ENGINEERING INVESTIGATIONS AT INACTIVE HAZARDOUS WASTE SITES

REMEDIAL INVESTIGATION/ FEASIBILITY STUDY

MACKENZIE CHEMICAL SITE
TOWN OF ISLIP, NEW YORK

NYSDEC SITE NO. 1-52-017

August 2000

Prepared For:

NEW YORK STATE DEPARTMENT OF ENVIRONMENTAL CONSERVATION

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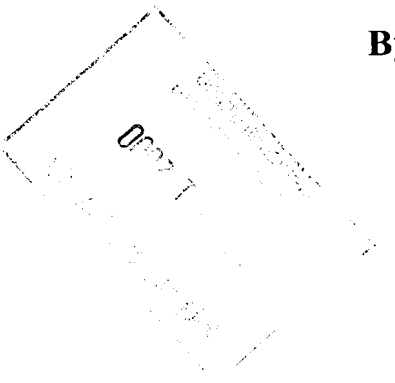
Bureau of Eastern Remedial Action



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FOR

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ONE CORDELLO AVENUE
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1.0 INTRODUCTION

Holzmacher, McLendon & Murrell, P.C. (H2M) was contracted by the New York State Department of Environmental Conservation (NYSDEC) to conduct a Remedial Investigation/Feasibility Study (RI/FS) of the MacKenzie Chemical site located at One Cordello Avenue in Central Islip, New York. The MacKenzie Chemical site has been listed by NYSDEC in the Registry of Inactive Hazardous Waste Disposal Sites in New York State (Site Number 1-52-017). The NYSDEC has classified the subject site as a Classification "2" (Class 2 Site) pursuant to the Environmental Conservation Law (ECL) §27-1305.4.b. A Class 2 site is a site at which:

- Disposal of a consequential quantity of hazardous waste has been confirmed and the hazardous waste or its components or breakdown products present a significant threat to the environment or to health; or
- Hazardous waste disposal has not been confirmed but the site has been listed on the Federal NPL.

The RI/FS process is being conducted under the terms of the New York State Superfund Standby Contract.

1.1 Purpose of the Report

The overall purpose of the RI Report is to evaluate the nature and extent of contamination on and off the subject site. Information in the report will be presented to the NYSDEC and used to initiate remedial measures, if and where appropriate. The specific objectives of the RI were as follows:

1. Provide sufficient analytical data on the site so that areas that have been previously identified or suspected as potential source areas of contamination are confirmed or determined to be either free of contamination or below regulatory levels. Evaluate any potential off-site impacts of site-related contamination.

2. If any previously identified or newly identified source areas are found to be present at the site, determine the nature, type, physical extent and migratory path of contamination at and/or emanating from those areas so that appropriate remedial measures can be implemented.

3. Qualitatively evaluate the impact of contamination quantified at the site on human health.

4. Document the areas that are free of contamination or that have been properly remediated.

5. Present and discuss the data necessary to support the development of remedial measures.

Analytical data have been collected to achieve these objectives using methods in accordance with NYSDEC protocols. Soil and groundwater samples were analyzed by approved methods subject to NYSDEC Analytical Services Protocol (ASP) and Contract Laboratory

Protocol (CLP) procedures. Additional data was acquired from previous investigations conducted at the site.

This report has been formatted as outlined in the U.S. Environmental Protection Agency (USEPA) Guidance Document, "Guidance on Remedial Investigations under CERCLA", EPA 540/G-89/004, October 1988 and the draft "Interim Final Guidance for Conducting RI/FS under CERCLA" EPA October 1988. The format also follows the proposed outline as presented in the NYSDEC – approved Final Remedial Investigation Work Plan (H2M, July 1998).

During the course of the remedial investigation, the NYSDEC encouraged communication with interested/affected public through the use of various methods such as fact sheets, public meetings, press notifications, etc. A draft version of this RI report, dated May 1999, was circulated to the public. The documents pertaining to the site, such as the draft RI were available for public review at two repositories; NYSDEC Region 1 Office, and the Central Islip Public Library. The NYSDEC in cooperation with the New York State Department of Health (NYSDOH), conducted a public meeting to discuss the draft RI for the subject site. This public meeting was held at the Central Islip Senior High School on Wednesday, May 26, 1999. During this public meeting, the site history, investigations and remedial program were discussed and questions solicited.

1.2 Site Background

This section of the RI Report provides an overview of the site, including site description and history, together with a discussion of previous investigations and interim remedial actions (IRMs) conducted at the site.

1.2.1 Site Description and History

The MacKenzie Chemical site is located at One Cordello Avenue, Central Islip, New York. The site is located within the Town of Islip, in Suffolk County. Figure 1.1 illustrates

the Location Map, and Figure 1.2 illustrates the Site Plan. The property, which contains a manufacturing building, storage warehouse and a warehouse/laboratory, is approximately 1.4 acres in size. The property is owned by Asish and Sarita Sen and Azad and Nutan Amand.

Originally owned by Ian MacKenzie, the site was used for the manufacture of various chemical products by MacKenzie Chemical Works, Inc. (MCW). Over the years of operation (1948-1987) numerous spills, explosions and fires occurred at the site. Three of the documented incidents include a methyl ethyl ketone (MEK) spill in 1977, a nitrous oxide release in 1978 and a MEK fire in 1979. MCW was later fined by the Suffolk County Department of Health Services (SCDHS) for the nitrous oxide release in violation of the air pollution laws.

1.2.2 Previous Investigations and Remedial Actions

In 1983, a Potential Hazardous Waste Site Preliminary Assessment was completed by NUS Corporation (under contract with the USEPA). NUS recommended that the ongoing cleanup of the site be completed and the threat to the groundwater defined. The NYSDEC has undertaken a potential responsible party (PRP) search, and at this time no viable PRP has been identified with the resources to perform an RI/FS.

In 1991, NYSDEC contracted Lawler, Matusky & Skelly Engineers (LMS) to perform a Phase II investigation of the site. The Phase II was completed by LMS in 1993 and included a literature search, site reconnaissance, geophysical survey, soil gas survey, drilling of soil borings and monitoring wells, site survey and the sampling of the groundwater and shallow soils. The findings and recommendations of the Phase II were documented in LMS's Phase II Investigation Report Dated April 1993.

The results of the 1993 Phase II Investigation completed by LMS indicated the presence of moderate levels of tetrachloroethylene (PCE), polycyclic aromatic hydrocarbons (PAHs), phthalatic acid esters (PAEs), N-nitrosodiphenylamine (NNDPA), mercury and lead in the soils on the site. Scattered areas of the site are also contaminated with gasoline related compounds,

phenol, dichlorobenzenes, trichlorobenzene, diesel fuel compounds, 2-nitroaniline (2NA), fluorenone, cobalt, copper, silver and zinc. LMS provided the following conclusions:

- Most of the compounds found in the soils appear to be related to manufacturing activities that occurred on the site.

- The PAH contamination is probably related to the railroad tracks and/or the asphalt company that operated on the site.

- The gasoline contamination is most likely a result of the auto repair business that also operated on site in the past in the vicinity of the former laboratory.

- The highest amount of contamination, which was found in the area behind the manufacturing building, appears to be the result of illegal dumping of waste materials.

- The four soil borings completed on site indicate that contamination tended to decrease with depth.

As part of the Phase II Investigation, a total of five (5) groundwater monitoring wells were installed and sampled. The groundwater sampling results indicated exceedances of groundwater standards for tetrachloroethylene, gamma-BHC, chromium, zinc, sodium, iron and manganese. The metals contamination in the groundwater appears to be associated with particulate matter, and the iron, manganese and sodium contamination is not associated with the site. An underground storage tank that had been excavated and placed in a debris pile at the site was also sampled and found to contain a fuel-related product. The Phase II analytical data have been tabulated and are contained in the RI/FS Work Plan, which is included in this RI by reference.

In July 1993, the Suffolk County Department of Health Services (SCDHS) completed nine hollow stem auger profile wells downgradient of the MacKenzie Chemical site. The major constituents found in the off-site profile wells were 1,2,3-trichloropropane, tetrachloroethene, and trichloroethene.

The 1,2,3-trichloropropane concentrations ranged from non-detect to 7,600 parts per billion (ppb) in Profile Well No. MW-5, located 600 feet downgradient of the MacKenzie property line. Trichloropropane was also detected in Profile Well Nos. MW-1, MW-2, MW-3 and MW-4 as high as 1,300 ppb. Profile Well Nos. MW-1 through MW-4 are located just downgradient of the MacKenzie site. According to the SCDHS, trichloropropane was used and stored (in three 10,000 gallon tanks) at the site.

Tetrachloroethene was also detected in Profile Well Nos. MW-1, MW-2, MW-3 and MW-4 at concentrations ranging from non-detect to 47 ppb. Trichloroethene was detected at 7 ppb in the upper part of the aquifer in Profile Well Nos. MW-1 through MW-4. However, higher concentrations ranging from 21 to 330 ppb were detected in Profile Well No. MW-8, 50 feet and 110 feet below the water table. Profile Well No. MW-8 is located 2,700 feet downgradient of the Mackenzie Chemical. The SCDHS data has been tabulated and contained in the RI/FS Work Plan, which is included in this RI by reference.

NYSDEC staff has visited the site on several occasions during the last two years, in order to determine the present condition of the site and to develop an RI/FS work plan. The project scoping visit, held on February 5, 1998, included representatives from NYSDEC, LMS, H2M, SCDHS and the Town of Islip. Security measures were instituted at the site to facilitate access during field activities. The Town of Islip representative requested that the tenants of the facility, who were operating the vehicle repair shop, remove various vehicles, boats, etc., which were in violation of the zoning law. Several large construction and debris piles, one with two large storage tanks and the other with used tires, were noted. The NYSDEC staff visited the site again on May 5, 1998. Subsequently, most of the vehicles and boats were removed. Approximately 100 five gallon pails of asphalt sealer were found in the one of the buildings.

1.3 Report Organization

This RI/FS Report follows the general outline proposed in the NYSDEC-approved RI/FS Work Plan (July 1998). Section 2.0 summarizes the investigation techniques used to conduct the RI field work. Section 3.0 discusses the physical characteristics of the MacKenzie Chemical site area, including surface features, surface water hydrology, surrounding land use, regional geology and hydrogeology. Section 4.0 presents the results of the field investigation in terms of the nature and extent of contamination in soils and groundwater. Quality Assurance/Quality Control (QA/QC), data validation and data usability are discussed in Section 5.0. Section 6.0 presents a discussion of the fate and transport of the contaminants. The qualitative health risk analysis conducted for the site is presented in Section 7.0.

2.0 STUDY AREA INVESTIGATION TECHNIQUES

This section of the RI/FS Report presents a description of the field investigation activities conducted during the investigation phase of the project. Investigative techniques and analytical procedures are discussed in subsections for each procedure and methodology used. A summary of the samples collected by media in support of the RI/FS is included in Table 2.1.

Field investigation activities during the RI/FS included the installation and sampling of groundwater monitoring wells, collection and analysis of surface soil samples, collection and analysis of groundwater samples using the Geoprobe method, air sampling, and completion of soil borings for both soil and groundwater collection.

As discussed in Section 1.0, the objectives of the RI included evaluating the nature and extent of contamination in the following media:

- On-site unsaturated and saturated soils associated with the previously identified source area and points of potential impact such as subsurface waste disposal systems, waste lagoons, and stormwater drywells.
- On- and off-site groundwater associated with the previously identified source area and other potential source areas discussed above.

To support the objectives of the RI/FS, several methodologies were utilized to collect representative samples of potentially impacted media (e.g., soil, groundwater, etc.). The following subsections describe in detail the methodologies used and the samples collected in support of the RI/FS.

2.1 Installation of Off-Site Vertical Profile Wells

To evaluate groundwater quality downgradient of the MacKenzie Chemical site, an extensive groundwater investigation was completed using the direct-push sampling technology (Geoprobe).

Based upon the review of the data from on-site wells and existing reports, eleven (11) geoprobe groundwater sampling locations (identified as VP-1 through VP-11) were selected and approved by the NYSDEC. The locations of the geoprobe groundwater sampling locations are shown on Figure 2.1. Groundwater samples were collected at varying depth intervals at each location and retained for analysis.

All groundwater samples from each interval were analyzed in the field for TCL VOCs by the on-site mobile laboratory. Samples collected from VP-2 at 80 feet below grade surface (bgs), VP-3 at 60 feet bgs, VP-4 at 120 feet bgs, VP-6 at 80 feet bgs, VP-8 at 80 feet bgs and VP-10 at 100 feet bgs were analyzed by the NYSDEC-approved laboratory. Each of these groundwater samples submitted to the analytical laboratory were analyzed for Target Compound List (TCL), Volatile Organic Compounds (VOCs), Target Analyte List (TAL) metals, pesticides and PCBs.

The geoprobe groundwater sampling was conducted from November 9 through November 17, 1998. To collect each groundwater sample, a screen point sampler was threaded onto the leading end of a probe rod and driven to the desired sampling interval (i.e., depth). While the sampler was driven to the desired depth, o-ring seals at the drive head and an expendable drive point provided a water tight system. Once the desired sampling interval was reached, chase rods were sent down the hole until the leading rod contacted the bottom of the sampler screen. The tool string was then retracted, while the screen was held in place with the chase rods. As the tool string was retracted, the expendable point was released from the sampler sheath. The tool string and sheath were retracted the full length of the screen to allow

groundwater to enter. This sampling procedure was completed at 60 feet, 80 feet, 100 feet and 120 feet below grade.

After review of the geoprobe vertical profile groundwater sampling analytical data, additional off-site groundwater sampling was performed. The purpose of the additional groundwater sampling was to better determine the extent and direction of the 1,2,3-trichloropropane plume at the deeper intervals of the aquifer and assist in locating the farthest off-site downgradient monitoring well to be installed. The additional off-site groundwater investigation was performed utilizing the HydroPunch sampling technique. The locations of the additional groundwater sampling locations are shown on Figure 2.1.1. From each of the additional groundwater sampling locations, samples were collected at varying intervals and analyzed by H2M Labs for TCL VOCs. Groundwater samples from HydroPunch-1 were collected from 120 feet, 140 feet and 160 feet below ground surface. From HydroPunch-2 groundwater samples were collected from 80 feet, 100 feet, 120 feet, 140 feet and 160 feet bgs. Groundwater samples from HydroPunch-3 were collected from 140 feet and 160 feet bgs, and from HydroPunch-4 from 120 feet, 140 feet and 160 feet bgs.

The HydroPunch groundwater sampling was conducted from December 9 through December 22, 1998. To collect each groundwater samples, drilling was conducted utlizing a hollow stem auger which was advanced below the depth of the sampling interval. The temporary groundwater sampling points were conducted utilizing the hollow stem auger technique to advance the borehole and the HydroPunch sampling device to collect discrete groundwater samples. The HydroPunch drive point was attached to a hollow 1.75-inch diameter sealable tube. The tube acts as a sample chamber and is isolated from the environment by two rubber O rings and two check valves. Once the desired sampling depth is achieved, the HydroPunch sampling device was opened by pulling back on the body of the tool, exposing a short section of screen. The groundwater present in the desired sampling location fills the chamber by hydrostatic pressure. Once the chamber is filled, the tool is withdrawn from the borehole. Increased hydrostatic head within the tool closes upper and lower check valves on the chamber, thereby retaining the water sample within the body of the sampler. This sampling procedure was completed at each of the HydroPunch sampling intervals listed above.

2.2 On-site Drainage Structure Soil Sampling

To evaluate the chemical and physical nature of the sediments in the bottom of on-site drainage structures, soil borings were conducted through the center of each accessible stormwater drywell. A total of nine soil borings (DS-2, DS-3, DS-6, DS-9, DS-11, DS-12, DS-13, DS-14 and DS-15) were completed utilizing the GeoProbe method. (see Figure 2.2). At each of the nine locations, a total of three soil samples (bottom of structure, 25 feet bgs and 40 feet bgs) were retained for analysis. Two of the three soil samples were submitted for TCL VOCs, plus 1,2,3-trichloropropane analysis by the mobile laboratory and one soil sample was sent to the analytical laboratory for TCL/ TAL analysis by CLP procedures. The TCL/TAL sample was collected from the bottom of the structure. The TCL/TAL analyses includes TCL VOCs, TCL semi-volatile organics (SVOCs), pesticides and PCBs, and TAL metals plus cyanide.

Two (2) waste lagoons located on the subject site were also sampled. The location of the sampling points is illustrated on Figure 2.3. The samples were collected utilizing the GeoPrope method from locations immediately downgradient of the subject waste lagoons, so as not to disrupt the integrity of the bottom of the waste lagoon. Three (3) soil samples were collected from each of the two (2) sampling points at three (3) discrete sampling intervals, 8 feet, 25 feet and 40 feet below ground surface. All six samples were analyzed for TCL VOCs, with two soil samples (WL-1[8-ft], and WL-2[8-ft]) being analyzed for SVOCs, TAL metals, pesticides and PCBs by the analytical laboratory.

In addition to the soil samples collected adjacent the two subject waste lagoons, samples of the liquid matrix encountered within one of these lagoons was sampled and analyzed in the field for TCL VOCs by the on-site mobile laboratory (DS-5). In addition, one liquid sample was collected from the discharge of subsurface pipe, near DS-12. This sample was also analyzed for TCL VOCs by the on-site mobile laboratory (DS-12 Pipe).

2.3 Soil Gas Sampling Program

To evaluate the presence of potential source areas and provide a better evaluation of the nature and extent of soil contamination in the potential source area, a soil gas sampling program was undertaken. The soil gas sampling program included sampling at four (4) on-site, and 12 off-site locations (see Figure 2.4), for a total of 16 sampling points. Soil gas samples were collected from three (3) discrete depths (five feet, ten feet and 15 feet below ground surface) at each of the 16 locations. The soil gas samples were analyzed for TCL VOCs.

Soil gas sampling was performed through a direct pull method were a volumetric air sampler drew air (the soil gas sampling media) through a sorbent tube. The air sampler used was a constant flow rotary carbon vain pump (Graseby Anderson model 10-709). The draw rate was continually monitored with a velocity meter. A sorbent tube was directly connected to a poly vinyl chloride (PVC) tube which was installed in the subsurface. The tubes were installed to depths of 5, 10 and 15 below grade. The sorbent tube was then connected to the velocity meter and the air sampler. Air sampling media was drawn through the sorbet tube for approximately 20 to 25 minutes at a rate of 0.16 to 0.2 liters per minute to provide a known sample volume.

2.4 Soil Sampling Program

To assist in preparing the qualitative risk assessment, thirty (30) on-site surface soil samples (SS-1 through SS-21) were collected from eighteen (18) locations near the potential source areas (i.e., drywells, areas of staining, etc.). The location of each soil sampling point is shown on Figure 2.5. All of the on-site soil samples were analyzed for TCL VOCs by the on-site mobile laboratory. The on-site soil sampling was performed utilizing direct push technology (probing). After reviewing the surface soil sampling results (0ft to 4ft) by the mobile laboratory, several borings were advanced deeper and sampled in an attempt to define the vertical extent of contamination.

Additional surface soil samples were collected off-site. Surface soil samples SS-100, SS-200, SS-300 and SS-400 were collected south of the subject site to determine the presence of off-site surface soil contamination. The location of each soil sampling point is shown on Figure 2.5. These four surface soil samples were collected from the surface (0 ft) to one-foot (1 ft) below grade, by use of a hand spade. All four soil samples were analyzed for TCL VOCs, SVOCs, and TAL metals by H2M Labs.

2.5 Off-Site Groundwater Monitoring Well Installation

Following completion of the off-site geoprobe vertical profile groundwater sampling, a total of ten (10) additional groundwater monitoring wells were installed at five locations. At two of these locations well triplets were installed, consisting of one shallow well, one intermediate well, and one deep well. The first well triplet is identified as OS-2S, OS-2I, OS-2D respectively, and the second is identified as OS-3S, OS-3I and OS-3D. The additional off-site deep wells were installed to evaluate the groundwater conditions downgradient of the site at depth. A potentiometric surface map, indicating a south-southeast groundwater flow direction for the shallow aquifer is presented in Figure 2.6. To determine the groundwater quality upgradient of the subject site, a monitoring well couplet was installed consisting of one shallow and one deep well, identified as OS-5S and OS-5D. The upgradient wells were installed directly north of the western terminus of the subject site, and just south of the railroad tracks. At the remaining two locations, single monitoring wells were installed, identified as OS-1D and OS-4D. The locations of these wells are illustrated in Figure 2.7. The well construction details are provided in Table 2.2.

Initially, ten groundwater samples were collected from the off-site monitoring wells, one sample from each of the ten wells. The wells were developed and sampled on January 21, 1999, approximately two weeks after installation of the last well. Each of the samples collected were analyzed for TCL VOCs, SVOCs, TAL metals, pesticides and PCBs by the analytical laboratory. All appropriate QA/QC samples as specified in the RI Work Plan were collected and analyzed.

Three (3) additional off-site monitoring well sampling programs were undertaken on August 10, 1999, November 16, 1999, and February 23, 2000. During all three additional sampling programs, all ten wells were sampled. It should be noted that the well casing of monitoring well OS-2D was damaged. All samples collected were analyzed for TCL VOCs, by the analytical laboratory.

2.6 On-Site Existing Groundwater Monitoring Well Sampling

Four existing on-site groundwater monitoring wells were sampled as part of this RI/FS to ascertain the groundwater conditions underlying the site. The four monitoring wells at the site are identified as MCMW-1, MCMW-3, MCMW-4 and MCMW-5. Monitoring well MCMW-2 could not be found due to regrading of the area. The location of the four on-site monitoring wells sampled are illustrated on Figure 2.8.

Groundwater samples were collected from each of these four monitoring wells on January 21, 1999, and retained for laboratory analysis. Each of the samples collected were analyzed for TCL VOCs, SVOCs, TAL metals, pesticides and PCBs by the analytical laboratory. All appropriate QA/QC samples as specified in the RI Work Plan were collected and analyzed.

2.7 Off-Site Manhole Sampling

During the August, 1999 off-site groundwater sampling event, a manhole at the entrance of 1 Cordello Drive was discovered. A grab sample of soils at the bottom of the manhole were collected. The soil sample collected was analyzed for TCL VOCs, SVOCs, and TAL metals by the analytical laboratory.

2.8 Drumed Waste Sludge Sampling

In order to provide access to the bottom of the on-site lagoons, waste sludge in the lagoons were removed and placed in twelve (12) 55-gallon drums. In order to dispose of the subject drums, a waste characterization sample was collected. The sample was analyzed in the laboratory for metals, volatile organics, and PCBs.

3.0 PHYSICAL CHARACTERISTICS

This section of the RI Report discusses the pertinent physical characteristics of the MacKenzie Chemical site including surface features, surface water hydrology, geology, hydrogeology, demography, land use and ecology. The site-specific geology and hydrogeology as determined by the field investigation are further discussed in Section 4.0.

3.1 Surface Features

The local topography surrounding the site consists of relatively flat terrain with a very slight southerly slope. Gradients of man-made surfaces (i.e., fill areas) at the site vary approximately five feet due to construction and demolition debris fill at the southwest corner of the site. The Long Island Rail Road tracks north of the site produces a berm approximately 2 feet above the general ground surface of the subject site. The eastern half of the subject site is currently used for storage of construction materials, such as sand and fill, and varying size piles. These materials are stored on the site on a temporary basis, and thus these surface features change regularly.

3.2 Surface Water Hydrology

No surface water bodies exist within the borders of the MacKenzie Chemical site. Additionally, there is no evidence of ephemeral streams or steam-cut channels on the site. Review of the Central Islip 7.5 minute quadrangle United States Geographic Survey (USGS) topographic maps support these field observations. A large low-lying area exists several miles east of the subject site, and is associated with the Connetquot Brook. Generally the ground rises gradually to the north, achieving a difference in elevation several miles to the north of approximately 70 feet.

3.3 Hydrogeologic Setting

The geologic formations that underlie Suffolk county are composed of a series of thick deposits of unconsolidated water bearing sediments of late Cretaceous and Pleistocene age. These unconsolidated deposits are underlain by crystalline bedrock of Precambrium age.

There are three primary water bearing aquifers underlying Suffolk County. These aquifers, from shallow to deep are the Upper Glacial, Magothy and Lloyd. The aquifers are considered to be hydraulically connected, with the Glacial and Magothy contributing recharge for the underlying Lloyd aquifer. Collectively, they are a federally designated sole source of drinking water for Long Island.

During the glacial retreat, the area was covered with outwash deposits that constitute most of the upper glacial aquifer of Long Island. Because these sand and gravel deposits contain virtually no interstitial clay and silt, the upper glacial aquifer is the most permeable aquifer on Long Island. The estimated average horizontal hydraulic conductivity of the outwash is from 1,000 to 1,500 gpd/ft^2. The direction of groundwater movement through Long Island's aquifers is horizontal, and is generally more rapid than the movement in the vertical direction. This arises because of an anisotropic effect: the largest dimensions of particles in the interbedded fine- and coarse-grained layers tend to be oriented horizontally.

Groundwater in the upper glacial aquifer flows away from two major highs on the main water table divide on Long Island. The general directions of groundwater flow of the Island are north toward Long Island Sound and south toward Great South Bay. Based on previous investigations, local groundwater flow at the site moves south to southeast toward Great South Bay.

The upper glacial aquifer is underlain by the Cretaceous unconsolidated deposits of the Magothy aquifer. The Magothy aquifer consists of beds and lenses of gray fine to coarse sand

that contains traces to large amounts of interstitial clay and silt. During Tertiary and most likely in Pleistocene times, the surface of the Magothy aquifer was deeply eroded. The average of vertical and horizontal permeabilities of the Magothy aquifer is about 5 gpd/ft^2 and 380 gpd/ft^2, respectively. The average transmissivity value is 150,000 gpd/ft.

The Magothy aquifer is underlain by the clay member of the Raritan formation. This formation completely covers the underlying Lloyd aquifer in the area. The relatively low permeability of the Raritan clay creates a slow movement of water into the Lloyd aquifer. The hydraulic head loss is much larger across this unit than across a comparable thickness of the Magothy and upper glacial aquifers. Thick, areally persistent Raritan clay that lies between Magothy and Lloyd aquifers impedes but does not prevent downward movement of groundwater into the Lloyd aquifer. The water in the Lloyd aquifer is confined between the clay member and bedrock. The Lloyd aquifer is moderately permeable, with an average horizontal permeability ranging from 300 to 400 gpd/ft. Downward leakage into the bedrock is negligible. Bedrock is poorly permeable to virtually impermeable. Some hard fresh water is contained in joints and fractures, but is impractical to develop at most places.

3.4 Demography and Land Use

A review of potentially exposed populations in support of the human-based risk assessment was conducted utilizing the 1998 Long Island Almanac. Almanac data within a one mile radius around the MacKenzie Chemical site was reviewed to determine the most probable potentially exposed populations. The largest local population is located to the south of the MacKenzie Chemical site (comprised of the Village of Centeral Islip), with a potentially exposed population of approximately 28,000 people. Review of neighboring land uses indicates that the population to the southeast is primarily residential, with small scale commercial properties also present. The area to the north and west of the site also contains some small scale industrial properties.

In addition to the general population, potentially significant sub-populations were also investigated. It was determined that there are five schools and one college (New York Institute of Technology) located within a 1 mile radius of the MacKenzie Chemical site. Of these, only one school and NY Institute of Technology are located hydraulically downgradient of the site. None of the schools should be adversely impacted by the MacKenzie Chemical site because all of the schools are connected to the public water supply.

4.0 NATURE AND EXTENT OF CONTAMINATION

This section of the RI Report evaluates and presents the nature and extent of contamination at the MacKenzie Chemical site, and is organized based upon the media sampled. Section 4.1 discusses the chemical nature of the soils at the site. Section 4.2 discusses the chemical nature of the groundwater beneath the site. Finally, Section 4.3 discusses the chemical nature of the off-site groundwater.

Because the MacKenzie Chemical facility is a NYSDEC Class 2 Inactive Hazardous Waste Site, the initial Standard Criteria and Guidance (SCG) for soils analyzed as part of the RI were selected to be the Recommended Soil Cleanup Objectives (RSCOs) presented in the NYSDEC Division Technical and Administrative Guidance Memorandum (TAGM): Determination of Soil Cleanup Objectives and Cleanup Levels, HWR-94-4046, January 24, 1994 (revised April 1995). The initial SCGs for groundwater are the Class GA Groundwater Quality Standards presented in the NYSDEC Water Quality Regulations for Surface Waters and Groundwaters, 6 NYCRR Parts 700-705.

4.1 Nature and Extent of Contamination in Soil

There are several areas of the MacKenzie Chemical facility where the chemical nature of in-situ soil was characterized during the current RI. The activities conducted for this characterization included the collection of on-site soil samples and soil borings near the identified source areas (waste lagoon areas, stained soils, etc.), soil borings through the existing on-site drainage structures and waste lagoons, and off-site surface soil samples south of the subject site property line.

4.1.1 Soil Sampling Results

To assist in evaluating the nature and extent of contamination and preparing the qualitative risk assessment, 31 on-site soil samples (SS-1 through SS-21) were collected from

areas near the potential source areas. The location of each of the surface and subsurface soil samples is shown in Figures 2.5 and 4.1. The on-site mobile laboratory analyzed all soil samples for TCL VOCs. After review of the soil sampling results (0 ft to 4 ft) from the mobile laboratory, several borings were advanced deeper and sampled in an attempt to define the vertical extent of contamination. All of the soil samples were collected from the unsaturated zone. Depth to water beneath the site is approximately 48 to 52 feet bgs. In addition, four (4) off-site surface soil samples (SS-100 through SS-400) were collected. The location of the off-site surface soil samples is illustrated in Figure 2.4. The off-site soil samples were analyzed in the laboratory for TCL VOCs, SVOCs, and TAL metals.

TCL VOCs

The TCL VOC analytical results from the mobile laboratory are presented in Table 4.1 and Figure 4.1. TCL VOCs were not detected in the shallow soil samples (e.g., 0- to 4-feet bgs) from SS-8, SS-9, SS-11, SS-20 and SS-21. Concentrations of several VOCs were well below the NYSDEC RSCO in the shallow soil samples from SS-1, SS-2, SS-10, SS-12, SS-13, SS-14 and SS-17, ranging from 2 (trichloroethene (TCE)) to 240 (toluene) ug/kg. Concentration levels of 1,2,3-trichloropropane (1,2,3-TCP) above the NYSDEC RSCO of 400 ug/kg were detected in the shallow soil samples from SS-3, SS-4, SS-5, SS-6, and SS-15, ranging from 570 to 680,000 ug/kg. PCE was detected in the shallow soil sample from SS-18 above the NYSDEC RSCO (1,400 ug/kg) at a concentration level of 2,340 ug/kg.

To determine the vertical nature of contamination, deeper soil samples were collected from the soil borings SS-3, SS-4, SS-5, SS-6, SS-13 and SS-15. As shown in Table 4.1 and Figure 4.1, 1,2,3-TCP was not detected above the NYSDEC RSCO in the deeper soil samples collected from SS-6, SS-13 or SS-15. The deeper soil samples collected from SS-5 contained 1,2,3-TCP at concentrations above the NYSDEC RSCO levels in the four to eight foot (4 –8 ft.) interval, but concentrations drop below applicable levels in the 20-24 foot and 40 foot intervals. The deeper soil samples from SS-3 (21 feet and 41 feet) detected higher concentrations of 1,2,3-

TCP than the 0-4 foot sampling interval. The 21 foot interval reported a concentration of 680,000 ug/kg, while the 41 foot sampling interval reported 1,2,3-TCP at 290,000 ug/kg.

The TCL VOC analytical results of the off-site sampling program from the analytical laboratory are presented in Table 4.1.1. TCL VOCs were not detected in any of the four soil samples.

TCL SVOCs

The TCL SVOC analytical results for the off-site soil samples are included in Table 4.1.2. As indicated in the table, no SVOCs above detected above the laboratory detection limit or their respective RSOCs.

TAL Metals

The TAL metals analytical results are included in Table 4.1.3. As indicated in the table, two TAL metals wre detected above their respective NYSDEC RSCO. Mercury concentrations ranging from 0.15 to 0.89 mg/kg were found in all four off-site soil samples. These concentrations are above the NYSDEC RSCO level of 0.1 mg/kg, but within or slightly above the EUS background concentration levels of 0.002 to 0.2 mg/kg. Zinc concentration levels ranging from 63.6 to 145 mg/kg were detected in all four off-site soil samples. These concentration levels are only slightly above the EUS background concentration of 9 to 50 mg/kg.

Summary of On-Site Soil Boring Sampling Results

In summary, significant concentrations of 1,2,3-TCP and PCE were detected in the unsaturated soils from six of the 18 on-site sampling locations (SS-3, SS-4, SS-5, SS-6, SS-13 and SS-15). Three of the on-site sampling locations (SS-3, SS-4 and SS-5) exhibit significant concentration levels of 1,2,3-TCP to depth (approximately 40 feet bgs). As indicated in Figure 4.1, the highest concentrations of 1,2,3-TCP were observed in the soil samples collected from

locations just east of the on-site two-story building. Concentrations of 1,2,3-TCP, with the exception of samples collected from SS-3, attenuated with depth where deeper soil samples were collected. No VOC or SVOC concentration levels in the off-site soil samples exceeded their respective levels of concern. Mercury and zinc were the only metals detected above their respective NYSDEC concentrations of concern.

4.1.2 On-Site Drainage Structure Soil Sampling Results

As per the NYSDEC-approved RI/FS Work Plan, a soil boring sampling program was completed through the center of accessible stormwater drywells on the site (see Figures 2.2 and 4.2). Soil samples were collected through the center of the nine accessible on-site drywells from three distinct intervals; the bottom of the structure, 25 feet and 40 feet bgs. Typically, the samples collected from the bottom of the drainage structure were submitted to the analytical lab for TCL VOCs, TCL SVOCs, TCL pesticides/PCBs and TAL metals plus cyanide analyses while the two samples collected at 25 and 40 feet bgs below each structure were submitted for TCL VOC plus 1,2,3-TCP analysis by the on-site mobile laboratory.

TCL VOCs

The TCL VOC analytical results from both the mobile laboratory and the NYSDEC-approved analytical laboratory are presented in Tables 4.2 and 4.3, respectively. 1,2,3-TCP was detected at 20,400 ug/kg in the soil sample collected from 14 feet bgs in soil boring DS-9; however, no detectable concentrations of 1,2,3-TCP were detected in the 25 to 27 foot or 40 foot sampling intervals from DS-9 indicating that 1,2,3-TCP attenuates with depth. Elevated concentration levels of 1,2,3-TCP were detected in soil boring DS-14. The 8 to 12 foot soil sample had a concentration of 87,000 ug/kg, and the 41 foot sampling interval reported 2,300 ug/kg, while the 21 foot bgs soil sample contained 7.2 ug/kg of 1,2,3-TCP, well below the 400 ug/kg RSCO. Figure 4.2 illustrates the concentrations of 1,2,3-TCP at the subject drainage structures. There were no other VOCs present above RSCO in any of the remaining soil borings.

In summary, the analytical laboratory results indicated a significant concentration level of 1,2,3-TCP in the shallow soil samples collected from DS-9 and DS-14. As indicated on Figure 4.2, both of these structures were present east or south of the on-site two-story building.

TCL SVOCs

The TCL SVOC analytical results are presented in Table 4.4. Several SVOC compounds were detected in soils from DS-13. The soil sample collected from DS-13 (10-12 foot sampling interval) contained several SVOCs above their respective RSCO. For example, benzo(a)anthracene was detected at a concentration level of 17,000 ug/kg in DS-13 well above the NYSDEC RSCO of 224 ug/kg. Chrysene was also detected in DS-13 at 14,000 ug/kg, well above the NYSDEC RSCO of 400 ug/kg. Both benzo(b)fluoranthene and benzo(k)fluoranthene were reported at 28,000 ug/kg and 11,000 ug/kg respectively. The mutual NYSDEC RSCO for these compounds is of 224 ug/kg. Benzo(a)pyrene was detected at a concentration level of 23,000 ug/kg, this compounds NYSDEC RSCO is 61 ug/kg. Indeno(1,2,3-cd)pyrene, with a NYSDEC RSCO is 3,200 ug/kg, was reported at a concentration level of 14,000 ug/kg. The concentration level of dibenzo(a,h)anthracene was reported at 2,400 ug/kg well above the NYSDEC RSCO of 14 ug/kg.

TCL Pesticides/PCBs

The TCL pesticides and PCBs analytical results are presented in Table 4.5. No pesticides or PCBs were detected above the Contract Required Detection Limits (CRDLs) in any of the nine samples analyzed by the analytical laboratory.

TAL Metals and Cyanide

The TAL metals and cyanide analytical results are presented in Table 4.6. With the exception of mercury in the soil samples from DS-9 and DS-12, and zinc in the soil samples

collected from DS-12, no TAL metals or cyanide were detected above their respective NYSDEC RSCOs and/or Eastern United States (EUS) background concentrations.

Mercury concentrations of 0.27 and 1.0 mg/kg were detected in soil samples from DS-9 and DS-12, respectively. These concentrations are above the NYSDEC RSCO level of 0.1 mg/kg and above the EUS background concentration level of 0.001 to 0.2 mg/kg. Zinc at 52.5 and 224 mg/kg was present in the soil samples collected from DS-12 and DS-13, respectively. This concentration level is only slightly above the Eastern United States (EUS) background concentration of 9 to 50 mg/kg.

Summary of On-Site Drainage Structure Soil Sampling Results

In summary, concentration of 1,2,3-TCP was detected in soil samples collected from drainage structures DS-9 and DS-14. These structures are located to the east and southeast of the two-story building in the western end of the subject site. In addition, SVOCs were present in concentrations exceeding NYSDEC RSCO in the soil sample from DS-13. There were no significant concentrations of TCL pesticides/PCBs detected in any of the soil samples collected from the on-site drainage structures. Mercury and zinc were the only metals detected above their respective NYSDEC concentrations of concern. Both metals were found in concentrations above both the NYSDEC RSCOs and the Eastern United States (EUS) background concentrations in the soil samples collected associated with on-site drainage structures.

4.1.3 On-Site Waste Lagoon Soil Sampling Results

A soil boring sampling program was completed at two on-site waste lagoons (see Figures 2.3 and 4.3). Soil samples were collected from borings adjacent to the two accessible on-site lagoons so that the integrity of the concrete bottom of the lagoons was not compromised. Three soil samples were collected from each of the two sampling points at 8 feet, 25 feet and 40 feet bgs. All six samples were analyzed for TCL VOCs. The 8-foot bgs soil sample from each

boring was also analyzed for TCL SVOCs, TCL pesticides/PCBs and TAL metals by the analytical laboratory.

Additionally, samples of the materials within each of the waste lagoons were collected and analyzed for waste-characterization purposes. The samples were analyzed for VOCs, TCLC SVOCs and metals. The results are presented in Section 4.3, *Nature and Extent of Contamination in Miscellaneous Areas, Drummed Waste Lagoon Sludge.*

TCL VOCs

The TCL VOC analytical results from the NYSDEC-approved analytical laboratory are included in Table 4.7 and Figure 4.3. With the exception of one slight exceedance of 1,2,3-TCP (RSCO of 400 ug/kg), no TCL VOC was present above its respective NYSDEC RSCO. 1,2,3-TCP at concentrations of >500, 50 and 40 ug/kg were detected in the 8-, 25- and 40-foot bgs soil samples, respectively collected from adjacent to Waste Lagoon Number 1. Additionally, MEK was detected in all three samples ranging in concentrations from 120 to 150 ug/kg. TCL VOCs were not detected in any of the soil samples collected adjacent to Waste Lagoon Number 2.

TCL SVOCs

The TCL SVOC analytical results are presented in Table 4.8. N-nitrosodiphenylamine was detected in both the WL-1 and WL-2 soil samples, with concentration levels of 25,000 and 1,700 ug/kg respectively. There is no NYSDEC RSCO established for this SVOC. Several SVOCs were detected in the 8-foot bgs soil sample from Waste Lagoon Number 2 exceeding their respective RSCO; however, it should be noted that all of the SVOCs present above SCGs were detected at concentrations below their respective NYSDEC Contract Required Detection Limit (CRDLs). The CRDL is the minimum level of detection acceptable under the Contract Laboratory Program Statement of Work. In general, the CRDL is the lowest concentration level of an analyte which can be detected by the laboratory instrument adjusted for sample size, dilution, and moisture.

TCL Pesticides/PCBs

The TCL pesticides/PCBs analytical results are presented in Table 4.9. No pesticides or PCBs were detected above the CRDLs in either of the two samples.

TAL Metals and Cyanide

The TAL metals and cyanide analytical results are presented in Table 4.10. None of the metals were detected above their respective NYSDEC concentration of concern.

Summary of On-Site Waste Lagoon Soil Sampling Results

In summary, based upon the analytical results from soil samples collected from adjacent to two on-site waste lagoons, there does not appear to be any significant impact to the unsaturated soils.

