzed for selected organic compounds and selected target analyte compounds will be validated using USEPA Region II protocols. CLP deliverables will be used to validate data according to current Region II protocols (S.O.P. No. HW-6 Revision 8 and S.O.P. No. HW-2 Revision XI). Data validation for confirmation analysis will be performed by an auditor.

Validation of non-CLP data will be performed in accordance with the analytical methods used and the general principles used in the above documents.

For samples analyzed by SW-846, the generic QC procedures listed in Volume 1, Section A, Part II, Chapter 1 and the specific QC procedures listed in Section 8 of each method will be followed. Verification data will be tabulated upon completion and submitted to EPA Region II.

All specified QC and deliverables will be supplied for all samples analyzed by CLP methods.

Results for all samples analyzed using non-CLP methodology will include the following raw data deliverables:

i) quantitation reports;
ii) gas chromatograms;
iii) an example of analyte and surrogate concentration calculations;
iv) cleanup procedures (where applicable);
v) surrogate recovery summaries;
vi) initial and continuing calibration data with summary forms;
vii) retention time windows; and
viii) blank sample data and summary forms.

The following Toxicity Characteristic Leaching Procedure (TCLP) deliverables will be supplied:

i) the TCLP and preparative extraction dates and analysis dates;
ii) a physical description of the samples;
iii) the sample weights and the extraction fluids and volumes used in TCLP extraction;
iv) the final volume of TCLP extract and the volume of extract analyzed;
v) the calculations used to compute percent dry solids and the weight of the liquid phase (if applicable);
vi) extraction logs for each sample, indicating the volume and pH of acid added and the pH of the extract at different intervals of time;
vii) a description of the materials of construction for extraction vessels, filtration devices, and ZHE extraction devices (i.e., glass, Teflon, PVC, stainless steel, etc.);
viii) the calculations used to compute TCLP extract concentrations for multiphase samples;
ix) when VOA samples consist of oily waste that cannot be filtered, describe how the TCLP extract is separated from the oily waste;
x) a copy of the sample log;
xi) any evidence of leakage in the ZHE device;
xii) a TCLP trip blank will be analyzed in addition to the method blanks; and
xiii) all deliverables indicated above for non-CLP analyses.

1.12.1 Turnaround Time

All samples will be sent to the laboratory promptly. The normal expected turnaround period for the various analyses are summarized below:

Waste characterization:	30 days
Waste characterization: (rush analysis)	5 days (verbal results)
TCL/TAL parameters:	40 days
TCL/TAL parameters: (rush analysis)	5 days (verbal results)
RSC parameters:	40 days
RSC parameters: (rush analysis)	5 days (verbal results)
Physicochemical parameters:	30 days
Physicochemical parameters: (rush analysis)	5 days (verbal results)

1.13 INTERNAL QC CHECKS

The QC checks described below will be used to assess the quality of both the sampling procedures and of the sample analyses used for this project.

1. Method Blank(s): Method blanks are to be prepared in the laboratory

and analyzed to assess possible laboratory contamination. The frequency of method blanks will be one per batch or a minimum of one per day.

2. Laboratory Control Samples (Method Spikes): Method spikes (blank spikes) will be prepared and analyzed. Reagent grade water is spiked with one or more selected compounds prior to extraction. The recovery of the compound(s) is used as a measure of the accuracy of the sample preparation and analysis procedures. At least ten percent of the total number of samples analyzed will also be method spike samples.

3. Calibration Check Sample(s): As specified in the analytical methods, calibration standards will be prepared and analyzed on a regular basis. The purpose of this calibration check is to ensure the validity of the calibration standard.

4. Replicate Sample(s): These samples are analyzed in order to establish control and assess the precision of analysis and/or of sampling. At least ten percent of the total number of samples to be analyzed will be replicated.

5. Matrix-Spike Sample(s): Matrix spike samples are from site(s) sampled in duplicate. This sample is spiked with one or more selected compounds prior to extraction. The recovery of the compound(s) is used as a measure of the accuracy of the sample preparation and analysis procedures. At least ten percent of the total number of samples analyzed will also be spiked samples.

6. Control Charts: Precision and accuracy will be monitored by use of control charts. Accuracy will be expressed in terms of percent recovery. A minimum of 20 data points are needed to construct the percent recovery control chart. The details of control charting are beyond the scope of this document, but at a minimum will include the following:

   i) the average (mean) recovery of 20 analyses (X);

ii) the standard deviation of the mean (SD);

iii) an upper and lower warning limit, which is the mean plus or minus two standard deviation units (X ± 2xSD); and

iv) an upper and lower control limit, which is the mean plus or minus three standard deviation units (X ± 3xSD).

Percent recoveries will then be plotted on the control chart to determine whether or not they are acceptable.

7. Surrogate Compounds: Surrogate compounds will be used to determine extraction efficiency and analytical accuracy as described in the analytical methods.

8. Reagent QC Checks: Reagent and solvent blanks are prepared in the laboratory and analyzed to determine background of reagents and solvents used in the routine analysis.

1.14 SPECIFIC ROUTINE PROCEDURES USED TO ASSESS DATA PRECISION, ACCURACY AND COMPLETENESS

1.14.1 Accuracy and Precision

Assessment of precision and accuracy of analytical data is accomplished via review of duplicate analyses (precision) and spike recovery (accuracy) in sample matrices. Precision is generally expressed as the relative percent difference (RPD). Accuracy is expressed as percent recovery. Precision will be assessed for each matrix since distribution of parameters may be non-homogeneous, especially in non-water matrices. Precision in samples will be reviewed with knowledge of the matrix and level of analyte present. Corrective action and documentation of substandard precision is a laboratory responsibility. Accuracy will reflect the impact of matrix interferences. Each method which provides QC requirements and acceptance criteria also specifies the method of generating the data to be reviewed. It is also the laboratory's responsibility to attempt to identify the source of substandard recoveries and either take corrective action or document the cause. The calculation is presented below:

Precision

$$RPD = \left| \frac{(D_2-D_1)}{(D_1+D_2)/2} \right| x\ 100$$

D_1 = matrix spike recovery
D_2 = matrix spike duplicate spike recovery
RPD = relative percent difference

For results near the associated detection limits, precision will be assessed based on the following criteria:

$$\text{Precision} = \left| \text{original result - duplicate result} \right| < \text{CRDL}$$

Accuracy

$$\%R = \frac{\text{observed value}}{\text{theoretical value}} x\ 100$$

%R = Percent Recovery

1.14.2 Completeness

Completeness is a measure of the amount of valid data obtained from a measurement system compared with the amount that was expected to be obtained under normal conditions.

To be considered complete, the data set must contain all QC check analyses verifying precision and accuracy for the analytical protocol. In addition, all data are reviewed in terms of stated goals in order to determine if the database is sufficient.

When possible, the percent completeness for each set of samples will be calculated as follows:

$$\text{Completeness} = \frac{\text{valid data obtained}}{\text{total data planned}} \times 100 \text{ percent}$$

1.14.3 Outliers

Procedures discussed previously will be followed for documenting deviations. In the event that a result deviates significantly from method established control limits, this deviation will be noted and its effect on the quality of the remaining data assessed and documented.

1.15 QA REPORTS

On a predetermined schedule, the QAO will meet with the Project Coordinator to review QC data summaries, documentation and other aspects of the analytical performance. The assessment of the QA/QC data shall be reported to the Project Manager. This report will highlight any areas that appear to require corrective action, and will also present proposed plans to rectify the apparent problems. Included in this report shall be any results of earlier corrective action that had been initiated.

QA audits are performed to assure and document that QC measures are being utilized to provide data of acceptable quality and that subsequent calculation, interpretation and other project outputs are checked and validated.

System and performance audits will be conducted by the QAO. The Project Manager and the QAO will conduct project audits of calculations, interpretations and reports which are based on the measurement system outputs. In addition, personnel from the USEPA or its authorized representatives may obtain access to performance audits.

1. Performance Audits: These audits are intended primarily for analytical and data generation system. This audit will be accomplished by the use of performance evaluation samples. These samples will be randomly

submitted by either the Project Manager or QAO during the period when surveys and studies are being carried out for the duration of the program. In addition, audit samples may be submitted by the USEPA.

2. System Audit: A systems audit will be conducted on all components of measurement systems to determine proper selection and utilization. The systems audit includes evaluation of both field and laboratory procedures. Systems audits will be made at regular intervals at each laboratory used and whenever a new analysis is initiated. The results of the systems audit will be reported in an appropriate QA report.

3. Organization and Personnel: The QA Plan organization is reviewed for compliance with the proposed organization and for clarity of assigned responsibility. Personnel assigned to the project will be evaluated to determine that assigned responsibility, skill and training of the personnel are properly matched. The Project Manager maintains firsthand knowledge of his team's capabilities and will discuss the organization's efficiency with the QAO. Assigned personnel may be interviewed by the QAO during an audit.

4. Facilities and Equipment: The audit will address whether field tools and analytical instruments are selected and used to meet requirements specified by the QA Plan objectives. Equipment and facilities provided for personnel health and safety will also be evaluated. Calibration and documentation procedures for instruments used in the field will receive special attention.

5. Analytical Methodology: A review of analytical methodology in regard to the data requirements for the QA Plan will be performed. An on-site observation of analyst technique, data reduction, and record keeping may be performed if determined necessary. A review of precision and accuracy data will be performed for each batch of samples.

6. Sampling and Sample Handling Procedure: An audit of scheduled samples versus samples collected versus samples received for analysis will be performed. Field documentation will be reviewed. If deemed

necessary, field or laboratory visits will be made to assure that designated control procedures are practiced during sampling activities.

7. Data Handling: During a systems audit, the QAO will review data handling procedures with the Project Manager. Accuracy, consistency and documentation will be discussed.

8. QA Plan Audit: QA Plan audits encompass the aspects of both the systems audit and the performance audit. The QA Plan audit typically occurs once but may occur more often if required. Timing is keyed to the systems involved and the QA Plan objectives.

9. QA Plan Audit Report: A written QA Plan Audit Report will be prepared for each QA Plan Audit and will include:

   i) an assessment of QA Plan team status in each of the major QA Plan areas;

   ii) clear statements of areas requiring improvement or problems to be corrected. Recommendation and assistance will be provided regarding proposed corrective actions or system improvements. If no action is required, the report will state that the QA Plan audit was satisfactorily completed;

   iii) a timetable for any corrective action required; and

   iv) a follow-up to assure that recommendations have been implemented.

The format for the QA Plan Audit is found below. The QA Plan Audit Report will be distributed to the Project Manager and the Project Coordinator.