4.2 Nature and Extent of Contamination in Groundwater

The nature and extent of contamination in groundwater was evaluated as part of the RI. The activities conducted for this phase of work included:

- Sampling of groundwater from the existing on-site monitoring wells
- Collection of groundwater samples in a comprehensive vertical profile investigation downgradient of the subject site utilizing the geoprobe sampling technique.
- Collection of deep vertical profile groundwater samples downgradient of the subject site utilizing the HydroPunch sampling technique.
- Installation and sampling of off-site groundwater monitoring wells, both downgradient and upgradient of the site.

4.2.1 On-Site Groundwater Sampling Results

The previously installed on-site monitoring wells, identified as MCMW-1, MCMW-3, MCMW-4 and MCMW-5 (see Figure 2.8) were sampled and the groundwater samples analyzed for TCL VOCs, SVOCs, TAL metals, pesticides/PCBs by the analytical laboratory. As previously mentioned, existing monitoring well MCMW-2 could not be located due to site re-grading activities.

TCL VOCs

The TCL VOC analytical results are presented in Table 4.11 and Figure 4.4. With the exception of PCE, no TCL VOCs were detected above laboratory detection limits in any of the groundwater samples. 1,2,3-TCP was detected in MCMW-3 and MCMW-5 at 250 µg/l and 40 µg/l, respectively . PCE was detected in groundwater samples collected from MCMW-3, MCMW-4 and MCMW-5 at concentrations above NYSDEC Class GA Water Quality Standard of 5 µg/l. Concentrations of PCE ranged from 13 µg/l (MCMW-3) to 54 µg/l (MCMW-5). Based upon a south southeast groundwater flow direction (see Figure 2.6.1) and the majority of the 1,2,3-TCP being detected in the unsaturated zone east and south of the two-story building, none of the existing on-site groundwater monitoring wells were ideally located to evaluate the on-site presence of 1,2,3-TCL.

TCL SVOCs

The TCL SVOC analytical results are presented in Table 4.12. With the exception of bis-(2-ethylhexyl)phthalate and 2-nitroanaline, no TCL SVOCs were detected in any of the groundwater samples. Bis-(2-ethylhexyl)phthalate was detected in the groundwater samples collected from all four wells ranging from 6 µg/l (MCMW-1) to 35 µg/l (MCMW-4), slightly above the NYSDEC groundwater standard of 5 µg/l. 14 µg/l of 2-nitroanaline was detected in the groundwater sample collected from MCMW-5, slightly above the NYSDEC groundwater standard of 5 µg/l.

TCL Pesticides/PCBs

The TCL pesticides/PCBs analytical results are presented in Table 4.13. No pesticides or PCBs were detected above the NYSDEC groundwater standards in any of the four samples.

TAL Metals and Cyanide

The TAL metals and cyanide analytical results are included in Table 4.14. As indicated in the Table, several TAL metals were detected above the Class GA Water Quality Standard. Arsenic was detected at 25.2 µg/l in MCMW-3 and 29.5 µg/l in MCMW-5, slightly above the NYSDEC standard of 25 µg/l. Cadmium was detected at concentrations of 16.8 µg/l and 19.2 µg/l in the same two wells respectively, which is above the NYSDEC standard of 5 µg/l. All four groundwater samples contained iron concentrations well above the NYSDEC standard of 300 µg/l. Iron concentrations ranged from 6,590 µg/l in MCMW-1 to 116,000 µg/l in MCMW-3. Lead concentrations were detected in MCMW-3 and MCMW-5 at 73.8 µg/l and 27.2 µg/l, respectively, above the groundwater standard of 25 µg/l. Manganese was detected in MCMW-1, MCMW-3 and MCMW-4 at 388 µg/l, 1,730 µg/l and 5,110µg/l respectively. The NYSDEC groundwater standard for manganese is 300 µg/l. The concentration of nickel in MCMW-4 (131 µg/l) was slightly above the standard of 100 µg/l. In monitoring well MCMW-5, aconcentration of 25,800µg/l was reported for sodium, slightly above the NYSDEC groundwater standard of 20,000 µg/l. None of the other TAL metals or cyanide were detected above the Class GA Water Quality Standards.

4.2.2 Off-Site Geoprobe Vertical Profile Groundwater Results

In order to evaluate groundwater quality downgradient of the site and effectively select locations for off-site groundwater monitoring wells, a series of geoprobe sampling locations were drilled downgradient of the MacKenzie Chemical site. The vertical profile groundwater sampling activities were conducted in two rounds. Data from the first round was used to select locations for the second round of sampling. The geoprobe vertical profile sampling points are

identified as VP-1 though VP-11 (see Figure 2.1). All 43 samples collected were analyzed for TCL VOCs by the on-site mobile laboratory. Samples collected from VP-2 at 80 feet bgs, VP-3 at 60 feet bgs, VP-4 at 120 feet bgs, VP-6 at 80 feet bgs, VP-8 at 80 feet bgs and VP-10 at 100 feet bgs were analyzed for TCL VOCs, SVOCs, TAL metals, pesticides and PCBs, by the analytical laboratory.

TCL VOCs

The TCL VOC analytical results from the on-site mobile laboratory for the geoprobe vertical profile sampling program are presented in Table 4.15. Acetone, a typical laboratory contaminant was detected in groundwater samples from VP-4 (100 foot sampling interval), VP-5 (60 foot sampling interval), and VP-7 (60 foot and 80 foot sampling intervals). PCE was detected at 5,600 ug/l in the shallow groundwater sample (60 feet) of VP-11 but not in the deeper samples. Additionally, PCE was not detected in any of the sampling points located downgradient of VP-11 (i.e., VP-5, VP-6, VP-9 and VP-10).

1,2,3-TCP was detected in several groundwater samples downgradient of the site exceeding the NYSDEC Class GA Water Quality Standard of 0.04 $\mu g/\ell$ (see Figure 4.5). The highest concentration of 1,2,3-TCP was detected in the 60-foot bgs groundwater sample collected from VP-2 which is located approximately 100-feet downgradient of the site. The 34,000 ug/l, 2,200 ug/l, 5,200 ug/l and 2,200 ug/l 1,2,3-TCP were detected in the 60-, 80-, 100- and 120-foot bgs samples, respectively collected from VP-2. Additionally, 1,2,3-TCP was detected in the 60-, 80- and 100-foot bgs groundwater samples collected from VP-11 at 570 ug/l, 9,300 ug/l and 2,000 ug/l, respectively. VP-11 was located approximately 500 feet downgradient of the site.

TCL SVOCs

The TCL SVOC analytical results are presented in Table 4.17. No TCL SVOCs were detected in any of the groundwater samples above Class GA Water Quality Standards.

TCL Pesticides/PCBs

The TCL pesticides and PCBs analytical results are presented in Table 4.18. No pesticides or PCBs were detected in groundwater in any of the six samples analyzed.

TAL Metals and Cyanide

The TAL metals and cyanide analytical results are presented in Table 4.19. Several metals including antimony, arsenic, barium, chromium, iron, manganese, nickel and sodium were detected in the one or more of the groundwater samples above their respective Class GA standard. It should be noted that all of the groundwater samples were very turbid; therefore, the analytical results are likely biased on the high side and may likely not reflect true aquifer conditions.

4.2.3 Off-Site HydroPunch Vertical Profile Groundwater Results

A second round of sampling was conducted utilizing HydroPunch sampling methodology to obtain vertical profile data beyond the attainable depth of the Geoprobe sampling device. These HydroPunch locations sampling points are identified as HydroPunch-1 through HydroPunch-4 (see Figure 2.1). The thirteen samples collected were analyzed at H2M Labs for TCL VOCs.

TCL VOCs

The TCL VOC analytical results for the HydroPunch vertical profile sampling program are presented in Table 4.20 and Figure 4.5.1. As indicated on Figure 4.5.1, 1,2,3-TCP was only detected in the 80-foot bgs groundwater sample collected from HP-2.

4.2.4 Off-Site Monitoring Well Groundwater Results

Following completion of the vertical profiling groundwater investigation, a total of ten additional groundwater monitoring wells were installed at five locations off-site. At two locations, well triplets (one shallow, one intermediate, and one deep well) were installed. Two other deep wells were installed downgradient of the site. An additional couplet (one shallow and one deep well) was installed north of the subject site to determine "background" conditions directly upgradient of the site. The off-site monitoring wells are identified as OS-1 through OS-5 (see Figure 2.7).

Four off-site monitoring well sampling events were undertaken to determine the groundwater quality up and downgradient of the subject site. The initial sampling event was undertaken January 21, 1999. Three subsequent sampling events were performed August 10, 1999, November 16, 1999 and February 23, 2000. The November sampling program was performed by the NYSDEC, and included only the five deep wells (OS-1, OS-2D, OS-3D, OS-4 and OS-5D). During the February 2000 sampling event, groundwater samples from four monitoring wells (OS-1D, OS-2I, OS-3D, and OS-4D) were split in the field and analyzed by the NYSDEC for quality assurance purposes. The laboratory results provided by the NYSDEC are contained in Appendix E. The initial January sampling program included the analysis for TCL VOCs, SVOCs, TAL metals, pesticides and PCBs. The subsequent sampling events included analysis for TCL VOCs only.

In addition, the U.S. Environmental Protection Agency (USEPA) also conducted a groundwater sampling program in April 2000. The results of USEPA sampling program are provided in Appendix F. The USEPA sampled seven (7) off-site downgradient wells; OS-2I, OS-2S, OS-3S, OS-3I, OS-3D, OS-4D, and OS-5D.

TCL VOCs

January 1999

The TCL VOC analytical results from the analytical laboratory for the January 1999 sampling event are presented in Table 4.21. 1,2,3-TCP was detected at 10 µg/l, 150 µg/l and > 1,000 µg/l in the groundwater samples collected from OS-2I, OS-3D and OS-3S, respectively. 1,2,3-TCP was not detected in the groundwater samples from any of the other wells. Additionally, low concentrations of 1,2-dichloropropane, TCE and PCE were detected in the groundwater samples.

August 1999

The TCL VOC analytical results from the analytical laboratory for the August 1999 sampling event are presented in Table 4.22. 1,2,3-TCP was found above NYSDEC groundwater quality standard in all monitoring wells with the exception of monitoring well OS-3D. The concentration levels of 1,2,3-TCP ranged from a high of 3,000 ug/l in OS-3S to a low of 2 ug/l in OS-2S. The NYSDEC groundwater quality standard for 1,2,3-TCP is 0.04 ug/l. No other VOCs were detected in any of the monitoring well samples.

November 1999

The TCL VOC analytical results from the NYSDEC are presented in Appendix E. No TCL VOC was found in any of the groundwater samples from the five deep monitoring wells sampled.

February 2000

The TCL VOC analytical results from the NYSDEC are presented in Table 4.23. As indicated in Table 2.23, 1,2,3-TCP was found in significant concentrations exceeding the

NYSDEC groundwater standard in six of the samples collected. Concentrations ranged from an estimated high of 8,900 ug/l in OS-3S to an estimated low of 1 ug/l in OS-2D. The NYSDEC groundwater quality standard for 1,2,3-TCP is 0.04 ug/l. In addition, benzene was detected at 110 ug/l in the groundwater sample collected from OS-3S, well above the NYSDEC groundwater standard of 1 ug/l.

USEPA April 2000

The TCL VOC analytical results from the USEPA are presented in Appendix F. As indicated, 1,2,3-TCP was found in significant concentration, 1,400 ug/l, in the sample collected from monitoring well OS-3S. The reported concentration exceeded the laboratory calibration range, and may be higher than reported. The remaining six monitoring wells sampled did not contain reportable concentration of any other VOCs.

TCL SVOCs

The TCL SVOC analytical results are presented in Table 4.24. With the exception of bis(2-ethylhexyl)phthalate, no TCL SVOCs were detected in any of the groundwater samples above NYSDEC Class GA Water Quality Standards. 40 µg/l for bis(2-ethylhexyl)phthalate was reported in the groundwater sample collected from OS-2D at the 160 foot sampling interval, above the NYSDEC Class GA Water Quality Standard of 5 µg/l.

TCL Pesticides/PCBs

The TCL pesticides and PCBs analytical results are presented in Table 4.25. No pesticides or PCBs were detected in groundwater in any of the ten samples analyzed.

TAL Metals and Cyanide

The TAL metals and cyanide analytical results are presented in Table 4.26. As indicated in the Table, several TAL metals were detected above the Class GA Water Quality Standard. Cadmium was detected at 10.4 µg/l in OS-3S and at 6.7 µg/l in OS-5S, slightly above the NYSDEC standard of 5 µg/l. Chromium was detected in concentrations of 124, 54.5 and 102 µg/l in OS-2D, OS-3S and OS-5D respectively, which is slightly above the NYSDEC standard of 50 µg/l. Iron was found in nine of the ten samples, and was found significantly above the respective NYSDEC Class GA Water Quality Standards in OS-3S (45,200 µg/l) and OS-5S (40,200 µg/l). The lead concentrations in OS-2D, OS-3S and OS-5S of 30.3 µg/l, 35.3 µg/l and 25.6 µg/l, respectively, are above the NYSDEC standard of 25 µg/l. Sodium was detected in exceedence of standards in two of the ten samples.

4.2.5 Summary of Nature and Extent of Contamination in Groundwater

TCL VOCs

Based upon the available analytical data, the primary VOC of concern in groundwater beneath and downgradient of the site is 1,2,3-TCP. The on-site monitoring well network does not have the correct geometry to accurately depict the groundwater conditions beneath the site. However, based upon the location of the source are and the results of the off-site groundwater investigation, it is likely that the groundwater is impacted to a depth of approximately 120 to 140 feet bgs south and southeast of the on-site two-story building. Additionally, the shallow aquifer beneath the site is impacted by relatively low concentrations of PCE (e.g., 13 to 54 ug/l).

The off-site 1,2,3-TCP plume appears to extent downgradient of the site past VP-11 to a maximum depth of approximately 120 to 140 feet bgs. The concentrations of 1,2,3-TCP were much higher in the groundwater samples collected utilizing the geoprobe sampling technique than those sample collected from monitoring wells. This may be due to a diluting effect of the wells equipped 10-foot long screens versus those samples collected with the 2-foot long

geoprobe screen. Figures 4.6.1 through 4.6.4 illustrate the 1,2,3-TCP concentrations reported for each of the off-site monitoring well sampling events. Figure 4.7 illustrates the anticipated 1,2,3-TCP plume cross-section.

TCL SVOCs and Pesticides/PCBs

Based upon the analytical data, SVOCs and Pesticides/PCB do not pose a problem with respect to on- or off-site groundwater.

TAL Metals

Some metals were detected above their respective Class GA standard in groundwater samples collected from monitoring wells and through the geoprobe sampling technique. The groundwater samples collected with the geoprobe were highly turbid; therefore, the analytical results are likely biased high. Metals exceeding Class GA standards were present in groundwater samples collected from both upgradient and downgradient monitoring wells; therefore, there is likely not a site-related source of metals contamination. This is also supported by the on-site soils data.

4.3 Nature and Extent of Contamination in Miscellaneous Areas

Waste Lagoons and Drain Pipe

Two potential source areas of contamination were identified on the subject site; one of the two waste lagoons (DS-5), and an excavated subsurface drain pipe (DS-12 PIPE). Liquids present in each structure were collected and analyzed for TCL VOCs by the on-site mobile laboratory.

TCL VOCs

The TCL VOC analytical results from the analytical laboratory are presented in Table 4.27. As shown in the table 1,2,3-TCP was the only TCL VOC quantified. 1,2,-3-TCP was detected in the waste lagoon liquid at a concentration of 3,900 ug/kg and in the drain pipe sample at 11,000,000 ug/kg (see Figure 4.3). It should be noted that these high concentrations resulted in very high detection limits.

Off-Site Manhole

A grab sample from the bottom of a manhole found at the entrance to 1 Cordello Drive was analyzed in the laboratory for TCL VOCs, SVOCs and TAL metals.

The TCLP metals analytical results from the analytical laboratory are presented in Appendix G. All the metals reported were within the applicable RSCO, with the exception of arsenic that was reported at 2,180 mg/kg, and zinc with a reported concentration of 66.7 mg/kg. The RSCO for arsenic is 7.5 mg/kg, or site background. Site background levels for the eastern U.S. is 3 to 12 mg/kg. The RSCO for zinc is 20 mg/kg or site background which is 9 to 50 mg/kg in the eastern U.S.

The analytical results for VOCs and SVOCs are contained in Appendix G. The sample collected contained are no reportable concentrations of either VOCs or SVOCs.

Drummed Waste Lagoon Sludge

Waste lagoon sludge was stored in 12 55-gallon drums on-site. In order to dispose of these drums, a waste characterization sampled was collected and analyzed in the laboratory for metals, volatile organics and PCBs.

The analytical results of this waste characterization are provided in Appendix H. The waste characterization reported detectable levels of several metals including barium, chromium, copper, mercury, and lead. Relatively high levels of several SVOCs were also reported. These

include naphthalene, acenaphthene, fluorene, phenanthrene, anthracene, fluoranthene, pyrene, chrysene, benzo(a)anthracene, benzo(b)fluoranthene, benzo(k)fluoranthene, benzo(a)pyrene, indeno(1,2,3-c,d)pyrene, benzo(g,h,I)perylene, 2-methylnaphthalene and dibenzofuran. Reportable TCL purgeable organics included toluene, ethylbenzene, and total xylenes. None of the reported TCL VOCs, SVOCs or metals exceed their respective hazardous waste threshold. The sample analyzed contained no reportable PCBs concentration levels.

These drummed wastes were disposed of by Environmental Services, Inc. at the Clean Water of New York facility in Staten Island, New York on June 14, 1999. The waste manifest for transportation and disposal are provided in Appendix H.

4.4 Soil Gas Sampling Results

To evaluate the presence of potential source areas and provide a better evaluation of the nature and extent of soil contamination in and around the potential source area, a soil gas sampling program was undertaken. The soil gas sampling program included sampling at four on-site locations and twelve (12) off-site locations south of the subject site (see Figure 2.5). Soil gas samples were collected from three discrete depths, five feet, ten feet and 15 feet bgs, at each of the four locations. The air samples were analyzed for TCL VOCs, by H2M Labs.

TCL VOCs

The TCL VOC analytical results from the analytical laboratory for the on-site and off-site sampling locations are presented in Tables 4.28 and 4.29, respectively. As shown in table 4.28 there were several TCL VOCs found throughout the soil column in each of the four on-site locations. The highest concentrations, and those found in each of the 12 on-site samples are dichlorofluoromethane (ranging from 11 micrograms per cubic meter (ug/m^3) to 150 ug/m^3), TCE (ranging from 3 ug/m^3 to 300 ug/m^3), PCE (ranging from 60 ug/m^3 to 600 ug/m^3), and 1,2,3-TCP (ranging from 60 ug/m^3 to 2,200 ug/m^3) (see Figure 4.8).

As indicted in Table 4.29, there were also several TCL VOCs found throughout the soil column in each of the 12 off-site locations. The highest concentrations, and those found in 35 of the 36 off-site samples, were of TCE (ranging from 4 ug/m^3 to 330 ug/m^3). Acetone was reported in 28 of the 36 samples (ranging from 3 ug/m^3 to 300 ug/m^3). Dichlorofluoromethane (ranging from 2 ug/m^3 to 220 ug/m^3) was reported in 33 of the 36 off-site soils gas air samples collected. Absent was 1,2,3-TCP, which was not reported in any of the 36 samples collected off-site.

None of the TCL VOCs identified are above the Occupational Safety and Health Administration (OSHA) Permissible Exposure Limit (PEL). The PEL is OSHA's occupational exposure limit. This exposure limit is a time-weighted average (TWA) limit, or a maximum concentration exposure limit that can not be exceeded at any time. The highest concentration level of 1,2,3-TCP in AS#4 at 15 feet bgs of 2,200 ug/m^3 is far below the OSHA PEL TWA of 300,000 ug/m^3. In general the concentrations of the TCL VOCs identified tend to increase with increasing depth at each of the four locations.

5.0 QA/QC, DATA VALIDATION AND DATA USABILITY

This section of the RI describes the various procedures used during the field investigation and in evaluating the analytical data to ensure that the data collected were of the highest quality possible. Quality assurance/quality control (QA/QC) procedures, data validation results, and data usability are discussed in Sections 5.1, 5.2, and 5.3, respectively.

5.1 QA/QC Procedures

QA/QC procedures for both the field activities and laboratory work were developed and presented in the NYSDEC-approved RI/FS Work Plan. The purpose of establishing and following strict field- and laboratory-specific procedures was to ensure that the data collected were precise, accurate, representative, complete, and comparable.

5.1.1 Field QA/QC

Field QA/QC procedures included the use of specially developed forms and logs for the collection of repetitive data such as well development and groundwater sampling. Additionally, all other site-specific observations were recorded in project-specific log books. Specific information recorded in the log books and field forms were those required in the Work Plan. Additionally, all QA/QC procedures stipulated in the Work Plan such as Chain-of-Custody procedures, field measurement requirements, etc., were followed.

5.1.2 Field Blanks and Duplicates

In order to meet project-specific Data Quality Objectives (DQOs), various types of QA/QC blank and duplicated samples were collected and analyzed. These QA/QC samples included trip blanks, field blanks and blind duplicate samples.

Trip Blanks

Trip blanks containing analyte-free water were obtained from the NYSDEC-approved analytical laboratory, transported to the site and returned without opening. Trip blanks serve as a check for contamination originating from sample transport, shipping, and from site conditions. Trip blanks were not utilized for samples analyzed by the mobile lab in accordance with the NYSDEC-approved Work Plan.

Trip blanks were not utilized during the drainage structure soil sampling phase investigation phase of work. However, as indicated in Table 4.3, TCL VOCs were not detected in several of the soil samples indicating that the sample results were not impacted by sample transport and shipping. Trip blanks were not utilized during the collection of groundwater samples utilizing the hydropunch sampling technique. However, as indicated in Table 4.20, TCL VOCs were not detected in several of the groundwater samples indicating that the sample results were not impacted by sample transport and shipping. Trip blanks were not utilized during the collection of groundwater samples from the off-site monitoring well network. However, as indicated in Table 4.21, site-related TCL VOCs were not detected in several of the groundwater samples indicating that the sample results were not impacted by sample transport and shipping.

Trip blanks were utilized during the following sampling activities:

- Collection of three soil samples from each of two waste lagoons. As indicated in Table 4.7, TCL VOCs were not detected in the trip blank; therefore, these soil sample results were not impacted by sample transport and shipping.
- Collection of groundwater samples from the on-site monitoring well network. TCL VOCs were not detected in the trip blank; therefore, these groundwater sample results were not impacted by sample transport and shipping.

- Collection of groundwater samples from the vertical profile wells. As indicated in Table 4.16, with the exception of a low concentration of methylene chloride (a typical laboratory contaminant) in one of the trip blanks, TCL VOCs were not detected in the trip blank; therefore, these groundwater sample results were not impacted by sample transport and shipping.

Field Blanks

Field blanks were used to determine the effectiveness of the decontamination of sampling devices (i.e., bailers, split-spoon samplers, sample sleeves, etc.) during the sample collection phases of the investigation. Field blanks were collected by pouring analyte free water through the sampling devices into the appropriate sample containers. Field blank samples were collected and analyzed for TCL VOCs, TCL SVOCs, TCL pesticides/PCBs, and TAL metals (including cyanide).

Field blanks were utilized during the soil boring/sampling phase of the project. Factory-decontaminated polyethylene liners inserted into geoprobe core barrels were the sampling devices utilized. As indicated in Table 4.2, no TCL VOCs were detected in the field blank associated with the soil samples collected from the drainage structures. Therefore, the factory and field decontamination procedures were effective and there are no concerns with regards to cross contamination impacting the analytical results of these samples.

A field blank was utilized during the collection of groundwater samples from the on- and off-site monitoring well network. As indicated in Tables 4.11, 4.12, 4.13, 4.14 , 4.21, 4.22, 4.23, 4.24 and 4.25 no site-related VOCs, SVOCs, pesticides/PCBs or TAL metals were detected in the filed blank associated with these samples. Therefore, the factory and field decontamination procedures were effective and there are no concerns with regards to cross contamination impacting the analytical results of these samples.

Two field blanks were utilized during the collection of groundwater samples from the vertical profile wells. As indicated in Tables 4.15, 4.16, 4.17, 4.18 and 4.19, no site-related VOCs, SVOCs, pesticides/PCBs or TAL metals were detected in the field blank associated with these samples. Therefore, the factory and field decontamination procedures were effective and there are no concerns with regards to cross contamination impacting the analytical results of these samples.

Blind Duplicate Samples

Blind duplicate samples were utilized as an additional QA/QC measure throughout the RI. Each of the duplicated samples were assigned fictitious names in the field; therefore, the analytical laboratory was unaware of the duplicates making them true blind samples. A comparison of analytical results between the sample and blind duplicate are used to determine if the data reported by the laboratory are precise, accurate, representative, and comparable.

A complete discussion of the blind duplicate results for samples submitted to the NYSDEC-approved laboratory is included in the Data Validation section (Section 5.2). This section details the blind duplicate results associated with the samples analyzed by the on-site mobile laboratory.

A blind duplicate of the soil sample from beneath a drainage structure was collected and analyzed by the mobile laboratory. As indicated on Table 4.2, No VOCs were detected in the 40 foot soil sample from DS-13 and the corresponding blind duplicate (DS-13X). These data indicate that the mobile laboratory reported data for the soil samples are precise, accurate, representative, and comparable.

Two blind duplicate samples were collected and analyzed by the mobile laboratory during the vertical profile well sampling activities. As indicated in Table 4.15, the correlation between the original and duplicate samples VP-3-60 ft./VP-3X and VP-9-

100 ft./VP-9X were extremely good indicating that the mobile laboratory reported data for the groundwater samples are precise, accurate, representative, and comparable.

5.2 Data Validation

As per the Work Plan, the CLP analytical packages and results generated by NYSDEC-approved analytical laboratory underwent independent data validation by Ms. Judy Harry of Data Validation Services (DVS). Methodologies utilized were those of the 1995 NYSDEC ASP. The analyses for the project were conducted under Sample Data Groups (SDGs) Accredited Case Nos. 2457, 2473, 2506, 2541, 2573, 3058 and 3192. The DVS summary reports for the SDGs are included in Appendix A. It should be noted that only a portion of the samples were submitted to the NYSDEC analytical laboratory and subject to data validation activities.

As per NYSDEC CLP procedures, the concentrations and data qualifiers shown on the summary analytical tables in Section 4.0 have been edited to reflect the recommendations made by DVS. Therefore the analytical results presented in the data summary tables report validated data which are applicable for use in health-based risk assessments.

Data validation was performed following the most current federal and state guidelines. The following items were reviewed:

- Data Completeness
- Custody Documentation
- Holding Times
- Surrogate and Internal Standard Recoveries
- Matrix Spike Recoveries/Duplicate Correlations
- Field Duplicate Correlations
- Preparation/Calibration Spikes
- Control Spike/Laboratory Control Samples

- Instrument Tunes
- Calibration Standards
- Instrument IDLs
- Method Compliance
- Sample Result Verification

Following the reporting of five of the seven SDGs, evaluation of the VOC analyte 1,2,3-trichloropropane was requested. Because the affected samples were already out of holding time, the analytical laboratory reported the compound as a tentatively identified compound (TIC). The 1,2,3-TCP results were appropriately qualified in the data summary tables. Other discrepancies in the TCL/TAL analyses are discussed in the data validation report.

Common laboratory contaminants such as methylene chloride and acetone were present in associated method, trip and field blanks; therefore, the sample detections were edited to reflect a non-detection at the contract-required detection limit (CRDL) or originally reported values, whichever was greater.

In general, the analytical data reported by the on-site mobile laboratory and NYSDEC-approved laboratory was of sufficient quality to support the DQOs of the RI.

5.3 Data Usability

As part of the RI process, usable data, by definition, is that data which may be used as part of the health-based risk assessment. However, in accordance with the requirements of the NYSDEC, a less stringent qualitative human exposure assessment was conducted in place of a health-based risk assessment. Therefore, the DQOs for this project are somewhat less stringent than those required for support of a quantitative health-based risk assessment.

The results of the QA/QC evaluation indicate that the surface-, soil- groundwater- and soil vapor-quality VOC data reported by both the mobile and NYSDEC-approved laboratories were precise, accurate, representative, and comparable. Therefore, the data are considered usable and support the conclusions drawn in Section 4.0 (Nature and Extent of Contamination), Section 7.0 (Human Exposure Assessment) and Section 9.0 (Feasibility Study).

6.0 CONTAMINANT FATE AND TRANSPORT

The purpose of this section is to provide a discussion of the fate and transport mechanisms for the migration of 1,2,3-TCP in air, unsaturated soil and groundwater.

6.1 Potential Routes of Migration

Based upon the results of analytical testing summarized in Section 4.0, 1,2,3-TCP was detected in on-site unsaturated soil, on-site groundwater and off-site groundwater samples at levels exceeding NYSDEC's concentrations of concern. Additionally, 1,2,3-TCP was also detected in soil vapor samples collected from several on-site sampling locations. Therefore, the potential routes of migration include:

- Migration of 1,2,3-TCP from unsaturated soils to the air resulting in vapors.
- Migration of 1,2,3-TCP in unsaturated zone soils.
- Migration of both free-phase and dissolved 1,2,3-TCP in groundwater.

Migration of 1,2,3-TCP in Air

As discussed in Section 4.0, high concentrations of 1,2,3-TCP were detected in unsaturated-zone soil samples and soil-gas samples collected from on the site. The tendency for a compound to volatilize from a liquid state into the atmosphere is a function of its vapor pressure. 1,2,3-TCP has reported vapor pressures of 1mm Hg at 48°F and 3 mm Hg at 68°F. These vapor pressures are lower than those of other more common VOCs such at TCE (58 mm Hg at 68°F), PCE (14 mm Hg at 68°F) and benzene (78.1 mm Hg at 68°F). This indicates that 1,2,3-TCP is relatively non-volatile and only low amounts will change phase from a liquid to a vapor state at standard temperature and pressure.

The vapor density of a compound is a function of its molecular weight compared to that of air. 1,2,3-TCP's vapor density of 6.03 g/l at 77°F is approximately 5.1 times heavier than air;

therefore, if present at significant concentrations in the atmosphere, 1,2,3-TCP vapors will tend to concentrate in low areas such a excavations, basements, etc. There were no reportable concentration levels of 1,2,3-TCP from off-site soil gas samples collected from points south of the subject site.

Migration of 1,2,3-TCP in Unsaturated Soil

With its relatively low vapor pressure, 1,2,3-TCP will tend to remain in a liquid phase versus changing to a vapor phase. In the unsaturated zone, free-phase liquid 1,2,3-TCP will tend to migrate downwards due to the influence of gravity. Some of the liquid will adsorb onto the soil particles due to capillary forces. The amount of free-phase liquids that will adsorb onto the soil particles will be a function of the soil's grain size and carbon content. The tendency for a chemical to partition between particles containing organic carbon (e.g., soil retardation) and water is known as the soil partition coefficient (K_{oc}). According the NYSDEC TAGM 4046, 1,2,3-TCP has a K_{oc} of 68. This relatively low value indicates that 1,2,3-TCP will not strongly adsorb with organic carbon in soil.

Approximately 20 inches per year of precipitation infiltrates into the ground in this portion of Long Island. As this water flows downward through the unsaturated zone in response to gravity, it will dissolve a portion of any 1,2,3-TCP that is present in the soil which will result in a downward contaminant migration pathway through the unsaturated zone, eventually reaching groundwater. The general migration of liquids (water or free-phase product) will be predominantly downward with little dispersion in the sands and gravels of the Upper Glacial aquifer. Liquids may encounter low-permeability zones, which could result in non-vertical migration.

Migration of 1,2,3-TCP in Groundwater

Free-phase 1,2,3-TCP has a specific gravity of approximately 1.4 (water has a specific gravity of 1.0); therefore, any free-phase product which migrate to the saturated zone will tend to

sink and form dense nonaqueous-phase liquids (DNAPLs). Once in groundwater, DNAPLs tend to migrate downward through the water column by gravity with some lateral dispersion. DNAPLs can migrate horizontally if the liquids encounter a low-permeability material such as silt or clay. There will also be some dispersion of the dissolved portion of the plume, which will be a function of the solubility of the contaminant. 1,2,3-TCP has a solubility in water of 2,700 milligrams per liter (mg/l).

1,2,3-TCP was detected in groundwater samples collected from downgradient of the site. The contaminants will tend to migrate following the natural hydrogeologic flow field. Based upon site-specific hydrogeologic data, groundwater flow direction is to the southeast with a gradient of approximately 0.001 feet per foot (see Figure 2.6). Utilizing the USGS standard hydraulic conductivity (K) of 270 feet per day for the Upper Glacial aquifer, a maximum un-retarded groundwater flow velocity of 0.9 feet per day was calculated (see Table 6.1 for backup calculations). As indicated on Table 6.1, the maximum that groundwater is expected to travel over a 10-year period is 3,285 feet. Halogenated VOCs would tend to migrate at a slower rate through groundwater due to the physical/chemical properties of the contaminants and the aquifer system including factors such as retardation due to carbon in the soils, natural attenuation due to biodegradation (aerobic biodegradation) and chemical degradation, and dilution due to dispersion and diffusion.

7.0 HUMAN EXPOSURE ASSESSMENT

The purpose of this exposure assessment is to qualitatively evaluate the chemicals of concern and the affected media with respect to potential exposure pathways and receptors for human health. For the MacKenzie Chemical site, the following pathways were evaluated:

- Ingestion of contaminated soil.
- Inhalation of contaminated vapors and/or dust.
- Direct contact with potentially contaminated runoff water.
- Ingestion of contaminated groundwater.
- Dermal contact to contaminated soils
- Dermal contact to contaminated groundwater.

Potential human receptors in the vicinity of the site include:

- Workers on the site.
- Trespassers who transit the site.
- Residents who live in the area.
- Remedial construction workers who will install potential on- and off-site remedial systems.

Since the area is highly developed, there is little wildlife in the area that could be impacted by chemical contamination related to the MacKenzie Chemical site.

The following conservative worst-case scenario assumptions were made in the qualitative exposure pathway analyses:

- Contaminated soil is in contact with groundwater and dissolved contaminants in the soils may be released to groundwater.

- Contaminated unsaturated soils may release VOCs into the atmosphere.
- Individuals who work or trespass on the property may come in contact with potentially contaminated on-site surface and unsaturated-zone soils.
- Remedial efforts may expose potentially contaminated soils and groundwater on and off of the property.

7.1 Exposure and Pathway Overview for the Site

To evaluate potential exposures to the site in a qualitative fashion, various exposure scenarios were classified in terms of the general release mechanisms including:

1. Infiltration from soil moisture to groundwater.
2. Volatilization.
3. Wind erosion producing dust during remedial measures.
4. Direct contact to soil and potentially contaminated groundwater.
5. Water runoff.

Direct exposures to the chemicals of concern from the above-referenced mechanisms could potentially occur in the following ways:

1. Ingestion of contaminated soil.
2. Inhalation of vapors
3. Inhalation of potentially contaminated dust during remedial measures.
4. Direct contact with potentially contaminated runoff water.
5. Ingestion of contaminated groundwater.
6. Dermal adsorption of contaminants via direct contact with contaminated soils and groundwater.

Potential exposure pathways are examined for functionality and completeness as follows:

- Functional Exposure Pathways – A functional pathway requires that a contaminant source, release mechanism and transport mechanism be present. If any of these three components is absent, the pathway is considered nonfunctional. The functional pathways for this site are included in Table 7.1.
- Complete Pathway – A complete pathway requires a functional exposure pathway, potential receptors to the exposure and an exposure/uptake route. An exposure is considered incomplete and the risks qualitatively low if one or more of these components is missing.

7.1.1 Functional Exposure Pathways

The five functional exposure pathway components and their status with respect to the MacKenzie Chemical site are discussed below:

Ingestion of Contaminated Soil

Based upon the review of the soil analytical data presented in Section 4.0, significant concentrations of 1,2,3-TCP were detected above the NYSDEC RSCO of 400 ug/kg in the on-site unsaturated-zone soils resulting in a contaminant source. Additionally, 1,2,3-TCP, TCE and PCE were detected in on-site vapor samples collected from 5-, 10- and 15-feet bgs. VOC-impacted soils could be brought to the surface of the site during excavation activities where they could be potentially ingested. Therefore, as indicated on Table 7.1, this functional exposure pathway is completable.

Inhalation of Vapors

Based upon the review of the soil analytical data presented in Section 4.0, 1,2,3-TCP were detected above concentrations of concern in the on-site surface (e.g., 0-4 feet) and deeper unsaturated zone soils (e.g., 4-41 feet) indicating that there are sources of VOC-type contaminants that could be released in the form of vapors. 1,2,3-TCP, TCE and PCE were detected in on-site vapor samples collected from 5-, 10- and 15-feet bgs. Additionally, 1,2,3-TCP and PCE were both detected in on- or off-site groundwater samples. There is a contaminant

source, release mechanism (i.e., volatilization of VOCs from impacted soils) and transport mechanism (i.e., airborne VOC vapors present on the site). Therefore, the potential for human inhalation of vapors from on-site contaminated soils is considered possible and this functional exposure pathway is completable.

Inhalation of Dust During Remedial Measures

As discussed in previous subsections, 1,2,3-TCP was detected in on-site soil samples above NYSDEC concentrations of concern. Therefore, this functional exposure pathway is considered completable due to a contaminant source; a release mechanism (VOCs present in the near-surface soil samples) and a transport mechanism (VOCs released during potential near-surface excavation remediation activities). (see Table 7.1).

Direct Contact with Potentially Contaminated Runoff Water

The site is unpaved and stormwater generally does not pond, rather it infiltrates into the subsurface. Therefore, the potential for human exposure to potentially contaminated site runoff is considered low and this functional exposure pathway lacks a contaminant source.

Ingestion of Contaminated Groundwater

Based upon a review of NYSDEC records and the results of a survey conducted by the NYSDEC, there are no known private drinking-water wells in the area downgradient of the site. However, several wells have been identified for non-potable use (i.e., irrigation), and one private drinking water well has been identified to the east (cross-gradient) of the subject site. As indicated in Figure 7.1 and Table 7.2, there are several public water supply wells fields owned and operated by the Suffolk County Water Authority (SCWA) south, southeast and southwest of the site. The SCWA Carleton Avenue well field, located approximately 3,100 feet south southeast of the facility, is the nearest public water supply well located downgradient of the site. According to NYSDEC records, the well field consists of one well (Carleton Ave. #1 – S-67197) which is completed to a depth of 763 feet bgs in the Magothy aquifer. As indicated in Section 4.0, the VOC groundwater plume extends a maximum of 800 feet south southeast of the site with a maximum depth of 100 to 120 feet bgs. Therefore, the SCWA Carleton Avenue well field is

not located within the vertical or horizontal foot print of the site-related plume. Additionally, none of the other SCWA well fields shown on Figure 7.1 are currently located within the vertical or horizontal foot print of the site-related plume. While this functional exposure pathway contains a contaminant source (contaminated on-site saturated soils), a release mechanism (groundwater moving through and dissolving the VOCs in the source area) and a transport mechanism (hydrogeologic flow of on-site contaminated groundwater off of the site), the off-site impact to groundwater is limited both horizontally and vertically. Therefore, the ingestion of contaminated groundwater exposure pathway is considered not completable (see Table 7.1).

Dermal Adsorption of Contaminants Via Direct Contact with Contaminated Soil

As discussed in previous subsections, 1,2,3-TCP was detected in on-site soil samples above NYSDEC concentrations of concern. Therefore, this functional exposure pathway is considered completable due to a contaminant source; a release mechanism (VOCs present in the near-surface soil samples) and a transport mechanism (VOCs released during potential near-surface excavation activities). (see Table 7.1).

Dermal Adsorption of Contaminants Via Direct Contact with Contaminated Groundwater

As discussed in previous subsections, 1,2,3-TCP was detected in off-site groundwater samples above NYSDEC concentrations of concern. Additionally, although no drinking water wells were identified, the results of the NYSDEC survey indicate the presence of private wells which could be utilized for irrigation purposes. Therefore, this functional exposure pathway is considered completable due to a contaminant source; a release mechanism (groundwater moving through and dissolving the VOCs in the source area) and a transport mechanism (hydrogeologic flow of on-site contaminated groundwater off of the site). (see Table 7.1).

7.1.2 Complete Pathway

As discussed previously, a complete pathway requires a functional exposure pathway, potential receptors to the exposure and an exposure/uptake route. As indicated in Section 7.1.1

and Table 7.1, there are four completable functional exposure pathways with respect to human health which will be evaluated in this section including:

- Ingestion of contaminated soil.
- Inhalation of vapors and/or dust.
- Dermal adsorption of contaminants via direct contact with contaminated soil.
- Dermal adsorption of contaminants via direct contact with contaminated groundwater.

This section of the human exposure assessment details potential receptors and exposure/uptake routes.

Workers on the Site

The potential for workers on the site to be exposed to site-related contaminants includes:

- Ingestion of on-site contaminated soils - this pathway is potentially completable for on-site worker due to the presence of impacted unsaturated-zone soils at the site. There are currently no indications of contaminated off-site soils; therefore, off-site workers can not be exposed.
- Inhalation of vapors or dust - on-site workers may be exposed to VOC vapors and/or contaminated dust emanating from impacted soil piles during future excavation activities.
- Dermal adsorption of contaminants via direct contact with contaminated soil - Workers may be exposed to contaminated unsaturated soils during on-site excavation activities.
- Dermal adsorption of contaminants via direct contact with contaminated groundwater - There are no on-site water wells; therefore, there is little potential for on-site worker exposure to contaminated groundwater.

Trespassers Who Transit the Site

Site security consists of wire mesh fencing with three gates that are now locked. This fencing is old and maybe scaled by individuals. Additionally, there is ample evidence that

trespassers occasionally transit the site and could potentially be at risk due to the presence of on-site contaminants. The potential for trespassers to be exposed to site-related contaminants includes:

- Ingestion of on-site contaminated soils - this pathway is potentially completable due to the presence of impacted unsaturated-zone soils at the site.
- Inhalation of vapors and potentially contaminated dust - trespassers may be exposed to VOC vapors and/or potentially contaminated dust emanating from impacted soil piles during future excavation activities.
- Dermal adsorption of contaminants via direct contact with contaminated soil - trespassers may be exposed to contaminated unsaturated soils if soil stockpiles generated during on-site excavation activities are left uncovered.
- Dermal adsorption of contaminants via direct contact with contaminated groundwater - There are no on-site water wells; therefore, there is little potential for on-site worker exposure to contaminated groundwater.

Residents Who Live in the Area

The potential for residents who live in the area of the site to be exposed to site-related contaminants by potentially completable functional pathways includes:

- Ingestion of contaminated soil by residents - there are no indications of off-site contaminated unsaturated soils.
- Inhalation of vapors for residents – A series of soil-vapor samples were recently collected from a residence adjacent to the site in order to determine the presence of contaminants in unsaturated soil off of the site. The results of this recent sampling will be evaluated by the NYS DEC and DOH once they are available. The only other potential impact to residents may be from the off gassing of VOCs from groundwater conveyed to the surface by private irrigation wells. However, due to the low vapor

pressure of 1,2,3-trichloropropane and the low concentration of this analyte observed in subject monitoring wells, this potential impact is considered negligible.

- Inhalation of potentially contaminated dust during remedial activities for residents – Fugitive airborne dust from near-surface soils from the site would only be likely during remediation activities that entail subsurface excavation activities. Such activities incorporate dust reduction practices. In addition, during any such activity a community monitoring program would be initiated that would greatly reduce the likelihood of dust exposure to residence.
- Dermal adsorption of contaminants via direct contact with contaminated soil – residents are not likely to be in direct contact with impacted soil from the site.
- Dermal adsorption of contaminants via direct contact with contaminated groundwater – The only materials residents may come into dermal contact with is contaminated groundwater conveyed to the surface by privately-owned irrigation wells.

Remedial Construction Workers

Remedial construction workers could potentially be exposed for short periods of time to contaminants of concern during the installation, testing and operation of any remediation system the NYSDEC deems warranted. However, as all of the workers will be: working under a NYSDEC-approved Health and Safety Plan,; knowledgeable of site conditions; and utilize appropriate personal protective equipment, the exposure/uptake route is considered incomplete. Therefore, the qualitative risk is considered low.

7.2 Toxicity Assessment

1,2,3-TCP is the primary contaminant of concern in on-site soil and on- and off-site groundwater for the MacKenzie Chemical site. In its pure form, 1,2,3-TCP (CAS No. 96-18-4) is a colorless liquid with a strong chloroform-like odor and has industrial uses as a polymer crosslinking agent, paint and varnish remover, solvent and degreasing agent, and a cleaning and maintenance solvent. 1,2,3-TCP was also a manufacturing by-product of 1,3-dichloropropane

(1,3-DCP) which was a fumigant applied to potato crops, but is no longer available in the United States.

According to the USEPA Integrated Risk Information System (IRIS) database, 1,2,3-TCP is reasonably anticipated to be a human carcinogen based on the evidence of malignant tumor formation at multiple sites in multiple species of experimental animals. However, there are no adequate data available to evaluate the carcinogenity of 1,2,3-TCP in humans. The NYSDEC 1993 Class GA groundwater standard for 1,2,3-TCP was 5.0 ug/l; however, the NYSDEC lowered the Class GA standard to 0.04 ug/l in March of 1998. The NYSDEC based the low Class GA standard on human health effects with respect to a water source and considers the compound to be oncogenic (carcinogenic).

1,2,3-TCP is included in the NYSDEC April 1995 Technical Administrative Guidance Memorandum 4046: Determination of Soil Cleanup Objectives and Cleanup levels. As discussed in Section 4.0, the NYSDEC RSCO for 1,2,3-TCP is 400 ug/kg. The RSCO is based on a soil cleanup objective to be protective of groundwater of 340 ug/kg and systemic toxicants concentration of 500 mg/kg.

The primary route of potential occupational exposure to 1,2,3-TCP is inhalation of vapors. Other routes of exposure are ingestion and dermal contact. Direct contact to 1,2,3-TCP may cause eye irritation; cause redness and pain if absorbed through the skin; cause severe irritation to the digestive track and may cause central nervous system effects if swallowed; cause nausea, and dizziness and headaches if inhaled.

OSHA has established a Permissible Exposure Level of 300 mg/m^3 (50 ppmv) as an 8-hour time-weighted average. Although OSHA has not identified 1,2,3-TCP as an occupational carcinogen, the National Institute of Occupational Safety and Health (NIOSH) recommends that it should be treated as such.

Based upon the above-referenced discussion, chronic exposure to relatively low concentrations of 1,2,3-TCP may cause carcinogenic effects. Additionally, several negative health effects may occur due to acute exposures to high concentrations.

7.3 Risk Characterization

Based upon the completability of potentially functional pathways and exposure/uptake routes, a qualitative risk per functional exposure pathway and potentially exposed receptors was prepared. As indicated in Table 7.3, several of the receptor evaluations would be potentially exposed with functional exposure pathways consisting of ingestion of contaminated soil, inhalation or vapors and dermal absorption of contaminated soil. There are low qualitative risks to all potential receptors to contact contaminated runoff water, ingest site-related contaminated groundwater or come into dermal contact with groundwater.

8.0 FEASIBILITY STUDY

The objective of the MacKenzie Chemical Feasibility Study (FS) is to develop, screen and evaluate appropriate remedial actions, which will achieve the remedial objective established for the site. Based on the nature and extent of contamination at the MacKenzie Chemical site as determined during the RI, the recommended remedial action objective for the site is to provide for the attainment of NYS Standards, Criteria, and Guidelines (SCGs) at the limits of the area of concern (i.e., public water supply wells downgradient of the site) to the extent practical. The FS will evaluate methods to prevent, minimize, or eliminate the release of hazardous substances from the site and to minimize the risk to human health and the environment. This FS is consistent with NYSDEC's Technical and Administrative Guidance Memorandum (TAGM) HWR 90-4030, entitled "*Selection of Remedial Actions at Inactive Hazardous Waste Sites*".

8.1 Summary of Nature and Extent of Contamination

The RI established the nature and extent of soil and groundwater contamination at the site. Volatile organic contaminants (VOCs), consisting primarily of 1,2,3-trichloropropane (1,2,3-TCP) and to a lesser extent tetrachloroethylene (PCE), were detected in unsaturated soils on the eastern portion of the property soils, at depths in excess of forty-one feet (41') below grade at some locations. However, the majority of the impacted soils appear to be shallower, located at depths of ten feet below grade and immediately below on-site drainage structures (e.g., drywells). Extensive soil contamination was not detected in the two (2) former waste lagoons located onsite. However, an aqueous sample of the liquids contained within waste lagoon #1 resulted in elevated levels of 1,2,3-TCP (3,900 ug/l). An aqueous sample was also collected from a drain pipe located southeast of the main building, resulting in concentrations of 1,2,3-TCP of 11,000,000 ug/l. It appears that waste lagoon #1 and the drainage pipe outfall may also be sources of the 1,2,3-TCP contamination.

VOC contamination, primarily 1,2,3-TCP and PCE, has been quantified in groundwater both on-site and downgradient of the site. Local groundwater flow is in a south to southeast direction toward the Great South Bay. There are three hydraulically interconnected primary

water bearing aquifers underlying the subject site. These aquifers, from shallow to deep, are the Upper Glacial, Magothy, and Lloyd. The groundwater investigation was limited to the Upper Glacial aquifer and a portion of the Magothy aquifer. The groundwater plume extends approximately 800 feet southeast of the subject site. Based on the location of the source area and the results of the off-site groundwater investigation, groundwater is impacted to a depth of approximately 100 to 120 feet below grade.

8.2 Identification and Development of Alternatives

8.2.1 Introduction

Remedial actions at the site should strive to attain New York State Soil Cleanup Goals (SCGs) and Federal Applicable, or Relevant and Appropriate Requirements (ARARs) or other applicable Federal and state environmental standards. Potentially applicable federal ARARs fall within three categories: Chemical-Specific, Action-Specific, and Location-Specific. NYSDEC has elected to categorize its ARARs as SCGs and has also divided SCGs into the aforementioned three categories. Each category is briefly described below.

- Chemical-Specific SCGs - Usually technology or risk-based numerical limitations or methodologies that, when applied to site-specific conditions, result in the establishment of acceptable concentrations of a chemical that may be found in, or discharged to, the ambient environment. Appendix I contains a list of chemical-specific ARARs/SCGs for groundwater cleanup, soil cleanup, groundwater discharge, air emissions, and transport and disposal.

- Action-Specific SCGs - Usually technology or activity-based requirements or limitations on actions taken with respect to hazardous substances. These requirements typically define acceptable treatment, storage, and disposal procedures for hazardous substances during the implementation of the response action.

- Location-Specific SCGs - Restrictions placed on the concentration of hazardous substances or the conduct of activities solely because the activities occur at a special

location. These requirements relate to the geographical or physical position of the site rather than the nature of the materials or the proposed remedial action. These requirements limit the type of remedial action that can be implemented and may impose additional constraints on a cleanup action.

8.2.2 Remedial Action Objectives

Remedial action objectives (RAOs) establish media-specific cleanup goals for protecting human health and the environment through reduction of the volume, mobility and toxicity of constituents of concern. RAOs may include establishing chemical-specific concentrations or eliminating exposure pathways, since protection of human health may be achieved by minimizing exposure and/or by reducing contaminant levels. Remedial action objectives that are protective of the environment typically seek to preserve or restore groundwater or soil to target cleanup levels.

Contaminant levels within each environmental media at the MacKenzie Chemical site were compared to chemical specific cleanup levels to determine whether remedial actions are warranted. For groundwater, cleanup levels are the NYSDEC Class GA Groundwater Quality Standards (Final Express Terms for Amendments to Title 6, Chapter X, Parts 700-706, March 1998) and NYS drinking water standards as indicated in State Sanitary Code, Chapter I, Subpart 5-1, Public Water Systems. These water standards are summarized in Appendix I, Table A.1 "Chemical-Specific ARARs for Groundwater Cleanup Criteria." Generally, only two volatile organic compounds (VOCs) were detected above groundwater standards during the RI well sampling, namely, 1,2,3-TCP and PCE, and therefore, are the constituents of concern.

The same two VOCs, 1,2,3-TCP and PCE, were detected in site soils above the New York State Recommended Soil Cleanup Objectives (RSCOs), which are the cleanup criteria for the soil matrix. Several semi-volatile organic compounds (SVOCs) were also detected above the NYS RSCOs at one or more location on-site. They include bis(2-ethylhexyl)phthalate, di-n-octylphthalate, benzo(b)fluoranthene, benzo(k)fluoranthene, chrysene, benzo(a)pyrene, indeno(1,2,3-cd)pyrene, and di-benzo(a,h)anthracene.

8.3 Identification of Remedial Technologies

This section of the FS evaluates potentially feasible remedial technologies for their implementability, for their ability to meet SCGs, and for their ability to provide overall protection of human health and the environment within a reasonable time frame. Remedial technologies which will not be able to achieve the remedial action objectives, or which prove difficult to implement based on site conditions will be eliminated from further consideration. Remedial technologies that are deemed suitable for site conditions and site contaminants will be developed into remedial action alternatives for further consideration in Section 8.4 of this report.

8.3.1 Soil Remediation Technologies

Potentially applicable remediation technologies for the soil matrix are presented below and are also summarized in Table 8-1.

8.3.1.1 Excavation and Disposal

This remedial alternative would require the excavation of contaminated soils for off-site disposal at a permitted disposal facility. The ultimate off-site disposal option (landfill, treatment or recycling will be dependent on the contaminants and concentration levels in the soil, whether the soil exhibits any hazardous characteristics or whether the soils contain an F-listed RCRA hazardous waste. This remedial alternative is technically viable and will be retained for further analysis.

8.3.1.2 Chemical Treatment

Chemical treatment alternatives are comprised of four broad categories where chemicals are utilized to reduce organic or inorganic contaminants: mobilization, immobilization, detoxification, or stabilization/solidification. These classes of chemical treatment technologies can be employed in-situ or ex-situ.

- Mobilization is the flushing of contaminated soil using flushing agents (surfactants, dilute acids, bases, and water) to extract the contaminants. In this process an aqueous solution is injected, contaminants are mobilized into solution, and the resulting liquid is captured and pumped out for treatment. Because there are several different chemical contaminants in soil consisting of VOCs and SVOCs, several different flushing agents would need to be used. This further complicates treatment of the flushing solution and will likely impede the overall effectiveness of this treatment process. This treatment technology will not be retained for further analysis.

- Immobilization includes the process of precipitation (for dissolved metals), chelation (for metals), and polymerization (for organics) to modify the chemical contaminant into a less mobile form. Immobilization is still relatively unproven as a viable treatment alternative and is therefore eliminated from further consideration.

- Detoxification attempts to alter the contaminants into a less toxic form through the process of oxidation, reduction, neutralization and hydrolysis. This method is also relatively unproven as a viable treatment alternative for use on the soil matrix and is eliminated from further consideration.

- Stabilization/Solidification processes chemically or physically bind the contaminants into a solid matrix, which minimizes or eliminates the potential for contaminant leaching and chemical interaction. Stabilization/solidification products commonly used include silicate, organic polymer, thermoplastics, cement, or molten glass as fixation agents to create a stiffened concrete-like product. This treatment technology will be retained for further evaluation.

8.3.1.3 Biological Treatment

This remedial technology relies on microbial action to break down the contaminants within the soil into non-hazardous substances. This treatment technology can be applied in-situ or ex-situ. Bioremediation primarily applies to organic and petroleum based contaminants,

which are biodegradable. The process is relatively slow and could take several years for complete remediation. Bioremediation is most effective in the treatment of soils containing moderate to low levels of 1,2,3-TCP, and would not be effective in the treatment of inorganic contaminants. A partially chlorinated alkene would likely be treated best aerobically, while perchlorinated alkanes (of which 1,2,3-TCP is considered) and alkenes would be treated anaerobically. Chlorinated aliphatic compounds can be toxic to bacteria, either by their solvent effect, which disrupts biological membranes, or by metabolic activation that generates toxic intermediates which react with cellular macromolecules, or by both effects. Therefore, this remedial technology is removed from further discussion.

9.3.1.4 Collection and Treatment

Soil Vapor Extraction (SVE) is an in-situ soil remedial technology that utilizes a vacuum to remove volatile organic compounds from the subsurface soil matrix. The extracted air may be treated before being discharged to the atmosphere. The performance or effectiveness of an SVE system depends on properties of the contaminants and the geology of the site. SVE technology is generally effective on VOCs, is limited in effectiveness on SVOCs because of the relatively low vapor pressure of these compounds, and is ineffective on inorganic compounds. Because of the presence of 1,2,3-TCP and SVOCs in the soil at the MacKenzie site, all of which possesses relatively low vapor pressures, SVE technology, if employed, would likely need to be thermally enhanced (addition of heat) in order to be effective on the contaminants found at this site. Based on site contaminants and site geology, this technology can be effective and therefore is retained for further consideration.

8.3.1.5 Institutional Controls

A deed restriction is an institutional control to minimize potential threats to public health and the environment by restricting the use of a property in a manner that prevents exposure. The deed restriction would be recorded on the property deed to prohibit a change in site use without NYSDEC approval. However, while a deed restriction can limit how a site can be developed (e.g., industrial or residential) it can not control the activities that is conducted on the site that

could result in direct contact exposure (e.g., excavation). Furthermore, although 1,2,3-TCP exists in the soil at levels significant enough to act as an on-going source area, the deed restriction does not address the continued release of contaminants from soil to groundwater. Therefore, use of an institutional control will not be considered further.

8.3.1.6 No Further Action

Under the No Further Action alternative, no additional soil cleanup actions would be undertaken at the site. The no action alternative poses a potential risk to the public and to the environment because contaminated soil is present in the soils and potentially accessible for contact. Additionally, VOC-contaminated soils are acting as a source of on-going groundwater contamination. Although the No Further Action alternative does not meet the remedial action objectives for this site, it will be further evaluated as a procedural requirement as it provides a basis for comparison with other alternatives.

8.3.2 Groundwater Remediation Technologies

Potentially applicable remediation technologies for impacted groundwater are presented below and are also summarized in Table 8-1.

8.3.2.1 Containment

Containment of impacted groundwater at the MacKenzie Chemical site would require either the construction of impermeable slurry walls or sheet piling.

- Slurry walls would be constructed to contain the groundwater contaminant plume. Slurry wall construction would require the installation of a network of trenches to surround the entire plume. The trenches would be backfilled with low permeability slurry (for example, a betonite-cement grout mixture) in order to prevent further migration of the plume. Based on the areal extent of the VOC plume (approximately

800 feet long and 300 feet in width at its widest part), as well as the depth of the plume (in excess of 100 feet), this option is not feasible.

- Sheet Piling is similar to slurry walls, in that this method would require surrounding the groundwater contaminant plume with impermeable steel sheeting to prevent the further migration of the plume. Similar to slurry wall installation, because of the large areal extent and depth of the plume, this option would not be feasible.

Therefore, containment of the groundwater plume was deemed infeasible and thus, eliminated from further consideration.

8.3.2.2 In-Situ Treatment

In-situ treatment is the process by which contaminants are remediated in-place without the need to remove the contaminants to the surface for treatment. In-situ treatment technologies for groundwater remediation include biological, chemical and physical treatment.

- In-situ biological treatment would require the development of microorganisms capable of decomposing specific organic contaminants. Generally this process requires the addition of oxygen and nutrients to create an environment in the aquifer in which these microorganisms can thrive. A partially chlorinated alkene would likely be treated best aerobically, while perchlorinated alkanes (of which 1,2,3-TCP is considered) and alkenes would be treated anaerobically. Chlorinated aliphatic compounds can be toxic to bacteria, either by their solvent effect, which disrupts biological membranes, or by metabolic activation that generates toxic intermediates which react with cellular macromolecules, or by both effects. Because 1,23-TCP and PCE degrade anaerobically, this remedial action alternative will not be considered further.
- In-situ chemical treatment of groundwater would require the introduction of chemicals to degrade, immobilize or flush out the contaminants. Strong oxidizing chemicals (ozone, hydrogen peroxide, potassium permanganate, etc.) are used to

promote the degradation of organic constituents, accomplished through oxidation-reduction reactions. Several commercially available patented processes have been developed within the past several years that utilize hydrogen peroxide or other strong oxidizers to promote degradation of chlorinated organic compounds into steam and carbon dioxide. This treatment technology, while still considered innovative, has been successfully employed to treat groundwater plumes with organic compounds.

- Reactive Treatment Wall – A reactive barrier wall would encompass the construction of a wall containing a reactive media to a depth intersecting an impermeable layer. Oxidation of volatile organic contaminants occurs while passing through the wall with groundwater flow. This technology is not feasible for this site application due to the relatively large areal extent and depth of the plume (300 feet wide and over 100 feet deep).

- Physical treatment attempts to immobilize, detoxify or transfer the contaminants to another media where they are more readily collected and/or treated. Methods currently used include air sparging and in-well stripping. Air sparging is a process where air is introduced under pressure below the water table to increase the rate of volatilization of VOCs in the saturated zone. Air sparging is generally used in conjunction with vapor extraction technology (system that utilizes vacuum to remove VOCs from the subsurface soil) to effectively capture VOCs volatilized from the saturated zone as well as reduce VOC levels in the unsaturated soils. In-well stripping technologies (which include systems such as UVB (Unterdrick-Verdampfer-Brunnen) and Density-Driven Convection (DDC) systems), are also in-situ remedial technologies but use air stripping principles to remove VOCs by passing air through the groundwater circulated within the well bore. These systems essentially act as in-situ groundwater extraction and treatment systems.

In-situ treatment technologies for groundwater via air sparging, in-well stripping, and in-situ chemical oxidation were considered potentially feasible, and will be considered further.

8.3.2.3 Collection and Treatment

This option would require the construction of recovery wells of sufficient capacity and number to create a hydraulic boundary to intercept all or a portion of the groundwater contaminant plume. The collected groundwater would be treated and then discharged.

Groundwater extraction and treatment utilizes recovery wells to collect contaminated groundwater for treatment. The treated effluent can be recharged back to groundwater, or discharged to the Publicly-Owned Treatment Works (POTW). Local POTWs are typically hesitant to accept treated groundwater into the sewer because of the additional hydraulic load the discharge would place on their systems. Discharge to a POTW was therefore not considered further. Groundwater extraction and treatment technology with various treatment options is technically viable and will be retained for further analysis. Different treatment technologies that can be used with this remedial approach are discussed in the following sections.

8.3.2.3.1 Ex-Situ Biological Treatment

Ex-situ biological treatment, using activated sludge systems, trickling filters or rotating biological contractors, attempt to create a controlled environment which maximizes the growth of the microorganisms required for the breakdown of organic material. Biological treatment processes produce a sludge that might require additional treatment.

These options are not feasible because 1,2,3-TCP degrades anaerobically, and because low levels of VOCs (low relative to these treatment methods) in the on-site groundwater. Therefore, treatment of groundwater by biological means was deemed impractical and the processes eliminated from further consideration.

8.3.2.3.2 Ex-situ Chemical Treatment

Chemical treatment processes include chemical precipitation and ultraviolet (UV) oxidation.

- Chemical precipitation is primarily used in the treatment of solutions containing dissolved metals. Chemicals are added to the water to react with dissolved contaminants to form a precipitate, which is then settled out of the liquid. Coagulants are used to stabilize the suspended particles. Once the suspended particles are chemically reacted with the coagulant (coagulation process), the solution undergoes a slow mechanical mixing process to allow the aggregation of smaller particles to form into larger aggregates (flocculation), which settle out of solution. These larger aggregates are referred to as the floc. Common reagents introduced to promote settling and improve flocculation include lime, sulfide and calcium or sodium carbonate. Because VOCs would not be effectively treated using this process, chemical precipitation was eliminated from further consideration.
- UV oxidation is a chemical oxidation process that utilizes ultraviolet (UV) light as a catalyst for the reaction of dissolved VOCs to produce carbon dioxide and water. Non-hydrocarbon dissolved contaminants, including naturally occurring metals and minerals, will also be subject to the oxidation reaction. Common sources of oxygen include hydrogen peroxide, air, chlorine, ozone and permanganate. The effectiveness of UV oxidation is dependent upon organic and inorganic contaminant loading, pH and the ability of the groundwater to transmit light. This alternative is feasible and was retained for further consideration.

8.3.2.3.3 Physical Treatment

Physical treatment techniques include reverse osmosis, sedimentation, ion exchange, filtration, carbon absorption and air stripping.

- Reverse osmosis involves pressurizing the contaminated water stream as it is fed through

a membrane from which the water and the contaminant are segregated. Membranes utilized in the reverse osmosis process are characterized either as natural or synthetic. Synthetic membranes are generally used during desalination processes. Natural membranes can be utilized in the removal of dissolved organics and inorganics. Reverse osmosis requires pretreatment to prevent solids loading across the membrane, temperature variations, or the coating of the membrane. The residual contaminant flow and spent membranes require disposal. This treatment technology is not applicable to treatment for VOCs. Therefore, this alternative was removed from further consideration.

- Sedimentation utilizes gravity to remove particulate matter. Groundwater is transferred to a basin or tank, in which gravitational settling is allowed to occur with sufficient detention time. This process can be enhanced through the addition of chemical coagulants to settle out the suspended solids. Sedimentation is effective in the removal of inorganic material, but not effective in the removal of VOCs. For this reason, sedimentation was eliminated from further consideration.

- Ion exchange is the process by which a substitution of ions occurs between the waste stream and an ion exchange resin. Resins are generally "charged" with H^+ or OH^- ions and can be divided into four groups. Cation exchange resins containing strong acids are generally used in the treatment of heavy metals; cation exchange resins containing weak acids are generally used in the treatment of simple and complex organic bases. Strong base anion resins are utilized in the removal of weak mineral acids; strong mineral acids are best removed with weak base anion resins. The process is reversed during regeneration of the resin, with discharge of the wasted ions and replenishment of original ions transferred from a regeneration solution to the resin. The waste regeneration solution requires disposal. Ion exchange units must not be loaded with waste streams containing suspended solids, and may be sensitive to temperature and pH, depending on the type of resin required. Ion exchange technology is not selective in the contaminants being removed, and therefore removes all ions in solution. As a result, large ion exchange columns are typically required to achieve the desired removal. Use of this treatment technology is not feasible due to space considerations and the amount of waste materials (i.e., regeneration wastes) requiring management after treatment. This

treatment technology is also not applicable to treatment of VOCs and thus eliminated from further consideration.

- Filtration: Filtration is the process by which suspended matter is removed from water. It is accomplished by passing a water stream through a porous media of appropriate size. Filtration is utilized in pretreatment systems for a variety of treatment alternatives, but is not effective in the removal of VOCs. Filtration was therefore eliminated from further consideration.

- Carbon Adsorption: Carbon adsorption treatment is accomplished by passing the affected groundwater through a vessel containing activated carbon. Consideration of temperature and contact time is required for complete treatment. The carbon used in this process is available in two forms, granular activated carbon (GAC) and powdered activated carbon (PAC). The adsorption of the organic material to the carbon particles is a three-stage process. The first stage is the movement of the organic material through the water to the solid-liquid interface. The second stage is the movement of the organic material within the carbon system to adsorption sites located on the carbon particles. The actual chemical adsorption between the carbon particle and the organic material is minimal. The third stage, physical attraction, completes the adsorption process. Breakthrough of contaminants occurs when the carbon adsorption sites are at full capacity. When this occurs, the carbon must be regenerated. This technology has been proven effective in many groundwater remediation projects involving treatment of VOCs, and was therefore retained for further consideration.

- Air Stripping: Air stripping involves the intimate contact between the contaminated groundwater and air, resulting in a transfer of VOCs within the groundwater from the liquid phase to the air phase. This process would require the construction of a tower filled with an inert plastic media designed to maximize the volume of liquid in contact with air. Additional air treatment may be required at the point of air discharge. Because air stripping has been proven effective in the remediation of VOC contaminated groundwater, air stripping was retained for further analysis.

8.3.2.3.4 No Further Action (Monitoring Only)

The No Further Action alternative is evaluated as a procedural requirement and provides a basis for comparison with other alternatives. As with all other alternatives, the No Further Action alternative would include a groundwater monitoring program to monitor contaminant levels over time. If all residents in the area are connected to public water, there is no risk to public health posed by the contaminants in groundwater. However, as the plume migrates, groundwater in downgradient surrounding areas would become impacted. Although the No Further Action alternative does not meet the remedial action objectives for this site, it will be further evaluated as a procedural requirement as it provides a basis for comparison with other alternatives

8.4 Development and Screening of Remedial Action Alternatives

The purpose of this section is to develop an appropriate range of site management options that will be analyzed more fully in the detailed analysis phase of the FS.

Table 8-1 summarizes the potential remedial alternatives retained from the initial screening of soil and groundwater remediation technologies in Section 2.3. The remediation technologies have been assembled into remedial action alternatives. In this section, remedial action alternatives will be evaluated on to their effectiveness, implementability, and relative costs for implementation. The development and preliminary screening of these remedial action alternatives are summarized in Table 8-2.

8.4.1 Soil Remedial Action Alternative Evaluation

8.4.1.1 Alternative No. 1: No Further Action

Under the No Further Action alternative, no soil cleanup actions would be undertaken at the site. Discharges to the onsite drainage structures and subsurface soils ceased several years ago and the groundwater impacts may have been magnified by these discharges. Contaminant

concentrations in soil would remain relatively unchanged. The impacted soil would continue to leach contaminants to groundwater. The No Action alternative could be coupled with a groundwater monitoring program to monitor contaminant levels over time.

Effectiveness – The human health exposure assessment identified several potentially completability functional pathways consisting of ingestion of contaminated soil, inhalation of vapors and/or dermal absorption of contaminated soil because of the presence of significant concentrations of 1,2,3-TCP in on-site soils. VOC-impacted soils could be brought to the surface if excavation activities occurred at these locations, and potentially resulting in exposure via ingestion, direct contact or inhalation. With soil concentrations remaining above the NYS RSCOs, the No Further Action alternative poses a potential risk to human health because of direct contact exposure concerns. This alternative also poses a potential threat to the environment because significant levels of 1,2,3-TCP are present in the soil and would continue to degrade groundwater quality.

Implementability - The No Further Action alternative is readily implemented since no remedial actions would be undertaken.

Recommendation – This remedy is not protective of human health or the environment, however, this alternative will be retained for detailed analysis as required under the NCP.

8.4.1.2 Alternative No. 2: Excavation and Disposal

This remedial alternative encompasses the removal of the source areas, namely the drywell structures, waste lagoons, and subsurface soils that contain contaminants above RSCO. Excavated soils would be transported for disposal at an off-site location that is licensed and permitted to accept this waste material.

Effectiveness – This alternative is an effective means of source area remediation. By removing the source of the contamination that is feeding the groundwater, groundwater concentrations would also be expected to decrease over time. Further, source area removal

would reduce the overall timeframe and cost associated with any groundwater remediation program. Excavation activities would be focused on the western portion of the property in an area where significant concentrations of 1,2,3-TCP (up to 680,000 ug/kg) were found at maximum depths between 4 feet and 41 feet below grade. This area has an overall areal extent of approximately 3,000 square feet. There are four other isolated areas within the property where 1,2,3-TCP exceeded the soil cleanup criteria. These areas total 1,300 square feet and have maximum excavation depths of 15 feet at three of these locations and 6 feet at the fourth location.

Implementability – Conventional excavation methods can be used to remove soils to significant depths; however, depending on the final targeted depth, the excavations may need to be shored which can significantly increase costs. In at least one on-site location (i.e., SS-3), contamination extends to approximately 41 feet below grade. Sheeting and shoring would be needed to secure embankments adjacent to site structures.

Recommendation – Soil removal to 41 feet below grade is achievable. This remedial alternative will be retained for further analysis.

8.4.1.3 Alternative No. 3: In-Situ Solidification and Stabilization/Chemical Fixation

Soils would be stabilized in place by chemical fixation/stabilization techniques. The objective of the stabilization process is to reduce the overall leachability of the contaminants so that contaminated soils can be left in place without posing a threat to the public or the environment. Chemicals are mixed with the impacted soil in place to fixate the contaminants within the soil column. This treatment process reduces the overall solubility, toxicity and mobility of the contaminants. The maximum depth to which soil contamination extends is approximately 41 feet below grade, which is within the vertical limits for which this remedial technology can be effectively implemented. The effectiveness of the treatment process would be evaluated by assessing soil leachability to determine whether contaminants are leaching from the treated soil and potentially impacting the underlying groundwater. Leachate levels would be evaluated against the groundwater quality standard for 1,2,3-TCP of 0.04 ug/l.

Effectiveness – Because 1,2,3-TCP is not a common contaminant typically encountered during remedial cleanups, there has been no known development done on treatment of 1,2,3-TCP relative to soil stabilization. Bench and pilot testing would be required to develop a specific chemical mix to stabilize 1,2,3-TCP in soil and determine its treatability. Furthermore, because the groundwater standard for 1,2,3-TCP is low (0.04 ug/l), the likelihood for successful stabilization of 1,2,3-TCP within the soil matrix may prove to be a challenge.

Implementability – The number of vendors currently available to implement this treatment alternative remain limited. Specialty equipment and chemistry is required for implementation of this remedial technology.

Recommendation – Because of the lack of chemical specific data available on the treatability of 1,2,3-TCP and the extremely low treatment goal of 0.04 ug/l for this compound, this remedial alternative will not be retained for further consideration.

8.4.1.4 Alternative 4 - Soil Vapor Extraction (with Thermal Enhancement)

Soil Vapor Extraction (SVE) has been proven to be effective at removing volatile organic contaminants from permeable soils. As contaminated air is extracted through the impacted soil in the unsaturated zone, contaminants that are sorbed onto soil particles volatilize into the air stream. Depending on the concentrations in the extracted soil gas, the air can be vented to the atmosphere with or without pretreatment.

Factors that contribute to the effectiveness of a conventional SVE system are the chemical and physical properties of the contaminants and the soil lithology of the unsaturated soil. Based on the RI, site geology should be conducive to vapor extraction. The contaminant's chemical properties that impact the effectiveness of an SVE system include vapor pressure and Henry's Law Constant, both of which provides an indication as to the volatility of a compound. Generally, SVE is effective on compounds with a Henry's law constant greater than 0.01 or a vapor pressure greater than 1 mm Hg @ 20°C. The Henry's law constant for 1,2,3-TCP is 0.013

and its vapor pressure is 2 mm Hg @ 20°C. These chemical properties suggest that conventional SVE would only be marginally effective on removal of 1,2,3-TCP. However, if the treatment process was thermally enhanced, use of SVE technology can be viable.

This technology is an enhancement of SVE. Thermal enhancements for SVE would involve transferring heat (in the form of steam or hot air) to the subsurface to increase the vapor pressure of VOCs and to increase air permeability in the subsurface formation by drying it out. In addition to the volatility of the contaminant compound, the removal of contaminants by SVE is also controlled by a number of transport and removal mechanisms such as gas advection, chemical partitioning to the vapor phase, gas-phase contaminant diffusion, sorption of contaminant on soil surfaces, and chemical or biological transformation. Thermal enhancement technologies raise the soil temperature to increase the reaction kinetics for one or all of the removal and transport mechanisms, making SVE treatment more effective.

System components for a thermally enhanced SVE system would include a vacuum blower, a heat exchanger, a steam generator and an air cooler. Off-gases from the SVE system would be treated with vapor phase granular activated carbon (GAC) to meet NYSDEC Air Guide 1 discharge requirements.

Effectiveness – Geologic conditions beneath the site, consisting primarily of sand and gravel, would tend to lend itself to SVE treatment. Thermal enhancement, in the form of hot air or steam injection, would help to increase the volatility of 1,2,3-TCP.

Implementability – Installation of the thermally enhanced SVE system would use conventional construction techniques and readily available equipment (e.g., vacuum blower, heat exchange, steam generator, air cooler, vapor phase GAC).

Recommendation – Steam injection can effectively increase the volatility and reduce the viscosity of a contaminant, thereby increase recovery rates. SVE with thermal enhancement is deemed viable and will be retained for further evaluation in later sections of this report.

8.4.2 Groundwater Remedial Action Alternative Evaluation

8.4.2.1 Alternative No. 1: No Further Action with Continued Monitoring

Under the No Further Action alternative, no active groundwater remediation would be undertaken at the site. Groundwater that has already been impacted by VOCs would remain untreated. Some dilution and attenuation would occur as groundwater migrates away from the site. Periodic sampling of selected on- and off-site monitoring wells would be performed on a quarterly basis for a period of fifteen (15) years to assess changes in contaminant levels and migration. Fifteen years was chosen to be consistent with the time frame estimated for an active groundwater pump and treat system.

Effectiveness - Concentrations that are currently above a groundwater quality standard for a Class GA (Sole Source) aquifer will remain above standard. If groundwater is left untreated, contaminants could potentially reach the Suffolk County Water Authority (SCWA) public water supply wells located generally to the south and southeast of the site. The closest of the three well fields is the Carleton Avenue well field (Carlton Avenue #1-S67197), which is located approximately 3,100 feet to the south-southeast of the site. The other two wells are located significantly farther away; the SCWA Bellmore Avenue well field is located approximately 2.1 miles to the southeast and the Fisher Avenue well field is located approximately 2.5 miles to the east-southeast of the site. Although these public supply wells are screened at a depth deeper than that observed for the site contaminants, the potential exists that the wells could become impacted in the future.

Implementability - This alternative is very easily implemented. Periodic groundwater monitoring would be performed at nine (9) selected on-site and off-site monitoring wells to assess groundwater quality, and to identify any further impact to groundwater.

Recommendation – Although this alternative does not provide long-term protection to the potential downgradient receptors (i.e., SCWA supply wells) this alternative will be retained for detailed analysis as required under the NCP.

8.4.2.2 Alternative No. 2: Groundwater Treatment by In-Situ Air Sparging with Ozone Injection (C-Sparge™ Method)

Groundwater sparging is a term applied to the injection of air below the water table to induce contaminant removal by volatilization in order to remediate organic contaminant plumes. Groundwater beneath the site would be treated using a series of air sparge points and vapor extraction wells. Under a conventional air sparge system, air is introduced under pressure below the water table to increase the rate of volatilization of VOCs in the saturated zone SVE system. Air is injected through wells screened within the contaminated aquifer. The air rises through the aquifer volatilizing dissolved VOCs and removing VOCs absorbed to soils within the saturated zone. A vacuum extraction system is used in conjunction with the air sparge system to capture the VOCs.

Air sparging with SVE is most effective when used at sites with unconsolidated materials such as sand and gravel, or in relatively permeable formations. A significant limitation of a conventional air sparge system is the depth contaminants are present beneath the groundwater table. As a general rule, air sparging is effective only up to a depth of 20 feet below the groundwater table. Beyond 20 feet, injection of compressed air into the aquifer becomes problematic. At the MacKenzie site the saturated thickness of the plume is over 70 feet. Groundwater contamination extends from the groundwater table, which is at 50 feet below grade, down to 120 feet below grade.

A relatively new proprietary method based on a combination of air sparge technology and in-situ chemical oxidation technology is the C-Sparge™ (Criegee Oxidation) System. This system injects an air/ozone mixture into the aquifer using a patented spargepoint system. The micro-fine bubbles of encapsulated ozone (O_3) created by the spargepoints are dispersed through the water and the saturated soil formation. An advantage of ozone over air is that ozone is over ten times more soluble than oxygen. As such, it can be transferred into the aqueous phase more rapidly than oxygen. The ozone bubbles strip the hydrocarbon contaminants and oxidizes them to produce non-toxic by-products (e.g., carbon dioxide and dilute acid). Studies have shown

radius of influence from 30 feet to greater than 100 feet depending on site soil conditions. Favorable site conditions for sparging include permeability of between 10^{-1} to 10^{-5} cm/sec, flow velocity of less than 10 feet/day, and aquifer thickness of 10 to 100 feet. Conditions at the MacKenzie site meet all three criteria, and therefore, from a hydrogeologic perspective, is well suited for sparging.

Effectiveness – Air sparging using ozone (C-Sparge™ System) is a relatively new technology. Because 1,2,3-TCP is not a common site contaminant, there has been no development done to date on the treatability of 1,2,3-TCP using this technology, however, based on the chemical makeup of this compound (chlorinated hydrocarbon) and its similarity to 1,1,1-trichloroethane, this technology, in theory should be effective in oxidizing 1,2,3-TCP. Bench testing and field pilot testing would be needed to confirm the applicability of this treatment technology on 1,2,3-TCP, and to determine what site specific radius of influence can be achievable.

Implementability - This treatment alternative uses conventional well installation techniques and equipment. Ozone that is used in the injection process would be generated locally using an ozone generation system placed near the sparge points. K-V Associates, Inc., holds the patent on the C-Sparge™ System.

Recommendation – Although bench scale and pilot testing would need to be performed to confirm the applicability of this treatment technology on 1,2,3-TCP, this remedial alternative will be retained for detailed analysis.

8.4.2.3 Alternative No. 3: Groundwater Treatment by In-Well Stripping

In-well stripping is an in-situ technology for the treatment of organic contaminants in groundwater and can be utilized to prevent plume migration and source area contaminant reduction. Under this alternative, the groundwater contaminant plume would be treated using a series of groundwater circulation wells (also referred to as in-situ stripping wells) to capture and circulate groundwater within the aquifer. No groundwater is extracted from the ground; all

treatment occurs in place. The stripping well is constructed with two screens, one intercepting the groundwater table, and one at the bottom of the treatment well. Groundwater is drawn into the well through the lower section of the double-screened well and is discharged through the upper screen back into the aquifer just above the water table. Upward groundwater flow is achieved using pressurized air within the well to cause the mixture of air and water to rise within the well, or can be achieved by use of a submersible pump. The continuous movement of groundwater upward through the well causes water to circulate within the aquifer surrounding the well. Groundwater that is captured by the stripping cell circulates several times through the well before it is released downgradient of the capture zone. With each pass through the stripping well, additional VOCs are removed from the groundwater. The contaminated air drawn up through the well can be collected for treatment before it is discharged to the atmosphere, if necessary.