QUALITY ASSURANCE PLAN AUDIT REPORT FORM
(Topics for inclusion in report)

Organization and Personnel
Facilities Utilized
Analytical Methodologies
Sampling and Sample Handling
Quality Control Measures Utilized
Data Handling
Quality Assurance Deficiencies
Recommended Corrective Actions and Schedule

1.16 PREVENTATIVE MAINTENANCE

It will be the responsibility of the ELC to follow the instrument manufacturer's suggested instrument maintenance program for all instruments and equipment which are to be utilized by the external laboratory. The ELC will prepare documentation of the proper institution all maintenance programs.

1.17 CORRECTIVE ACTION

Corrective actions will be deemed necessary and/or appropriate by the QAO or the ECL. Corrective actions may include and are not limited to the following:

i) additional training and/or reassignment of personnel;
ii) replacement of solvents and/or reagents that yield unacceptable blank values;
iii) reclamation of insurgents with fresh standards; and/or
iv) replacement of the analytical equipment.

The analytical laboratory utilized will be equipped with multiple instruments required to perform each procedure to minimize the chance of excessive down time due to equipment failure.

FIGURES

FIGURE E-1

CHAIN OF CUSTODY RECORD

CRA CONESTOGA-ROVERS & ASSOCIATES 651 Colby Drive Waterloo, Ont. N2V 1C2 (519)884-0510	SHIPPED TO (Laboratory Name):	REFERENCE NUMBER:

SAMPLER'S SIGNATURE: ______________ PRINTED NAME: ______________

SEQ. No.	DATE	TIME	SAMPLE No.	SAMPLE TYPE	No. OF CONTAINERS	PARAMETERS										REMARKS

TOTAL NUMBER OF CONTAINERS		HEALTH/CHEMICAL HAZARDS	

RELINQUISHED BY: ① ______________	DATE: TIME:	RECEIVED BY: ② ______________	DATE: TIME:
RELINQUISHED BY: ② ______________	DATE: TIME:	RECEIVED BY: ③ ______________	DATE: TIME:
RELINQUISHED BY: ③ ______________	DATE: TIME:	RECEIVED BY: ④ ______________	DATE: TIME:

METHOD OF SHIPMENT: WAY BILL No.

White —Fully Executed Copy Yellow —Receiving Laboratory Copy Pink —Shipper Copy Goldenrod —Sampler Copy	SAMPLE TEAM: ______________ ______________	RECEIVED FOR LABORATORY BY: ______________ DATE:________ TIME:________

TABLES

TABLE E-1

DATA QUALITY OBJECTIVES OF THE ANALYTICAL PROGRAM FOR THE REMEDIAL DESIGN/REMEDIAL ACTION
OCCIDENTAL CHEMICAL CORPORATION
HOOKER/RUCO SITE
HICKSVILLE, NEW YORK

Sample Activity	*Data Quality Objectives*
Groundwater Sampling	Characterize anticipated influent groundwater stream for design of treatment system by means of providing representative samples to be used in treatability studies
Soil Sampling	Delineate the extent of RSC's in the soils in the former drum storage area and the base of Sump 2 and delineate the extent of selected organic compounds in the soils in the vicinity of MW-E and the base of Sump 2
Waste Characterization Sampling	Characterize all waste generated by the remedial program for purposes of disposal. Analytical results will be used to satisfy the minimum requirements of the treatment, storage and disposal facility (TSDF)

TABLE E-2

SAMPLE ANALYSIS PROGRAM
OCCIDENTAL CHEMICAL CORPORATION
HOOKER/RUCO SITE
HICKSVILLE, NEW YORK

Sample Activity	*Parameter*	*Method Reference*		*Matrix*
Waste Characterization Sampling	Ignitability	SW-846 1010		Soil
		SW-846 1010		Groundwater
	Corrosivity	SW-846 1110		Soil
		SW-846 9040/9041		Groundwater
	Reactivity			
	Cyanide	SW-846, Chapter 7.3.3		Soil
	Sulfide	SW-846, Chapter 7.3.4		Soil
	Cyanide	SW-846 9010		Groundwater
	Sulfide	SW-846 9030		Groundwater
		Preparation	*Analysis*	
	TCLP Metals	40 CFR 261, Appendix II	SW-846 6010/7000	Soil
	TCLP VOCs	40 CFR 261, Appendix II	SW-846 8240	Soil
	TCLP BNAs	40 CFR 261, Appendix II	SW-846 8270	Soil
	TCLP Pesticides	40 CFR 261, Appendix II	SW-846 8080	Soil
	TCLP Herbicides	40 CFR 261, Appendix II	SW-846 8150	Soil

TABLE E-2

SAMPLE ANALYSIS PROGRAM
OCCIDENTAL CHEMICAL CORPORATION
HOOKER/RUCO SITE
HICKSVILLE, NEW YORK

Sample Activity	*Parameter*	*Method Reference*	*Matrix*
Groundwater Sampling	Selected TCL Parameters	CLP OLM 01.9 (7/93)	Groundwater
	Selected TAL Parameters	CLP ILM 03.0 (2/93)	Groundwater
	Total Suspended Solids	SM 2540-D	Groundwater
	Total Dissolved Solids	SM 2540-C	Groundwater
	Biochemical Oxygen Demand (BOD)	SM 5210-B	Groundwater
	Chemical Oxygen Demand (COD)	SM 5220-B	Groundwater
	Hardness	SM 2340-B	Groundwater
	Total Organic Carbon (TOC)	SM 5310-B	Groundwater
	Alkalinity	USEPA 310.1	Groundwater
	Sulfate	USEPA 375.4	Groundwater
	Ammonia	USEPA 350.2	Groundwater
	Fluoride	USEPA 340.2	Groundwater
	Nitrate (as N)	USEPA 353.2	Groundwater
	Nitrite (as N)	USEPA 353.2	Groundwater
	Total Organic Nitrogen (as N)	USEPA 351.3	Groundwater
	Oil and Grease	USEPA 413.1	Groundwater
	Total Phosphorus (as P)	USEPA 365.2	Groundwater
	Sulfide (as S)	USEPA 376.1	Groundwater
	Chloride	USEPA 325	Groundwater

TABLE E-2

SAMPLE ANALYSIS PROGRAM
OCCIDENTAL CHEMICAL CORPORATION
HOOKER/RUCO SITE
HICKSVILLE, NEW YORK

Sample Activity	*Parameter*	*Method Reference*	*Matrix*
Soil Sampling	Selected TCL Parameters	CLP OLM 01.9 (7/93)	Soil
	RSCs Parameters	KGD Method (1)	Soil
Treatability Study Sampling	Selected TAL Metals	CLP ILM03.0 (2/93)	Groundwater
	RSCs	KGD Method (1)	Groundwater
	TSS	SM 212	Groundwater
	TDS	SM 209C	Groundwater
	Chloride	EPA 325	Groundwater
	Alkalinity	EPA 310.1	Groundwater
	Hardness	SM 314B	Groundwater
	TOC	SM 505	Groundwater
	COD	SM 508	Groundwater
	pH	EPA 150.1	Groundwater
	Redox potential (eH)	-	Groundwater
	Dissolved oxygen	EPA 360.2	Groundwater
	Nitrate (as N)	EPA 353.2	Groundwater
	Sulfate	EPA 375.4	Groundwater
	Reduced iron (ferric, ferrous)	SM 4500D	Groundwater
	Ammonia (as N)	EPA 350.2	Groundwater
	Total Phosphorus (as P)	EPA 365.2	Groundwater
	Turbidity	EPA 180.1	Groundwater
	Selected TCL Organics	CLP OLM01.9 (7/93)	Groundwater
	di-n-butylphthalate	CLP OLM01.9 (7/93)	Groundwater

TABLE E-2

SAMPLE ANALYSIS PROGRAM
OCCIDENTAL CHEMICAL CORPORATION
HOOKER/RUCO SITE
HICKSVILLE, NEW YORK

Sample Activity	*Parameter*	*Method Reference*	*Matrix*

Notes:

(1)	Method developed by Occidental Chemical Corporation for Groundwater and Soil analysis of Site-specific compounds. Method referenced from OxyChem letter to USEPA dated May 13, 1992.
BNA	Base/Neutral Acid Extractable.
COD	Chemical Oxygen Demand.
RSCs	Ruco Site Chemicals.
TAL	Target Analyte List.
TCL	Target Compound List.
TCLP	Toxicity Characteristic Leaching Procedure.
TDS	Total Dissolved Solid.
TOC	Total Organic Carbon.
TSS	Total Suspended Solid.
VOCs	Volatile Organic Compounds.

TABLE E-3

PARAMETERS
OCCIDENTAL CHEMICAL CORPORATION
HOOKER/RUCO SITE
HICKSVILLE, NEW YORK

Parameters	*Method Reference*	*Matrix*	*Sample Preservation*	*Holding Time* (1)	*Sample Container* (2)
Ignitability	SW-846-1010 (3)	Soil	4°C (±2°C)	--	8 oz. glass
Corrosivity	SW-846 9040/9041 (3)	Water	4°C (±2°C)	--	8 oz. glass
	SW-846 1110 (3)	Soil	4°C (±2°C)	--	8 oz. glass
Reactivity					
Cyanide	SW-846, Chapter 7.3.3 (3)	Soil	4°C (±2°C)	As soon as possible	8 oz. glass
Sulfide	SW-846, Chapter 7.3.4 (3)	Soil	4°C (±2°C)	As soon as possible	8 oz. glass
Cyanide	SW-846 9010 (3)	Water	4°C (±2°C)	As soon as possible	8 oz. glass
Sulfide	SW-846 9030 (3)	Water	4°C (±2°C)	As soon as possible	8 oz. glass

TABLE E-3

PARAMETERS
OCCIDENTAL CHEMICAL CORPORATION
HOOKER/RUCO SITE
HICKSVILLE, NEW YORK

Parameters	*Method Reference*		*Matrix*	*Sample Preservation*	*Holding Time*	*Sample Container*
	Preparation	*Analysis*				
Toxicity						
TCLP Metals	40 CFR 261 Appendix II	SW-846 6010/7000 (3)	Soil	4°C (±2°C)	56 days(4)	8 oz. glass
					360 days (5)	8 oz. glass
TCLP BNA	40 CFR 261 Appendix II	SW-846 8270 (3) SW-846 8080 (3)	Soil	4°C (±2°C)	61 days (6)	8 oz. glass
TCLP Pesticides	40 CFR 261 Appendix II		Soil	4°C (±2°C)	61 days (6)	8 oz. glass
TCLP Herbicides	40 CFR 261 Appendix II	SW-846 8150 (3)	Soil	4°C (±2°C)	61 days (6)	8 oz. glass
TCLP VOA	40 CFR 261 Appendix II	SW-846 8240 (3)	Soil	4°C (±2°C)	28 days (7)	40 mL glass with Teflon septa
TSS		SM 212 (8)	Water	4°C (±2°C)	7 days	1L HDPE
TDS		SM 209C (8)	Water	4°C (±2°C)	7 days	1L HDPE
BOD		SM 209B (8)	Water	4°C (±2°C)	Analyze immediately	2-1L amber glass
COD		SM 508 (8)	Water	Cool, 4°C, H_2SO_4 to pH <2	Analyze immediately	125 mL HDPE
Hardness		SM 314B (8)	Water	HNO_3 or H_2SO_4 to pH <2	6 months	250 mL HDPE
Chromium (hexavalent)		7197 (3)	Water	4°C (±2°C)	24 hours to analysis	500 mL HDPE