Effectiveness – The effectiveness of in-well stripping is primarily dependent upon the aquifer characteristics (e.g., hydraulic conductivity, geology, mineral content,) and contaminant chemical characteristics (e.g., solubility, Henry's Law Constant, vapor pressure). Hydrogeological conditions at and near the MacKenzie site, consisting mostly of sands and gravels, suggests that in-well stripping can be well suited to this site. However, the primary contaminant of concern at the site, 1,2,3-TCP, has a relatively low Henry's Law Constant. For any given compound in water, a higher Henry's law constant will mean that the compound would be more easily removed from water by stripping. To compensate for the low Henry's Constant, a high air to water ratio would be needed to effectuate removal. Even using a high air flow rate, the in-well stripper technology may not be able to reduce contaminant levels down to 0.04 ug/l, which is the groundwater standard for 1,2,3-TCP.

Implementability – The in-well stripping system uses conventional installation well drilling techniques and equipment (i.e., air compressors, vacuum blowers, etc.). If necessary, off-gas generated during the in-well stripping process would be collected and treated through treatment units containing vapor-phase carbon. However, as indicated above, because 1,2,3-TCP is not readily stripped from groundwater, high air to water flow ratios would be needed in order to effectuate contaminant removal. High air flow rates and low contaminant loading of 1,2,3-

TCP will make vapor phase treatment very inefficient. While this technology can be readily implemented, it will likely not be able to achieve the removal efficiency needed.

Recommendation - In-well stripping will not be cost effective because of the high air to water flow rate needed to achieve effective treatment. With high air flow rates, treatment of the off-gas will also not be cost effective. Additionally, in-well stripping may not be able to achieve the removal efficiency needed to meet the groundwater cleanup objective. Therefore, this remedial alternative will not be retained for further consideration.

8.4.2.4 Alternative No. 4: Groundwater Extraction and Treatment

8.4.2.4.1 Groundwater Collection and Discharge

Under this alternative, the groundwater plume would be collected via extraction wells and treated to remove VOCs, primarily 1,2,3-TCP, to levels in compliance with NYSDEC groundwater discharge standards. The treated water would then be recharged back to the aquifer. Periodic monitoring of groundwater would be conducted in order to observe groundwater cleanup progress and to ensure capture of the contaminant plume. Periodic sampling of treatment system influent and effluent would also be conducted to monitor treatment system efficiency and compliance with discharge requirements.

Hydraulic control is proposed for the portion of the plume with total VOCs concentrations over 100 parts-per-billion (ppb). The 100 ppb contour for total VOCs extend approximately 800 feet downgradient of the MacKenzie property, to about the extent of South Road. It is anticipated that two (2) extraction wells would be sufficient to capture the targeted portion of the contaminant plume. To accelerate groundwater cleanup, one well would be located closer to the facility near where the highest concentrations of 1,2,3-TCP have been observed in groundwater (near VP-2). The second well would be located approximately 500 feet downgradient of the site (in the vicinity of VP-11) and would intercept the groundwater plume at about the 100 ppb contaminant contour. The combined pumping rate for the two wells would be approximately 65 gpm.

Because of limited availability of property in the residential neighborhood downgradient of the site, the extracted groundwater would be piped back to a centralized treatment system on the MacKenzie property. This would require the installation of approximately 1,000 linear feet of below grade piping under public roadways and right-of-ways. Treated water would be discharged back to the aquifer. The permeability of the Upper Glacial aquifer makes groundwater recharge or injection a viable option for discharge. Groundwater recharge can be accomplished using on-site drywells, recharge basins, and/or injection wells. With the limited availability of land surface that can be dedicated to constructing recharge basins, use of drywells or injection wells would be preferable because they would be constructed below grade. The locations and exact number of diffusion wells or drywells would be established during remedial design.

Effectiveness – Groundwater pump-and-treat has been proven to be effective at removing and hydraulically controlling contaminant plumes. The effectiveness of the groundwater pump-and-treat system is primarily dependent upon aquifer characteristics, contaminant chemical characteristics, and the extent of groundwater contamination. From our experience with other sites on Long Island, hydraulic capture of this plume is readily achievable.

Implementability - Conventional well installation techniques and pump equipment could be used, and contractors and materials are readily available. Because the extraction wells would be located off-site and the surrounding neighborhood is mostly residential, off-site access would be needed from private landowners, and/or from public agencies or municipal authorities to install the extraction wells and the collection piping on public property or along right-of-ways.

Recommendation – This process option will be retained for detailed analysis.

8.4.2.4.2 Groundwater Treatment

Several ex-situ groundwater technologies are available to treat the VOC contaminated groundwater once it is extracted from the ground. These include granular activated carbon

(GAC) adsoprtion, air stripping, and ultraviolet (UV) oxidation. These treatment technologies are briefly described and evaluated below.

Granular Activated Carbon

Activated carbon is an excellent adsorbent due to the large degree of surface area contained within the carbon particle that is accessible for the adsorption process. Adsorption is a natural process in which molecules of a liquid or gas are attracted to and then held at the surface of a solid. In addition to the "outer" surface area on the carbon particle, "inner" cavities allow for significant surface area per mass of particle. Contaminants in the untreated water adsorb onto the granular activated carbon. As contaminant loading on the carbon reaches the adsorptive capacity of the carbon near the top of the filter, the interface between the saturated and the "clean" carbon moves downward through the carbon bed inside the pressure vessel. When the carbon in the filter vessel is fully loaded with contaminants (i.e., at its adsorptive capacity), no further removal will take place and contaminants will begin to be found in the filter effluent. Effluent monitoring and estimates of the adsorptive capacity of the carbon enable the carbon in the filter to be replaced prior to contaminant breakthrough. The GAC can be regenerated by heating at high temperatures. On-site carbon regeneration facilities only prove economical for a facility having a very high rate of GAC consumption. Off-site carbon regeneration is usually preferred. The frequency with which the carbon must be regenerated or replaced depends on several factors, including the nature and concentration of the contaminants to be removed, the total flow through the carbon vessel, and the total amount of carbon in the filter vessel.

Based on empirical data, the adsorptive capacity of carbon is on the order of 10% (0.1 pounds of 1,2,3-TCP per pound of activated carbon). GAC is a viable treatment option to be used as a stand alone technology, or in conjunction with air stripping.

Air Stripping

Groundwater treatment by air stripping is generally implemented by pumping untreated groundwater to the top of a packed-column, which contains a specified height and cross-sectional area of inert "packing" material along with water distribution and collection systems. The column receives ambient air under pressure in an upward vertical direction from the bottom of

the column as the water flows downward, hence the term "counter-current packed column air stripping". The packed tower promotes intimate contact between the gas phase and the liquid phase so as to enhance the establishment of equilibrium between phases. Air stripping removes VOCs from the untreated groundwater by transferring them to the air phase. Based on the estimated influent feed concentration to the stripping tower, the anticipated concentration of 1,2,3-TCP in the off-gas from the air stripper is expected to be below the NYS Air Guide 1 Annual Guideline Concentration of 140 g/m^3 for this compound. Therefore, treatment of the air stripper off-gas would not be required.

A compound's Henry's Constant provides an indication as to the ease in which a compound can transfer from the liquid phase to the air phase. The lower the Henry's Law Constant, the more difficult to strip the compound from the liquid phase. The Henry's constant for 1,2,3-TCP of 0.013 is considered to be low and not ideal for air stripping. In order to achieve the mass removal needed for 1,2,3-TCP to be below the groundwater discharge standard of 0.04 ug/l, a tower with over 170 feet of packing material would theoretically be required (assuming a standard 30-inch diameter tower). A tower of this size is impractical, even if multiple towers were to be used in series. In general, a standard 30-inch diameter tower containing 25 feet of packing material can achieve on the order of 90% removal efficiency. To rely on the air stripper to achieve 0.04 ug/l on the discharge becomes impractical and economically infeasible. Therefore, while air stripping can still be used to remove about 90% of the 1,2,3-TCP, it would need to be used in conjunction with another technology that is capable of treating the residual concentrations down to 0.04 ug/l at a reasonable cost, such as GAC.

Preheating influent groundwater to improve the strippability of 1,2,3-TCP was preliminarily evaluated, but was deemed economically infeasible because of high energy costs to preheat the influent water.

UV-Oxidation

UV-oxidation utilizes a combination of ultraviolet ("UV") light and a chemical oxidant, such as ozone or hydrogen peroxide, to break down VOCs by photochemical oxidation. A typical UV/hydrogen peroxide system consists of a hydrogen peroxide feed system or an ozone

generator in conjunction with oxygen or air source, and an UV-oxidation reactor. The reactor provides controlled, simultaneous UV-oxidant contact. The ultimate end products of UV oxidation treatment are trace salts, carbon dioxide and water or non-toxic intermediates.

Discussions with vendors of this technology indicate that this technology will likely not be effective on 1,2,3-TCP because of its chemical makeup (i.e., aliphatic saturated hydrocarbon). Hydrogen peroxide typically reacts very slowly with saturated alkanes. To design and operate an UV-Oxidation system with sufficient contact time for complete oxidation of 1,2,3-TCP would not be economically feasible because of the large reactor needed and high energy cost associated with maintaining the UV source.

Effectiveness - Air stripping and GAC adsorption can be utilized for treatment of 1,2,3-TCP in groundwater. While GAC can be used as a stand alone technology capable of reducing 1,2,3-TCP to the discharge standard of 0.04 ug/l, air stripping is only cost-effective in reducing 1,2,3-TCP concentrations by about 90%. For an air stripper to further reduce 1,2,3-TCP levels down to the requisite discharge standard of 0.04 ug/l, an incremental 150 feet of additional packing would be required, making air stripping technology no longer practical.

UV-oxidation was determined to not be cost-effective for treatment of 1,2,3-TCP because of the high residence time needed to completely oxidize this compound to carbon dioxide and water.

Implementability - Air stripping and GAC adsorption would require the purchase and construction of commonly available equipment. There are little to no inherent difficulties in the site-specific design of these treatment units. The location of the two extraction wells off-site necessitates access agreements from private landowners, or from municipal authorities to install the extraction wells and the collection piping on public property or along right-of-ways.

Recommendation – It is recommended that GAC be retained for detailed analysis. Air stripping technology will also be retained, recognizing that a secondary treatment technology

would be required to make this treatment option viable. UV-oxidation will not be retained because of the high residence times needed for effective treatment.

8.4.2.5 Alternative 5 – In-Situ Chemical Oxidation

In concept, in-situ chemical oxidation is intended to simulate and increase the rate at which chemical and biological processes that are occurring naturally onsite, but which are occurring at extremely slow rates. In-situ chemical oxidation entails the staged application of a strong oxidizer into the aquifer to promote the degradation of organic constituents in groundwater and saturated soil. Where hydrogen peroxide is used, the basic transformation reaction involves the reaction of hydrogen peroxide (H_2O_2) with dissolved hydrocarbons (HC) in a groundwater medium (H_2O) to produce steam and carbon dioxide (CO_2). This reaction can be expressed as:

$$H_2O_2 + 2HC + H_2O \xrightarrow{\text{inhibitor/initiator/enhancer/catalyst}} 3H_2O + CO_2$$

Substituted hydrocarbons will also undergo oxidation, with the halide being released as a free radical.

To increase the rate of reaction, hydrogen peroxide can be transformed into hydroxyl radicals utilizing chemical additives to act as a catalyst (e.g., ferrous sulfate heptahydrate) according to Fenton's Reaction:

$$Fe^{+2} + H_2O_2 \longrightarrow Fe^{+3} + OH^- + \bullet OH$$

The hydroxyl radical (i.e., denoted as •OH) reacts typically a million to a billion times faster than other simple oxidants such as hydrogen peroxide, making the reaction process favorable for use as a remediation technology. Other commercially available oxidizers include potassium permanganate, sodium permanganate, and magnesium peroxide.

Effectiveness – In-situ chemical oxidation is being used to remediate organic compounds in groundwater and saturated soil at sites across the country, and is also undergoing extensive testing at Department of Defense and Department of Energy sites. This treatment technology is

considered to still be innovative; the commercial use of this treatment process as a remediation technology began only within the last 5 years. Because 1,2,3-TCP is not a common site contaminant typically encountered during remedial cleanups, there has been no known development done on the treatment of 1,2,3-TCP using this technology, however, extensive bench and field testing has been successfully performed on the oxidation of other chlorinated hydrocarbons. Bench testing and full scale field pilot testing would be needed to confirm the applicability of this treatment technology on 1,2,3-TCP.

Implementability – Application of the in-situ chemical oxidation technology would require the installation of several groundwater injection points to inject the oxidation chemistry. The contaminants in groundwater have already migrated away from the site and the highest concentrations are now beneath a residential neighborhood. The injection points would have to be located within accessible areas such as public right-of-ways. These locations are not the optimal for targeting the entire contaminant plume.

The number of vendors currently available to implement this treatment alternative is somewhat limited. Some commercially available in-situ chemical oxidation systems include CleanOx, Geo-Cleanse, and Regenesis. Patented equipment and/or proprietary chemicals (e.g., Fenton Reaction chemistry) are required for implementation of this remedial technology.

Recommendation – Although bench scale and pilot testing would need to be performed to confirm the applicability of this treatment technology to site contaminants, this remedial alternative will be retained for detailed analysis.

8.5 Detailed Analysis of Alternatives

This section of the FS presents the detailed qualitative and quantitative analysis of remedial alternatives which were developed and evaluated in the previous section. Under the NYS Superfund guidance (NYSDEC TAGM No. HWR-90-4030), each remedial alternative must be evaluated using the seven criteria listed below which provides the basis for selecting the recommended remedial action for the site.

- Compliance with New York State Standards, Criteria, and Guidelines
- Overall protection of human health and the environment
- Short-term effectiveness
- Long-term effectiveness and permanence
- Reduction of toxicity, mobility, and volume of contaminants
- Implementability
- Cost

These evaluation criteria are consistent with those outlined in the National Contingency Plan, and presented in the USEPA Superfund guidance documents. The seven evaluation criteria for remedial action selection address the following concerns. An alternative must satisfy the first two evaluation criteria listed below in order for the alternative to be considered for selection.

- Compliance with New York State Standards, Criteria, and Guidelines (SCGs) - This criterion describes how the alternative complies with ARARs, and appropriate New York State SCGs. The remedial action alternatives will be evaluated relative to their ability to comply with the previously established ARARs.
- Overall Protection of Human Health and the Environment - This assessment draws on the results the overall evaluations to describe whether, and how, each alternative provides protection of human health and the environment.
- Short-Term Effectiveness - The effectiveness of alternatives in protecting human health and the environment during implementation, construction and operation is evaluated using this criterion. Short-term effectiveness is assessed by protection of the community, protection of workers, environmental impacts, and the time frame until protection is achieved.
- Long-Term Effectiveness and Permanence - This criterion evaluates the long-term protection of human health and the environment, the potential risk remaining after completing the remedial action, and the permanence of the remedial alternative. It is measured by the magnitude of risk remaining from untreated waste or treatment

residuals, by the adequacy of the controls in achieving clean-up criteria, and by the reliability of the controls against possible failure.

- Reduction of Toxicity, Mobility, and Volume of Contaminants - This criterion evaluates the anticipated performance of treatment alternatives. There is a statutory preference for selecting remedial actions with treatment technologies that permanently and significantly reduce toxicity, mobility or volume of the hazardous wastes as their principal element. Specific factors include: (1) the amount of hazardous materials that will be destroyed or treated; (2) the degree of expected reduction in toxicity, mobility or volume; (3) the degree to which the treatment will be irreversible; and (4) the type and quantity of treatment residuals that will remain following treatment.

- Implementability - This criterion evaluates the technical and administrative feasibility, and the availability of services and materials in implementing the remedial alternative. Factors used to assess technical feasibility include construction and operational considerations, reliability of technology, ease of implementing the remedial action and monitoring considerations.

- Cost - Order of magnitude cost estimates (-30% to +50%) inclusive of capital and operation and maintenance (O&M) costs are developed to help evaluate the overall cost-effectiveness of the remedial action alternatives. Capital costs include equipment, construction/installation, engineering and associated administrative costs. O&M costs are post construction costs incurred to ensure effective operation (e.g., utilities, chemical stock, waste disposal, operation labor, etc.), and also include the monitoring costs associated with implementing the remedial action. All costs are developed (using Year 2000 dollars) to the same level of detail in order to provide for an even basis for comparison. Present worth calculations are used to compare the cost-effectiveness of these alternatives. Present worth values were calculated based on the estimated life span for each remedial action, using a five percent (5%) interest rate. The estimated lifespan of the remedial alternative varied depending on the treatment method.

Subsections 8.5.1 and 8.5.2 present the individual analyses for each of the remedial alternatives. A summary of the detailed screening evaluation is provided in Table 8-3.

8.5.1 Detail Analysis of Soil Remediation Alternatives

8.5.1.1 Alternative No. 1: No Further Action

Under the No Further Action alternative, additional soil remedial activities would not be performed at the site. Any cleanup of soils would only occur through natural degradation and attenuation processes. Concentrations of contaminants in soil would remain relatively unchanged.

Compliance with New York State Standards, Criteria, and Guidelines (SCGs) - Under the No Further Action alternative, concentrations of contaminants in soil would remain above the NYS RSCOs.

Overall Protection of Human Health and the Environment – The No Further Action alternative poses a potential risk to human health because of direct contact exposure concerns if the contaminated site soils were brought to the surface. This alternative also poses a potential threat to the environment because VOCs would continue to act as a source of groundwater contamination. This remedy does not provide for long-term protection to human health or the environment.

Short-Term Effectiveness - Since no remedial actions are being implemented under this alternative, there will be no short-term effects to the community, to workers, or to the environment associated with implementation of an action.

Long-Term Effectiveness and Permanence - As this alternative does not involve any active remediation activities, no efforts would be needed to maintain this remedy. Concentrations of contaminants in soil would remain relatively unchanged.

Reduction of Toxicity, Mobility, and Volume of Contaminants – Contaminants from the source area will continue to leach from the soil matrix to groundwater, further degrading

groundwater quality. The size of the groundwater plume will continue to increase as contaminants migrate further from the site.

Implementability – The No Further Action scenario is readily implemented since no remedial actions would be undertaken. Based on the foregoing, the No Action alternative is not an appropriate management option for the site.

Cost - The present worth order of magnitude cost estimate for the No Further Action alternative includes only O&M costs for quarterly groundwater monitoring using nine existing monitoring wells for VOCs. These wells include MCMW-1 (background well), MCMW-3, OS-1D, OS-2S, OS-2I, OS-2D, OS-3S, OS-3I, and OS-3D to monitor the plume. The present worth cost for this alternative was developed based on a fifteen (15) year monitoring period to be consistent with the time frame estimated for the groundwater pump and treat alternative. There are no capital costs associated with this alternative. The present worth O&M cost for groundwater monitoring is estimated at $311,391. A breakdown of these costs is provided in Table 8-4.

8.5.1.2 Alternative No. 2: Excavation and Disposal

This alternative involves contamination reduction through source area removal of impacted soils. Soil excavation activities would encompass the removal of drywell structures, waste lagoons sludges, and subsurface soils that contain contaminants (primarily 1,2,3-TCP) above an RSCO. Contaminated soil from the source area would be excavated and the soil would be transported off-site for disposal at a facility licensed and permitted to accept this waste material.

From the remedial investigation, five (5) areas of soil contamination exist onsite. Contamination in these areas generally extends to approximately 15 to 20 feet below grade. However, at several locations (i.e., SS-3, SS-4, and DS-14), contamination has been detected as deep as 41 feet below grade. While excavation to these depths is achievable, sheeting/shoring is required to protect the foundation of the adjacent building, and to minimize excavation cave-ins.

Sheeting/shoring will significantly increase the overall cost of implementation.

The first area for excavation is located on the western portion of the property where significant concentrations of VOCs, including 1,2,3-TCP of up to 680,000 ug/kg, were found at maximum depths ranging from 4 to 41 feet below grade. A stormwater drywell (DS-9) is located within this area. This area is situated between two on-site buildings and has an areal extent of approximately 3,000 square feet. Approximate excavation depths are shown on Figure 8-1. Based on the location of the excavation in proximity to the existing on-site structures, sheeting and shoring would be required.

The second excavation area was identified during the collection of soil samples from a boring constructed through a stormwater drywell (DS-14) located on the southwest portion of the property. The highest concentration of 1,2,3-TCP (87,000 ug/kg) was detected at 12 feet below grade, while 1,2,3-TCP was well below the RSCO at 21 feet below grade (7.2 ug/kg). 1,2,3-TCP was also detected at a concentration of 2,300 ug/kg at 41 feet below grade. Because this data point is below a clean zone, it was not considered to be environmentally significant and therefore, was not included for excavation. Based on other soil samples collected in the vicinity of this location, it is assumed that the area of soil impact is limited to a 400 square foot area surrounding this sample point and extends vertically to a maximum depth of approximately 16 feet below grade.

The third area of soil contamination was identified at soil boring (SS-15) located in the northeast portion of the property. Elevated concentrations of 1,2,3-TCP (22,000 ug/kg) were detected at 4 feet below grade. Soil samples collected at 8 feet below grade were non-detect. It is assumed that the area of soil impact is limited to a 400 square foot area surrounding this sample point, and contamination does not exceed 6 feet below grade. Based on the excavation's location in proximity to buildings located on-site, sheeting and shoring may be required.

The fourth area of soil contamination identified during the RI was from a boring conducted adjacent to and targeting a waste lagoon on the northeast portion of the property. The boring was not constructed through the bottom of the lagoon so as to not impact the integrity of

the concrete bottom of the lagoon. 1,2,3-TCP was detected in soil sample WL#1, collected at 8 feet below grade, at a concentration of greater than 500 ug/kg. Soil samples collected at 25 feet below grade were below the RSCOs. Since this sample was collected from adjacent to and not directly beneath the lagoon, it is conceivable that contaminant concentrations directly beneath the lagoon may be higher. Therefore, the areal extent of this area is assumed to be 400 square feet to encompass the entire lagoon. Soil contamination is assumed to extend beneath the lagoon to approximately 16 feet below grade.

The fifth area of soil contamination identified during the RI was from a boring constructed through a drainage structure, designated as DS-13 on the northeast portion of the property. Several semi-volatile organic compounds (SVOCs) were detected above NYSDEC RSCO in soil sample DS-13, collected at 10 feet below grade. The contamination areal extent of this area is assumed to be 100 square feet and is assumed to extend approximately 15 feet below grade.

Compliance with New York State Standards, Criteria, and Guidelines (SCGs) – This remedial alternative complies with the SCGs for soil. Soil removal will eliminate the VOCs from acting as a continuing source of contamination to the groundwater. By removing the source area feeding the groundwater, contaminant concentrations in groundwater would be expected to decrease over time, helping to reduce the overall timeframe and cost associated with the selected groundwater remediation program.

Overall Protection of Human Health and the Environment – Source area removal is protective of human health and the environment. The potential for direct contact exposure is eliminated.

Short-Term Effectiveness – The potential can exist for site workers and residents from the community to be exposed to dust generated from soil excavation activities. However, these risks can be effectively minimized through administrative and engineering controls taken during field activities. During excavation, dust erosion and control measures would be taken to minimize the release of airborne particulate matters to the atmosphere. On-site air monitoring

would be conducted within the work zones, and downwind of the work areas to assess potential exposure to the community. A community air monitoring plan, consistent with NYSDOH guidance, would be implemented. Gloves and other personal protective clothing and equipment (e.g., coveralls, boots, hard-hats, safety glasses, etc.) whould be worn to minimize any risk from inhalation, ingestion, or direct contact to remediation contractors. This remedial alternative can be completed in less than 2 months.

Long-Term Effectiveness and Permanence – Excavation and off-site disposal offers long term protection to the public health and environment. This remediation approach also offers the quickest means of eliminating the source area. Soil excavation and off-site disposal is a permanent remedy because the contaminants are physically removed from the site. No further maintenance of the disposed soil would be required.

Reduction of Toxicity, Mobility, and Volume of Contaminants – Source area removal of the contaminated soil eliminates the ability of the contamination to migrate to groundwater, and reduces the overall volume of the contaminant in the source area. There would be no reduction in the contaminant's toxicity since the contaminant is being removed from the existing media and not being treated onsite.

Implementability - This alternative involves the removal of source area material through excavation and disposal off-site. This can be accomplished using conventional construction equipment and methods. Sheeting/shoring will be necessary since some of the excavations extend at least 41 feet below grade and/or are located within close proximity to site structures.

Based on the site contaminants and limited knowledge of the former activities conducted at the facility, it is not anticipated that the excavated soil would exhibit any hazardous characteristics (i.e., RCRA ignitability, corrosivity, reactivity or TCLP leachability), or contain an F-listed waste. Therefore, the soil would likely be managed as non-hazardous waste for disposal.

Cost – The order of magnitude cost for excavating the five areas described above and disposing of this material off-site is estimated at $1,457,960. A breakdown of this cost is presented in Table 8-5. Costs may significantly vary if additional areas of soil contamination are encountered; utilities are present within or in close proximity to the excavations; or if site structures are demolished resulting in sheeting and shoring not being required. Furthermore, if based on soil testing, or if information is identified to indicate that the soil contains an F-listed waste material, the cost for soil disposal could significantly increase.

8.5.1.3 Alternative 3 – In-Situ Solidification and Stabilization/Chemical Fixation

This alternative was removed from consideration (see Section 8.4.1.3 of this document).

8.5.1.4 Alternative 4 - Soil Vapor Extraction with Thermal Enhancement

VOCs contained in the soil at the MacKenzie site would be treated using a thermally enhanced soil vapor extraction (SVE) system. SVE is an in-situ unsaturated (vadose) zone soil remediation technology in which a vacuum is applied to the soil to induce the controlled flow of air and remove volatile contaminants from the soil. The gas leaving the soil may be treated to meet local air discharge regulations.

The Henry's law constant and vapor pressure of 1,2,3-TCP is not ideal for treatment by SVE. To facilitate extraction, steam injection would be used to increase the mobility of 1,2,3-TCP. Steam is forced into the aquifer through injection wells to improve the volatility of the contaminants. Volatilized contaminants rise through the vadose zone where they are removed by vacuum extraction and then treated. Heating the soil while venting can optimize the effectiveness of SVE because heating effectively increases the vapor pressure of the contaminant and increases its removal rate.

The thermally enhanced SVE system assumes up to eight (8) vapor extraction wells; six (6) shallow vacuum extraction wells would be screened between 5 to 20 feet below grade, and

two (2) deeper vapor extraction wells would be screened between 20 to 40 feet below grade. The radius of influence of these vacuum wells has been conservatively estimated to be 25 feet.

The vacuum extraction wells would be manifolded together into a central treatment system. Steam would be introduced into the subsurface via injection points. Preliminary estimates assume sixteen (16) injection wells. The approximate locations of the vent wells, the steam injection wells, and the treatment system is shown on Figure 8-2.

The treatment train would include a moisture separator (knock-out drum), a vacuum blower, a heat exchanger and an air cooler/dehumidifier, and vapor phase carbon drums, all housed in an enclosure. The estimated vacuum flow rate for the SVE is 500 cfm. The system would also include a steam boiler to generate the steam used for injection. Additionally, a heat exchanger may be utilized to preheat the water used in generating the steam while at the same time lower the temperature of the heated soil gas before passing through the air cooler. Off-gas from the SVE system would be treated using vapor phase carbon prior to discharge to the atmosphere. The need for off-gas treatment would be confirmed during pilot testing/remedial design.

Because of the limited field studies performed on 1,2,3-TCP, a field pilot test should be conducted to confirm the effectiveness of a thermally enhanced SVE system on this contaminant. The pilot test should also confirm the unsaturated soil's pneumatic permeability, and estimate the areal influence of the vacuum extraction and the steam injection wells. The exact configuration and number of vacuum extraction wells and steam injection points would be determined based on the results of the field pilot.

The SVE system would not be effective at remediating the soils impacted by SVOCs. Therefore, the DS-13 area (approximately 10 feet by 10 feet by 15 feet deep), containing SVOCs above NYSDEC RSCOs, would be remediated by excavation and disposal offsite. The area to be excavated is estimate to be 20 feet x 20 feet by 10 feet deep.

Compliance with New York State Standards, Criteria, and Guidelines (SCGs) – The treatment system will reduce concentration of VOCs contained within the soil. The ARARs for site soils should be achieved using thermally enhanced SVE.

Overall Protection of Human Health and the Environment – This remediation alternative is protective of human health and the environment. By reducing contaminant concentrations within the source area, the potential for direct contact exposure is significantly reduced. Furthermore, by treating the source area feeding the groundwater, contaminant concentrations in groundwater are expected to decrease over time. Source area remediation also reduces the overall timeframe and cost associated with the selected groundwater remediation program.

Short-Term Effectiveness – This alternative poses no short-term risk to the public or the environment. The SVE system can be operated safely. Off-gas from the SVE would be treated prior to discharge to the atmosphere using vapor phase carbon, if needed, to meet local discharge regulations, and therefore, should not impact air quality in the surrounding community. Periodic monitoring of the VOC off-gas would be performed.

Long-Term Effectiveness and Permanence – With the removal of the contaminants from the soil, potential threats posed to the public through the direct contact exposure pathway are significantly minimized. Source area remediation also offers long-range protection to the environment by preventing further degradation of groundwater quality. Contaminants are transferred from soil to the air phase, and if needed, transferred onto vapor phase carbon. The carbon would be regenerated at an off-site location. This remedial alternative is a permanent remedy because the contaminants would be physically removed from the site.

Reduction of Toxicity, Mobility, and Volume of Contaminants – Source area remediation using this technology reduces the overall mobility and volume of contaminants contained within the soil, preventing additional contaminants from migrating from soil to groundwater. The overall volume of contaminants contained within the source area will gradually decrease through the life of the SVE. The toxicity of the contaminants will be unaffected. The SVE treatment system does not generate significant residual waste that requires treatment or off-site disposal,

with the possible exception of spent carbon that may be used in treatment of the air discharge. Spent carbon would be transported off-site for regeneration.

Implementability – Installation of the thermally enhanced SVE system would utilize conventional construction techniques and readily available equipment (e.g., vacuum extraction and steam injection wells, vacuum blower, steam generator, heat exchanger, air cooler, vapor phase GAC). A field pilot test should be performed prior to design and installation.

Cost - Order of magnitude cost estimates for the thermally enhanced SVE treatment system is presented in Table 8-6. The present worth (assuming 5 years of operation, at 5%) is estimated at approximately $1,017,556. This cost includes capital costs associated with the installation of the eight (8) vacuum extraction wells, and sixteen (16) steam injection points, as well as the mechanical equipment (blower, steam generator, heat exchanger, air cooler), piping, electrical system controls, and ancillary equipment and structures associated with the SVE system. Annual O&M costs include maintenance and upkeep of the treatment system, vapor phase carbon replacement (if required), utilities, operating labor, monthly off-gas monitoring, and reporting over the assumed 5-year life of the treatment system.

8.5.2 Detailed Analysis of Groundwater Remedial Actions

8.5.2.1 Alternative No. 1: No Action with Continued Monitoring

The No Further Action alternative does not provide for active cleanup of groundwater. 1,2,3-TCP, the primary site-related contaminant in groundwater, would continue to exceed its groundwater quality standard. Natural attenuation will occur to some extent through biodegradation, dilution and dispersion processes. Periodic sampling of select on- and off-site monitoring wells that adequately define the plume would be performed to assess contaminant levels and plume migration.

The closest receptor for the groundwater exposure route is the SCWA's Carlton Avenue well field (Carlton Avenue #1-S67197), located approximately 3,100 feet downgradient from the

MacKenzie site, and approximately 2,300 feet downgradient from the leading edge of the groundwater plume. There is nothing to suggest that the supply well has been impacted by contaminants from the MacKenzie site. However, the potential exists that the supply well could become impacted in the future because the well field is within the downgradient path of the plume.

Groundwater monitoring would be conducted to evaluate changes in plume concentrations over time. A quarterly monitoring program utilizing nine (9) of the existing on-site and off-site monitoring wells would be implemented for 15 years to monitor changes in contaminant concentrations. These wells would include MCMW-1 (background well), MCMW-3, OS-1D, OS-2S, OS-2I, OS-2D, OS-3S, OS-3I, and OS-3D. Groundwater would be monitored for VOCs.

Compliance with New York State Standards, Criteria, and Guidelines (SCGs) - Under the No Further Action alternative, concentrations of 1,2,3-TCP in groundwater would continue to exceed the New York State Class GA Groundwater Quality Standard of 0.04 ug/l.

Overall Protection of Human Health and the Environment - The No Further Action alternative does not provide for long-term protection to human health and the environment. The size of the contaminant plume will continue to increase as it migrates away from the site. If groundwater is left untreated, contaminants could potentially reach the SCWA's Carleton Avenue well field, the key receptor of the plume. Although this supply well is screened significantly deeper (763 feet below grade) than that observed for the site contaminants (120 feet below grade), the supply well potentially could become contaminated. A breach in the casing of the supply well could potentially allow contaminants to be drawn down from the shallow aquifer to the zone where the supply well is pumping. Therefore, the No Further Action alternative does not provide long-term protection to the public and the environment, and is not consistent with the remedial action objectives.

Short-Term Effectiveness - The No Further Action alternative does not pose any short-term risks to the community or the environment since area residents within the path of the plume

are served by public water. Since no remedial actions are being taken, there will be no short-term effects to the community, to workers, or to the environment associated with implementation of an action. Activities associated with continued groundwater monitoring would pose no health threats.

Long-Term Effectiveness and Permanence - Since the No Further Action alternative would not involve active remediation, no efforts would be needed to maintain this remedy. Natural attenuation of the plume will occur through biodegradation, dilution and/or dispersion. Based on the concentrations of 1,2,3-TCP observed near the site and because 1,2,3-TCP does not readily biodegrade, its concentration will likely still be above standard when the plume eventually reaches the Carleton Avenue well field. This remedy is not protective of human health or the environment.

Reduction of Toxicity, Mobility, and Volume of Contaminants - Contaminant destruction would only occur through passive, natural degradation processes. The volume, toxicity and mobility of the contaminants would be relatively unaffected. Over time, concentrations of the 1,2,3-TCP within the plume will slowly decrease as a result of dilution, biodegradation and plume dispersion, however, not at a rate significant enough to achieve groundwater standards by the time the plume reaches the SCWA well field. Based on literature values, the biodegradation half-life of 1,2,3-TCP is on the order of 12 months to 4 years (ref. *Handbook of Environmental Degradation Rates*, Phillip H. Howard, 1991). Furthermore, as the plume migrates, the size of the plume also increases, spreading the contaminants across a larger area.

Implementability - The No Further Action alternative is readily implemented since no remedial actions would be undertaken. Quarterly monitoring of groundwater from select on- and off-site monitoring wells would be conducted to monitor changes in groundwater quality.

Cost - The present worth order of magnitude cost estimate for the No Further Action alternative includes only O&M costs for continued quarterly groundwater monitoring using nine existing monitoring wells. The present worth cost for this alternative was developed based on a fifteen (15) year monitoring period, to be consistent with the time frame estimated for a pump

and treat system. There are no capital costs associated with this alternative. The present worth O&M cost for groundwater monitoring is estimated at $311,391. These costs are summarized in Table 8-7.

8.5.2.2 Alternative No. 2: Groundwater Treatment by In-Situ Air Sparging with Ozone Injection (C-Sparge™ Method)

This alternative utilizes the C-Sparge™ (Criegee Oxidation) Method to create a treatment wall ("bubble fence") to remediate groundwater as it flows through the aquifer. A mixture of ozone and air is injected into the aquifer in the form of microbubbles using injection well points (spargepoints®). By creating micro-bubbles of ozone, the surface area of the ozone bubbles is maximized. Air stripping of contaminants occurs as the microbubbles of ozone percolate up through the aquifer. Once the contaminant is stripped, it is oxidized within the microbubbles by ozone into carbon dioxide and a dilute acid (e.g., HCl, HFl). While all of the system's spargepoints® will be used, the system only operates two spargepoints® at a time. Each set of two spargepoints® operates for 30-minutes at a time. After 30 minutes, the two spargepoints® are turned off and the next set of two spargepoints® is activated, rotating sequentially between all of the spargepoints®. In areas of significant contamination, recirculation zones are created within the aquifer, which helps to disperse the ozone bubbles surrounding the spargepoints® wells and to increase the retention time of ozone within the treatment zone.

Two treatment systems will be utilized to intercept and remediate the plume. The first system would be located along South Road near the leading edge of the plume. It is estimated that this system would be comprised of six (6) spargepoints® spaced approximately 50 feet on center. The spacing allows for a 30% overlap of the radius of influence for each well (estimated to be approximately 35 feet based on the geology of the area). The spargepoints® would be installed to a depth of 120 feet below grade with a 5-foot screen at the bottom. Microbubbles would be injected through the screen of the spargepoints® into the aquifer to create a "fence" of ozone bubbles. VOCs contained in groundwater that passes through this treatment zone are stripped and oxidized. The treatment system consists of a wall mounted box approximately 36 inches high by 14 inches wide that would be utilized to generate the ozone and compressed air,

as well as provide system logic for sequential spargepoints® operation. A small enclosure would likely be needed to house the treatment system in a remote location near the South Road spargepoints® system.

The second treatment system would be located closer to the source area. This system would be placed approximately 150 feet downgradient of the site along Brightside Avenue. Because higher concentrations are anticipated at this location, a recirculating well system would be utilized. This system would be comprised of an estimated eight (8) spargepoints®, spaced approximately 90 feet on center. This spacing allows for a 30% overlap of the radius of influence for each well (estimated to be 65 feet). These spargepoints® would also be installed to 120 feet below grade. The spargepoints® well to be used with the recirculation system includes three well screens. The lower well screen is used for injection of ozone. An expandable packer separates the upper and intermediate well screens. Groundwater is pumped from the upper screen (inlet screen) through the packer down to the intermediate screen (outlet screen) where the groundwater is injected with the microbubbles of ozone and discharged back into the aquifer. The water is then recaptured within the upper screen. This circular movement of water between the upper and intermediate screens creates a recirculating groundwater zone. Recirculation of groundwater through the spargepoints® increases the retention time of the ozone in the aquifer and increases the radius of influence surrounding each treatment well. This system would be a palletized unit with a larger air compressor. A cross-section of a typical spargepoints® well is shown on Figure 8-3. A layout of the two treatment systems (at South Road and at Brightside Avenue) is shown on Figure 8-4.

The C-Sparge™ treatment system is designed to eradicate contaminants without generation of any toxic byproducts. Undergoing complete oxidation, chlorinated hydrocarbons compounds are transformed into carbon dioxide and hydrochloric acid. However, if needed, air emission controls can be implemented. Since each spargepoint® intersects the unsaturated zone with a screen, a vacuum can be induced at each well head to capture vapors through this screen. Pilot testing should be performed to determine the need for vapor phase controls. For the cost estimate presented for this treatment alternative, it has been assumed that vapors will be captured

at the Brightside Avenue treatment system only. Vapor phase carbon vessels would be used for off-gas treatment.

Based on regional hydrogeologic values, the groundwater flow velocity at and near the site is approximately 0.9 feet per day. The estimated time for the dissolved groundwater to travel between the first and second treatment system (from Brightside Avenue to South Road) is approximately 8 years, assuming a retardation factor of 3.28. To be conservative, the duration of the treatment system presented in the cost section has been based on 10 years of system operation.

Compliance with New York State Standards, Criteria and Guidelines (SCGs) – Through the use of this groundwater remedial alternative, SCGs for groundwater will be achieved. The groundwater plume downgradient of the treatment systems would eventually achieve SCGs via additional dilution and natural attenuation. Aquifer rehabilitation is consistent with federal and NYS groundwater protection strategies.

Overall Protection of Human Health and the Environment - This alternative provides an additional level of protection to human health and the environment thorough aquifer rehabilitation. The only potential human health exposure risk is if the plume impacts the Carlton Avenue well field downgradient of the site. With the implementation of active groundwater remediation, the potential risk posed to the Carleton Avenue well field by the MacKenzie plume would be significantly reduced.

Short-Term Effectiveness - Implementing in-situ air sparging with ozone injection would pose no short-term risk to the public or environment. It is not anticipated that vapor phase controls would be required, although they have been included at the Brightside Avenue treatment system located immediately downgradient of the source area, as a contingency. Pilot testing should be performed to determine the need for vapor phase controls.

Long-Term Effectiveness and Permanence – In-situ air sparging with ozone injection offers long range protection. Remediating the groundwater plume prevents impacted

groundwater from migrating further off-site, and from migrating towards the downgradient SCWA public well field. A groundwater monitoring program would be implemented during the operational life of the treatment system to ensure groundwater remediation (assumed to be 10 years). This remedial alternative is considered a permanent solution, provides for long-term protection to the public and the environment through aquifer rehabilitation, and is consistent with the remedial action objectives for the site.

Reduction of Toxicity, Mobility, and Volume of Contaminants – By creating a treatment wall (i.e. bubble fence), contaminated groundwater will be remediated near the site and at a downgradient location. With active remediation, contaminant concentrations in the groundwater will decrease. Furthermore, contaminants are oxidized in the aquifer without creating toxic transformation byproducts. 1,2,3-TCP would be transformed into carbon dioxide and hydrochloric acid.

The C-Sparge™ Method generates no significant residual waste steams that require additional treatment or off-site disposal, with the possible exception of an air discharge containing low levels of VOCs. Pilot testing would be performed to determine if any VOCs in groundwater are being volatilized through the spargepoints® during the circulation process that would necessitate off-gas controls. If warranted, emissions from the spargepoint® can be effectively treated using vapor phase carbon. Spent carbon would be transported off-site for regeneration.

Implementability – This alternative involves the installation of spargepoint® wells, underground piping, and treatment systems. Installation of the spargepoint® wells would utilize conventional well drilling and construction methods. The C-Sparge™ is patented by K-V Associates, Inc., and therefore, availability of vendors is limited.

Because the spargepoint® wells will be located off-site, private or public property would need to be identified for the installation of the spargepoint® wells and treatment units. Below grade piping would need to be installed to connect each spargepoint to the treatment system for delivery of ozone and compressed air. Further, a small enclosure (approximately 4-foot square)

would be needed to house the treatment unit at a remote location near the South Road spargepoints® system. Similarly, space would need to be identified to house the enclosure (6 feet by 10 feet) for the Brightside Avenue treatment system. Maintenance for the two treatment units would be minimal.

Cost - Order of magnitude cost estimates for this treatment system are presented in Table 8-8. The present worth (assuming 10 years of operation, at 5%) for this treatment alternative is estimated at $1,138,007. These costs include capital costs associated with equipment and installation. Annual O&M costs include maintenance and upkeep of the treatment system, GAC replacement (Brightside Avenue only), utilities, operating labor and semi-annual groundwater monitoring and reporting over a 10-year period.

8.5.2.3 Alternative No. 3: Groundwater Treatment by In-Well Striping

This alternative was removed from further consideration (see Section 8.4.2.3 of this document).

8.5.2.4 Alternative No. 4: Groundwater Extraction and Treatment

This alternative involves capturing and treating the off-site groundwater plume. Groundwater would be collected using extraction wells and treated using either air stripping technology followed by GAC, or with GAC to reduce VOC levels down to NYSDEC groundwater discharge standards. The treated water would be discharged back to groundwater.

Due to the areal extent of the plume, two (2) pumping wells would be required to capture the plume to the 100 ppb contaminant contour. The Theis non-equilibrium well function equation was used to estimate the theoretical response of the aquifer to pumping (i.e., drawdown) in order to identify well locations and pumping rates. A hydraulic conductivity of 270 feet per day (regional value) and a saturated thickness of 60 feet were used to estimate aquifer transmissivity. Based on this approach, it was estimated that two (2) extraction wells would be sufficient to provide for the desired hydraulic capture.

The extraction system would encompass one recovery well pumping at roughly 15 gpm. This well would be located immediately downgradient of the site to target the portion of the plume where the highest 1,2,3-TCP concentrations have been observed in groundwater (near monitoring point VP-2). The second recovery well would pump at roughly 50 gpm and would be located to target the location area of high 1,2,3-TCP concentration (at VP-11). The 100 ppb contour is within the downgradient capture radius of this well. This well would be located along Hazel Street about half way between Brightside Avenue and South Road. The estimated effective downgradient radius of influence of these wells is roughly 100 feet for the 15 gpm well, and roughly 275 feet for the 50 gpm well. Aquifer pump testing is recommended during the remedial design phase to confirm site-specific aquifer characteristics, and to determine pumping rates and well locations.

A centralized treatment system would be constructed on-site to treat water captured by the two recovery wells. On-site discharge of treated groundwater will require the installation of leaching pools (drywells) or injection wells. Based upon a maximum flow of approximately 93,600 gallons per day (gpd) and a water recharge rate of 8 gallons per day per square foot of sidewall leaching area (sandy soils, low suspended solids content), approximately twenty-four (24) ten-foot diameter by twenty foot deep leaching pools would be required for recharge. Alternatively, two to four injection wells can be used for recharge. The approximate location of the extraction, treatment and recharge system is shown in Figure 8-5.

8.5.2.4.1 Alternative No. 4A - Groundwater Treatment by Carbon Adsorption

Groundwater treatment would be provided by a series of granular activated carbon filter units. Based upon the estimated pumping rates and projected VOC loading, three (3)-3000 pound carbon filters would be required. Two carbon units in series, in a lead-lag arrangement, would be on line at any given time. A third unit would be in a standby mode until the first unit requires changing out. Liquid phase GAC has proven very effective in the removal of VOCs from groundwater, and is capable of meeting groundwater discharge standards. Removal efficiencies of 99% and greater are typical.

The projected maximum average combined influent concentration of 1,2,3-TCP from the two extraction wells is assumed to be 10 mg/l. The actual combined influent concentration is anticipated to be lower because the extraction wells draw groundwater from all directions around the wells, not just from the direction of the highest concentration. Based on empirical data, the carbon adsorption rate for 1,2,3-TCP is on the order of 10% (0.1 pounds of contaminant per pound of carbon consumed). Annual carbon consumption based on 65 gpm and an influent 1,2,3-TCP concentration of 10 mg/l is estimated to be on the order of 28,000 pounds per year as follows:.

$(1/0.1\ lb_{gac}/lb_{1,2,3\text{-}TCP})$ x (1 lb/453.59 g) x (10 mg $_{1,2,3\text{-}TCP}$ /l) x (3.785 l/gallon) x (0.001 g/mg) x (65 gallons/min) x (525,600 min/yr) = 28,508 lb_{gac}/year

It is anticipated that nine of the existing monitoring wells would be sampled on a semi-annual basis for the duration of the active remediation (i.e., assumed to be 15 years). The number of the wells to be sampled and the sampling frequency may be modified upon start-up and operation of the treatment system. Additional sampling of influent and effluent groundwater would also be conducted to monitor treatment performance and effluent compliance.

8.5.2.4.2 Alternative No. 4B - Groundwater Treatment by Air Stripping and GAC Polishing

Primary treatment would be provided by a counter-current packed tower air stripper. Based upon the estimated pumping rate and projected VOC loading, using a standard sized air stripping tower of 30-inches in diameter with 25 feet of packing would achieve at least 90% removal. This results in a concentration of approximately 1 mg/l of 1,2,3-TCP in the air stripper effluent. Additional treatment is necessary to further reduce this level down to the groundwater discharge standard of 0.04 ug/L. For a packed tower air stripper to achieve the desired removal, an additional 150 feet of packing would be needed, making this option infeasible. Instead, residual levels of 1,2,3-TCP in the air stripper effluent would be further treated using liquid phase GAC down to the groundwater discharge standard of 0.04 ug/l. Assuming an influent

concentration of 1 mg/L of 1,2,3-TCP to the GAC filter units, annual consumption of liquid phase carbon is estimated to be on the order of 3,000 pounds per year.

Because 1,2,3-TCP is not readily strippable, a high air to water flow ratio on the order of approximately 150:1 would be needed. With a groundwater flow rate of 65 gpm, the air flow rate would be roughly 1,300 feet per minute (cfm). Based on the anticipated contaminant loading rate in the groundwater and the air flow rate needed for air stripping, the concentration of 1,2,3-TCP in the off-gas from the air stripper is expected to be below the NYS Air Guide 1 Annual Guideline Concentration of 140 g/m^3 for this compound. Therefore, treatment of the air stripper off-gas would not be required.

Periodic monitoring of groundwater would be conducted to observe groundwater cleanup progress and to ensure capture of the contaminant plume. Sampling of influent and effluent groundwater would also be conducted to monitor treatment performance and effluent compliance.

Compliance with New York State Standards, Criteria, and Guidelines (SCGs) - Collection and treatment of the on-site groundwater plume will achieve ARARs for on-site groundwater, and off-site groundwater would eventually achieve ARARs via further dilution and natural attenuation. Any portion of the plume not captured by the groundwater treatment system would eventually achieve ARARs via further dilution and natural attenuation. The treatment options evaluated are capable of reducing VOC concentrations to meet groundwater discharge standard for 1,2,3-TCP as stipulated in 6NYCRR Part 703.6. Groundwater remediation for aquifer rehabilitation is consistent with federal and NYS groundwater protection strategies.

In order to discharge treated water to the ground, a State Pollutant Discharge Elimination System (SPDES) permit must be obtained. Groundwater discharge limits under the SPDES permit will be established based on the groundwater effluent standards stipulated in 6NYCRR Part 703.6. At a minimum, monthly monitoring and reporting will be required for the discharge of treated effluent to groundwater.

This remedial action alternative, regardless of which treatment option is selected would be effective in reducing the concentrations of 1,2,3-TCP in groundwater to meet NYS groundwater discharge standards.

Overall Protection of Human Health and the Environment – This alternative provides an additional level of protection to human health and the environment thorough aquifer rehabilitation. With the implementation of active groundwater remediation, the potential risk posed to the Carleton Avenue well field by the MacKenzie site plume would be alleviated.

Short-Term Effectiveness - Implementing groundwater collection and treatment would pose no short-term risk to the public or environment, and would be effective in establishing control of plume migration. Both treatment options (liquid phase GAC or air stripping with GAC polish) can be operated safely.

Operation of the air stripper will generate a vapor phase emission to the atmosphere. However, it is not expected that vapor phase controls would be required. VOC emission rates from the air stripper will be relatively low and should not impact air quality in the surrounding community.

Long-Term Effectiveness and Permanence – Groundwater pump and treat provides hydraulic control of the plume preventing contaminated groundwater from migrating further off-site, and from migrating towards the downgradient SCWA public well field. This remedial approach provides for long term protection to the public, as well as protection to the environment through aquifer rehabilitation. Both treatment technologies (liquid phase GAC or air stripping with GAC polish) are considered permanent solutions since contaminants will be removed from the groundwater media.

Reduction of Toxicity, Mobility, and Volume of Contaminants - Capture of contaminated groundwater would reduce the overall mobility of contaminants in the groundwater matrix. With active aquifer rehabilitation, contaminant concentrations in the groundwater will continue to decrease. Use of GAC will generate a waste stream requiring periodic regeneration. Because air

emission control is not anticipated, air stripping would generate no wastes (e.g., spent vapor phase carbon) requiring further treatment or disposal.

Implementability – This alternative involves the installation of extraction wells, underground piping, treatment system, and leaching pools or diffusion wells. Installation of the groundwater recovery wells would utilize conventional well drilling and construction methods. Contractors and materials are readily available. Similarly, process equipment for air stripping, and liquid vapor phase carbon is also readily available and easily installed and operated

Because the groundwater recovery wells will be located off of the MacKenzie site, property would need to be identified for the installation of the extraction wells. Below grade collection piping would need to be installed to convey the water back to the MacKenzie site for treatment. Permission would be required from private property owners and/or municipal authorities to install the extraction wells and collection piping on private property or along public right-of-ways.

Both GAC and air stripping generally require little maintenance. Because of naturally occurring iron in the groundwater, iron scaling may cause fouling of the packing material in the stripping tower, requiring periodic shutdown of the stripper so that the packing material can be cleaned. Use of GAC would require frequent testing of the effluent stream to monitor for carbon breakthrough. The activated carbon, after reaching its adsorptive capacity, would need to be regenerated. Because on-site carbon regeneration is not cost effective for the MacKenzie site, off-site carbon regeneration would be necessary.

Cost - Order of magnitude cost estimates for carbon adsorption (Groundwater Alternative 4A), and for air stripping with GAC polish (Groundwater Alternative 4B) are presented in Tables 8-9 and 8-10, respectively. The present worth (assuming 15 years of operation, at 5%) for these two treatment alternatives are $2,599,557 (Groundwater Alternative 4A) and $2,445,854 (Groundwater Alternative 4B). These estimates include capital costs associated the extraction wells, the treatment system including mechanical equipment, treatment shed, electrical, piping and controls, and construction of an on-site recharge system. Annual O&M costs include

maintenance and upkeep of the treatment system, GAC replacement, utilities, operating labor and groundwater monitoring, which reflects monthly effluent monitoring, semi-annual groundwater sampling, analysis and reporting over a 15-year period.

8.5.2.5 Alternative 5 – In-Situ Chemical Oxidation

This alternative would treat groundwater in-situ through the injection of process chemistry beneath the groundwater table to create a treatment zone. In-situ chemical oxidation can be conducted on any organic compound if sufficient energy is created to initiate and sustain the reaction, with sufficient retention time. These reactions are generally completed in very short time periods.

One of the emerging technologies in the forefront of in-situ chemical oxidation treatment is the CleanOx process that uses hydrogen peroxide to produce hydroxyl radical in the presence of ferrous iron which acts as a catalyst. The initial hydroxyl radical generating reaction is known as Fenton's reaction. The hydroxyl radical is a significantly stronger oxidizing agent than ozone or hydrogen peroxide. It readily reacts with organic and other oxidizable compounds. Hydroxyl radicals are formed which in turn oxidize the chlorinated organic contaminants, resulting in carbon dioxide, water and free chloride radicals. The effectiveness of this technology would be dependent on the absence of "scavengers" in the aquifer. The process chemistry is not selective in the oxidation process and chemistry can be consumed by the "scavengers" in the aquifer prior to eradicating the contaminants.

This treatment method entails the injection of a pH adjusting agent, a ferrous catalyst and hydrogen peroxide into the aquifer. During application, the process undergoes an exothermic reaction within the aquifer and may result in a volume expansion and the generation of steam and carbon dioxide within the aquifer. Across the site where the reaction takes place, the heat that is generated is absorbed by the groundwater resulting in a slight increase in the groundwater temperature. The exothermic nature of the reaction and the high heat capacity of water necessitate that the process solution be injected below the groundwater table. The volume expansion and heat generated from the exothermic reaction results in a pressure front

surrounding the injection points. This induced pressure assists in the migration of the process chemistry to the sites of dissolved contaminants. On contact with the process chemistry, the chlorinated organic contaminants are oxidized, resulting in carbon dioxide, water and free chloride radicals. A rapid rate of destruction of the dissolved contaminants will preclude the need for hydraulically controlling groundwater.

Generally this technology is utilized to treat an entire groundwater contamination area. However, because the majority of the plume has migrated off-site and is present under residential properties and structures, this limits the ability to inject chemistry throughout the plume. Instead, two injections would be applied to create a treatment curtain of chemistry to oxidize contaminants as it migrates through. Based on the current plume configuration, two injection well networks would be installed. Each treatment system would be comprised of eight (8) injection well clusters screened at 60 feet to 80 feet and at 80 feet to 100 feet below grade. Since the injection wells would be exposed to process chemistry, the screen and riser of each well would be constructed of stainless steel material. These wells would be installed at approximately 35 feet on center and each well is estimated to have a treatment radius of 20 feet. This spacing provides a 15% overlap of the radius of influence for each well. The location of the two injection networks is shown on Figure 8-6.

It is estimated that groundwater velocity in this area to be approximately 0.9 feet/day. Applying a retardation factor of 3.28, contaminant velocity is estimated at 0.27 feet/day. Based on this, a chemical injection schedule of approximately 3 injections per year is anticipated. The estimated time of travel for the dissolved groundwater plume to travel between the two injection networks is 7 to 8 years, resulting in an estimated 24 applications of the process chemistry. This estimation assumes that the source area feeding the dissolved plume has been remediated. Therefore the cost for this alternative has been based on 8 years of periodic injections.

Bench scale treatability testing should be performed to characterize and evaluate the effects of the reaction chemistry on site groundwater quality. Based on the results of the bench scale treatability tests, pilot scale transitory tests would be performed on-site to develop empirical data and relationships between the groundwater chemistry and hydrogeology. This is

typically a small scale application of the oxidation chemistry into a limited area of the site, followed by groundwater monitoring to assess the results of the reaction over time. The on-site pilot phase data will identify the selected chemistry to be used for full scale injection, as well as the locations and amounts of injected chemistry per injection location.

Compliance with the New York State Standards, Criteria, and Guidelines (SCGs) – Through the use of this groundwater remedial alternative, SCGs for groundwater on-site and groundwater downgradient of the injection well network will be achieved. The residual concentrations in groundwater downgradient of the furthest downgradient injection network would eventually achieve SCGs via additional dilution and natural attenuation. Aquifer restoration is consistent with federal and NYS groundwater protection strategies.

Overall Protection of Human Health and the Environment - This alternative provides an additional level of protection to human health and the environment thorough aquifer rehabilitation. With the implementation of the in-situ chemical oxidation, the potential risk posed to the Carleton Avenue well field by the MacKenzie site contaminant plume would be reduced.

Short-Term Effectiveness – The potential can exist for site workers and residents from the community to be exposed to some of the hazards associated with chemical injection. These risks can be effectively minimized through administrative and engineering controls taken during field activities. This treatment method requires the transportation and handling of chemicals (i.e. a dilute acid, a ferrous catalyst and hydrogen peroxide) at locations in a residential neighborhood. Risks associated with chemical transportation and usage can be safely managed by limiting handling of chemicals to properly trained workers. Health and safety plans and contingency plans would need to be in place, including coordination with local public safety agencies (e.g., police, fire department). However, injection of chemistry into the aquifer results in an exothermic reaction generating significant heat and pressure. Although the depth to groundwater is approximately 45 feet below grade, there may be basements and underground utilities that are within 30 feet of the zone of injection. The risk to and potential for impact to these structures must be thoroughly evaluated prior to any implementation. The generation of

heat and pressure resulting from exothermic reactions could pose a potential risk to nearby structures.

Long-Term Effectiveness and Permanence – This remedial alternative provides for long term protection to public health and environment through the rehabilitation of the aquifer. The contaminants are completely oxidized in the aquifer without creating toxic transformation byproducts. Treatment of the plume prevents contaminants from migrating towards the SCWA well field. A groundwater monitoring program would be implemented to assess the effectiveness of the remediation.

Reduction of Toxicity, Mobility, and Volume of Contaminants – Through the creation of a treatment wall, contaminated groundwater will be remediated at a downgradient location. This will reduce the overall mobility, toxicity and volume of contaminants in the groundwater matrix. Organic contaminants in groundwater are oxidized to produce non-toxic byproducts consisting of carbon dioxide, water and free chloride radicals. With the destruction of contaminants, dissolved concentrations in groundwater will continue to decrease with time. There are no associated waste streams associated with this technology.

Implementability – This alternative would require the installation of injection well points to target the zone of contamination. Installation of the injection wells would utilize conventional well drilling and construction methods. Contractors and materials are readily available. Patented equipment and/or proprietary chemicals are required for implementation of this remediation technology. Because the injection wells will be located off of the MacKenzie property, land would need to be identified for the installation of the wells. Aside from the periodic injections and groundwater monitoring, maintenance requirements are minimal.

Because 1,2,3-TCP has not been widely studied relative to in-situ oxidation, bench scale testing and full-scale pilot testing should be performed. Also, the risk posed to subsurface structures resulting from heat and pressure generated from the chemical reactions must be thorough evaluated prior to proceeding with any field applications.

Cost - Order of magnitude cost estimates for this treatment technology are presented in Table 8-11. The present worth (assuming 24 injections over 8 years, at 5%) for this treatment alternative is estimated at $2,050,922. These costs include capital costs associated with injection well installation, laboratory bench test, site pilot test, and full-scale remediation. A total of 24 injections have been budgeted over an 8 year period. Groundwater monitoring, which reflects semi-annual groundwater sampling, analysis and reporting is presented for an 8-year period.

8.6 Recommendations for Remedial Action

The objective of the MacKenzie Feasibility Study (FS) was to develop, screen and evaluate appropriate remedial actions, which are protective of human health and the environment through the reduction of contaminant toxicity, volume and mobility. Table 8-12 provides a summary of costs associated with the technologies presented in Section 8.5.

The selected remedial technology for soil is Soil Alternative 4 - Soil Vapor Extraction with Thermal Enhancement. This alternative, along with Soil Alternative 2 – Excavation and Disposal, is protective of human health and the environment, and capable of meeting the SCGs. Soil Alternative 4 is the most cost effective and was therefore selected based on cost. Chemical characteristics associated with this compound, specifically a low Henry's constant and vapor pressure, make this compound less than ideal for volatilization. Case histories involving remediation of 1,2,3-TCP are not readily available since this compound is not a typical site contaminant. The only case history identified relative to the remediation of 1,2,3-TCP using SVE was for the Tyson's Dump Federal Superfund Site in Merion Township, Pennsylvania. According to the remediation contractor, 1,2,3-TCP was readily removed utilizing SVE outfitted with several enhancements including soil heating. Therefore, since a very limited soil remediation history associated with this compound is available, we recommend that pilot testing be performed to confirm the effectiveness of a thermally enhance SVE system in removing 1,2,3-TCP from the unsaturated soil column. If through pilot testing the SVE system is determined not to be efficient, the excavation and disposal alternative (Soil Alternative 2) should be implemented.

The selected remedial alternative for groundwater is Groundwater Alternative 2 - Groundwater Treatment by In-Situ Air Sparging with Ozone Injection (C-Sparge™ Method). This alternative along with Groundwater Alternative 4A - Groundwater Extraction and Treatment using Liquid Phase Carbon, and Groundwater Alternative No. 4B - Groundwater Extraction and Treatment via Air Stripping and Liquid Phase Carbon polishing, is protective of human health and the environment and is capable of meeting the SCGs. As presented in the feasibility study, groundwater monitoring would be conducted at existing monitoring wells to observe groundwater cleanup progress and ensure the hydraulic capture and treatment of the contaminant plume. Groundwater Alternative 2 is the most cost-effective as compared to the other groundwater treatment alternatives. Because 1,2,3-TCP is not a common site contaminant, coupled with the newness of this treatment technology, there has been no studies performed specific to the treatment of 1,2,3-TCP using ozone. However, because this compound has similar chemical characteristics as 1,1,1-trichloroethane and propane, both of which are readily stripped and oxidized by ozone, this treatment method should be effective on 1,2,3-TCP. As with the soil remediation program, we recommend a pilot test be performed to confirm the effectiveness of in-situ air sparge system with ozone injection in chemically oxidizing 1,2,3-TCP in groundwater. If through pilot testing this treatment alternative is determined not to be efficient, the pump and treatment with air stripping followed by liquid phase carbon alternative (Groundwater Alternative 4B) should be implemented.

In summary, the two recommended alternatives for soil and groundwater are:

- Soil Alternative 4 - Soil Vapor Extraction with Thermal Enhancement
- Groundwater Alternative 2 - Groundwater Treatment by In-Situ Air Sparging with Ozone Injection (C-Sparge™ Method)

Pilot testing is recommended for both remediation alternatives prior to proceeding with design.

FIGURES

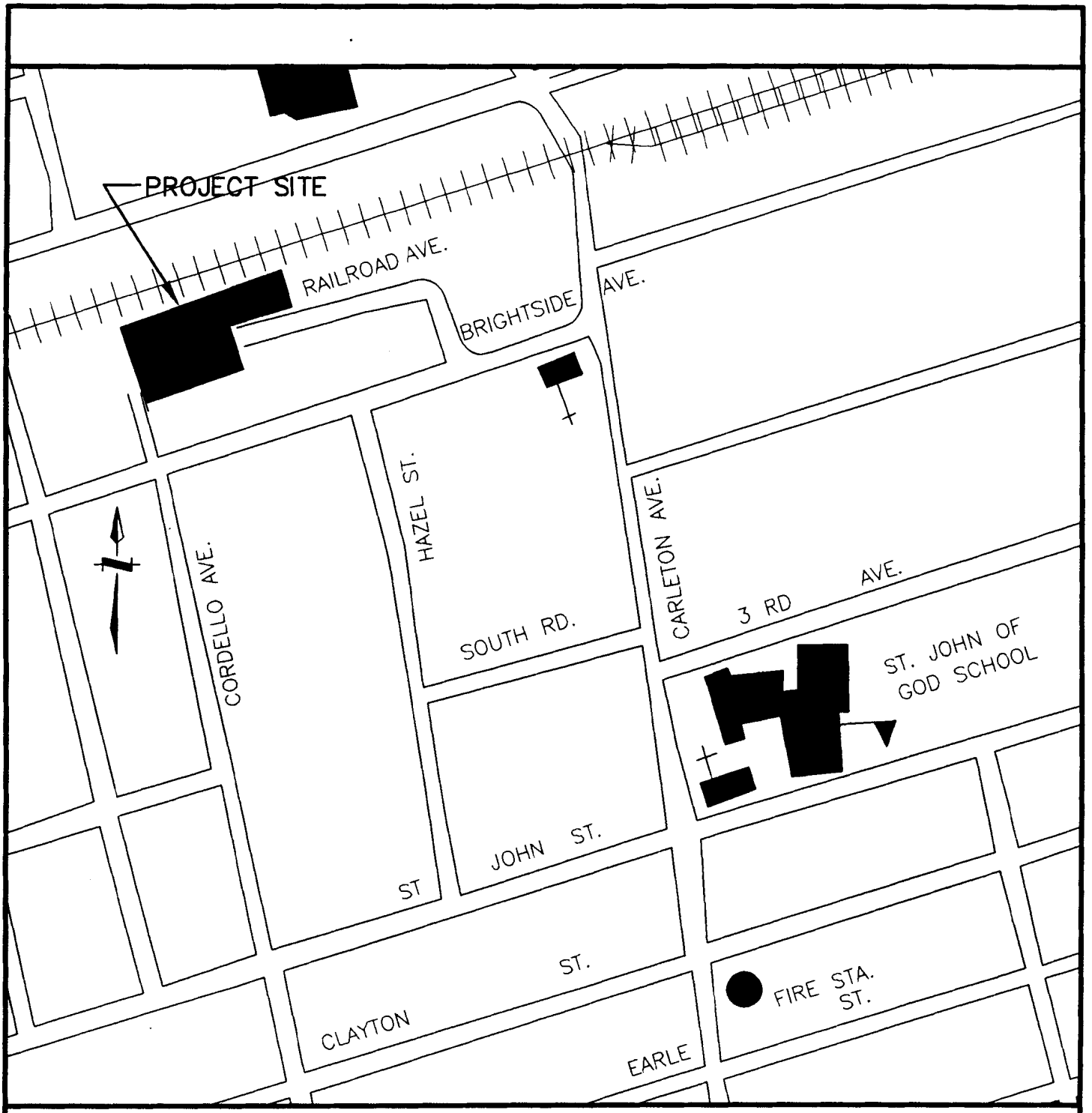
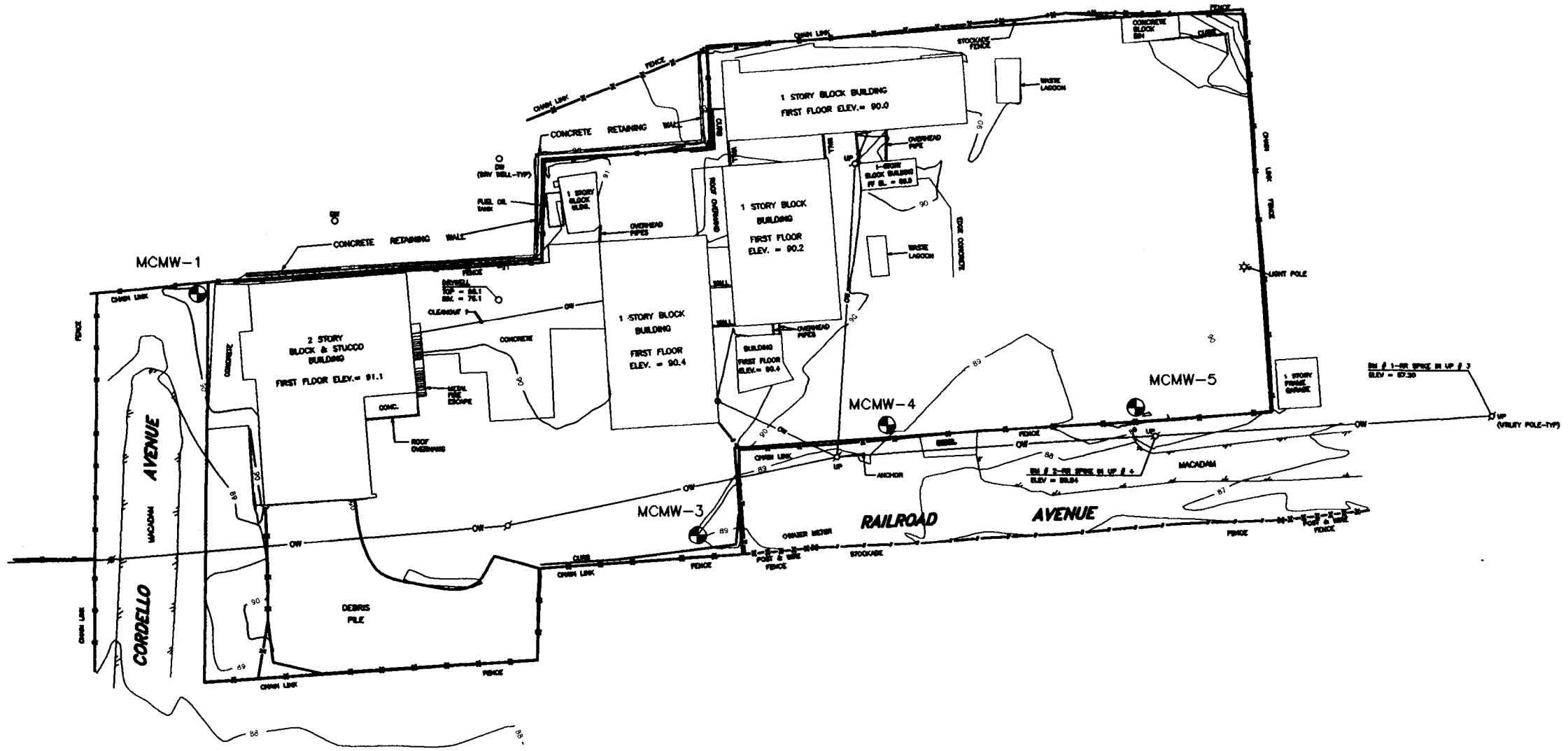


FIGURE 1.1
LOCATION MAP
MACKENZIE CHEMICAL
NYSDEC SITE NO. 1-52-017

SCALE: 1" = 300'

H2MGROUP ENGINEERS • ARCHITECTS • PLANNERS • SCIENTISTS • SURVEYORS
MELVILLE, N.Y. SHELTON, CT. TOTOWA, N.J.



LEGEND

- MONITORING WELL
- MACADAM
- UTILITY POLE
- OVERHEAD WIRES
- CHAIN LINK FENCE
- STOCKADE FENCE
- POST AND WIRE FENCE
- PROPERTY LINE
- DRYWELL
- CONTOUR LINE (5 FOOT INTERVAL)
- CONTOUR LINE (1 FOOT INTERVAL

FIGURE 1.2
SITE PLAN
MACKENZIE CHEMICAL
NYSDEC SITE NO. 1-52-017

SCALE: 1"= 50'

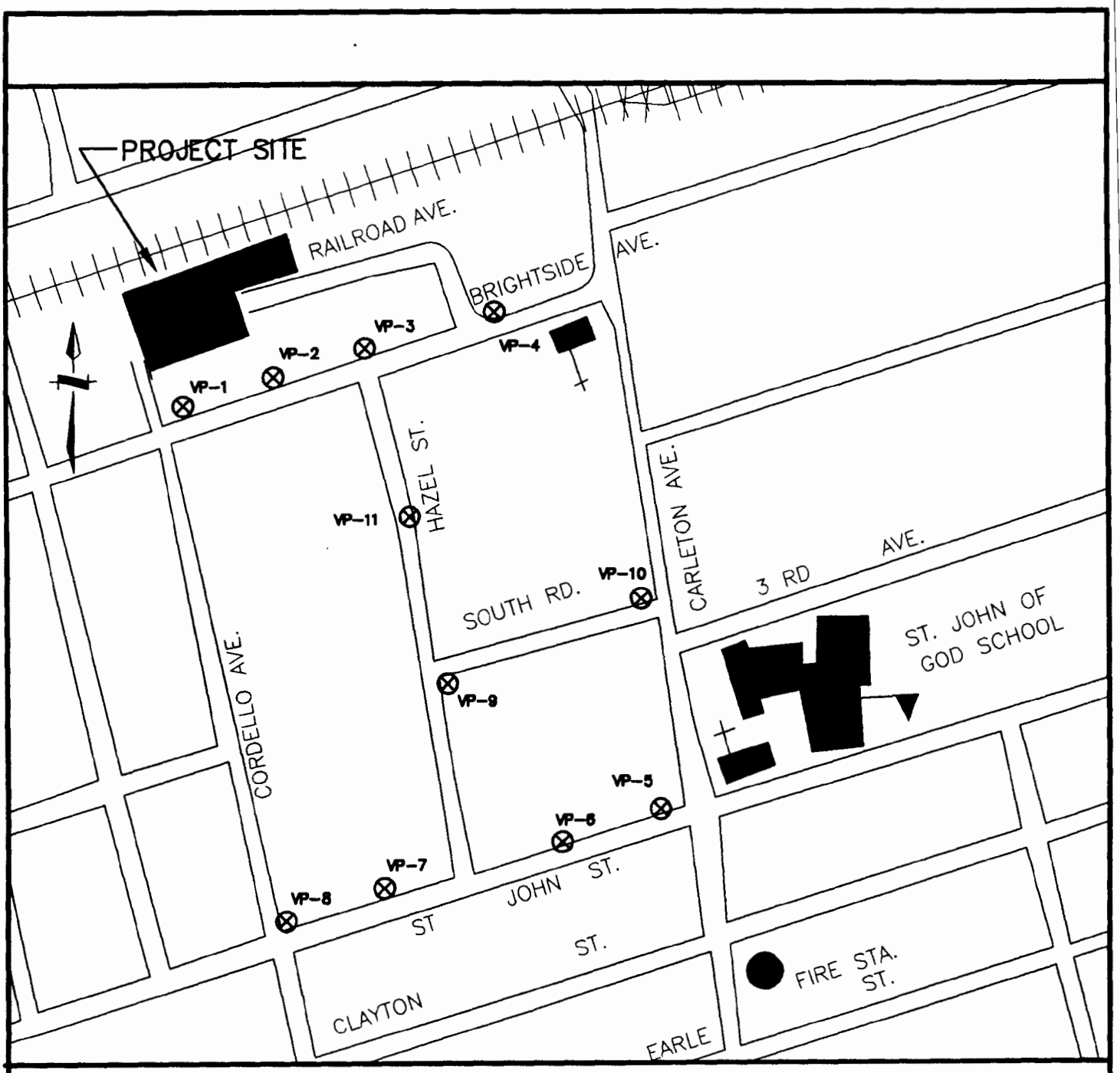


FIGURE 2.1
OFF-SITE VERTICAL PROFILE
WELL SAMPLE LOCATION MAP
MACKENZIE CHEMICAL
NYSDEC SITE NO. 1-52-017

SCALE: 1" = 300'

LEGEND:

⊗ = VERTICAL PROFILE WELL

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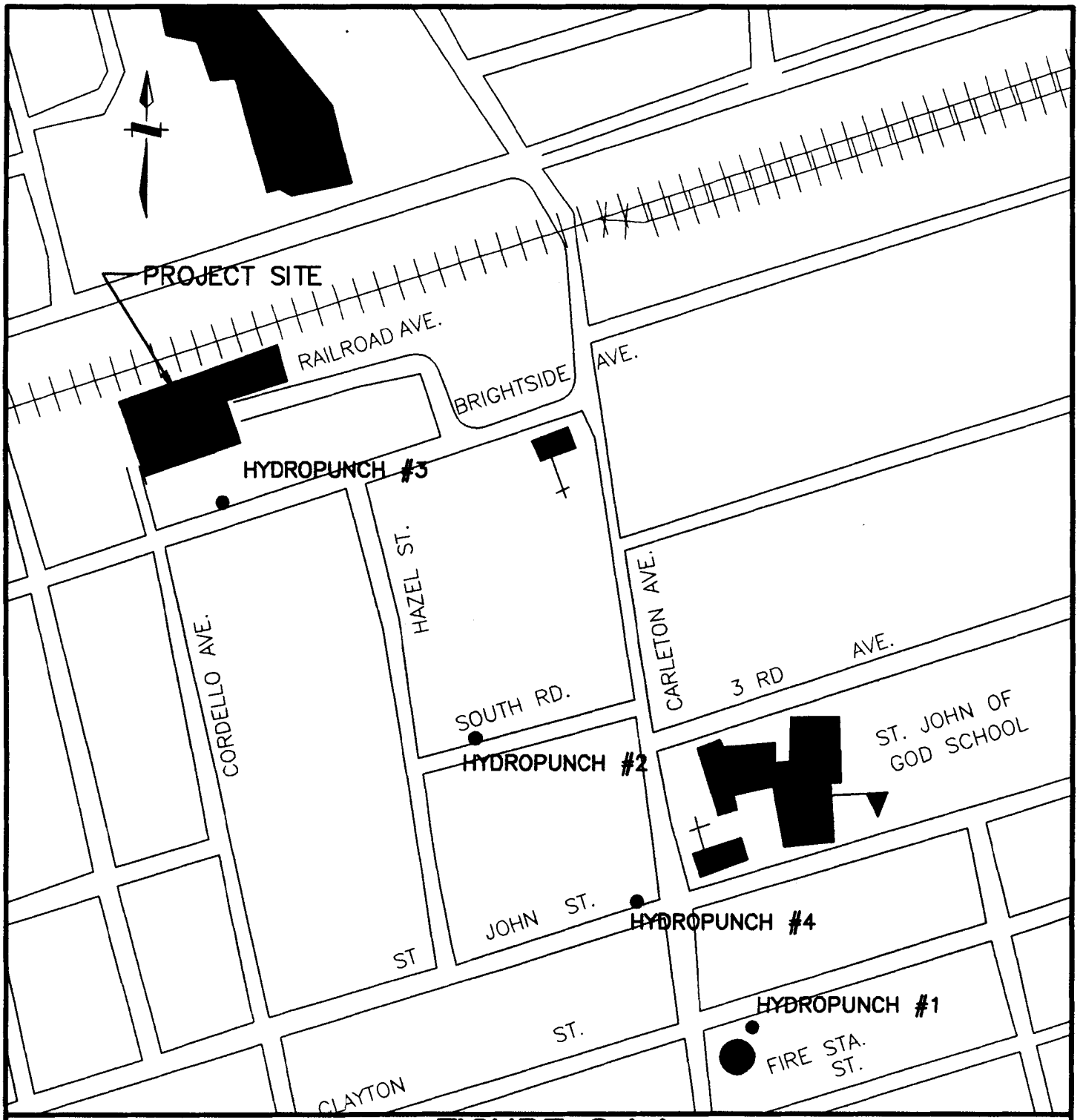


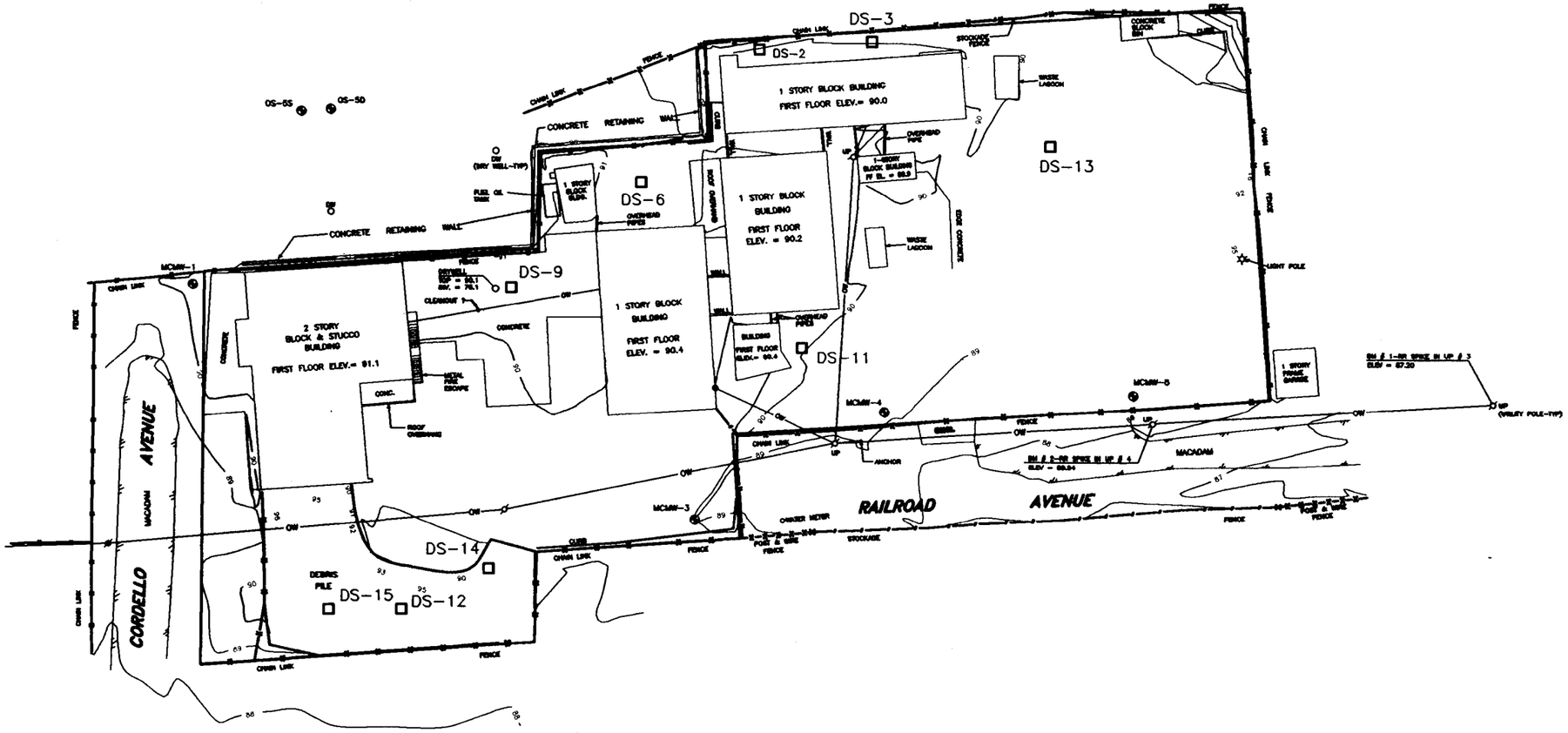
FIGURE 2.1.1
HYDROPUNCH LOCATION MAP
MACKENZIE CHEMICAL
NYSDEC SITE NO. 1-52-017

SCALE: 1" = 300'

LEGEND:

● = HYDROPUNCH SAMPLE

H2MGROUP
ENGINEERS • ARCHITECTS • PLANNERS • SCIENTISTS • SURVEYORS
MELVILLE, N.Y. SHELTON, CT. TOTOWA, N.J.