TABLE E-3

PARAMETERS
OCCIDENTAL CHEMICAL CORPORATION
HOOKER/RUCO SITE
HICKSVILLE, NEW YORK

Parameters	*Method Reference*	*Matrix*	*Sample Preservation*	*Holding Time*	*Sample Container*
TOC	SM 505 (8)	Water	Cool, 4°C, HCl/H_2 SO_4 to pH <2	28 days	2-40 mL VOC vials
Alkalinity	EPA 310.1 (9)	Water	4°C (±2°C)	14 days	250 mL HDPE
Sulfate	EPA 375.4 (9)	Water	4°C (±2°C)	28 days	125 mL HDPE
Ammonia (as N)	EPA 350.2 (9)	Water	pH<2 H_2SO_4, 4°C	28 days	1L HDPE
Fluoride	EPA 340.2 (9)	Water	None	28 days	500 mL HDPE
Nitrate (as N)	EPA 353.2 (9)	Water	pH<2 H_2 SO_4, 4°C	28 days	250 mL HDPE
Nitrite (as N)	EPA 353.2 (9)	Water	pH<2 H_2SO_4, 4°C	28 days	250 mL HDPE
Total Organic Nitrogen (as N)	EPA 351.3 (9)	Water	pH<2 H_2SO_4, 4°C	28 days	1L HDPE
Total Phosphorus (as P)	EPA 365.2 (9)	Water	pH<2 H_2SO_4, 4°C	28 days	125 mL HDPE
Sulfide (as S)	EPA 376.1 (9)	Water	pH >9 NaOH, ZnOAC, 4°C	7 days	1L HDPE
Chloride	EPA 325 (9)	Water	None	28 days	125 mL HDPE
Oil and Grease	EPA 413.1 (9)	Water	4°C (±2°C)	28 days	2-1L amber glass
RSC Parameters	KGD Method (10)	Water	4°C (±2°C)	Extract 7 days Analyze 40 days	1L amber glass
	KGD Method (10)	Soil	4°C (±2°C)	Extract 7 days Analyze 40 days	1L amber glass
TCL Volatiles	CLP (11)	Water	Cool, 4°C (±2°C), HCl to pH <2	10 days	2-40 mL VOC vials
	CLP (11)	Soil	4°C (±2°C)	10 days	2-40 mL VOC vials

TABLE E-3

PARAMETERS
OCCIDENTAL CHEMICAL CORPORATION
HOOKER/RUCO SITE
HICKSVILLE, NEW YORK

Parameters	*Method Reference*	*Matrix*	*Sample Preservation*	*Holding Time*	*Sample Container*
TCL Extractables	CLP (11)	Water	4°C (±2°C)	Extract 5 days Analyze 40 days	1L amber glass
	CLP (11)	Soil	4°C (±2°C)	Extract 10 days Analyze 40 days	8 oz. amber glass
TAL Metals	CLP (12)	Water	Cool, 4°C (±2°C), HNO_3 to pH <2	180 days	1L HDPE
TAL Mercury	CLP (12)	Water	Cool, 4°C (±2°C), HNO_3 to pH <2	26 days	1L HDPE
TAL Cyanide	CLP (12)	Water	Cool, 4°C (±2°C), NaOH to pH >12	12 days	1L HDPE
pH	EPA 150.1 (9)	Water	None	Analyze immediately	60 mL HDPE
Redox Potential (eH)	-	Water	None	Analyze immediately	60 mL HDPE
Dissolved Oxygen	EPA 360.2 (9)	Water	None	8 hours to analysis	300 mL BOD bottle
Reduced Iron (Ferric, Ferrous)	SM 4500D (8)	Water	4°C (±2°C)	Analyze immediately	500 mL HDPE
Turbidity	EPA 180.1 (9)	Water	4°C (±2°C)	48 hours to analysis	250 mL HDPE

TABLE E-3

PARAMETERS
OCCIDENTAL CHEMICAL CORPORATION
HOOKER/RUCO SITE
HICKSVILLE, NEW YORK

Notes:

(1)	All holding times begin at the time of sampling, except CLP samples where holding times begin with verified time of sample receipt (VTSR).
(2)	All sample containers shall conform to the QA/QC requirements specified in the OSWER Directive #9240.0SA, "Specifications and Guidance for Obtaining Contaminant-Free Sample Containers", December 1992. Triple volume will be collected for all aqueous samples requiring QC analyses.
(3)	"Test Methods for Evaluating Solid Waste" (SW-846), Third Edition, Office of Solid Waste and Emergency Response, November 1986, revised July 1992.
(4)	Mercury requires extraction within 28 days and analysis within 28 days; total elapsed holding time is 56 days.
(5)	Metals, excluding mercury, require extraction within 180 days and analysis within 180 days, total elapsed holding time is 360 days.
(6)	Semi-volatiles require extraction within 14 days, prepare extraction within 7 days and analysis within 40 days; total elapsed holding time is 54 days.
(7)	Volatiles require extraction within 14 days and analysis within 14 days; total elapsed holding time is 28 days.
(8)	"Standard Methods for Examination of Water and Wastewater", 18th Edition, 1992 (including 1994 Addendum).
(9)	"Methods for Chemical Analysis of Water and Wastes", 600/4-79-020, Revised March 1983.
(10)	Ketone, Glycol, Diol method attached in Attachments 1 and 2.
(11)	United States Environmental Protection Agency, "Contract Laboratory Protocols, Statement of Work for Organic Analyses, Multi-Media, Multi-Concentration", OLM 01.9, (7/93)
(12)	United States Environmental Protection Agency, "Contract Laboratory Protocols, Statement of Work for Inorganic Analyses, Multi-Media, Multi-Concentration", OLM 03.0 (2/93).
BOD	Biochemical Oxygen Demand.
COD	Chemical Oxygen Demand.
HDPE	High Density Polyethylene.
RSC	Ruco Site Chemicals
TAL	Target Analyte List.
TCL	Target Compound List.
TCLP	Toxicity Characteristic Leaching Procedure.
TDS	Total Dissolved Solids.
TOC	Total Organic Carbon.
TSS	Total Suspended Solids.
VOA	Volatile Organic Analyte.
-	No holding time specified.

ATTACHMENT E.1

KGD METHOD

ATTACHMENT E-1
ANALYTICAL METHOD FOR DETERMINATION OF SELECTED KETONE, GLYCOL AND DIOL COMPOUNDS IN ENVIRONMENTAL SAMPLES

APRIL 27, 1992
REVISED OCTOBER 18, 1995

1.0 SCOPE AND APPLICATION

This method can be used to determine the concentration of selected ketone, glycol, and diol compounds in environmental samples (soils, sediments, and waters). The following is the list of compounds this method was developed to analyze. Other compounds may also be determined by this method following acceptable verification.

MTBE Extractable Compounds

2,2,4,4-Tetramethyl-1,3-pentanone
2-Ethoxyethanol
2-Ethoxyethyl acetate
2,6-Dimethyl-4-heptanol
2-Ethyl-1-hexanol
Dimethyl malonate
Hexanonic acid
2,2,4-Trimethyl-1,3-pentane diol
2-Ethylhexanoic acid
Heptanoic acid
Octanoic acid
bis(2-Ethylhexyl)adipate
2-Ethyl-2(hydroxymethyl)-1,3-propane diol

Water Soluble Compounds

1,2-Propane diol
Ethylene glycol
1-Methyl-2-pyrrolidinone
1,3-Butane diol
2,2,-Dimethyl-1,3-propane diol
Dipropylene glycol
1,4-Butane diol
Diethylene glycol
1,6-Hexane diol
e-Caprolactam
Triethylene glycol
1,2,6-Trihydroxyhexane

2.0 METHOD SUMMARY

Aqueous samples are prepared and analyzed for the above compound lists. For the first group of compounds, a 500 mL aliquot of the sample is extracted with MTBE (methyl-tert-butylether) and concentrated to 10 mLs using a rotary evaporator. The extract is analyzed by gas chromatography using a flame ionization detector (GC/FID).

A second 500 mL aliquot of the aqueous sample is concentrated to 10 mLs by rotary evaporation and analyzed by GC/FID to determine the water-soluble compound concentrations.

For soil/sediment samples, a 30 gram aliquot is extracted with methanol by sonication and concentrated to 10 mLs by rotary evaporation. The extract is analyzed for both of the above lists of compounds using GC/FID.

3.0 INTERFERENCES

Contamination can occur from dirty glassware or equipment. Care should be taken to ensure all equipment and glassware is thoroughly cleaned and in good working order. Several of these compounds, especially the acids, are subject to degradation in the GC system if there are active sites present. The injection port should be silanized and the GC column inspected for evidence of active sites prior to any analyses.

Extreme care must be exercised during the concentration of the extracts particularly with the concentration of the aqueous aliquot. Significant loss of analytes can occur if the sample froths or "bumps" during the concentration.

This method employs a flame ionization detector which responds to any material which burns in an air/hydrogen flame. The presence of petroleum products such as gasoline, fuel oils, etc. may cause positive interferences which could make compound identification difficult or impossible.

4.0 APPARATUS AND MATERIALS

- Gas Chromatograph: Analytical system complete with FID including syringes, column supplies, recorder, data system, gases, etc. Instrument must accept capillary and/or megabore columns.
- Column: Poly(ethylene glycol) phase, 30m x 0.53mm I.D. (DB-FFAP, Stabilwax-DA, or equivalent).
- Detector: Flame ionization detector (FID).
- Rotary Evaporator: Buchi Model R-114 or equivalent.
- Vacuum: pump or water aspirator.
- Silicon carbide boiling chips: approximately 10/40 mesh.
- Volumetric flasks: Class A various sizes.
- Syringes: (10 µL, 100 µL, 1000 µL).
- Separatory funnels: 1000 to 2000 mL.

- Vials: glass (2, 10 and 20 mL capacity with teflon lined screw cap).
- Graduated cylinders: 100 and 500 mL sizes.
- Beakers: pyrex (various sizes).
- Sonicator: Heat Systems, Ultrasonic Inc. Model W-385 or equivalent with 3/4-inch standard disrupter horn. (Must have minimum 375 watt output capacity.)
- Sonabox Acoustic Enclosure: recommended to decrease cavitation sound.
- Pasteur pipettes.
- Vacuum Filtration Apparatus: Buchner funnel, Whatman #41 filter paper or equivalent, filter flask, 500 mL.
- Analytical Balance: top loader, accurate to 0.01 grams.