LEGEND

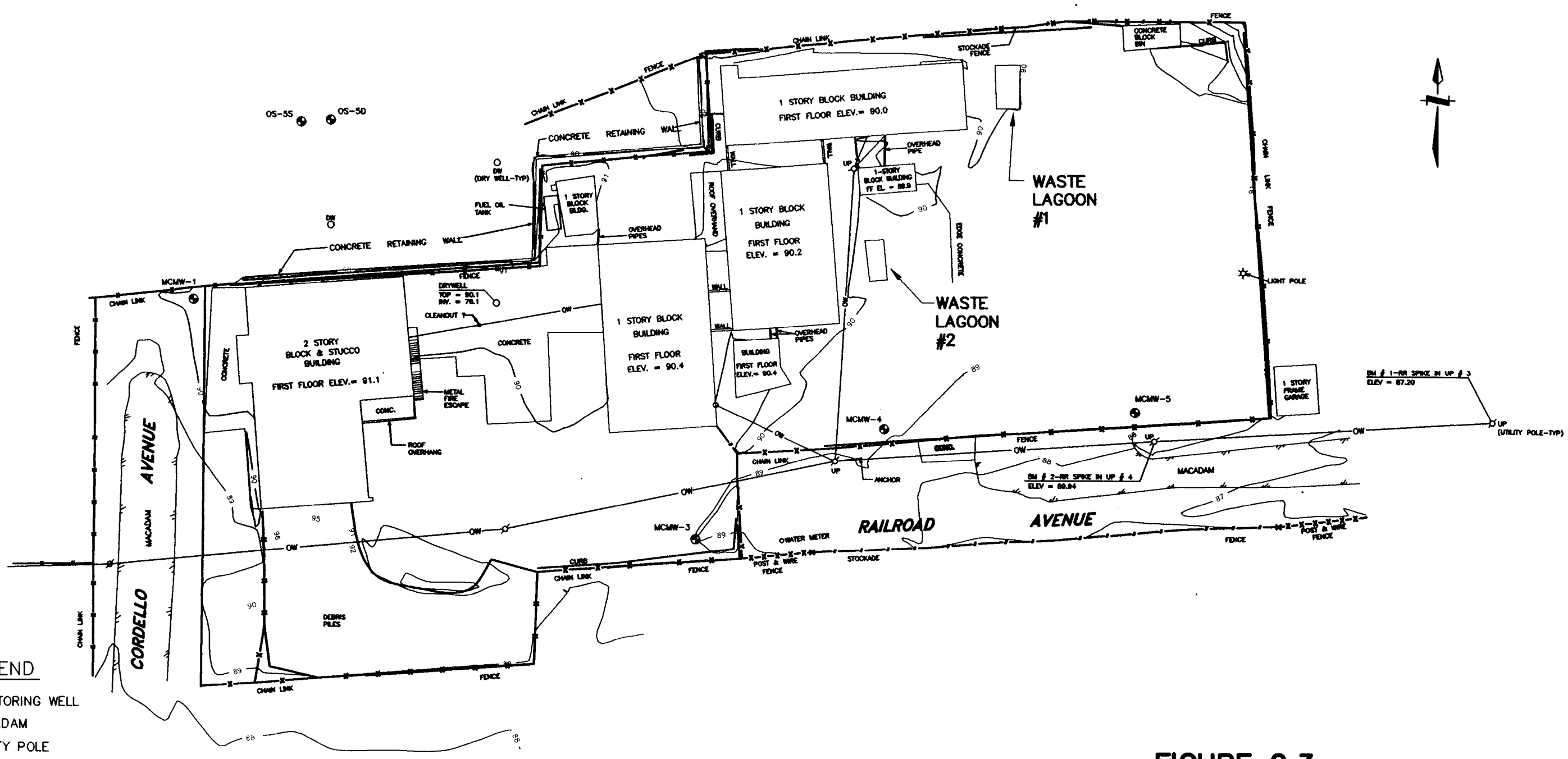
- MONITORING WELL
- MACADAM
- UTILITY POLE
- OVERHEAD WIRES
- CHAIN LINK FENCE
- STOCKADE FENCE
- POST AND WIRE FENCE
- PROPERTY LINE
- DRYWELL
- CONTOUR LINE (5 FOOT INTERVAL)
- CONTOUR LINE (1 FOOT INTERVAL
- DRAINAGE STRUCTURE DS-15

NOTE:

THERE IS NO DS-1, DS-4, DS-5, DS-7, DS-8 OR DS-10

FIGURE 2.2
DRAINAGE STRUCTURE SOIL SAMPLING LOCATIONS
MACKENZIE CHEMICAL
NYSDEC SITE NO. 1-52-017

SCALE: 1"= 40'



LEGEND

- MONITORING WELL
- MACADAM
- UTILITY POLE
- OVERHEAD WIRES
- CHAIN LINK FENCE
- STOCKADE FENCE
- POST AND WIRE FENCE
- PROPERTY LINE
- DRYWELL
- CONTOUR LINE (5 FOOT INTERVAL)
- CONTOUR LINE (1 FOOT INTERVAL
- WASTE LAGOON

FIGURE 2.3
WASTE LAGOON SOIL SAMPLING LOCATIONS
MACKENZIE CHEMICAL
NYSDEC SITE NO. 1-52-017

SCALE: 1"= 40'

H2MGROUP ENGINEERS • ARCHITECTS • PLANNERS • SCIENTISTS • SURVEYORS
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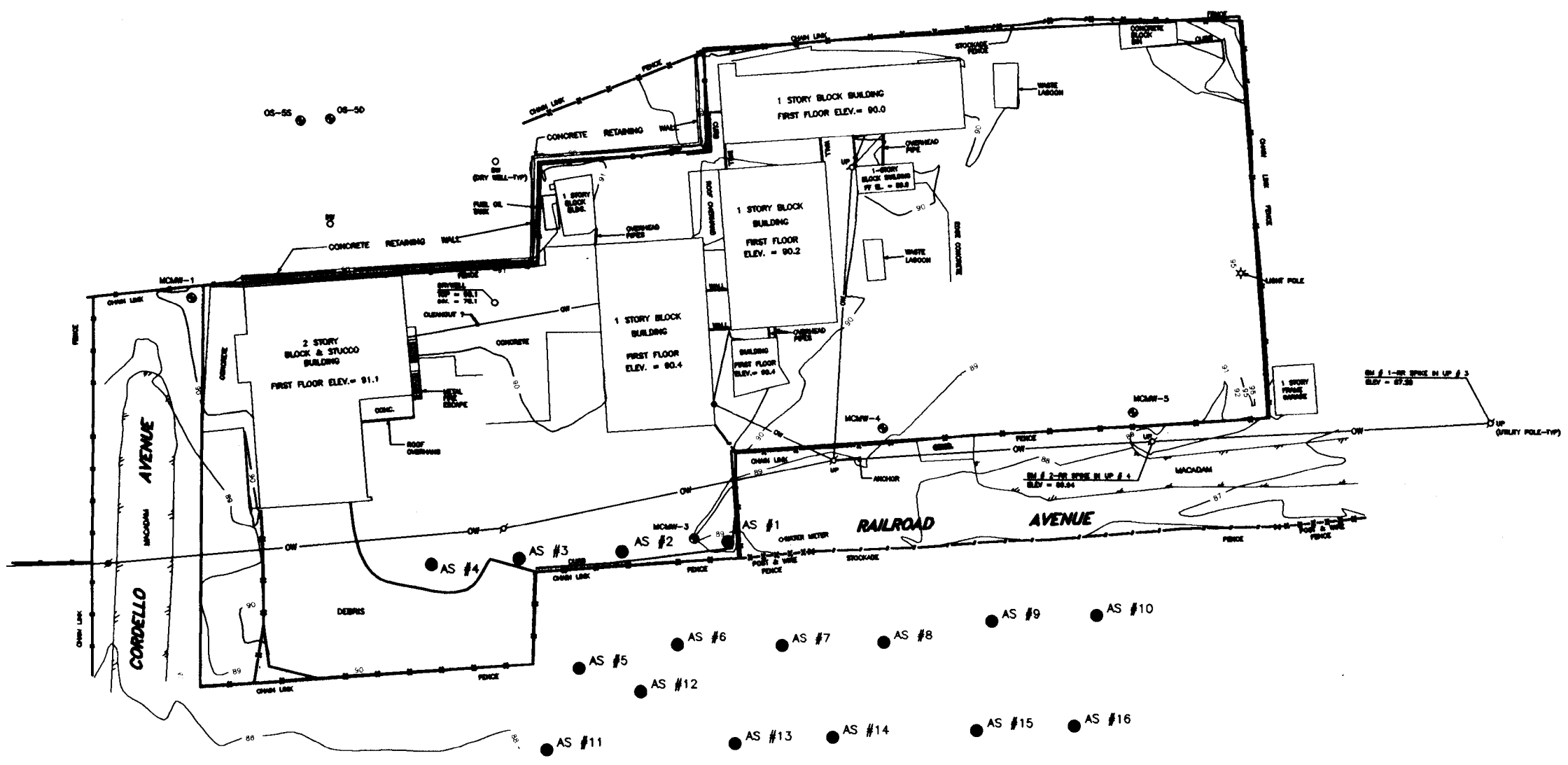

LEGEND

- MONITORING WELL
- MACADAM
- UTILITY POLE
- OVERHEAD WIRES
- CHAIN LINK FENCE
- STOCKADE FENCE
- POST AND WIRE FENCE
- PROPERTY LINE
- DRYWELL
- CONTOUR LINE (5 FOOT INTERVAL)
- CONTOUR LINE (1 FOOT INTERVAL
- SOIL GAS SAMPLES POINT AS #1

FIGURE 2.4
SOIL GAS
AIR SAMPLING LOCATIONS
MACKENZIE CHEMICAL
NYSDEC SITE NO. 1-52-017

SCALE: 1"= 50'

H2MGROUP ENGINEERS • ARCHITECTS • PLANNERS • SCIENTISTS • SURVEYORS
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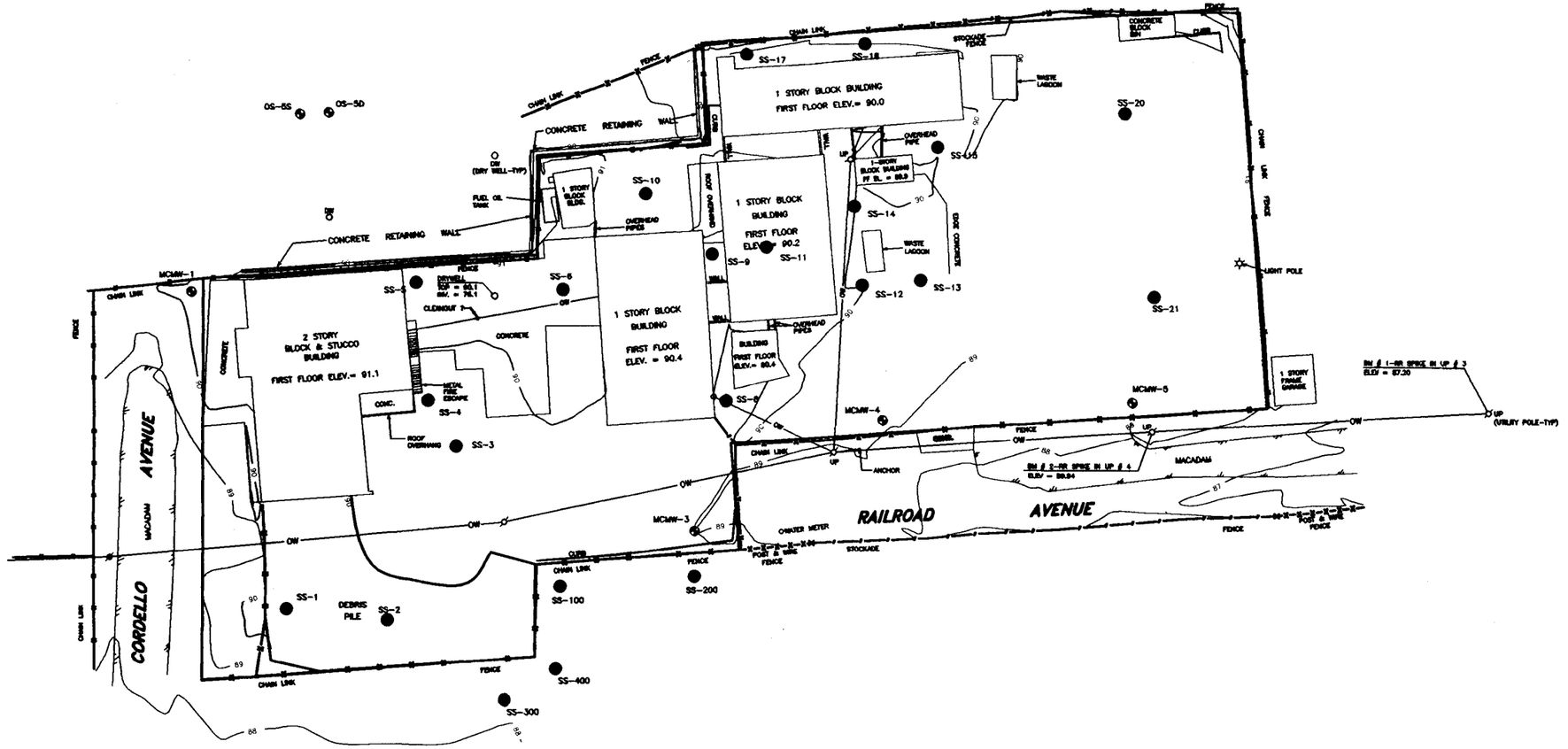


LEGEND

- MONITORING WELL
- MACADAM
- UTILITY POLE
- OVERHEAD WIRES
- CHAIN LINK FENCE
- STOCKADE FENCE
- POST AND WIRE FENCE
- PROPERTY LINE
- DRYWELL
- CONTOUR LINE (5 FOOT INTERVAL)
- CONTOUR LINE (1 FOOT INTERVAL
- SURFACE SOIL SAMPLE (SS-3)

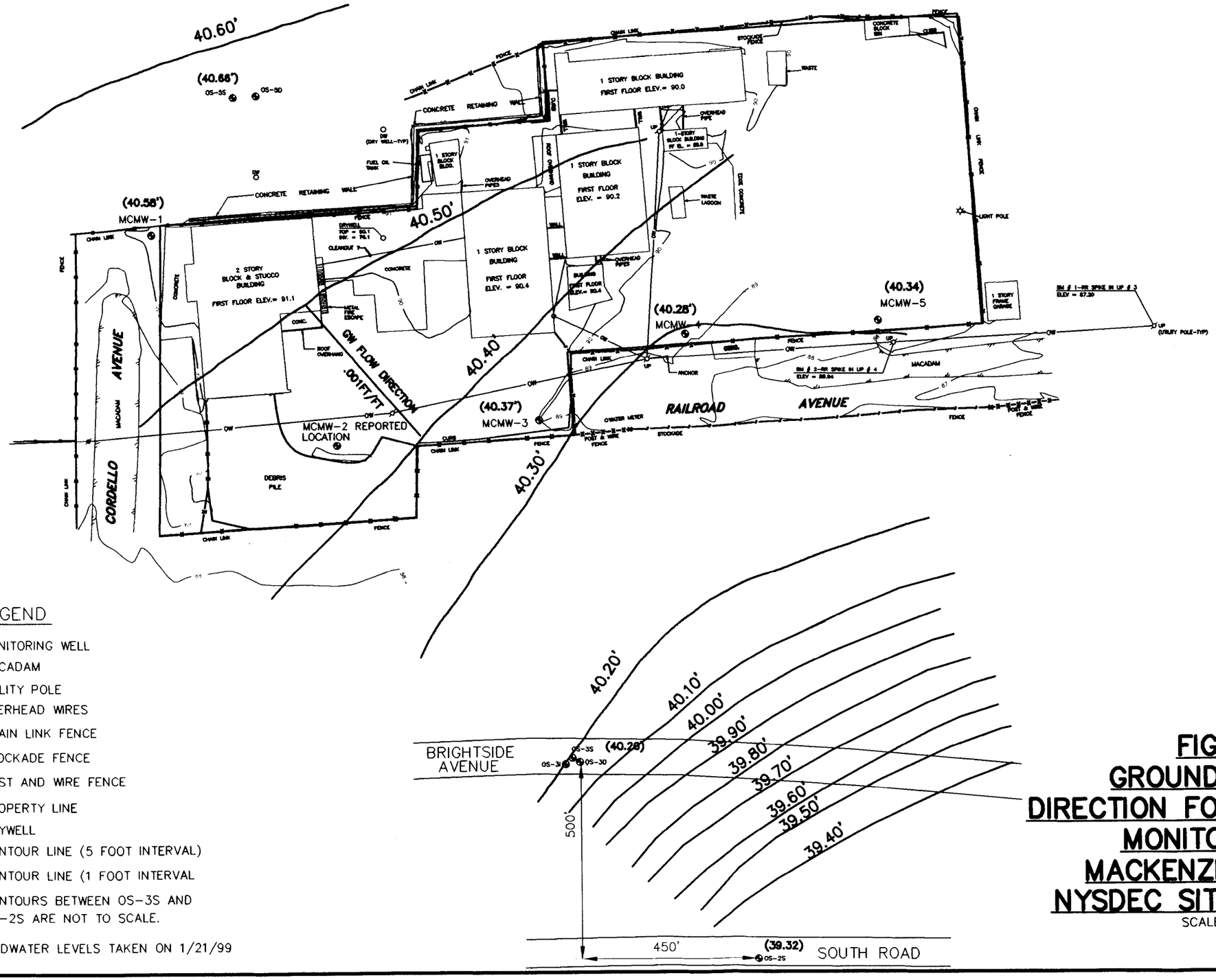
NOTE:

THERE IS NO SS-7, SS-16 OR SS-19

FIGURE 2.5
SOIL SAMPLING LOCATIONS
MACKENZIE CHEMICAL
NYSDEC SITE NO. 1-52-017

SCALE: 1"= 50'

H2MGROUP ENGINEERS • ARCHITECTS • PLANNERS • SCIENTISTS • SURVEYORS
MELVILLE, N.Y. SHELTON, CT. TOTOWA, N.J.



LEGEND

- MONITORING WELL
- MACADAM
- UTILITY POLE
- OVERHEAD WIRES
- CHAIN LINK FENCE
- STOCKADE FENCE
- POST AND WIRE FENCE
- PROPERTY LINE
- DRYWELL
- CONTOUR LINE (5 FOOT INTERVAL)
- CONTOUR LINE (1 FOOT INTERVAL
- * CONTOURS BETWEEN OS-3S AND OS-2S ARE NOT TO SCALE.

GROUNDWATER LEVELS TAKEN ON 1/21/99

FIGURE 2.6
GROUNDWATER FLOW DIRECTION FOR SHALLOW DEPTH MONITORING WELLS
MACKENZIE CHEMICAL
NYSDEC SITE NO. 1-52-017

SCALE: 1"= 50'

H2MGROUP ENGINEERS • ARCHITECTS • PLANNERS • SCIENTISTS • SURVEYORS
MELVILLE, N.Y. SHELTON, CT. TOTOWA, N.J.

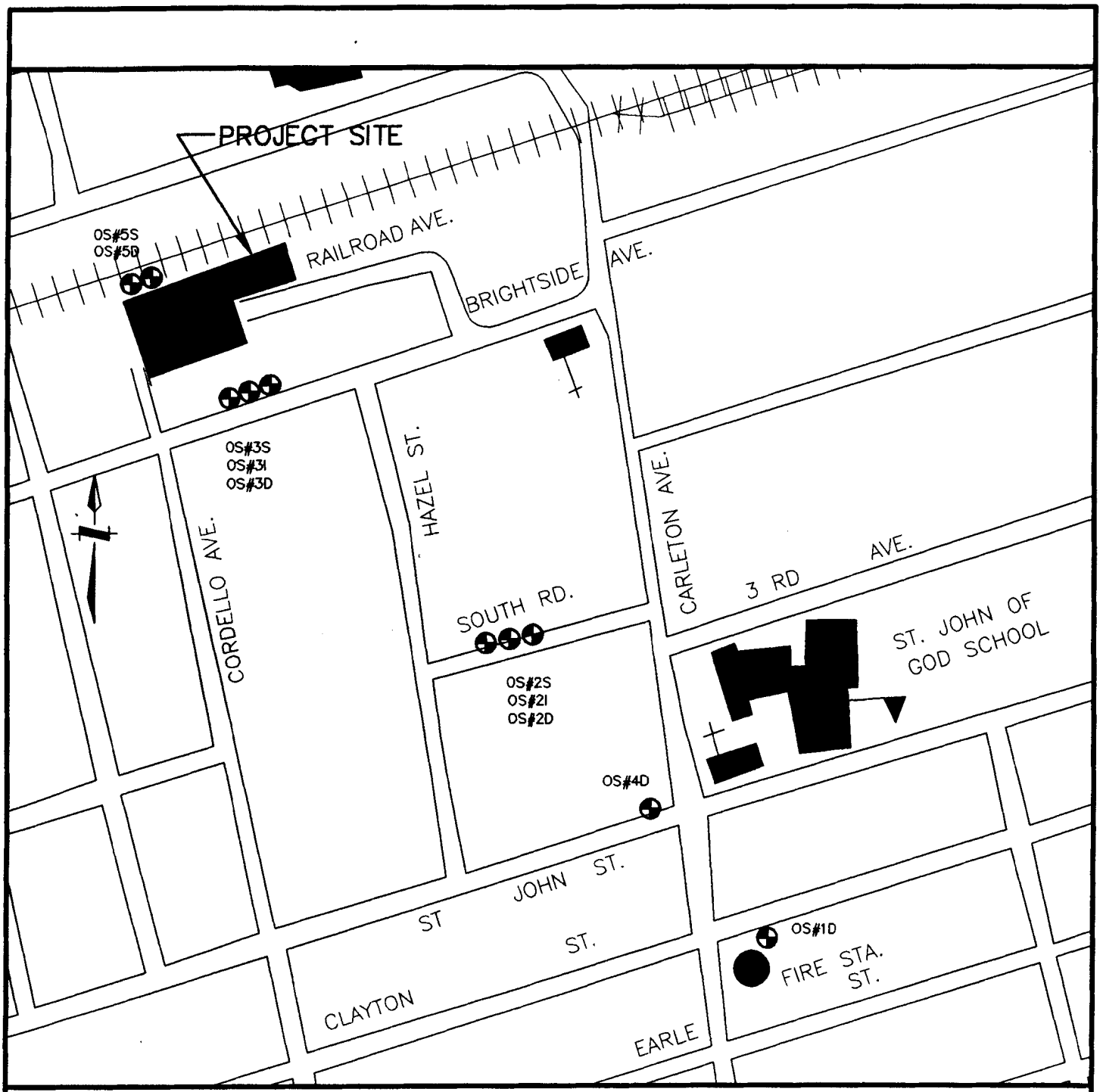


FIGURE 2.7
OFF-SITE MONITORING WELL LOCATION MAP
MACKENZIE CHEMICAL
NYSDEC SITE NO. 1-52-017

SCALE: 1" = 300'

LEGEND:

MONITORING WELL

H2MGROUP

ENGINEERS • ARCHITECTS • PLANNERS • SCIENTISTS • SURVEYORS

MELVILLE, N.Y. SHELTON, CT. TOTOWA, N.J.

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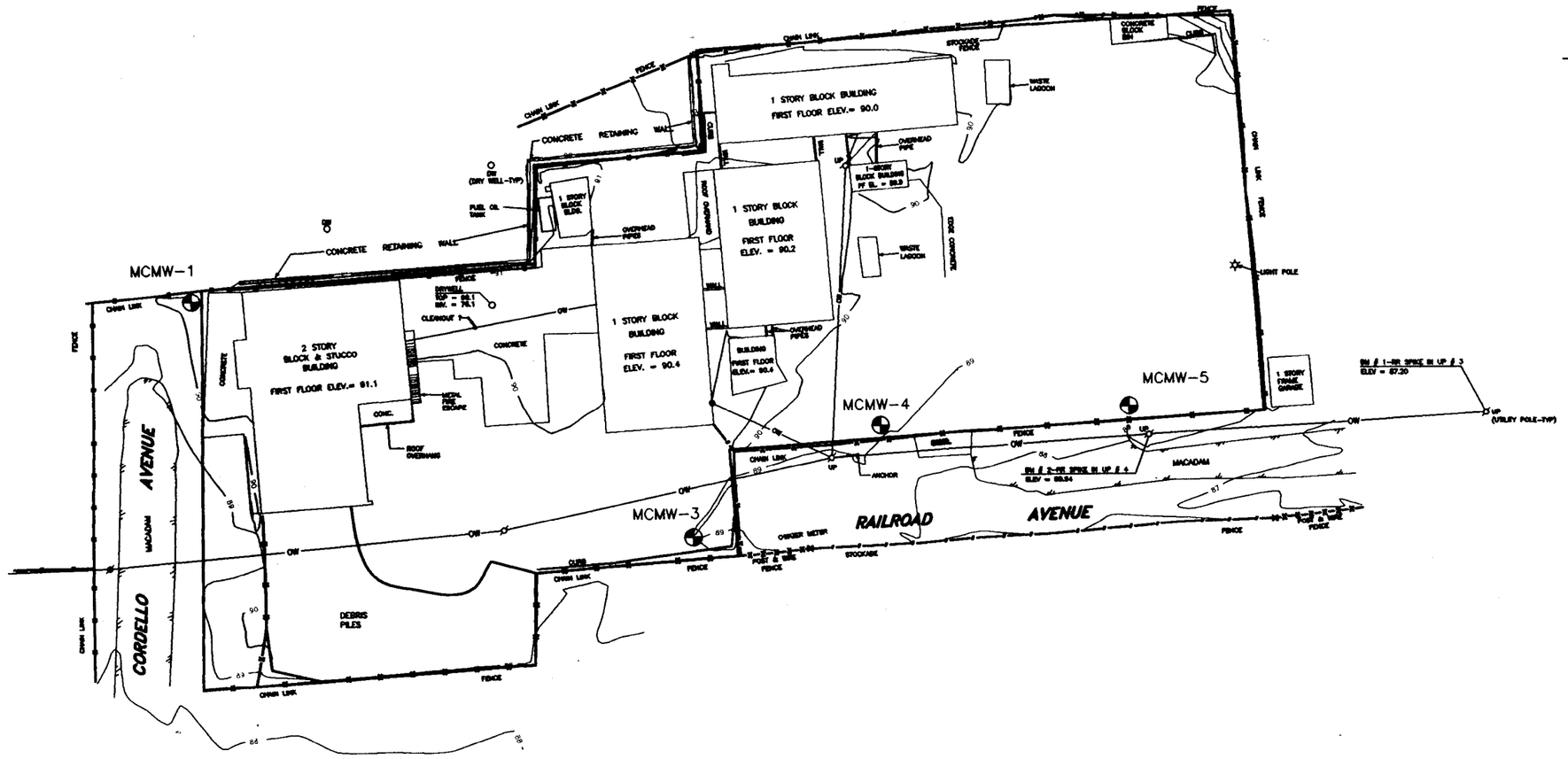


LEGEND

- MONITORING WELL
- MACADAM
- UTILITY POLE
- OVERHEAD WIRES
- CHAIN LINK FENCE
- STOCKADE FENCE
- POST AND WIRE FENCE
- PROPERTY LINE
- DRYWELL
- CONTOUR LINE (5 FOOT INTERVAL)
- CONTOUR LINE (1 FOOT INTERVAL

FIGURE 2.8
ON-SITE MONITORING WELL LOCATION MAP
MACKENZIE CHEMICAL
NYSDEC SITE NO. 1-52-017

SCALE: 1"= 50'

H2MGROUP ENGINEERS • ARCHITECTS • PLANNERS • SCIENTISTS • SURVEYORS
MELVILLE, N.Y. SHELTON, CT. TOTOWA, N.J.

SS-5	
DEPTH	1,2,3-TCP (mg/kg)
4'	180,000
8'	25,000
24'	230
40'	140

SS-6	
DEPTH	1,2,3-TCP (mg/kg)
4'	7500
21'	ND
41'	ND

SS-10	
DEPTH	1,2,3-TCP (mg/kg)
4'	28

SS-17	
DEPTH	1,2,3-TCP (ug/l)
4'	70

SS-18	
DEPTH	1,2,3-TCP (ug/l)
4'	140

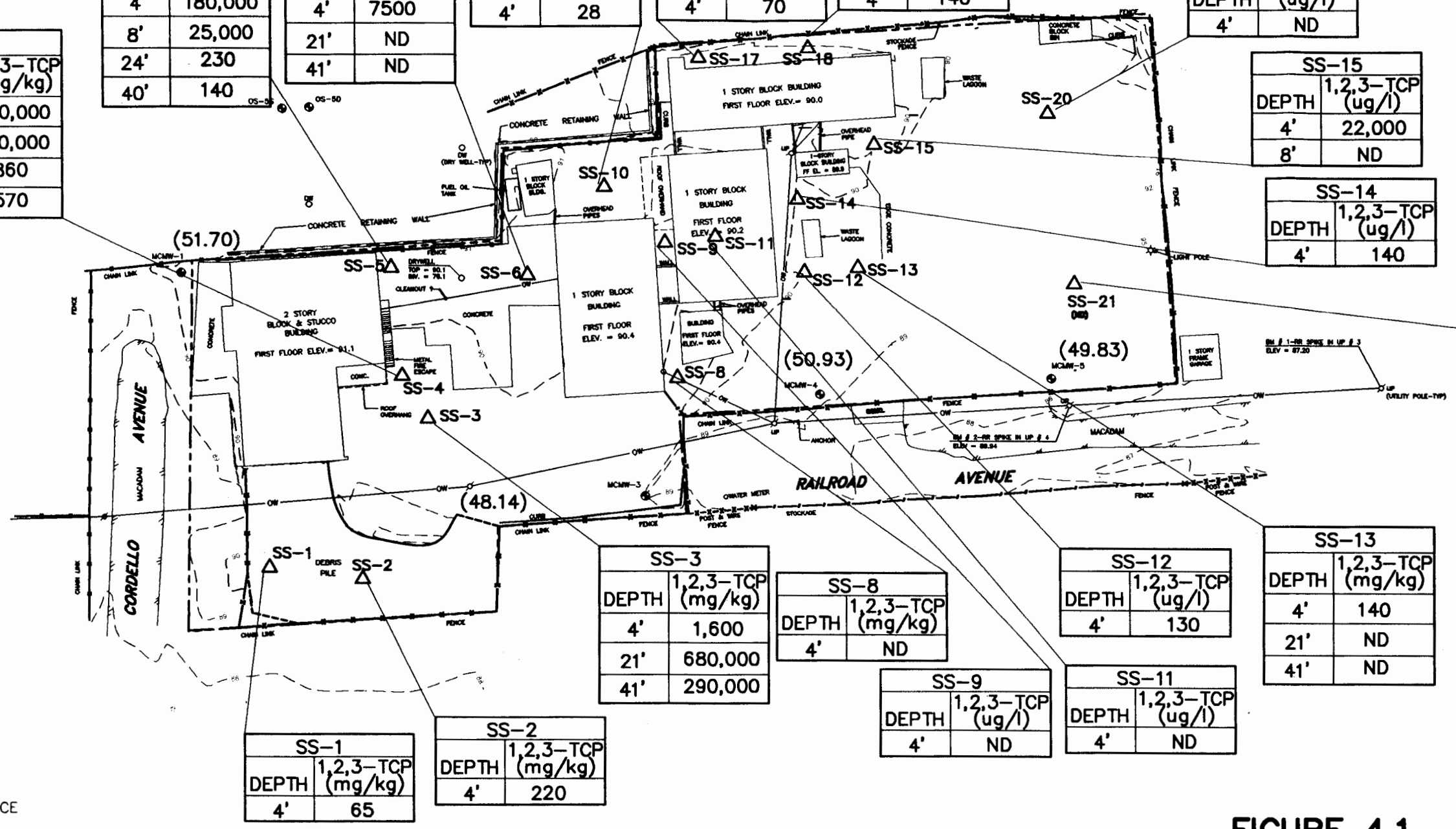
SS-20	
DEPTH	1,2,3-TCP (ug/l)
4'	ND

SS-4	
DEPTH	1,2,3-TCP (mg/kg)
4'	100,000
8'	110,000
21'	860
41'	570

SS-15	
DEPTH	1,2,3-TCP (ug/l)
4'	22,000
8'	ND

SS-14	
DEPTH	1,2,3-TCP (ug/l)
4'	140

SS-21	
DEPTH	1,2,3-TCP (ug/l)
4'	ND



SS-3	
DEPTH	1,2,3-TCP (mg/kg)
4'	1,600
21'	680,000
41'	290,000

SS-8	
DEPTH	1,2,3-TCP (mg/kg)
4'	ND

SS-12	
DEPTH	1,2,3-TCP (ug/l)
4'	130

SS-13	
DEPTH	1,2,3-TCP (mg/kg)
4'	140
21'	ND
41'	ND

SS-9	
DEPTH	1,2,3-TCP (ug/l)
4'	ND

SS-11	
DEPTH	1,2,3-TCP (ug/l)
4'	ND

SS-1	
DEPTH	1,2,3-TCP (mg/kg)
4'	65

SS-2	
DEPTH	1,2,3-TCP (mg/kg)
4'	220

LEGEND

- MONITORING WELL
- MACADAM
- UTILITY POLE
- OVERHEAD WIRES
- CHAIN LINK FENCE
- STOCKADE FENCE
- POST AND WIRE FENCE
- PROPERTY LINE
- DRYWELL
- CONTOUR LINE (5 FOOT INTERVAL)
- CONTOUR LINE (1 FOOT INTERVAL
- ND NON DETECT
- △ SURFACE SOIL SAMPLE

SS-2

NOTE:

THERE IS NO SS-7, SS-16 OR SS-19

FIGURE 4.1
SOIL SAMPLES LOCATIONS WITH CONCENTRATIONS OF 1,2,3-TRICHLOROPROPANE MACKENZIE CHEMICAL NYSDEC SITE NO. 1-52-017

SCALE: 1"= 50'

all units are ug/kg

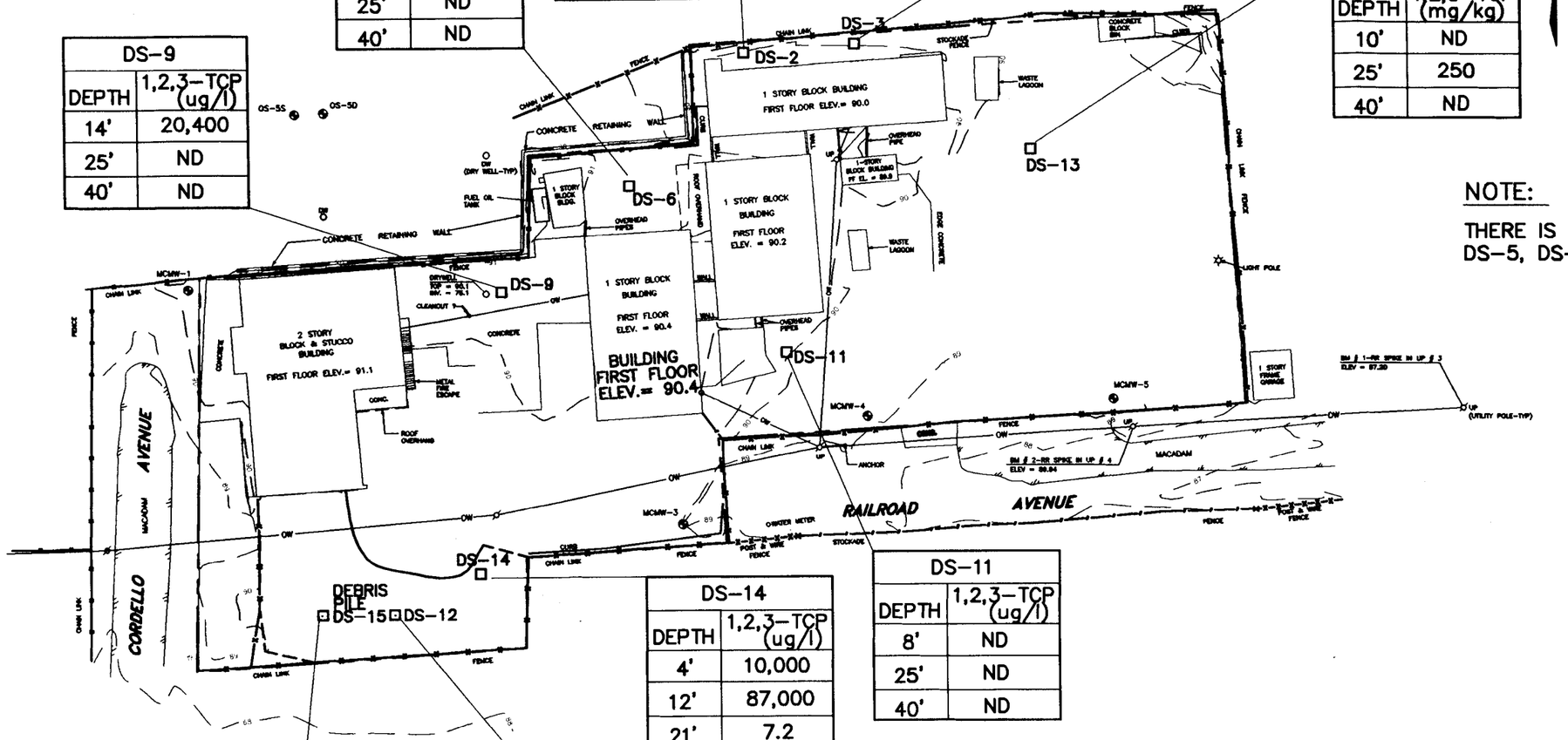
DS-2	
DEPTH	1,2,3-TCP (ug/l)
10'	ND
25'	ND
40'	ND

DS-3	
DEPTH	1,2,3-TCP (ug/l)
10'	ND
25'	ND
40'	ND

DS-6	
DEPTH	1,2,3-TCP (ug/l)
10'	ND
25'	ND
40'	ND

DS-9	
DEPTH	1,2,3-TCP (ug/l)
14'	20,400
25'	ND
40'	ND

DS-13	
DEPTH	1,2,3-TCP (mg/kg)
10'	ND
25'	250
40'	ND



NOTE:

THERE IS NO DS-1, DS-4, DS-5, DS-7, DS-8 OR DS-10

LEGEND

- MONITORING WELL
- MACADAM
- UTILITY POLE
- OVERHEAD WIRES
- CHAIN LINK FENCE
- STOCKADE FENCE
- POST AND WIRE FENCE
- PROPERTY LINE
- DRAINAGE STRUCTURE

DS-13

DS-14	
DEPTH	1,2,3-TCP (ug/l)
4'	10,000
12'	87,000
21'	7.2
	2,300

DS-11	
DEPTH	1,2,3-TCP (ug/l)
8'	ND
25'	ND
40'	ND

DS-15	
DEPTH	1,2,3-TCP (ug/l)
10'	ND
25'	ND
40'	ND

DS-12	
DEPTH	1,2,3-TCP (mg/kg)
10'	150
25'	ND
40'	250

FIGURE 4.2
DRAINAGE STRUCTURE SOIL SAMPLING LOCATIONS 1,2,3-TRICHLOROPROPANE MACKENZIE CHEMICAL NYSDEC SITE NO. 1-52-017

SCALE: 1"= 50'

all units are mg/kg

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DS-5
1,2,3-TCP (ug/kg)
3,900

WL#1	
DEPTH	1,2,3-TCP (ug/l)
8'	> 500
25'	50
40'	40

WL#2	
DEPTH	1,2,3-TCP (ug/l)
8'	ND
25'	ND
40'	ND

DS-12 PIPE
1,2,3-TCP (ug/kg)
11,000,000

LEGEND

- MONITORING WELL
- MACADAM
- UTILITY POLE
- OVERHEAD WIRES
- CHAIN LINK FENCE
- STOCKADE FENCE
- POST AND WIRE FENCE
- PROPERTY LINE
- DRYWELL
- CONTOUR LINE (5 FOOT INTERVAL)
- CONTOUR LINE (1 FOOT INTERVAL
- ND NON DETECT

FIGURE 4.3
WASTE LAGOON SOIL SAMPLES WITH CONCENTRATIONS OF 1,2,3-TRICHLOROPROPANE MACKENZIE CHEMICAL NYSDEC SITE NO. 1-52-017

SCALE: 1"= 40'

all units are ug/kg

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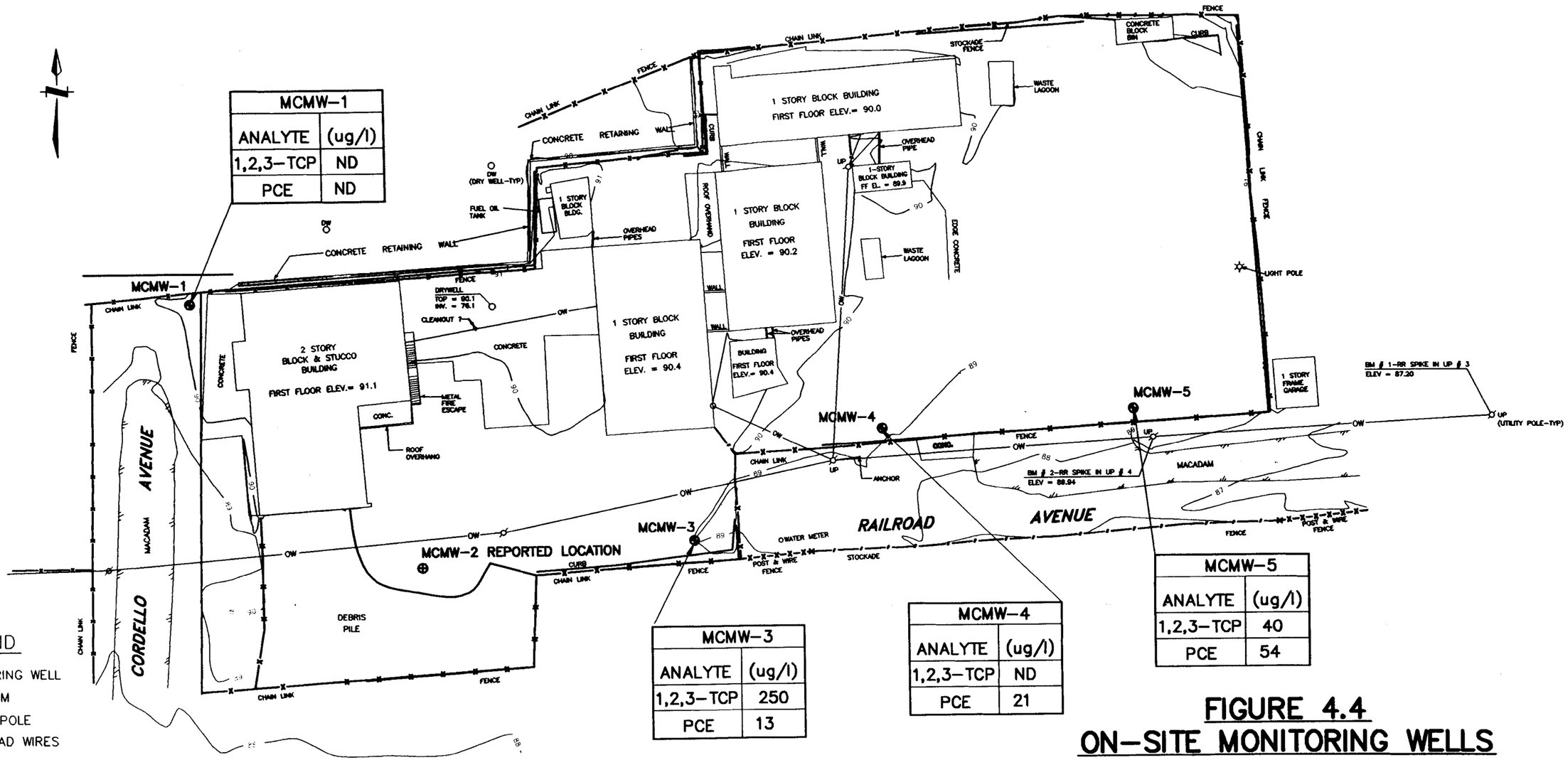

MCMW-1	
ANALYTE	(ug/l)
1,2,3-TCP	ND
PCE	ND

MCMW-3	
ANALYTE	(ug/l)
1,2,3-TCP	250
PCE	13

MCMW-4	
ANALYTE	(ug/l)
1,2,3-TCP	ND
PCE	21

MCMW-5	
ANALYTE	(ug/l)
1,2,3-TCP	40
PCE	54

LEGEND

- MONITORING WELL
- MACADAM
- UTILITY POLE
- OVERHEAD WIRES
- CHAIN LINK FENCE
- STOCKADE FENCE
- POST AND WIRE FENCE
- PROPERTY LINE
- DRYWELL
- CONTOUR LINE (5 FOOT INTERVAL)
- CONTOUR LINE (1 FOOT INTERVAL

ND = NON DETECT

NOTE: MCMW – 2 WAS NOT LOCATED
ON SITE WELLS ARE 65' BGS
SAMPLE DATA IS FROM ANALYTICAL LABORATORY

FIGURE 4.4
ON-SITE MONITORING WELLS WITH CONCENTRATIONS OF VOCs
MACKENZIE CHEMICAL
NYSDEC SITE NO. 1-52-017

SCALE: 1"= 40'

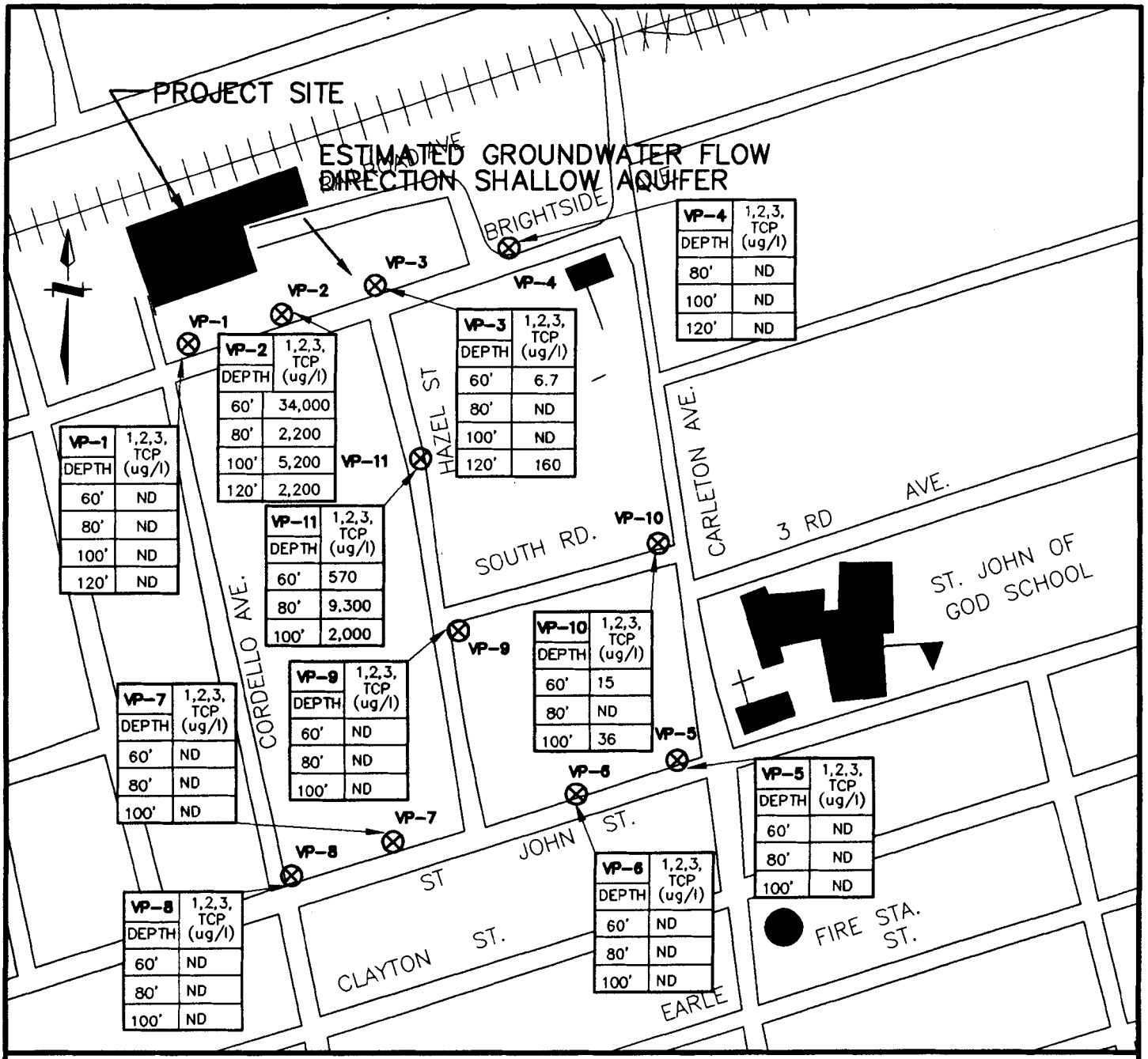

FIGURE 4.5
OFF-SITE VERTICAL PROFILE WELL SAMPLE LOCATION MAP WITH CONCENTRATIONS OF 1,2,3-TRICHLOROPROPANE
MACKENZIE CHEMICAL
NYSDEC SITE NO. 1-52-017

SCALE: 1"=300'

LEGEND:

ND = NON DETECT
⊗ = VERTICAL PROFILE WELL

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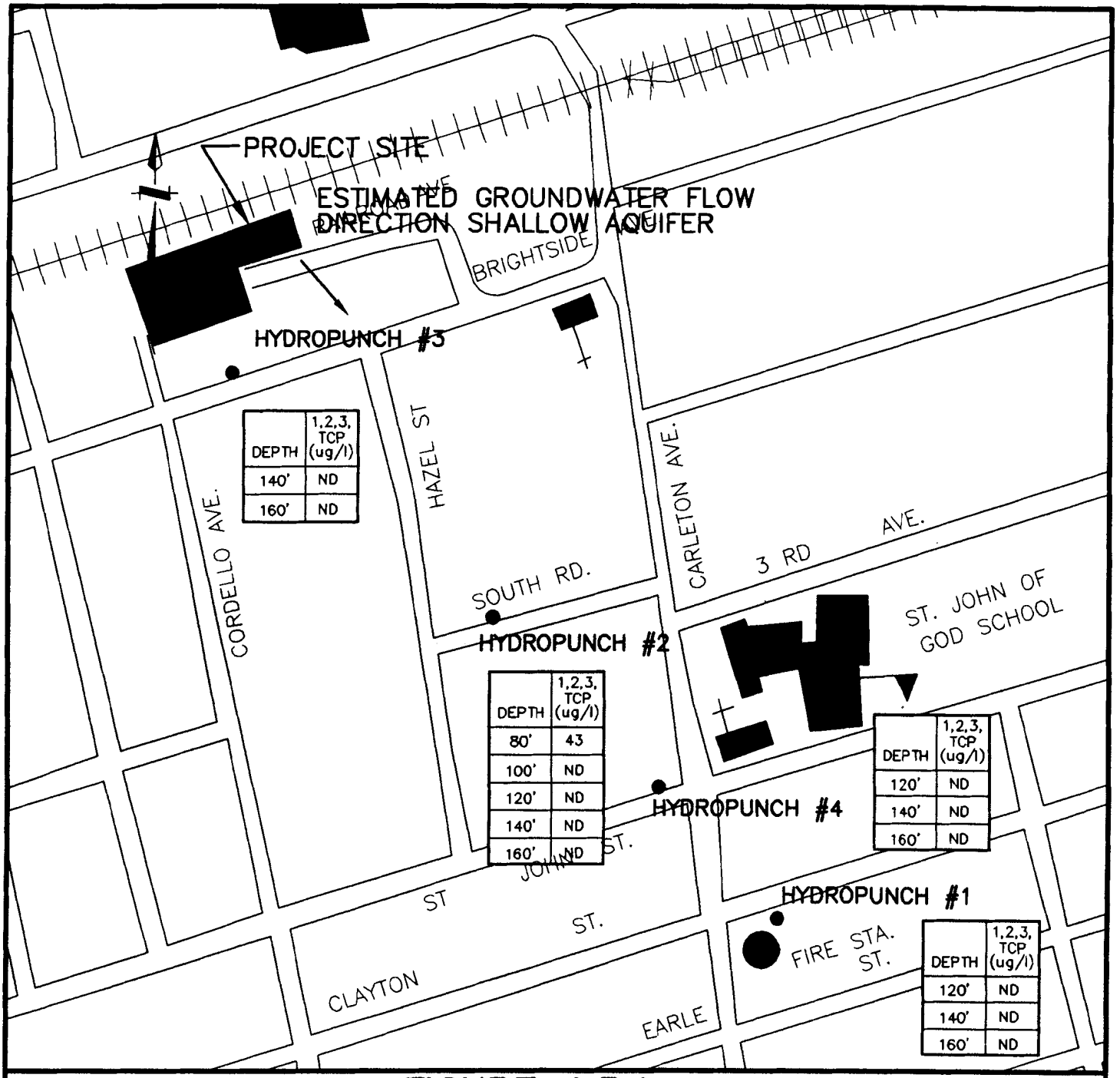

FIGURE 4.5.1
HYDROPUNCH LOCATION MAP WITH CONCENTRATIONS OF 1,2,3-TRICHLOROPROPANE
MACKENZIE CHEMICAL
NYSDEC SITE NO. 1-52-017

SCALE: 1" = 300'

ANALYSIS DONE BY H2M LABS. INC

LEGEND:

ND = NON DETECT

● = HYDROPUNCH SAMPLE

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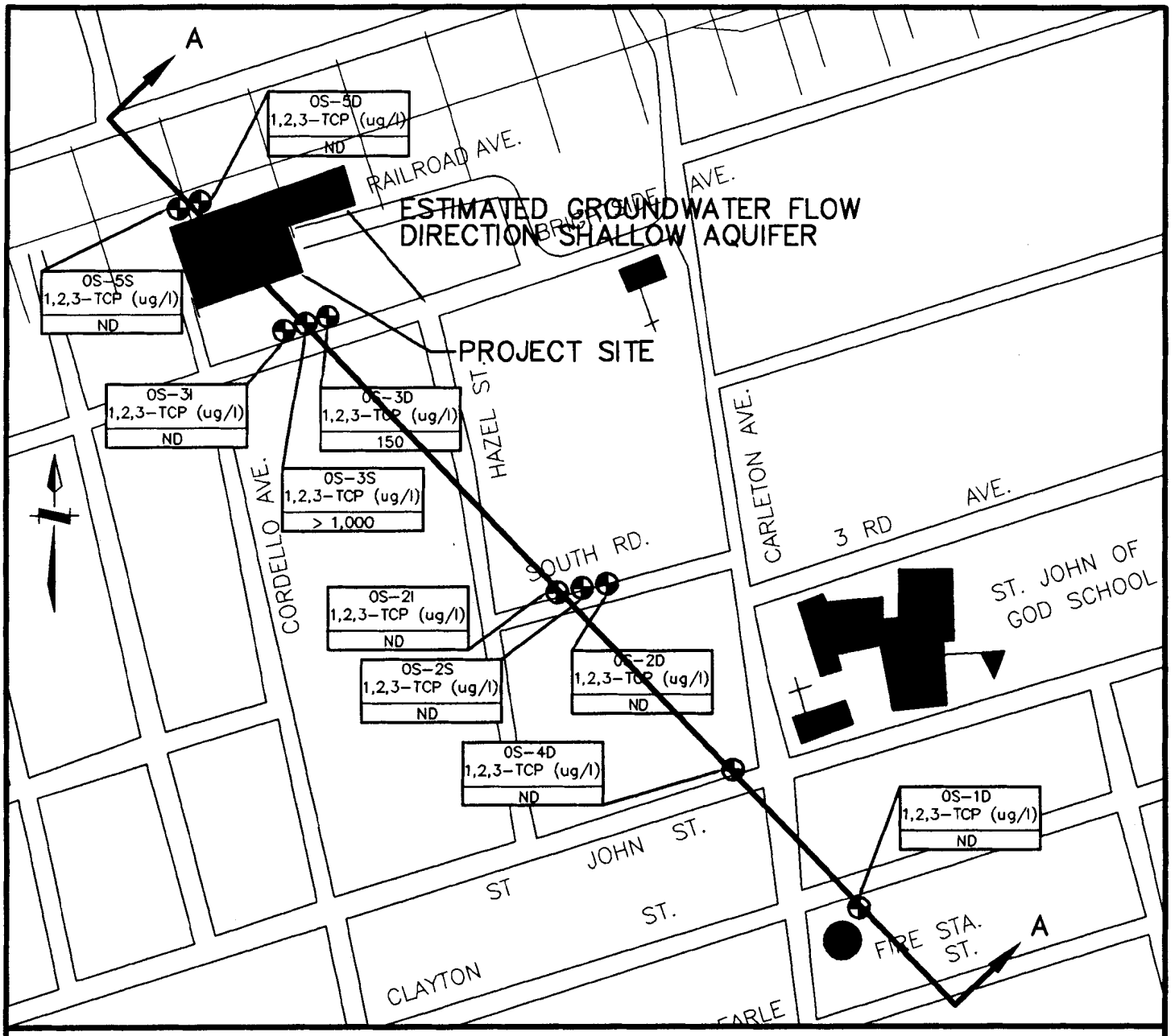

FIGURE 4.6.1
OFF-SITE MONITORING WELLS
JANUARY 1999
CONCENTRATIONS OF
1,2,3-TRICHLOROPROPANE
MACKENZIE CHEMICAL
NYSDEC SITE NO. 1-52-017

SCALE: 1"=300'

OFF-SITE WELLS LEGEND:

- S 60' BGS
- I 120'-130' BGS
- D 130'-160' BGS
- ND NON DETECT
  SAMPLE DATA IS FROM ANALYTICAL LABORATORY
- MONITORING WELL

SEE FIGURE 4.7 FOR CROSS SECTION

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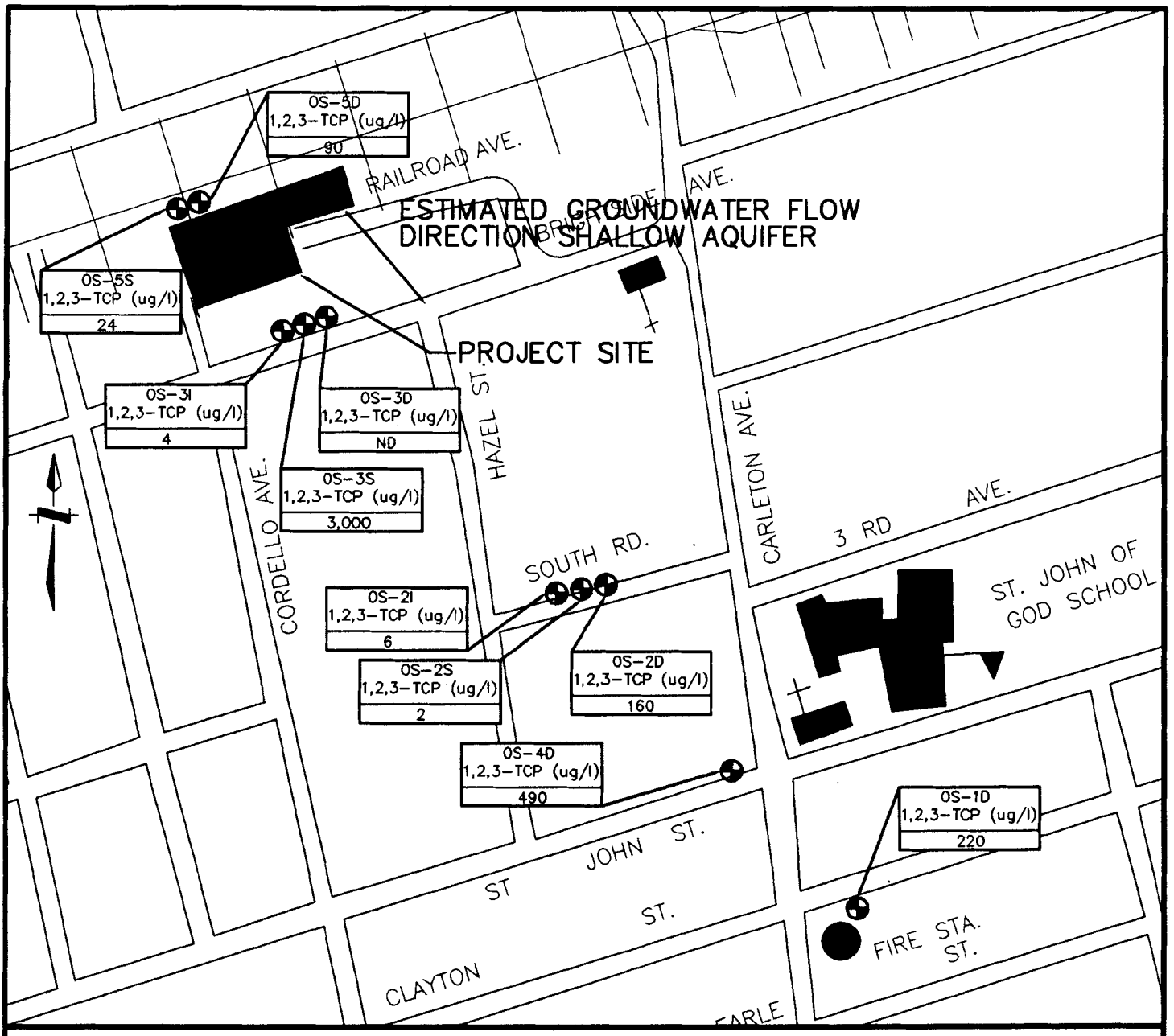

FIGURE 4.6.2
OFF-SITE MONITORING WELLS
AUGUST 1999
CONCENTRATIONS OF
1,2,3-TRICHLOROPROPANE
MACKENZIE CHEMICAL
NYSDEC SITE NO. 1-52-017

SCALE: 1"=300'

OFF-SITE WELLS LEGEND:

- S 60' BGS
- I 120'-130' BGS
- D 130'-160' BGS
- ND NON DETECT
- SAMPLE DATA IS FROM ANALYTICAL LABORATORY
- ⊕ MONITORING WELL

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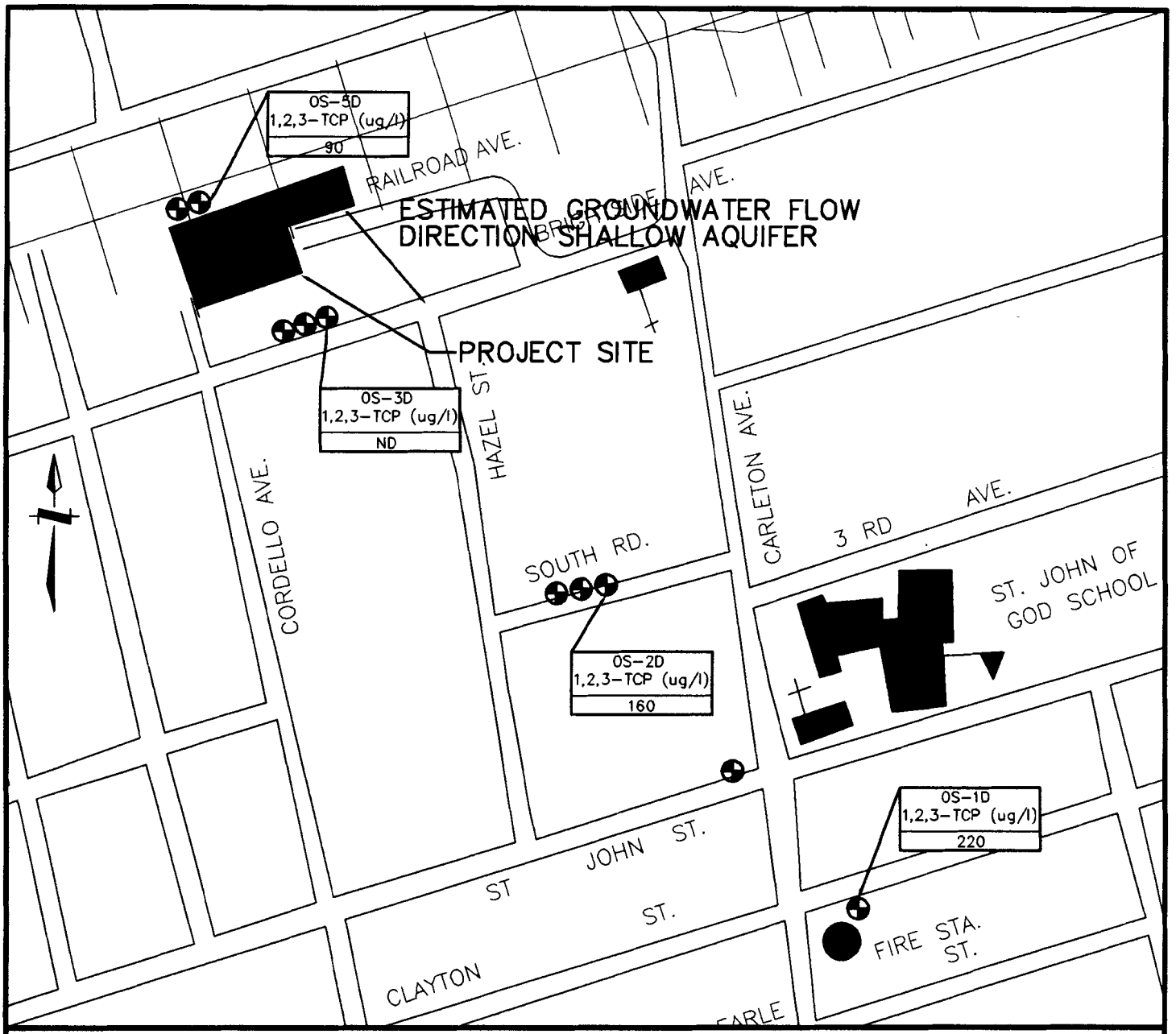

FIGURE 4.6.3
OFF-SITE MONITORING WELLS
NOVEMBER 1999
CONCENTRATIONS OF
1,2,3-TRICHLOROPROPANE
MACKENZIE CHEMICAL
NYSDEC SITE NO. 1-52-017

SCALE: 1"=300'

OFF-SITE WELLS LEGEND:

- S 60' BGS
- I 120'-130' BGS
- D 130'-160' BGS
- ND NON DETECT SAMPLE DATA IS FROM ANALYTICAL LABORATORY
- ⊕ MONITORING WELL

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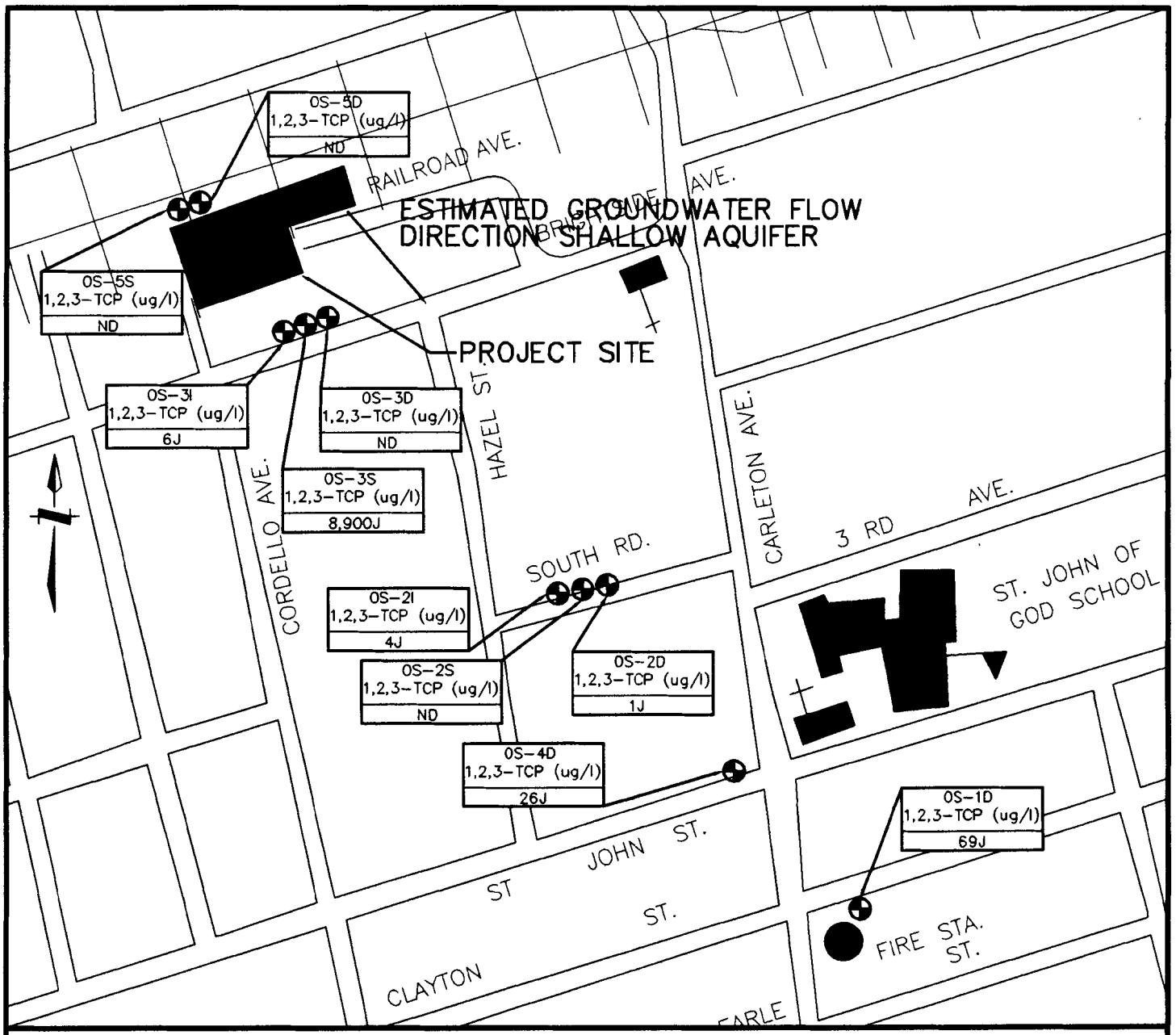

FIGURE 4.6.4
OFF-SITE MONITORING WELLS
FEBRUARY 2000
CONCENTRATIONS OF
1,2,3-TRICHLOROPROPANE
MACKENZIE CHEMICAL
NYSDEC SITE NO. 1-52-017

SCALE: 1"=300'

OFF-SITE WELLS LEGEND:

- S 60' BGS
- I 120'-130' BGS
- D 130'-160' BGS
- ND NON DETECT SAMPLE DATA IS FROM ANALYTICAL LABORATORY
- MONITORING WELL
- J INDICARES AN ESTIMATED VALUE

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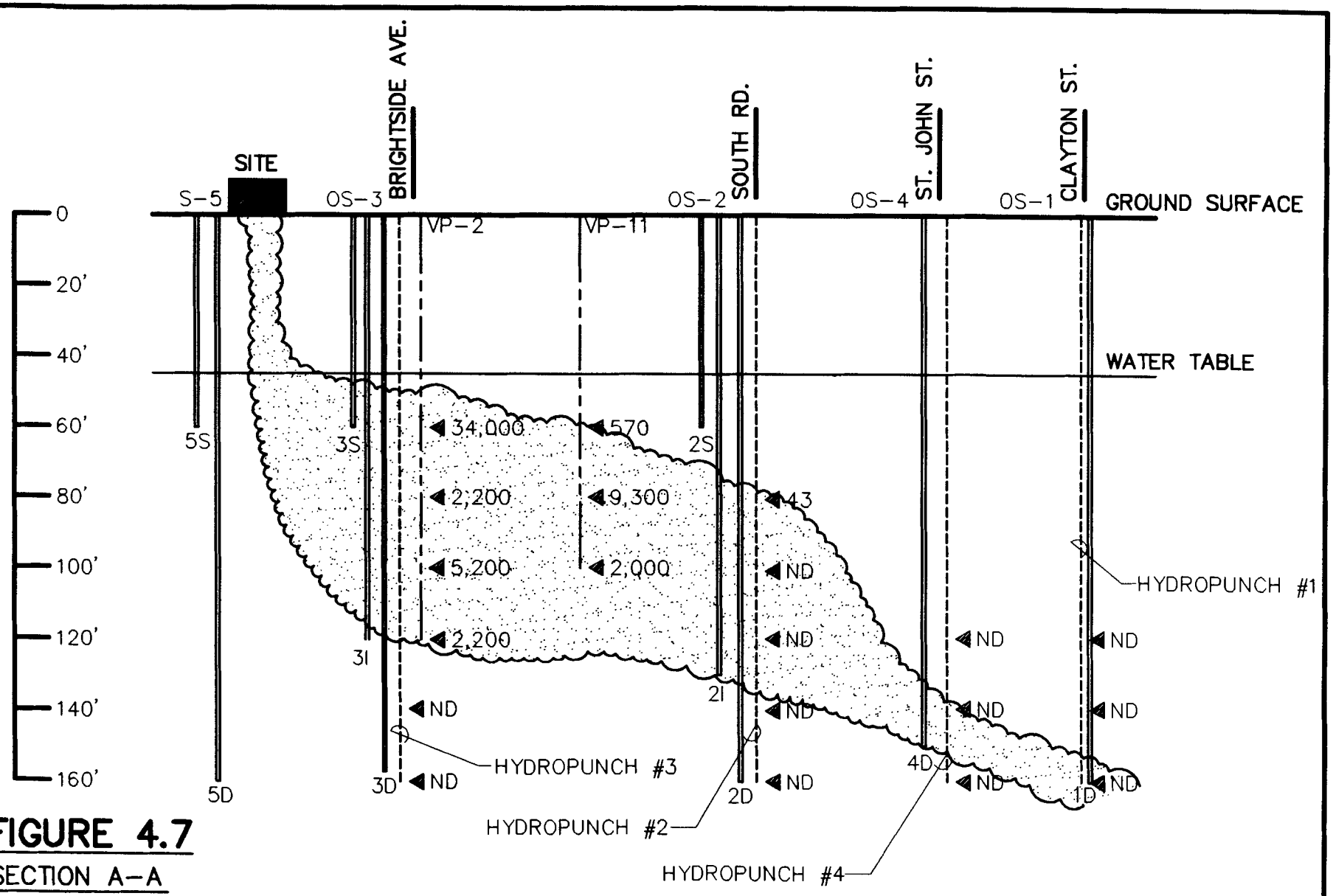
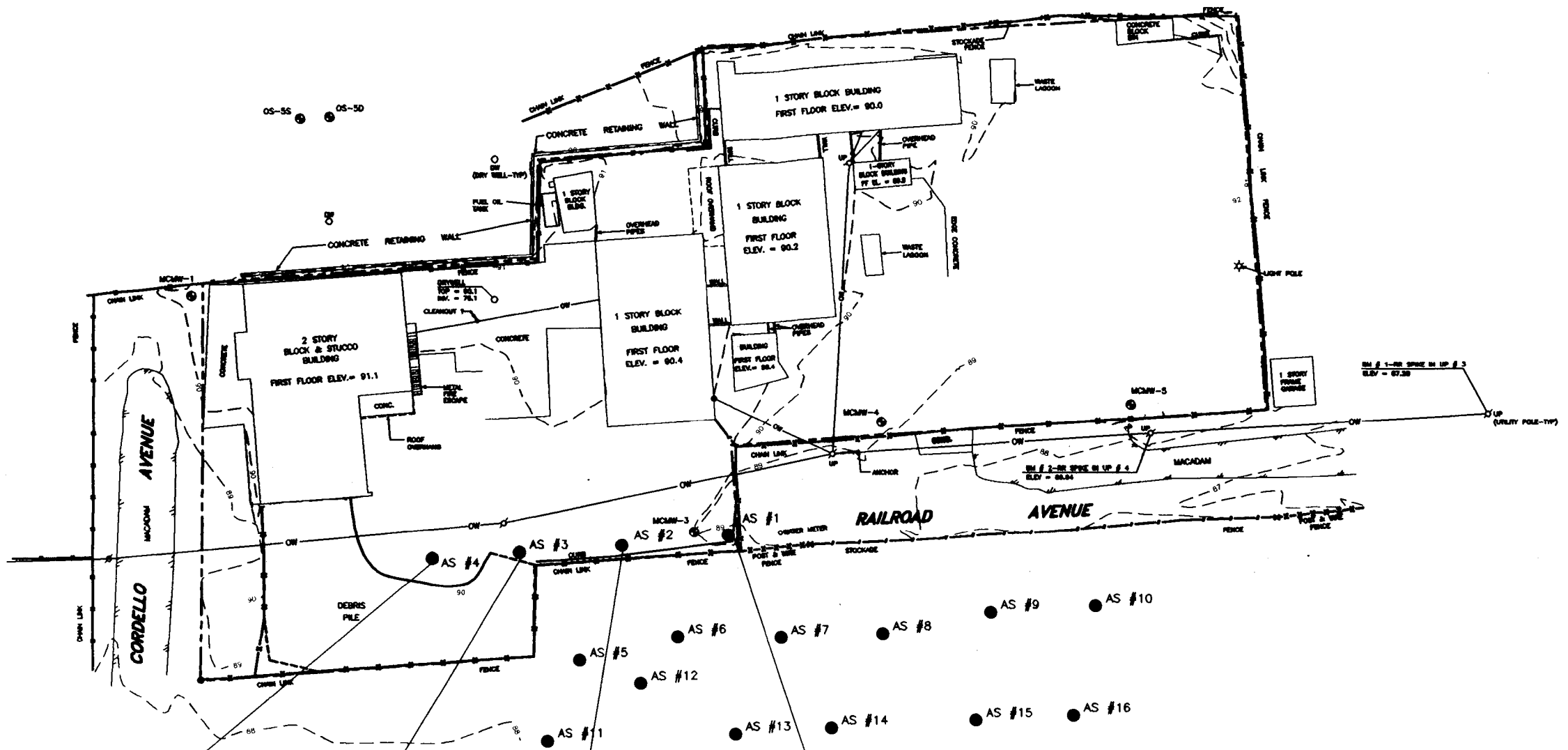


FIGURE 4.7

SECTION A–A

ANTICIPATED 1,2,3– TCP PLUME CROSS SECTION

HORIZONTAL SCALE: 1" = 300'
VERTICAL SCALE: 1" = 40'



LEGEND

- MONITORING WELL
- MACADAM
- UTILITY POLE
- OVERHEAD WIRES
- CHAIN LINK FENCE
- STOCKADE FENCE
- POST AND WIRE FENCE
- PROPERTY LINE
- DRYWELL
- CONTOUR LINE (5 FOOT INTERVAL)
- CONTOUR LINE (1 FOOT INTERVAL)
- SOIL GAS SAMPLES POINT