5.0 REAGENTS

Methanol: ACS reagent grade.

Methyl-tert-butyl ether: ACS reagent grade.

Stock standards: should be at concentrations near 10,000 µg/mL for all compounds except the following which should be at 50,000 µg/mL:

2,2,4,4-Tetramethyl-1,3-pentanone
1,2,6-Trihydroxyhexane
2-Ethyl-2(hydroxymethyl)-1-3-propane diol
bis(2-Ethylhexyl)adipate
Ethylene glycol
2-Ethyl-1-hexanol

Stock solutions: should be stored for a maximum of one year.

Calibration standards: calibration standards at a minimum of five levels for each analyte are prepared in methanol. The following are recommended levels, concentrations are µg/mL.

Compound	*Mix 1*	*Mix 2*	*Mix 3*	*Mix 4*	*Mix 5*
2,2,4,4-Tetramethyl-1,3-pentanone	5	10	20	50	100
2-Ethoxyethanol	50	100	200	300	500
2-Ethoxyethyl acetate	5	10	20	50	100
2,6-Dimethyl-4-heptanol	5	10	20	50	100
2-Ethyl-1-hexanol	50	100	200	300	500
Dimethyl malonate	5	10	20	50	100
Hexanoic acid	5	10	20	50	100
2,2,4-Trimethyl-1,3-pentane diol	5	10	20	50	100
2-Ethylhexanoic acid	5	10	20	50	100
Heptanoic acid	5	10	20	50	100
Octanoic acid	5	20	20	50	100
bis(2-Ethylhexyl)adipate	50	100	200	300	500
1,2-Propane diol	5	10	20	50	100
Ethylene glycol	50	100	200	300	500
1-Methyl-2-pyrrolidinone	5	10	20	50	100
1,3-Butane diol	5	10	20	50	100
2,2-Dimethyl-1,3-propane diol	5	10	20	50	100
Dipropylene glycol	5	10	20	50	100
1,4-Butane diol	5	10	20	50	100
Diethylene glycol	5	10	20	50	100
1,6-Hexane glycol	5	10	20	50	100
e-Caprolactam	5	10	20	50	100
Triethylene glycol	5	10	20	50	100
2-Ethyl-2(hydroxymethyl)-1,3-propane diol	50	100	200	300	500
1,2,6-Trihydroxyhexane	50	100	200	300	500

6.0 SAMPLE COLLECTION, PRESERVATION, AND HANDLING

Samples should be collected in clean 1-liter amber glass containers. After collection, samples should be stored at 4°C until extraction. Samples must be extracted within seven days of collection for aqueous samples and 14 days of collection for soils. Extracts can be stored at 4°C for 40 days prior to analysis.

7.0 PROCEDURE

Aqueous Samples - MTBE Extraction:

Measure 500 mL of sample into a separatory funnel. Add 100 mLs of MTBE to the sample, shake funnel for two minutes with periodic venting. Let sit until the layers separate.

Draw off the water layer from the bottom of the funnel into a clean beaker. Pour off the MTBE layer through the top of the funnel into another clean beaker. Pour the aqueous sample back into the separatory funnel.

Repeat the extraction steps two more times with aliquots of MTBE. Combine all extracts.

Quantitatively transfer the MTBE into the round bottom flask of the rotary evaporator. Concentrate the extract under vacuum (water bath temperature ≤40°C) to a final volume of approximately 5 mL. Transfer the extract quantitatively into a 10 mL volumetric flask and dilute to volume with MTBE. Store at 4°C until analysis.

Aqueous Samples - Water Concentration:

Using a graduated cylinder, measure 500 mL of sample and pour into the round bottom flask of the rotary evaporator.

Concentrate the extract, under vacuum (water bath temperature ≤55°C) to a final volume of approximately 5 mL. Transfer the extract quantitatively into a 10 mL volumetric flask and dilute to volume with reagent water. Store at 4°C until analysis.

Soil/Sediment Samples:

Using a clean spatula, mix the sample as much as possible to homogenize. Remove any loose rocks or vegetable manner. Weigh out an aliquot (10 grams) for percent solids. Dry at 104°C to constant weight and determine the percent solids.

Using a top loader balance weigh out 30 grams of sample into a 400 mL beaker. Add 150 mLs of methanol to the sample and mix.

Place the bottom surface of the sonicator probe approximately 1/2-inch below the surface of the liquid but above the sediment layer. Sonicate for three minutes at full power with pulse on and percent duty set at 50 percent. (Refer to manufacturers instructions for proper settings if different from Model W-385.) Raise the probe from the beaker and decant solvent into the vacuum filtration setup equipped with Buchner funnel and filter paper.

Repeat sonication with two more aliquots of methanol, combining all extracts.

Transfer the sediment to the Buchner funnel. Rinse the beaker with methanol and pour into the funnel. Repeat.

Continue to apply vacuum until all the liquid has gone through the filter.

Quantitatively transfer the methanol into the round bottom flask of the rotary evaporator. Concentrate the extract, under vacuum (water bath at a temperature of ≤40°C) to approximately 5 mL. Transfer the extract quantitatively into a 10 mL volumetric flask and dilute to volume with methanol. Store at 4°C until analysis.

8.0 GC ANALYSIS

Recommended GC Conditions:

Initial Oven Temperature	60°C
Initial Time	1 minute
Ramp	4°C/minute
Final Oven Temperature	230°C
Final Time	21.5 minutes
Injector Temperature	250°C
Detector Temperature	250°C
Injection Volume	3 µL
Column Head Pressure	5 PSIG

A summary of compound retention times is included in Table 1.

Instrument Calibration:

Calibrate the system using five levels for each compound. Calculate the calibration factor (Cf) for each compound by dividing the area of the peak and by the concentration of the standard in µg/mL. Determine the average Cf and percent relative standard deviation (RSD) for each compound.

If the percent RSD is ≤30 percent, the curve is considered linear and the average Cf can be used for calculations. If the percent RSD is >30 percent, a calibration curve should be used.

After calibration, inject an instrument blank to verify the analytical system is clean. Sample analysis can then begin.

The instrument calibration must be verified every ten samples. Inject a mid-range standard and calculate the percent difference (%D) for each compound as follows:

$$\%D = | Cf - Cf_{avg} | / Cf_{avg} \times 100$$

Where Cf is the calibration factor for the compound from the mid-range standard and Cf_{avg} is the average Cf from the initial calibration. If the %D ≤25 percent the system calibration curve is verified and sample analysis can continue. If the %D >25 percent then the analytical sequence must be stopped and maintenance performed. If maintenance does not correct the problem, the system must be recalibrated. A blank must be analyzed after each continuing calibration standard.

In lieu of running a new calibration curve each day, a calibration check standard can be analyzed. If the %D criteria of ≤25 percent are met, sample analysis may commence.

At the end of the analytical sequence, a closing calibration standard is analyzed. Calculate the Cf and %D for each compound.

9.0 CALCULATIONS

Aqueous Samples:

$\mu g/L = (Ax)(Vf)(Df)1000/(Cf_{avg})(Vs)$

Where:

Ax	=	Area compound of interest.
Vf	=	Final volume of extract, mLs.
Df	=	Dilution factor. If no dilution performed than Df = 1.
CF_{avg}	=	Average calibration factor.
Vs	=	Volume sample extracted, mLs.

Soil/Sediment Samples:

$mg/kg = (Ax)(Vf)(Df) / (Cf_{avg})(WS)(S)$

Where Ax, Vf, Df, and Cf_{avg} are as defined above:

Ws	=	Weight sample extracted, grams.
S	=	Decimal percent solids.

TABLE 1
ABSOLUTE RETENTION TIME COMPARISON

	RT, Min.
2,2,4,4-Tetramethyl-1,3-pentanone	6.71
2-Ehoxy ethanol	10.74
2-Ethoxyethyl acetate	13.12
2,6-Dimethyl-4-heptanol	14.72
2-Ethyl-1-hexanol	19.61
Dimethyl malonate	20.60
Hexanoic acid	31.01
2,2,4-Trimethyl-1,3-pentane diol	33.16
2-Ethyl hexanoic acid	33.87
Heptanoic acid	34.00
Octanonic acid	36.93
bis(2-Ethylhexyl)adipate	63.02
1,2-Propane diol	23.08
Ethylene glycol	24.24
1-Methyl-2-pyrrolidinone	26.15
1,3-Butane diol	27.72
2,2-Dimethyl-1,3-propane diol	29.60
Dipropylene glycol	30.41
1,4-Butane diol	32.92
Diethylene glycol	34.51
1,6-Hexane diol	38.77
e-Caprolactam	40.54
Triethylene glycol	43.65
2-Ethyl-2(hydroxymethyl)-1,3-propane diol	53.26
1,2,6-Trihydroxyhexane	57.65
2,2-Dimethyl-1,3-propane diol	25.91

ATTACHMENT E.2

KGD METHOD STARTUP STUDY

ATTACHMENT E-2
KGD METHOD STARTUP STUDY

INTRODUCTION

The Ketone, Glycol, Diol (KGD) Method developed by Occidental Chemical Corporation (OxyChem) in April 1992, was modified by IEA Laboratories (Monroe, CT) for use on soil samples. IEA performed a startup study to confirm the method's ability to analyze the KGD compounds in both soil and water matrices.

WATER STARTUP STUDY

The KGD method was previously validated for use on water samples by OxyChem in May 1992. To confirm IEA's ability to perform the method successfully, a startup study using reagent grade water samples was performed. Four aliquots were spiked at different concentration levels (see Table 1). Samples were extracted with methyl tert-butyl ether (MTBE) and concentrated to a 10 mLs final volume. This extract was analyzed for the "MTBE Soluble" list of compounds.

Three fresh aliquots of water were then spiked with the remaining compounds at three different concentrations (see Table 1), concentrated to 10 mLs, and analyzed for the "Water Soluble" compound list.

SOIL STARTUP STUDY

The original OxyChem method was modified for use on soil samples. This method was evaluated by IEA by spiking three soils in triplicate as detailed in Table 2. Samples were extracted with methanol followed by concentration to a final volume of 10 mLs. The extract was analyzed for all compounds using the modified poly(ethylene glycol) phase column (DB-FFAP or Stabilwax-DA). This column was capable of determining all compounds of interest in a single analytical run, eliminating the need for the second column specified in the original method.

RESULTS

The compound recoveries are summarized in Tables 3 and 4. IEA successfully performed the OxyChem KGD method on reagent grade water samples. The recoveries were all acceptable with the exception of 2-ethoxyethanol which had a 10 percent average recovery. The KGD compounds were successfully recovered from soil samples using the modified KGD method. Recoveries were generally acceptable for all compounds.

CONCLUSIONS

The KGD method for soil and water developed by OxyChem was successfully performed by an outside contract laboratory (IEA), and the results were found to be acceptable for the method's intended use.

TABLE 1

AQUEOUS MATRIX SPIKE CONCENTRATIONS (μg/L)

MTBE Compounds	*Low-1*	*Low-2*	*Medium*	*High*
2,2,4,4-Tetramethyl-1,3-pentanone	100	300	1000	10,000
2-Ethoxyethyl acetate	100	300	1000	10,000
2,6-Dimethyl-4-heptanol	100	300	1000	10,000
Dimethyl malonate	100	300	1000	10,000
Hexanonic acid	100	300	1000	10,000
2,2,4-Trimethyl-1,3-pentane diol	100	300	1000	10,000
2-Ethylhexanoic acid/heptanoic acid	200	600	2000	20,000
Octanoic acid	100	200	1000	10,000
2-Ethoxyethanol	500	1500	5000	50,000
2-Ethyl-1-hexanol	500	1500	5000	50,000
bis(2-Ethylhexyl)adipate	500	1500	5000	50,000

Water Soluble Compounds	*Low*	*Medium*	*High*
1,2-Propane diol	100	1000	10,000
Ethylene glycol	500	5000	50,000
1-Methyl-2-pyrrolidinone	100	1000	10,000
1,3-Butane diol	100	1000	10,000
2,2,-Dimethyl-1,3-propane diol	100	1000	10,000
Dipropylene glycol	100	1000	10,000
1,4-Butane diol	100	1000	10,000
Diethylene glycol	100	1000	10,000
1,6-Hexane diol	100	1000	10,000
e-Caprolactam	100	1000	10,000
Triethylene glycol	100	1000	10,000
2-Ethyl-2(hydroxymethane)-1,3-propane diol	100	1000	10,000
1,2,6-Trihydroxyhexane	100	1000	10,000

TABLE 2

SOIL MATRIX SPIKE CONCENTRATIONS (mg/kg)

MTBE Compounds	*Low-1*	*Medium*	*High*
2,2,4,4-Tetramethyl-1,3-pentanone	6.67	33.3	67
2-Ethoxyethyl acetate	6.67	33.3	67
2,6-Dimethyl-4-heptanol	6.67	33.3	67
Dimethyl malonate	6.67	33.3	67
Hexanonic acid	6.67	33.3	67
2,2,4-Trimethyl-1,3-pentane diol	6.67	33.3	67
2-Ethylhexanoic acid/heptanoic acid	6.67	33.3	67
Heptanoic acid	6.67	33.3	67
Octanoic acid	6.67	33.3	67
2-Ethoxyethanol	33	167	333
2-Ethyl-1-hexanol	33	167	333
bis(2-Ethylhexyl)adipate	33	167	333

Water Soluble Compounds	*Low*	*Medium*	*High*
1,2-Propane diol	6.67	33.3	67
Ethylene glycol	33	167	333
1-Methyl-2-pyrrolidinone	6.67	33.3	67
1,3-Butane diol	6.67	33.3	67
2,2,-Dimethyl-1,3-propane diol	6.67	33.3	67
Dipropylene glycol	6.67	33.3	67
1,4-Butane diol	6.67	33.3	67
Diethylene glycol	6.67	33.3	67
1,6-Hexane diol	6.67	33.3	67
e-Caprolactam	6.67	33.3	67
Triethylene glycol	6.67	33.3	67
2-Ethyl-2(hydroxymethane)-1,3-propane diol	33	167	333
1,2,6-Trihydroxyhexane	33	167	333

TABLE 3

WATER RECOVERY SUMMARY (Percent)

MTBE Soluble Compounds	*Low-1*	*Low-2*	*Medium*	*High*	*Average Recovery*
2,2,4,4-Tetramethyl-1,3-pentanone	46	65	75	72	**65**
2-Ethoxyethyl acetate	49	49	61	58	**54**
2,6-Dimethyl-4-heptanol	73	76	88	88	**81**
Dimethyl malonate	41	104	33	32	**53**
Hexanonic acid	21	18	18	45	**26**
2,2,4-Trimethyl-1,3-pentane diol	ND	61	119	122	**101**
2-Ethylhexanoic acid/heptanoic acid	27	27	28	41	**31**
Octanoic acid	62	75	85	91	**78**
2-Ethoxyethanol	ND	ND	8	11	**10**
2-Ethyl-1-hexanol	78	83	100	101	**91**
bis(2-Ethylhexyl)adipate	16	59	82	71	**57**

Water Soluble Compounds	*Low*	*Medium*	*High*	*Average Recovery*
1,2-Propane diol	39	63	81	**61**
Ethylene glycol	49	67	80	**65**
1-Methyl-2-pyrrolidinone	45	64	79	**63**
1,3-Butane diol	47	63	80	**63**
2,2,-Dimethyl-1,3-propane diol	47	65	80	**64**
Dipropylene glycol	49	68	79	**65**
1,4-Butane diol	50	65	79	**65**
Diethylene glycol	66	70	78	**71**
1,6-Hexane diol	51	66	79	**65**
e-Caprolactam	43	64	77	**61**
Triethylene glycol	57	62	73	**64**
2-Ethyl-2(hydroxymethane)-1,3-propane diol	33	29	42	**35**
1,2,6-Trihydroxyhexane	51	31	55	**46**

Notes:
ND Non-detect at associated value.

TABLE 4

SOIL RECOVERY SUMMARY (Percent)

	6.67 mg/kg			*33.3 mg/kg*			*67 mg/kg*			*Average Recovery*
	Rep 1	*Rep 2*	*Rep 3*	*Rep 1*	*Rep 2*	*Rep 3*	*Rep 1*	*Rep 2*	*Rep 3*	
MTBE Soluble Compounds										
2,2,4,4-Tetramethyl-1,3-pentanone	29	3	28	17	24	17	27	38	34	**24**
2-Ethoxy ethanol*	104	37	88	86	109	91	59	86	71	**81**
2-Ethoxyethyl acetate	60	18	50	49	62	51	34	49	40	**46**
2,6-Dimethyl-4-heptanol	71	33	59	62	73	64	42	61	51	**57**
2-Ethyl-1-hexanol*	79	42	67	82	96	85	56	80	68	**73**
Dimethyl malonate	71	26	59	60	73	62	40	58	48	**55**
Hexanonic acid	81	57	68	80	94	87	51	75	63	**73**
2,2,4-Trimethyl-1,3-pentane diol	92	67	79	86	98	93	59	83	73	**81**
2-Ethylhexanoic acid	77	57	65	79	92	85	49	70	61	**71**
Heptanoic acid	84	63	72	87	100	95	54	80	68	**78**
Octanoic acid	78	59	65	85	97	93	49	73	63	**74**
bis(2-Ethylhexyl)adipate*	89	80	79	86	99	90	46	65	70	**78**
Water Soluble Compounds										
1,2-Propane diol	105	67	94	96	112	102	64	97	79	**91**
Ethylene glycol	114	72	100	102	122	110	68	103	88	**98**
1-Methyl-2-pyrrolidinone	95	65	87	94	110	100	62	92	78	**87**
1,3-Butane diol	101	73	93	97	112	105	68	101	85	**93**
2,2,-Dimethyl-1,3-propane diol	101	73	92	97	111	104	67	100	83	**92**
Dipropylene glycol	100	78	92	97	110	106	69	99	86	**93**
1,4-Butane diol	102	80	94	99	114	110	70	101	89	**95**
Diethylene glycol	105	83	97	102	118	113	73	105	91	**99**
1,6-Hexane diol	111	94	108	115	130	125	78	112	103	**108**
e-Caprolactam	96	81	91	102	113	109	63	93	85	**93**
Triethylene glycol	100	96	101	112	125	124	68	104	99	**103**
2-Ethyl-2(hydroxymethane)-1,3-propane diol	91	84	86	110	224	126	54	77	86	**104**
1,2,6-Trihydroxyhexane	93	92	95	125	154	152	59	335	434	**171**

Notes:

* These compounds were spiked at 33, 167, and 333 mg/kg.

ATTACHMENT E.3

KGD MDL STUDY

ATTACHMENT E-3

METHOD DETECTION LIMIT STUDY FOR SELECTED KETONES, GLYCOLS, AND DIOLS

SUMMARY

A Method Detection Limit (MDL) Study was performed for selected Ketones, Glycols, and Diols using the analytical method developed by Occidental Chemical Company using the procedure referenced in Appendix B to 40 CFR Part 136 using seven replicates. MDLs for both aqueous and solid matrices were determined and are summarized in Table 1.0. The MDLs were acceptable for all compounds, with the exception of 2-ethoxyethanol in the aqueous matrix.

PROCEDURE: AQUEOUS MATRIX

Fourteen 500 mL aliquots of reagent water were spiked with the entire compound list, at concentrations approximately ten times the estimated detection limits (see Table 1.0). Half of the samples were extracted with methyl-tert-butylether (MTBE), concentrated to a final volume of 10.0 mls, and analyzed for the MTBE compound list. The remaining samples were concentrated to a final volume of 10 mls and analyzed for the "Water Soluble" list of compounds.

PROCEDURE: SOIL MATRIX

Seven 30 gram aliquots of purified sand were weighed out and spiked with the entire compound list at the concentrations listed in Table 1.0. Each aliquot was extracted with methanol and concentrated to a final volume of 10 mls. The extracts were then analyzed for the entire list of compounds.

GC ANALYSIS

The sample were analyzed on a Perkin-Elmer Model 8320 gas chromatograph equipped with a flame ionization detector. The column used was a 30 m x 0.53 mm Stabilwax DA. The instrument conditions were as follows:

Initial Oven Temperature	60°C
Initial Time	1 minute
Ramp	4°C/minute
Final Oven Temperature	230°C
Final Time	21.5 minutes
Injector Temperature	250°C
Detector Temperature	250°C
Injection Volume	3 µL

The instrument was calibrated at five levels prior to analysis. All associated raw data are available.

RESULTS

The results of the MDL study were as follows:

MTBE Compounds	*Aqueous MDL, µg/L*	*Soil MDL, mg/Kg*
2,2,4,4-Tetramethyl-1,3-pentanone	95	1.3
2-Ethoxyethyl Acetate	61	2.3
2,6-Dimethyl-4-heptanol	85	2.9
Dimethyl Malonate	46	2.4
Hexanoic Acid	51	1.1
2,2,4-Trimethyl-1,3-pentane Diol	118	3.4
2-Ethylhexanoic Acid	100	2.1
Heptanoic Acid	135	1.1
Octanoic Acid	183	1.8
2-Ethoxyethanol	5	2.4
2-Ethyl-1-hexanol	81	2.7
bis(2-Ethylhexyl)Adipate	661	18

Water Soluble Compounds	*Aqueous MDL, µg/L*	*Soil MDL, mg/Kg*
1,2-Propane Diol	287	2.5
Ethylene Glycol	1040	12
1-Methyl-2-pyrrolidinone	306	2.6
1,3-Butane Diol	263	2.9
2,2-Dimethyl-1,3-propane Diol	318	2.6
Dipropylene Glycol	2264	3.5
1,4-Butane Diol	171	2.1
Diethylene Glycol	813	4.5
1,6-Hexane Diol	247	3.2
e-Caprolactam	210	2.5
Triethylene Glycol	204	2.5
2-Ethyl-2-(hydroxymethane)-1,3-propane Diol	679	11
1,2,6-Trihydroxyhexane	876	11

All sample raw data are included.

CONCLUSIONS

The resulting MDLs are considered valid for their intended use (within ten times the spiking concentration) with the exception of 2-ethoxyethanol for the aqueous matrix. The MDL for 2-ethyoxyethanol is too low given the average percent recovery for this compound. Low recoveries for this compound were noted in the method validation study and were attributed to the high water solubility of the compound. Based on calibration data and results for the startup study, the true MDL for this compound can be estimated at 5000 µg/L.

TABLE 1.0

MDL STUDY
OCCIDENTAL CHEMICAL CORPORATION
SELECT KETONES, GLYCOLS AND DIOLS

	Aqueous MDL Concentration (µg/L)	*Soil Spike Concentration (mg/Kg)*
MTBE Compounds		
2,2,4,4-Tetramethyl-1,3-pentanone	500	6.7
2-Ethoxyethyl Acetate	500	6.7
2,6-Dimethyl-4-heptanol	500	6.7
Dimethyl Malonate	500	6.7
Hexanoic Acid	500	6.7
2,2,4-Trimethyl-1,3-pentane Diol	500	6.7
2-Ethylhexanoic Acid	500	6.7
Heptanoic Acid	500	6.7
Octanoic Acid	500	6.7
2-Ethoxyethanol	500	6.7
2-Ethyl-1-hexanol	500	6.7
bis(2-Ethylhexyl)Adipate	2500	33
Water Soluble Compounds		
1,2-Propane Diol	500	6.7
Ethylene Glycol	2500	33
1-Methyl-2-pyrrolidinone	500	6.7
1,3-Butane Diol	500	6.7
2,2-Dimethyl-1,3-propane Diol	500	6.7
Dipropylene Glycol	500	6.7
1,4-Butane Diol	500	6.7
Diethylene Glycol	500	6.7
1,6-Hexane Diol	500	6.7
e-Caprolactam	500	6.7
Triethylene Glycol	500	6.7
2-Ethyl-2-(hydroxymethane)-1,3-propane Diol	2500	33
1,2,6-Trihydroxyhexane	2500	33

ATTACHMENT E.4

QA/QC REVIEW OF STARTUP AND MDL STUDIES FOR KGD METHOD

ATTACHMENT E-4
QA/QC REVIEW OF METHOD STARTUP AND MDL STUDIES METHOD FOR THE ANALYSIS OF SELECTED KETONE, GLYCOL AND DIOL COMPOUNDS IN GROUNDWATER AND SOIL FOR THE HOOKER/RUCO SUPERFUND SITE
HICKSVILLE, NEW YORK
OCTOBER 16, 1995

SUMMARY

A gas chromatographic method was develop by OxyChem to analyze selected ketone, glycol and diol compounds (KGDs) in groundwater (see Table 1). To demonstrate the efficiency of this method, OxyChem performed a startup study in April 1992. A similar method startup study was performed in March 1995 by IEA Laboratories of Monroe, Connecticut. IEA's validation study results were considered acceptable with the exception of the 2-Ethoxy ethanol recovery which was 10%.

The KGD method was modified for use on soil matrices. A startup study was completed on nine soil samples and the recovery results were acceptable for all compounds.

MDL studies were completed on both water and soil matrices. All MDL results were acceptable with the exception of the water MDL for 2-Ethoxy ethanol which was shown to be higher than originally targeted. An estimated MDL for this compound of 5000 µg/L was determined based on the MDL and startup study results.

METHOD STARTUP STUDY - WATER SAMPLES

Sample Preparation

Three aliquots of reagent water were spiked with the "water-soluble" KGDs at concentrations of 100, 1,000, and 10000 µg/L. Some compounds previously determined to have lower extraction efficiencies were spiked at higher concentrations (200 - 50,000 µg/L).

Four aliquots of water were spiked with the "MTBE-soluble" KGDs at concentrations of 100, 300, 1,000, and 10, 000 µg/L (200 - 50,000 µg/L for compounds with lower extraction efficiencies).

Samples were extracted as specified in the KGD method.

Instrument Calibration

The gas chromatograph (GC) was calibrated using five standards for all compounds with the exception of 2,2,4-Trimethyl-1,3-pentane diol; bis(2-Ethylhexyl)adipate; and 2-Ethoxyethanol. Four-point calibrations were used for the first two compounds, and a three-point for the last due to poor integration for some of the standards. The poor integration was caused by inadequate chromatographic resolution and integration. To improve the chromatography, a different GC (equipped with a computer for integration) was used for the MDL study and will be used for all sample analyses.

All %RSD values were less than 30% indicating acceptable linearity of the curves. Instrument sensitivity was good over the calibration ranges.

Results

Samples were analyzed by GC and calculated correctly using average response factors from the calibration curves. The recoveries ranged from 26 - 101% with the exception of 2-Ethoxy ethanol which gave a 10% recovery.

METHOD STARTUP STUDY - SOIL SAMPLES

Sample Preparation

Nine aliquots of clean soil were spiked in triplicate with the KGDs at concentrations of 6.7, 33, and 67 mg/kg. Some compounds previously determined to have lower extraction efficiencies were spiked at higher concentrations (33, 167, and 333 mg/kg).

Samples were extracted as specified in the KGD method.

Instrument Calibration

The GC was calibrated using five standards for all compounds All %RSD values were less than 30% indicating acceptable linearity of the curves, with the exception of 2-Ethoxy ethanol which had a 42% RSD. The calibration curve for this compound showed some variability in response and sample results could be variable as well

Instrument sensitivity was good over the calibration ranges used.

Results

Samples were analyzed by GC and calculated correctly using average response factors from the calibration curves. The recoveries ranged from 46% to 108% with the exception of 2,2,4,4-Tetramethyl-1,3-pentanone which yielded a 10% recovery, and 1,2,6-Trihydroxyhexane which yielded a 171% recovery.

METHOD DETECTION LEVEL STUDY - SOIL AND WATER SAMPLES

Sample Preparation

Seven aliquots of water were spiked with the KGDs at concentrations of 500 µg/L with the exception of bis(2-Ethylhexyl)adipate, Ethylene glycol, 2-Ethyl-2-(hydroxymethane)-1,3-propane diol and 1,2,6-Tridroxyhexane which were spiked at 2,500 µg/L. Samples were extracted as specified in the KGD method.

Seven samples of clean soil were spiked with the KGDs at concentrations of 6.7 mg/kg with the exception of bis(2-Ethylhexyl)adipate, Ethylene glycol, 2-Ethyl-2-(hydroxymethane)-1,3-propane diol and 1,2,6-Tridroxyhexane which were spiked at 33 mg/kg. Samples were extracted as specified in the KGD method.

Instrument Calibration

The GC was calibrated using five standards for all KGDs. All %RSD values were less than 30% indicating acceptable linearity of the curves. Instrument sensitivity was acceptable over the calibration range for all compounds.

Results

Samples were analyzed by GC and calculated correctly using average response factors from the calibration curves. MDLs were calculated in accordance with 40 CFR Part 136 Appendix B. All results were acceptable with the exception of the water MDL for 2-Ethoxy ethanol which was not within ten times the spike concentration.

MDLs ranged from 50 to 2,300 µg/L for water samples, and 1 to 18 mg/kg for soil samples.

CONCLUSIONS

The startup and MDL studies have confirmed that the KGD method can be used for the analysis of the targeted compounds in water samples. The MDL for 2-Ethoxy ethanol (≈5000 µg/L) was higher than originally targeted; MDLs for the remaining compounds were determined experimentally to range from 50 to 2300 µg/L.

The startup and MDL studies have successfully demonstrated that the KGD method can be used for analysis of the targeted compounds in soil samples. Although outlying recoveries were reported for 2,2,4,4-Tetramethyl-1,3-pentanone and 1,2,6-Trihydroxyhexane in the startup study, good recoveries were shown for these compounds in the MDL study, soil MDLs ranged from 1-18 mg/kg.

ATTACHMENT E.5

CURRICULUM VITAE

DENISE ROBINSON TUHOVAK, B.S.

EDUCATION

B.S.	Chemistry, Canisius College, Buffalo, New York, 1986
Other Courses	USEPA Region II Training Course for CLP Organic Data Validation, Westchester Community College, Dr. John Samulian, June 1993
	USEPA Region II Training Course for CLP Inorganic Data Validation, Westchester Community College, Dr. John Rankin, March 1995
	Dupont Differential Scanning Calorimeter Training Course
	Varian Gas Chromatography Training Course
	Mattson FTIR Training Course
	40 Hour OSHA Training Course

EMPLOYMENT

1994-Present	Environmental Chemist TreaTek-CRA Company
1993-94	Environmental Chemist, Conestoga-Rovers & Associates
1990-93	Laboratory Manager, Advanced Environmental Services
1988-90	Research Chemist, Wilson Greatbatch Ltd.
1986-88	Analytical Chemist, Recra Environmental
1986	Research Assistant, Buffalo Color Corporation

AFFILIATIONS

American Chemical Society
New York Association of Approved Environmental Laboratories

PROFILE OF PROFESSIONAL ACTIVITIES

- Assessment and validation of ASP, CLP and SW846 analytical data and liaison with analytical laboratories in support of various investigative and remedial projects
- QA/QC Officer in charge of laboratory coordination and data assessment for RCRA facility investigations, groundwater monitoring and interim corrective measures programs at a pesticide manufacturing facility
- Preparation of analytical laboratory bidding documents
- Preparation of analytical Quality Assurance Project Plans (QAPPs)
- Liaison with EPA/State Agencies regarding QA/QC issues for various projects
- Performance of laboratory audits and assessments
- Laboratory Manager - responsible for laboratory personnel, data review and technical support

- Performed research for the design of lithium batteries for various medical and commercial applications
- CLP Report Writer - responsible for the quality control and compilation of organics CLP data packages
- Analytical Chemist performing organic analyses with a variety of analytical instrumentation on multi-media environmental samples

PUBLICATIONS

- "Low Temperature Electrolytes for Lithium/Silver Vanadium Oxide Cells", Journal of Power Sources, 34 (1991) 51-64 (with E. Takeuchi and C. Post)

ATTACHMENT E.6

WORK/QA PLAN SHORT FORM

WORK/QA PLAN SHORT FORM

Remedial Design at Occidental Chemical Corporation
Hooker/Ruco Site

OCCIDENTAL CHEMICAL CORPORATION

Quality Assurance Officer's Signature ______________________________

Quality Assurance Officer's Name: Patrick J. Garrity

1. **PROJECT:** Remedial Design Program for Operable Unit-1, Hooker/Ruco Site

2. **PROJECT REQUESTED BY:** USEPA

3. **DATE OF REQUEST:** September 18, 1995

4. **DATE OF PROJECT INITIATION:** Upon approval of the Remedial Design Work Plan (RDWP)

5. **QUALITY ASSURANCE OFFICER (QAO):** Patrick J. Garrity

6. **PROJECT DESCRIPTION:** A detailed description is provided in the RDWP.

   A. **Objective and Scope Statement:** To collect analytical data from surface and subsurface soils, and groundwater performed pursuant to Section 106(A) of CERCLA, 42 U.S.C. 9606(A).

   B. **Data Usage:** To define the presence of residual selected organic, inorganic, and physichemical parameters in the groundwater for design of a groundwater treatment system and to define the presence, extent and magnitude of selected organics and Ruko Site Chemicals (RSCs) in the soil for purposes of remediation within the facility's boundaries.

   C. **Monitoring Network Design and Rationale:** Groundwater sampling for characterization of influent groundwater stream and delineation of extent and magnitude of site chemicals in soil and sump sediments. Sample results will be used to design a groundwater treatment system during treatability studies and to determine if site soil requires cleanup.

D. Monitoring Parameters and their Frequency of Collection (not including QA/QC):

PUMPING TEST

Parameter	Number of Samples	Sample Matrix	Analytical Method (Reference)	Sample Preservation	Holding Time (1)	Sample Container
Selected VOCs (2)	6	Groundwater	CLP OLM 01.9 (3)	4° C (±2°C) HCl to pH<2	10 days from VTSR to analysis	2-40 ml VOC vials
di-n-Butylphthalate	6	Groundwater	CLP OLM 01.9 (3)	4° C (±2°C)	5 days VTSR to extraction; 40 days to analysis	1 L amber
Selected Metals (4)	6	Groundwater	CLP ILM 03.0 (3)	4° C (±2°C) HNO_3 to pH<2	mercury - 26 days from VTSR; remaining metals - 180 days from VTSR	500 ml HDPE
Chromium (hexavalent)	6	Groundwater	7197 (10)	4° C (±2°C)	24 hours to analysis	500 ml HDPE
Chromium (trivalent)	6	Groundwater	CLP ILM 03.0 (3)	4° C (±2°C) HNO_3 to pH<2	180 days to analysis	500 ml HDPE
Total Suspended Solids	6	Groundwater	2540D (5)	4° C (±2°C)	7 days to analysis	1 L HDPE
Total Dissolved Solids	6	Groundwater	2540C (5)	4° C (±2°C)	7 days to analysis	1 L HDPE
Biological Oxygen Demand	6	Groundwater	5210B (5)	4° C (±2°C)	48 hours to analysis	2-1L amber glass
Chemical Oxygen Demand	6	Groundwater	5220B (5)	4° C (±2°C) H_2SO_4 to pH<2	28 days to analysis	125 ml HDPE
Hardness	6	Groundwater	2340B (5)	4° C (±2°C) HNO_3/H_2SO_4 to pH<2	180 days to analysis	250 ml HDPE
Total Organic Carbon	6	Groundwater	5310B (5)	4° C (±2°C) HCl/H_2SO_4 to pH<2	28 days to analysis	2 - 40 ml VOC vials
Alkalinity	2	Groundwater	310.1(6)	4° C (±2°C)	14 days to analysis	250 ml HDPE
Sulfate	2	Groundwater	375.4 (6)	4° C (±2°C)	28 days to analysis	125 ml HDPE
Ammonia	2	Groundwater	350.2 (6)	4° C (±2°C) H_2SO_4 to pH<2	28 days to analysis	1 L HDPE
Fluoride	2	Groundwater	340.2 (6)	4° C (±2°C)	28 days to analysis	500 ml HDPE

PUMPING TEST (cont.)

Parameter	Number of Samples	Sample Matrix	Analytical Method (Reference)	Sample Preservation	Holding Time (1)	Sample Container
Nitrate (as N)	2	Groundwater	353.2 (6)	4° C (±2°C) H_2SO_4 to pH<2	28 days to analysis	250 ml HDPE
Nitrite (as N)	2	Groundwater	353.2 (6)	4° C (±2°C) H_2SO_4 to pH<2	28 days to analysis	250 ml HDPE
Total Organic Nitrogen (as N)	2	Groundwater	351.3 (6)	4° C (±2°C) H_2SO_4 to pH<2	28 days to analysis	1 L HDPE
Oil and Grease	2	Groundwater	413.1 (6)	4° C (±2°C)	28 days to analysis	2 - 1L amber glass
Total Phosphorous	2	Groundwater	365.2 (6)	4° C (±2°C) H_2SO_4 to pH<2	28 days to analysis	125 ml HDPE
Sulfide (as S)	2	Groundwater	376.1 (6)	4° C (±2°C) NaOH to pH>9, ZnOAc	7 days to analysis	1 L HDPE
Chloride	2	Groundwater	325 (6)	4° C (±2°C)	28 days to analysis	125 ml HDPE
RSCs (7)	2	Groundwater	KGD Method (8)	4° C (±2°C)	7 days to extraction 14 days to analysis	1 L amber glass

MONITORING WELL SAMPLING

Parameter	Number of Samples	Sample Matrix	Analytical Method (Reference)	Sample Preservation	Holding Time (1)	Sample Container
Selected VOCs (2)	5	Groundwater	CLP OLM 01.9 (3)	4° C (±2°C) HCl to pH<2	10 days from VTSR to analysis	2 - 40 ml VOC vials
di-n-Butylphthalate	5	Groundwater	CLP OLM 01.9 (3)	4° C (±2°C)	5 days VTSR to extraction; 40 days to analysis	1 L amber
Selected Metals (4)	5	Groundwater	CLP ILM 03.0 (3)	4° C (±2°C) HNO_3 to pH<2	mercury - 26 days from VTSR; remaining metals - 180 days from VTSR	1 L HDPE
Chromium (hexavalent)	5	Groundwater	7197 (10)	4° C (±2°C)	24 hours to analysis	500 ml HDPE
Chromium (trivalent)	5	Groundwater	CLP ILM 03.0 (3)	4° C (±2°C) HNO_3 to pH<2	180 days to analysis	1 L HDPE
Total Suspended Solids	5	Groundwater	2540D (5)	4° C (±2°C)	7 days to analysis	1 L HDPE
Total Dissolved Solids	5	Groundwater	2540C (5)	4° C (±2°C)	7 days to analysis	1 L HDPE
Biological Oxygen Demand	5	Groundwater	5210B (5)	4° C (±2°C)	48 hours to analysis	2 - 1L amber glass
Chemical Oxygen Demand	5	Groundwater	5220B (5)	4° C (±2°C) H_2SO_4 to pH<2	28 days to analysis	125 ml HDPE

MONITORING WELL SAMPLING (Cont.)

Parameter	Number of Samples	Sample Matrix	Analytical Method (Reference)	Sample Preservation	Holding Time (1)	Sample Container
Hardness	5	Groundwater	2340B (5)	4° C (± 2°C) HNO_3/H_2SO_4 to pH<2	180 days to analysis	250 ml HDPE
Total Organic Carbon	5	Groundwater	5310B (5)	4° C (± 2°C) HCl/H_2SO_4 to pH<2	28 days to analysis	2 - 40 ml VOC vials
Alkalinity	5	Groundwater	310.1(6)	4° C (± 2°C)	14 days to analysis	250 ml HDPE
Sulfate	5	Groundwater	375.4 (6)	4° C (± 2°C)	28 days to analysis	125 ml HDPE
Ammonia	5	Groundwater	350.2 (6)	4° C (± 2°C) H_2SO_4 to pH<2	28 days to analysis	1 L HDPE
Fluoride	5	Groundwater	340.2 (6)	4° C (± 2°C)	28 days to analysis	500 ml HDPE
Nitrate (as N)	5	Groundwater	353.2 (6)	4° C (±2°C) H_2SO_4 to pH<2	28 days to analysis	250 ml HDPE
Nitrite (as N)	5	Groundwater	353.2 (6)	4° C (±2°C) H_2SO_4 to pH<2	28 days to analysis	250 ml HDPE
Total Organic Nitrogen (as N)	5	Groundwater	351.3 (6)	4° C (±2°C) H_2SO_4 to pH<2	28 days to analysis	1 L HDPE
Oil and Grease	5	Groundwater	413.1 (6)	4° C (±2°C)	28 days to analysis	2 - 1L amber glass
Total Phosphorous	5	Groundwater	365.2 (6)	4° C (±2°C) H_2SO_4 to pH<2	28 days to analysis	125 ml HDPE
Sulfide (as S)	5	Groundwater	376.1 (6)	4° C (±2°C) NaOH to pH>9, ZnOAc	7 days to analysis	1 L HDPE
Chloride	5	Groundwater	325 (6)	4° C (±2°C)	28 days to analysis	125 ml HDPE
RSCs (7)	5	Groundwater	KGD Method (8)	4° C (±2°C)	7 days to extraction 14 days to analysis	1 L amber glass

FIELD INVESTIGATIONS OF SITE SOILS

Parameter	Number of Samples	Sample Matrix	Analytical Method (Reference)	Sample Preservation	Holding Time (1)	Sample Container
Former Drum Storage Area						
RSCs (7)	8	Soil	KGD Method (8)	4° C (±2°C)	7 days to extraction then 40 days to analysis	1 L amber glass
MW-E						
Selected VOCs (2)	2 or more	Soil	CLP OLM 01.9 (3)	4° C (±2°C)	10 days from VTSR	2-40 ml VOC vials
di-n-Butylphthalate	2 or more	Soil	CLP OLM 01.9 (3)	4° C (±2°C)	5 days VTSR to extraction; 40 days to analysis	1 L amber glass
Sump 2						
RSCs (7)	3	Soil	KGD Method (8)	4° C (±2°C)	7 days to extraction then 40 days to analysis	1 L amber glass
Selected VOCs (2)	3	Soil	CLP OLM 01.9 (3)	4° C (±2°C)	10 days from VTSR	2 - 40 ml vials
di-n-Butylphthalate	3	Soil	CLP OLM 01.9 (3)	4° C (±2°C)	5 days VTSR to extraction; 40 days to analysis	1 L amber glass

WASTE CHARACTERIZATION

Parameter	Number of Samples	Sample Matrix	Analytical Method (Reference)	Sample Preservation	Holding Time (1)	Sample Container
TCLP VOCs	(9)	Soil	1311/8240 (10)	4° C (±2°C)	14 days from collection to TCLP extraction; 14 days from extraction to analysis	40 ml glass with teflon septa
TCLP SVOCs	(9)	Soil	1311/8270 (10)	4° C (±2°C)	14 days from collection to TCLP extraction; 7 days from TCLP extraction to Prep extraction; 40 days from prep extraction to analysis.	8 oz glass
TCLP Pesticides	(9)	Soil	1311/8080 (10)	4° C (±2°C)	14 days from collection to TCLP extraction; 7 days from TCLP extraction to Prep extraction; 40 days from prep extraction to analysis.	8 oz glass
TCLP Herbicides	(9)	Soil	1311/8150 (10)	4° C (±2°C)	14 days from collection to TCLP extraction; 7 days from TCLP extraction to Prep extraction; 40 days from prep extraction to analysis.	8 oz glass
TCLP Metals (Except Mercury)	(9)	Soil	1311/ 6010/7000 (10)	4° C (±2°C)	180 days from collection to TCLP extraction; 180 days from extraction to analysis.	1 L glass amber
Ignitability	(9)	Soil	1010 (10)	4° C (±2°C)	No holding time specified	8 oz glass
Corrosivity	(9)	Soil	9045 (10)	4° C (±2°C)	No holding time specified	8 oz glass
Cyanide Reactivity	(9)	Soil	7.3.3.2. (10)	4° C (±2°C)	As soon as possible	8 oz glass
Sulfide Reactivity	(9)	Soil	7.3.4.2 (10)	4° C (±2°C)	As soon as possible	8 oz glass
Mercury	(9)	Soil	1311/7470 (10)	4° C (±2°C)	28 days from collection to TCLP extraction; 28 days from extraction to analysis	8 oz glass

TREATABILITY STUDY

Parameter	Number of Samples	Sample Matrix	Analytical Method (Reference)	Sample Preservation	Holding Time (1)	Sample Container
Initial Characterization						
Selected Organics	5	Groundwater	CLP OLM 01.9 (3)	4° C (±2°C) HCl to pH <2	10 days from VTSR to analysis	2-40 mL VOC vials
di-n-butylphthalate	5	Groundwater	CLP OLM 01.9 (3)	4° C (±2°C)	5 days from VTSR to extraction; 40 days to analysis	1 L amber glass
RSCs	5	Groundwater	KGD Method (8)	4°C (±2°C)	7 days to extraction 14 days to analysis	1 L amber glass
TSS	5	Groundwater	2540-D (5)	4°C (±2°C)	7 days to analysis	1 L HDPE
TDS	5	Groundwater	2540-C (5)	4°C (±2°C)	7 days to analysis	1 L HDPE
Chloride	5	Groundwater	325 (6)	4°C (±2°C)	28 days to analysis	125 mL HDPE
Alkalinity	5	Groundwater	310.1 (6)	4°C (±2°C)	14 days to analysis	250 mL HDPE
Hardness	5	Groundwater	2340-B (5)	4°C (±2°C) HNO_3/H_2SO_4 to pH<2	180 days to analysis	250 mL HDPE
TOC	5	Groundwater	5310-B (5)	4°C (±2°C) HCl/H_2SO_4 to pH <2	28 days to analysis	2-40 mL VOC vials
COD	5	Groundwater	5220-B (5)	4°C (±2°C) H_2SO_4 to pH<2	28 days to analysis	125 mL HDPE
pH	5	Groundwater	150.1 (6)	None	Analyze immediately	60 mL HDPE
Redox Potential (eH)	5	Groundwater	-	None	Analyze immediately	60 mL HDPE
Dissolved Oxygen	5	Groundwater	360.2 (6)	None	8 hours to analysis	300 mL BOD bottle
Nitrate	5	Groundwater	353.2 (6)	4°C (±2°C) H_2SO_4 to pH <2	28 days to analysis	250 mL HDPE
Sulfate	5	Groundwater	375.4 (6)	4°C (±2°C)	28 days to analysis	125 mL HDPE
Reduced Iron (ferric, ferrous)	5	Groundwater	4500 D (5)	4°C (±2°C)	Analyze immediately	500 mL HDPE
Ammonia (as N)	5	Groundwater	350.2 (6)	4°C (±2°C) H_2SO_4 to pH <2	28 days to analysis	1 L HDPE
Phosphorus (as P)	5	Groundwater	365.2 (6)	4°C (±2°C) H_2SO_4 to pH <2	28 days to analysis	125 mL HDPE
Turbidity	5	Groundwater	180.1 (6)	4°C (±2°C)	48 hours to analysis	250 mL HDPE
UV/Oxidation Testing						
Selected VOCs (2)	24	Groundwater	CLP OLM 01.9 (3)	4° C (±2°C) HCl to pH <2	10 days from VTSR to analysis	2-40 mL VOC vials
di-n-butylphthalate	24	Groundwater	CLP OLM 01.9 (3)	4° C (±2°C)	5 days from VTSR to extraction; 40 days to analysis	1 L amber glass
RSCs	24	Groundwater	KGD Method (8)	4°C (±2°C)	7 days to extraction 14 days to analysis	1 L amber glass
Pretreatment Testing						
TSS	14	Groundwater	2540-D (5)	4°C (±2°C)	7 days to analysis	1 L HDPE
TDS	14	Groundwater	2540-C (5)	4°C (±2°C)	7 days to analysis	1 L HDPE
Carbon Isotherm Testing						
RSCs	6	Groundwater	KGD Method (8)	4°C (±2°C)	7 days to extraction 14 days to analysis	1 L amber glass

PRE-EXCAVATION SAMPLING

Parameter	Number of Samples	Sample Matrix	Analytical Method (Reference)	Sample Preservation	Holding Time (1)	Sample Container
RSCs (7)	(9)	Soil	KGD Method (8)	4° C (±2°C)	7 days to analysis then 40 days to extraction	1 L amber glass

(1) Holding time from sample collection unless otherwise indicated.

(2) Selected VOCs include carbon disulfide, chlorobenzene, dichloroethylene, Tetrachloroethylene, Trichloroethylene, Vinyl chloride and 4-Methyl-2-pentanone.

(3) Method referenced from USEPA Contract Laboratory Programs (CLP) Statement of Work (SOW), for "Organic Analysis, Multi-Media, Multi-Concentration" OLM 01.9 (7/93) and "Inorganic Analysis, Multi-Media, Multi-Concentration" ILM 03.0 (2/93).

(4) Selected metals include iron, manganese, magnesium, potassium, sodium, calcium, cobalt, lead, nickel and zinc.

(5) Methods referenced from "Standard Methods for the Examination of Water and Wastewater", 18th Edition, 1992 (including 1994 Addendum).

(6) Methods referenced from "Methods for Chemical Analysis of Water and Wastes", EPA 600/4-79-020, revised March 1983.

(7) RSCs include Ethylene Glycol, Diethylene Glycol, Triethylene Glycol, Dipropylene Glycol, 2,2-Dimethyl-1,3-Propane Diol, 2,6-Dimethyl-4-Heptanol, 2,2,4-Trimethyl-1,3-Pentanediol, 2-Ethylhexanoic Acid, Octanoic Acid, and Hexanoic Acid.

(8) Method developed by Occidental Chemical Corporation for water and soil analysis of site-specific compounds. Method referenced from OxyChem letter to USEPA dated May 13, 1992.

(9) Number of samples will comply with receiving facility's requirements.

(10) Methods referenced from "Test Methods for Evaluating Solid Wastes" (SW-846), November 1986, revised September 1994.

E. QA Sample Parameter

QA Samples	*Parameter*	*Number of Samples*
Trip Blanks	Volatiles	1 per day
Field Blanks	all as above	1 per day
Field Duplicates	all as above	10%
MS/MSD/Dups (1)	as specified in the above methods	10%

7. **SCHEDULE OF TASKS AND PRODUCTS:** Reference Section 15.0 of the RDWP for schedule.

8. **PROJECT ORGANIZATION AND RESPONSIBILITY:**

The following is a list of key project personnel and their corresponding responsibilities:

Conestoga, Rovers and Associates (CRA) - sampling operations
CRA - sampling QC
Laboratory Manager, IEA Laboratories - laboratory analysis
Patrick J. Garrity, OxyChem - laboratory QC
CRA - data processing activities
Patrick J. Garrity, OxyChem - data quality reviews
CRA- performance auditing
CRA- systems auditing
Patrick J. Garrity, OxyChem - overall QA
Dr. Alan F. Weston - overall project coordination

9. **DATA QUALITY REQUIREMENTS AND ASSESSMENTS:** The precision and accuracy objectives will be based upon each method specified above.

10. **SAMPLING PROCEDURES:** Sample collection will be performed in accordance with procedures specified in the RDWP.

11. SAMPLING CUSTODY PROCEDURES: Legible labels will be affixed to each sample container containing all relevant information regarding sample collection and identification. The sampler will record all pertinent information regarding sample collection in a bound field log book. Chain of Custody forms (internal and external) will be used to maintain and document sample handling from collection through analysis.

12. CALIBRATION PROCEDURES AND PREVENTIVE MAINTENANCE:

Specific preventive maintenance procedures for field equipment will be consistent with the manufacturer's guidelines. Specific preventive maintenance protocols for laboratory equipment will be consistent with the contract laboratory's standard operating procedures.

13. DOCUMENTATION, DATA REDUCTION AND REPORTING:

A. **Objective and Scope Statement:** Data sheets, field logs, photographs and Chain of Custody documents will be kept by applicable personnel until the project is closed.

B. **Data Usage:** The designated laboratory will calculate and report the data to the OCC QAO, who will transmit the data to the USEPA.

14. DATA VALIDATION: The data validator (CRA) and QAO Officer (OCC)will review all raw data and will evaluate the results based on quality control checks (e.g. spike recoveries, blank results, duplicate recoveries, etc.). The data validation will be performed using the following documents as guidance:

USEPA "CLP Organics Data Review and Preliminary Review", SOP No. HW-6, Rev. #8, January 1992; and

USEPA "Evaluation of Metals Data for the Contract Laboratory Program (CLP)", SOP XI, January 1992.

For analyses performed using methodolgy not included in the CLP, data will be evaluated based on method QC criteria and the general principles used in the above documents.

15. **PERFORMANCE AND SYSTEMS AUDITS:** System and performance audits will be conducted by the QAO. The APM and the QAO will conduct project audits of laboratory/field calculations, interpretations and reports which are based on the measurement system outputs.

16. **CORRECTIVE ACTION:** The need for corrective action may be identified by system or performance audits, or by standard QC procedures. For each measurement system, the laboratory QA/QC Officer, working with the QAO, will be responsible for initiating the corrective action and the laboratory supervisor will be responsible for implementing the corrective action.

17. **REPORTS:** At the completion of the project a sampling and analysis report will be submitted. The report shall include the following: a) map of sample locations, b) sample I.D. numbers, c) sample analysis information, d) sample analytical results, e) QA/QC data, f) QA/QC review, and g) assessment of the data.