AS #4	
DEPTH	1,2,3–TCP (ug/m^3)
5'	1,900 E
10'	2,000 E
15'	2,200 E

AS #3	
DEPTH	1,2,3–TCP (ug/m^3)
5'	1,500 E
10'	1,900 E
15'	1,500 E

AS #2	
DEPTH	1,2,3–TCP (ug/m^3)
5'	1,200 E
10'	1,700 E
15'	2,100 E

AS #1	
DEPTH	1,2,3–TCP (ug/m^3)
5'	90
10'	60
15'	500 E

FIGURE 4.8
ON–SITE SOIL GAS AIR SAMPLING LOCATIONS WITH CONCENTRATIONS OF 1,2,3–TRICHLOROPROPANE
MACKENZIE CHEMICAL
NYSDEC SITE NO. 1–52–017

SCALE: 1"= 50'

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FIGURE 7.1
POTENTIAL DOWN GRADIENT RECEPTORS
MACKENZIE CHEMICAL
NYSDEC No. 1-52-017

SCALE: 1"= 1500'

LEGEND

☐ – MAGOTHY AQUIFER PUBLIC SUPPLY WELL

● – GLACIAL AQUIFER PUBLIC SUPPLY WELL

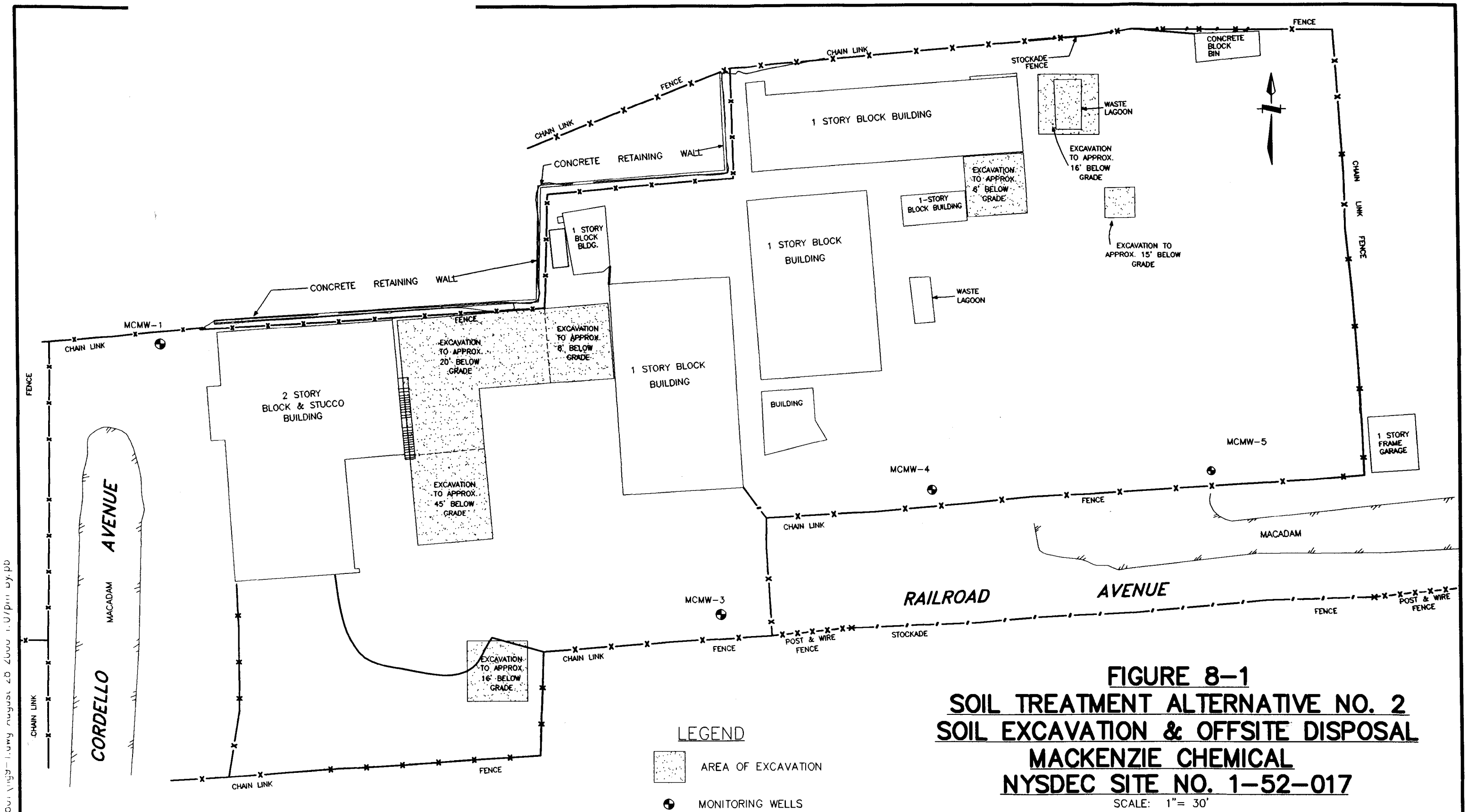
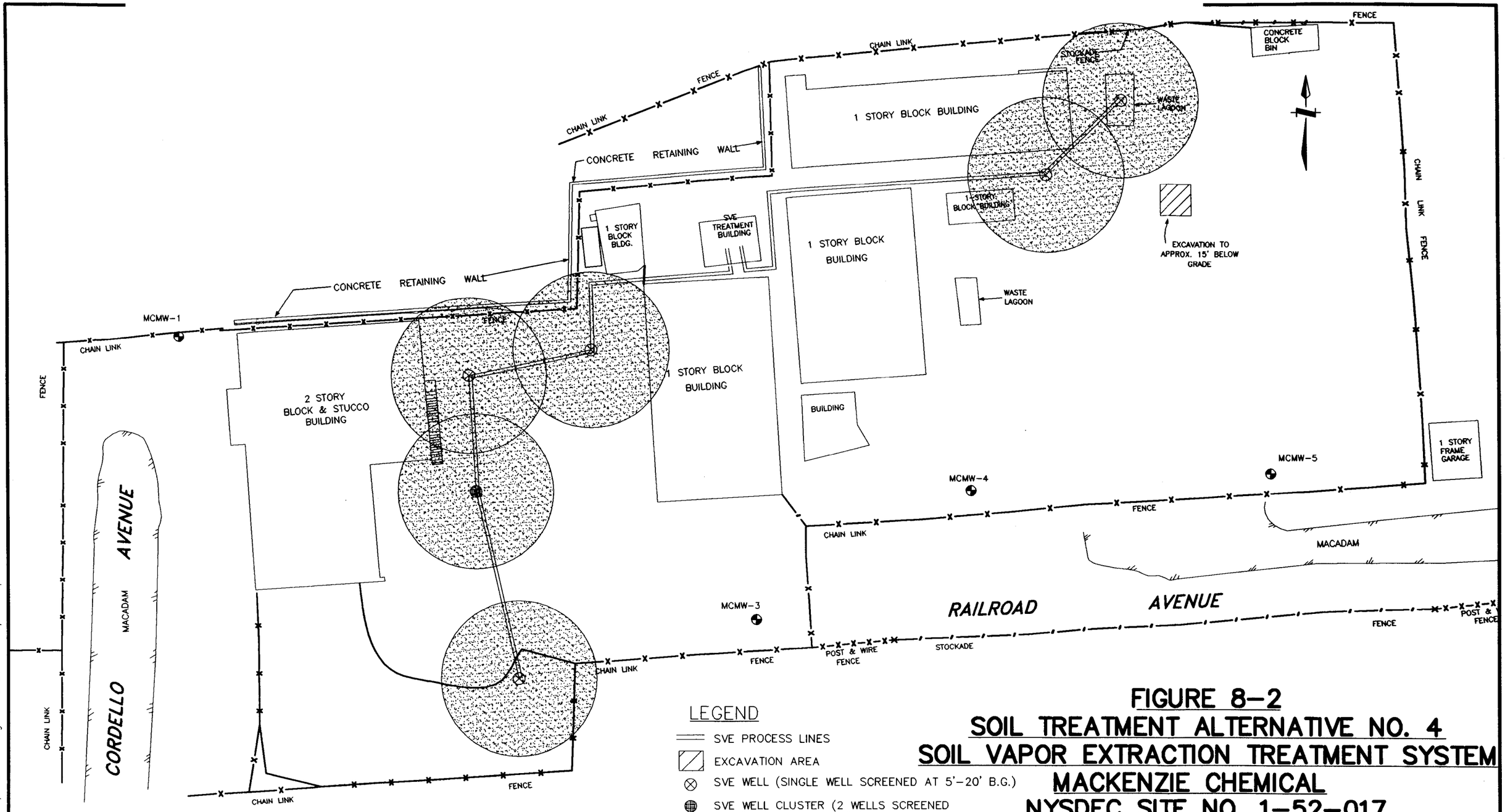


FIGURE 8-1
SOIL TREATMENT ALTERNATIVE NO. 2
SOIL EXCAVATION & OFFSITE DISPOSAL
MACKENZIE CHEMICAL
NYSDEC SITE NO. 1-52-017

SCALE: 1"= 30'

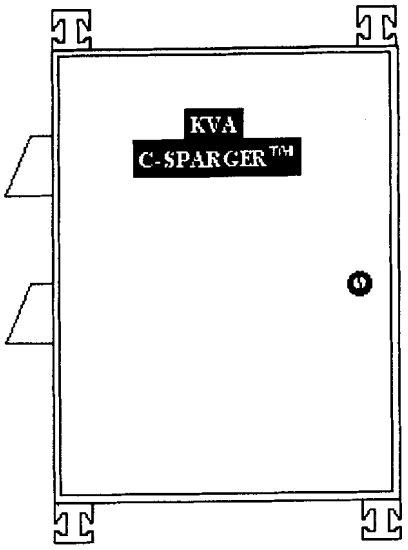


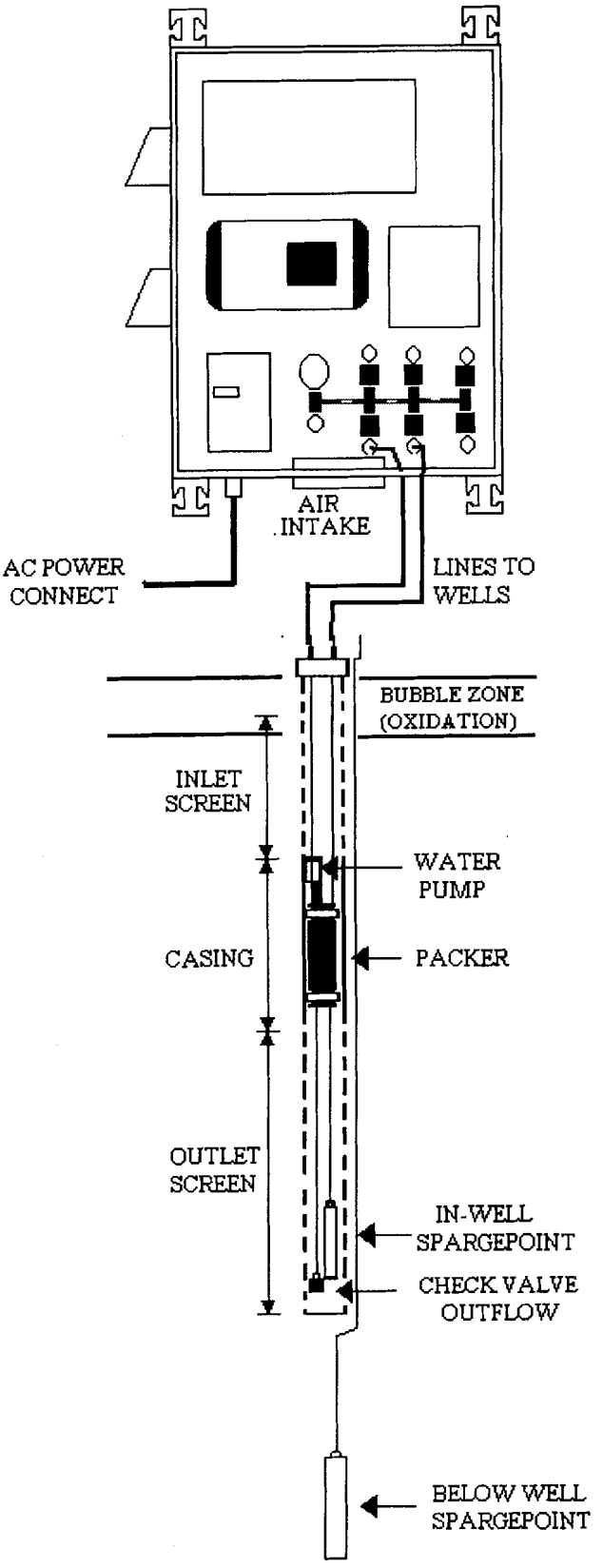
LEGEND

- SVE PROCESS LINES
- EXCAVATION AREA
- SVE WELL (SINGLE WELL SCREENED AT 5'–20' B.G.)
- SVE WELL CLUSTER (2 WELLS SCREENED AT 5'–20' & 20'–40' B.G.)
- SVE ESTMATED AREA OF TREATMENT
- MONITORING WELL

FIGURE 8–2
SOIL TREATMENT ALTERNATIVE NO. 4
SOIL VAPOR EXTRACTION TREATMENT SYSTEM
MACKENZIE CHEMICAL
NYSDEC SITE NO. 1–52–017

SCALE: 1"= 30'





KV Associates, Inc.

FIGURE 8-3
C-SPARGE BUBBLE FENCE CONTAINMENT SYSTEM
MACKENZIE CHEMICAL
NYSDEC SITE NO. 1-52-017

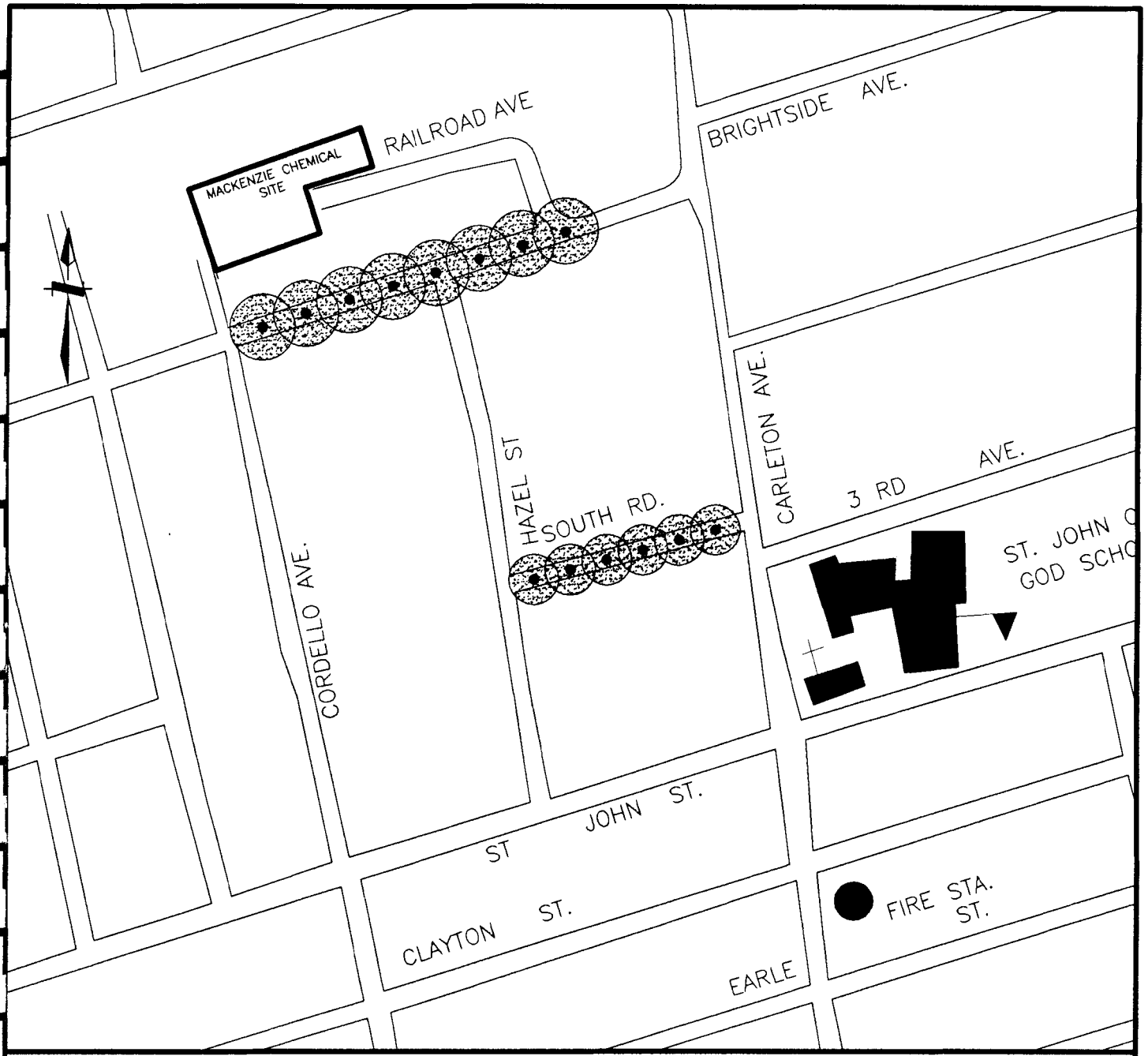


FIGURE 8–4
GROUND WATER TREATMENT ALTERNATIVE NO. 2
C–SPARGE BUBBLE FENCE SYSTEM
MACKENZIE CHEMICAL
NYSDEC SITE NO. 1–52–017

LEGEND:

● TREATMENT WELL

– C–SPARGER BUBBLE FENCE ESTIMATED ZONE OF INFLUENCE

SCALE: 1"=300'

NOTE: HIGHEST 1,2,3 – TCP CONC. USED FOR G.W. SAMPLES COLLECTED AT MULTIPLE DEPTHS

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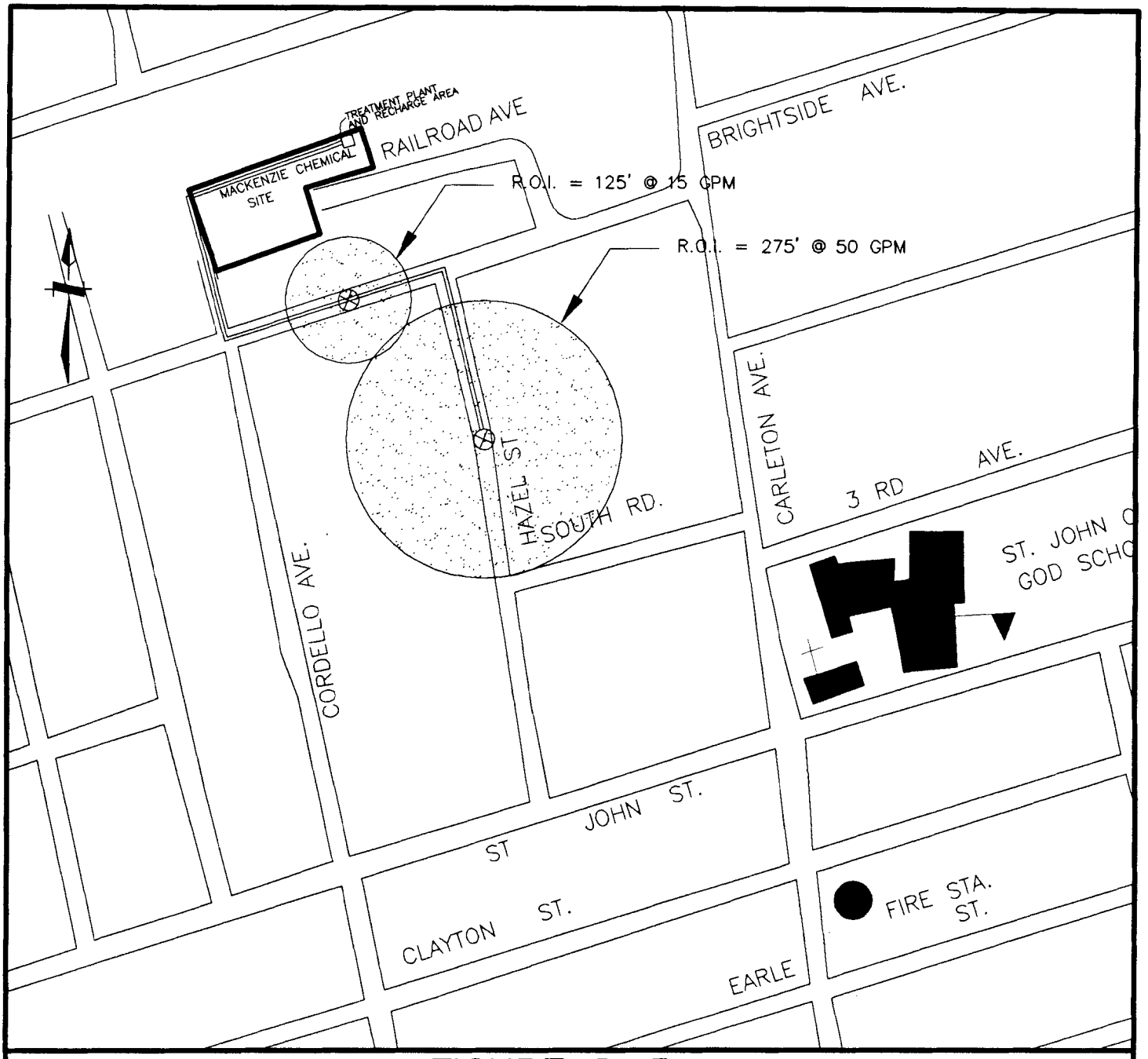

FIGURE 8-5
GROUNDWATER TREATMENT ALTERNATIVE NO 4
PUMP AND TREATMENT
MACKENZIE CHEMICAL
NYSDEC SITE NO. 1-52-017

SCALE: 1"=300'

LEGEND:

⊗ RECOVERY WELL

ZONE OF CAPTURE

PROCESS LINES

NOTE: HIGHEST 1,2,3 – TCP CONC. USED FOR G.W. SAMPLES COLLECTED AT MULTIPLE DEPTHS

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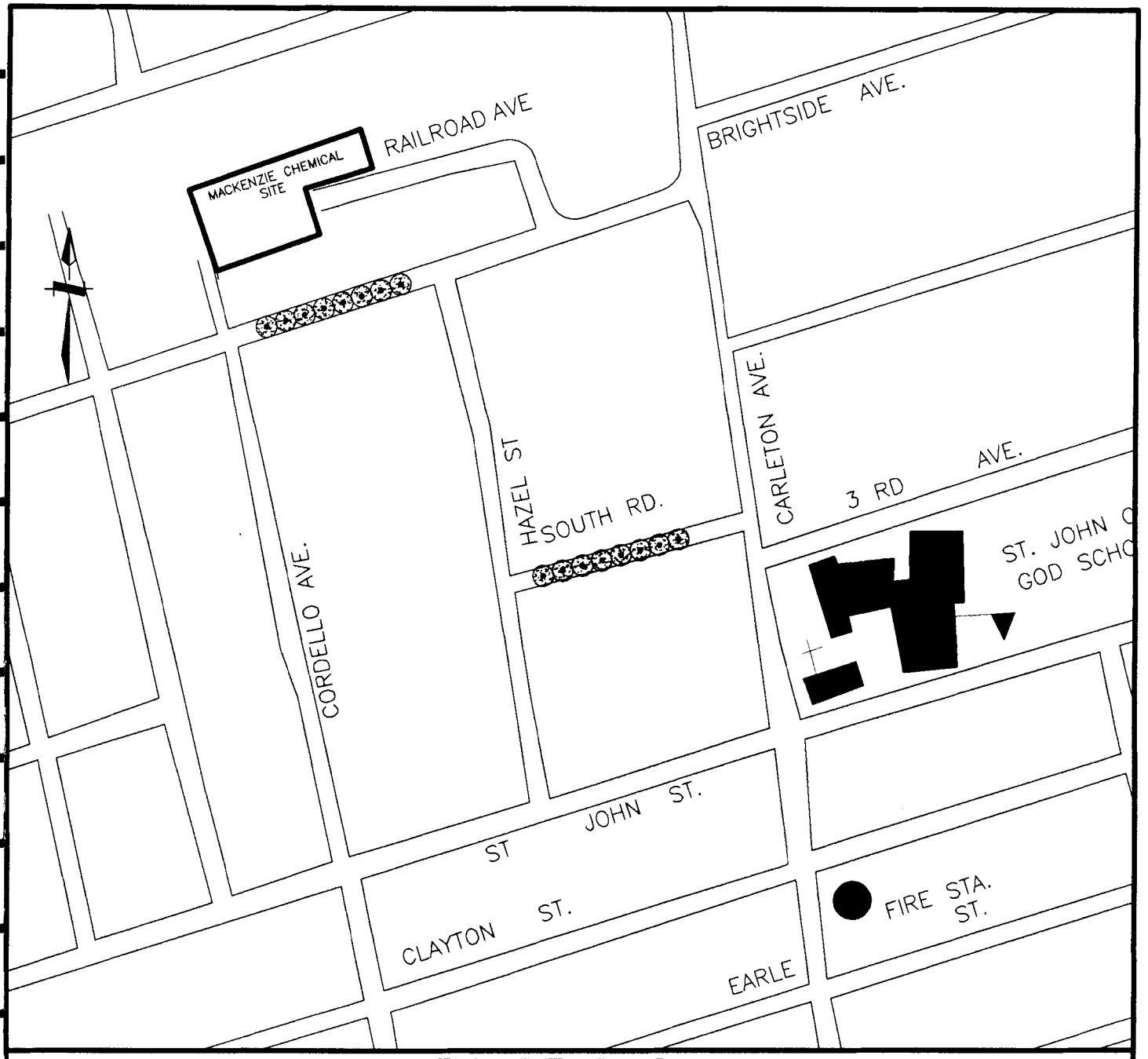

FIGURE 8-6
GROUND WATER TREATMENT ALTERNATIVE NO. 5
IN-SITU CHEMICAL OXIDATION
MACKENZIE CHEMICAL
NYSDEC SITE NO. 1-52-017

LEGEND:

- INJECTION WELL CLUSTER
- ESTIMATED TREATMENT AREA

SCALE: 1"=300'

NOTE: HIGHEST 1,2,3 – TCP CONC. USED FOR G.W. SAMPLES COLLECTED AT MULTIPLE DEPTHS

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TABLES

TABLE 2.1

MACKENZIE CHEMICAL

SAMPLE MATRIX CHART

Type	Matrix	Sample Designator	Total Samples Analyzed	Mobile Lab, TCL VOCs	NYSDEC-Approved Lab				Notes
					TCL VOCs	TCL SVOCs	TCL Pest/PCBs	TAL Metals	
Subsurface	Soil	DS-2 (25')	29	20	9	9	9	9	Soil samples from on-site drainage structures.
Surface	Soil	SS-1 (0-4')	31	31					Surface soil samples collected on site.
Subsurface	Soil	WL-1 (8')	6		6	2	2	2	Soil samples collected adjacent to waste lagoons.
Total Soil Samples per Analysis:			**66**	**51**	**15**	**15**	**15**	**15**	
Vertical Profile Well	Groundwater	VP-2 (80')	43	37	6	6	6	6	Groundwater samples off-site via geoprobe
Hydropunches	Groundwater	HP-1 (120')	13		13				Groundwater samples off-site via drill rig
Monitoring Well	Groundwater	OS-#1D	10		10	10	10	10	Groundwater samples from off-site MW's
Monitoring Well	Groundwater	MCMW-#1	4		4	4	4	4	Groundwater samples from on-site MW's
Miscellaneous	Liquids	DS-12-pipe	2	2					Liquid samples collected as per NYSDEC
Total Groundwater Samples per Analysis:			**72**	**39**	**33**	**20**	**20**	**20**	
Soil Gas	Air	AS#1 (5')	12		12				Air samples from soil gas locations bgs.
Total Air Samples per Analysis:			**12**		**12**				

TABLE 2.2

MACKENZIE CHEMICAL

MONITORING WELL CONSTRUCTION DETAILS

WELL ID	DATE INSTALLED	LOCATION	SCREEN INTERVAL (FT BGS)	TOTAL DEPTH (FT BGS)	SURFACE ELEVATION (FT MSL)	TOC ELEVATION (FT MSL)	DEPTH TO WATER (FT BGS)	WATER ELEVATION (FT MSL)	CASING WELL DIA.
MCMW-1	April 29, 1992	On Site	45-65	65.0	90.33	92.34	51.76	40.58	4"
MCMW-2*	April 21, 1992	On Site	45-65	65.0	NA	NA	NA	NA	NA
MCMW-3	April 22, 1992	On Site	45-65	65.0	89.00	88.51	48.14	40.37	4"
MCMW-4	April 24, 1992	On Site	45-65	65.0	89.24	91.21	50.93	40.28	4"
MCMW-5	April 27, 1992	On Site	45-65	65.0	89.40	90.17	49.83	40.34	4"
OS-1D	December 10, 1998	Off Site	160-150	160.0	80.68	80.41	42.12	38.29	2"
OS-2S	December 23, 1998	Off Site	60-50	60.0	79.89	79.50	40.18	39.32	2"
OS-2I	January 5, 1999	Off Site	130-120	130.0	79.99	79.68	40.31	39.37	2"
OS-2D	December 15, 1998	Off Site	160-150	160.0	79.90	79.66	41.20	38.46	2"
OS-3S	January 7, 1999	Off Site	60-50	60.0	87.45	87.06	46.86	40.20	2"
OS-3I	January 4, 1999	Off Site	120-110	120.0	87.39	87.07	46.86	40.21	2"
OS-3D	December 16, 1998	Off Site	158-148	158.0	87.34	87.11	46.96	40.15	2"
OS-4D	December 22, 1998	Off Site	155-145	155.0	78.41	78.01	39.27	38.74	2"
OS-5S	January 7, 1999	Off Site	60-50	60.0	89.86	89.56	48.90	40.66	2"
OS-5D	January 6, 1999	Off Site	150-140	150.0	89.65	89.39	48.79	40.60	2"

* = The area around MCMW-2 has been regraded and well could not be located.

TABLE 4.1

MACKENZIE CHEMICAL SITE

SOIL SAMPLES
VOLATILE ORGANIC COMPOUNDS - MOBILE LABORATORY

SAMPLE ID	SS-1	SS-2	SS-3			SS-4				NYSDEC
DEPTH OF SAMPLE[1]	0-4ft	0-4ft	0-4ft	21ft	41ft	0-4ft	4-8ft	21ft	41ft	RSCO[2]
PARAMETERS - (ug/kg)										
Chloromethane	< 10	< 100	< 100	< 20,000	< 20,000	< 20,000	< 2,500	< 100	< 100	NA
Vinyl Chloride	< 10	< 100	< 100	< 20,000	< 20,000	< 20,000	< 2,500	< 100	< 100	200
Bromomethane	< 10	< 100	< 100	< 20,000	< 20,000	< 20,000	< 2,500	< 100	< 100	NA
Chloroethane	< 10	< 100	< 100	< 20,000	< 20,000	< 20,000	< 2,500	< 100	< 100	1,900
1,1-Dichloroethene	< 10	< 100	< 100	< 20,000	< 20,000	< 20,000	< 2,500	< 100	< 100	400
Methylene Chloride	< 10	< 100	< 100	< 20,000	< 20,000	< 20,000	< 2,500	< 100	< 100	100
trans-1,2-Dichloroethene	< 10	< 100	< 100	< 20,000	< 20,000	< 20,000	< 2,500	< 100	< 100	250
1,1-Dichloroethane	< 10	< 100	< 100	< 20,000	< 20,000	< 20,000	< 2,500	< 100	< 100	200
cis-1,2-Dichloroethene	< 10	< 100	< 100	< 20,000	< 20,000	< 20,000	< 2,500	< 100	< 100	250
Chloroform	< 10	< 100	< 100	< 20,000	< 20,000	< 20,000	< 2,500	< 100	< 100	300
1,1,1-Trichloroethane	< 10	< 100	< 100	< 20,000	< 20,000	< 20,000	< 2,500	< 100	< 100	800
Carbon Tetrachloride	< 10	< 100	< 100	< 20,000	< 20,000	< 20,000	< 2,500	< 100	< 100	600
1,2-Dichloroethane	< 10	< 100	< 100	< 20,000	< 20,000	< 20,000	< 2,500	< 100	< 100	100
Trichloroethene	< 10	< 100	< 100	< 20,000	< 20,000	< 20,000	< 2,500	< 100	< 100	700
1,2-Dichloropropane	< 10	< 100	< 100	< 20,000	< 20,000	< 20,000	< 2,500	< 100	< 100	NA
Bromodichloromethane	< 10	< 100	< 100	< 20,000	< 20,000	< 20,000	< 2,500	< 100	< 100	NA
cis-1,3-Dichloropropene	< 10	< 100	< 100	< 20,000	< 20,000	< 20,000	< 2,500	< 100	< 100	NA
trans-1,3-Dichloropropene	< 10	< 100	< 100	< 20,000	< 20,000	< 20,000	< 2,500	< 100	< 100	NA
1,1,2-Trichloroethane	< 10	< 100	< 100	< 20,000	< 20,000	< 20,000	< 2,500	< 100	< 100	NA
Tetrachloroethylene	< 10	< 100	< 100	< 20,000	< 20,000	< 20,000	< 2,500	< 100	< 100	1,400
Dibromochloromethane	< 10	< 100	< 100	< 20,000	< 20,000	< 20,000	< 2,500	< 100	< 100	NA
Bromoform	< 10	< 100	< 100	< 20,000	< 20,000	< 20,000	< 2,500	< 100	< 100	NA
1,1,2,2,-Tetrachloroethane	< 10	< 100	< 100	< 20,000	< 20,000	< 20,000	< 2,500	< 100	< 100	600
1,2,3-Trichloropropane	65	220 D	1,600 D	680,000 D	290,000 D	100,000 D	110,000 D	860 D	570 D	400
Acetone	< 10	< 100	< 500	< 20,000	< 20,000	< 20,000	< 2,500	< 100	< 100	200
MEK	< 10	< 100	< 500	< 20,000	< 20,000	< 20,000	< 2,500	< 100	< 100	300
Benzene	< 10	< 100	< 500	< 20,000	< 20,000	< 20,000	< 2,500	< 100	< 100	60
MIBK	< 10	< 100	< 500	< 20,000	< 20,000	< 20,000	< 2,500	< 100	< 100	NA
Toluene	< 10	< 100	< 500	< 20,000	< 20,000	< 20,000	< 2,500	< 100	< 100	1500
MBK	< 10	< 100	< 500	< 20,000	< 20,000	< 20,000	< 2,500	< 100	< 100	NA
Chlorobenzene	< 10	< 100	< 500	< 20,000	< 20,000	< 20,000	< 2,500	< 100	< 100	1,700
Ethylbenzene	< 10	< 100	< 500	< 20,000	< 20,000	< 20,000	< 2,500	< 100	< 100	5,500
M&P Xylene	< 10	< 100	< 500	< 20,000	< 20,000	< 20,000	< 2,500	< 100	< 100	1,200
O- Xylene	< 10	< 100	< 500	< 20,000	< 20,000	< 20,000	< 2,500	< 100	< 100	1,200
Styrene	< 10	< 100	< 500	< 20,000	< 20,000	< 20,000	< 2,500	< 100	< 100	NA

NOTES:

[1] - Indicates depth below ground surface.

[2] - Recommended Soil Cleanup Objectives referenced from NYSDEC Division Technical and Administrative Guidance Memorandum: Determination of Soil Cleanup Objectives and Cleanup Levels (4/95).

D - Indicates a secondary dilution factor used for analysis

NA - Recommended Soil Cleanup Objective not established

TABLE 4.1 (con't)

MACKENZIE CHEMICAL SITE

SOIL SAMPLES
VOLATILE ORGANIC COMPOUNDS - MOBILE LABORATORY

SAMPLE ID	SS-5				SS-6			SS-8	SS-9	SS-10	SS-11	SS-12	NYSDEC
DEPTH OF SAMPLE[1]	0-4ft	4-8ft	20-24ft	40ft	0-4ft	21ft	41ft	0-4ft	0-4ft	0-4ft	0-4ft	0-4ft.	RSCO[2]
PARAMETERS - (ug/kg)													
Chloromethane	< 10,000	< 500	< 100	< 100	< 500	< 100	< 100	< 100	< 100	< 10	< 100	< 1	NA
Vinyl Chloride	< 10,000	< 500	< 100	< 100	< 500	< 100	< 100	< 100	< 100	< 10	< 100	< 1	200
Bromomethane	< 10,000	< 500	< 100	< 100	< 500	< 100	< 100	< 100	< 100	< 10	< 100	< 1	NA
Chloroethane	< 10,000	< 500	< 100	< 100	< 500	< 100	< 100	< 100	< 100	< 10	< 100	< 1	1,900
1,1-Dichloroethene	< 10,000	< 500	< 100	< 100	< 500	< 100	< 100	< 100	< 100	< 10	< 100	< 1	400
Methylene Chloride	< 10,000	< 500	< 100	< 100	< 500	< 100	< 100	< 100	< 100	< 10	< 100	< 1	100
trans-1,2-Dichloroethene	< 10,000	< 500	< 100	< 100	< 500	< 100	< 100	< 100	< 100	< 10	< 100	< 1	250
1,1-Dichloroethane	< 10,000	< 500	< 100	< 100	< 500	< 100	< 100	< 100	< 100	< 10	< 100	< 1	200
cis-1,2-Dichloroethene	< 10,000	< 500	< 100	< 100	< 500	< 100	< 100	< 100	< 100	< 10	< 100	< 1	250
Chloroform	< 10,000	< 500	< 100	< 100	< 500	< 100	< 100	< 100	< 100	< 10	< 100	< 1	300
1,1,1-Trichloroethane	< 10,000	< 500	< 100	< 100	< 500	< 100	< 100	< 100	< 100	< 10	< 100	< 1	800
Carbon Tetrachloride	< 10,000	< 500	< 100	< 100	< 500	< 100	< 100	< 100	< 100	< 10	< 100	< 1	600
1,2-Dichloroethane	< 10,000	< 500	< 100	< 100	< 500	< 100	< 100	< 100	< 100	< 10	< 100	< 1	100
Trichloroethene	< 10,000	< 500	< 100	< 100	< 500	< 100	< 100	< 100	< 100	< 10	< 100	2	700
1,2-Dichloropropane	< 10,000	< 500	< 100	< 100	< 500	< 100	< 100	< 100	100	< 10	< 100	< 1	NA
Bromodichloromethane	< 10,000	< 500	< 100	< 100	< 500	< 100	< 100	< 100	< 100	< 10	< 100	< 1	NA
cis-1,3-Dichloropropene	< 10,000	< 500	< 100	< 100	< 500	< 100	< 100	< 100	< 100	< 10	< 100	< 1	NA
trans-1,3-Dichloropropene	< 10,000	< 500	< 100	< 100	< 500	< 100	< 100	< 100	< 100	< 10	< 100	< 1	NA
1,1,2-Trichloroethane	< 10,000	< 500	< 100	< 100	< 500	< 100	< 100	< 100	< 100	< 10	< 100	< 1	NA
Tetrachloroethylene	< 10,000	< 500	< 100	< 100	< 500	< 100	< 100	< 100	< 100	< 10	< 100	< 1	1,400
Dibromochloromethane	< 10,000	< 500	< 100	< 100	< 500	< 100	< 100	< 100	< 100	< 10	< 100	< 1	NA
Bromoform	< 10,000	< 500	< 100	< 100	< 500	< 100	< 100	< 100	< 100	< 10	< 100	< 1	NA
1,1,2,2,-Tetrachloroethane	< 10,000	< 500	< 100	< 100	< 500	< 100	< 100	< 100	< 100	< 10	< 100	< 1	600
1,2,3-Trichloropropane	180,000 D	25,000 D	230 D	140 D	7,500 D	< 100	< 100	< 100	< 100	28	< 100	130 D	400
Acetone	< 10,000	< 500	< 100	< 100	< 500	< 100	< 100	< 100	< 100	< 10	< 100	3	200
MEK	< 10,000	< 500	< 100	< 100	< 500	< 100	< 100	< 100	< 100	< 10	< 100	< 1	300
Benzene	< 10,000	< 500	< 100	< 100	< 500	< 100	< 100	< 100	< 100	< 10	< 100	< 1	60
MIBK	< 10,000	< 500	< 100	< 100	< 500	< 100	< 100	< 100	< 100	< 10	< 100	< 1	NA
Toluene	< 10,000	< 500	< 100	< 100	< 500	< 100	< 100	< 100	< 100	< 10	< 100	< 1	1500
MBK	< 10,000	< 500	< 100	< 100	< 500	< 100	< 100	< 100	< 100	< 10	< 100	< 1	NA
Chlorobenzene	< 10,000	< 500	< 100	< 100	< 500	< 100	< 100	< 100	< 100	< 10	< 100	< 1	1,700
Ethylbenzene	< 10,000	< 500	< 100	< 100	< 500	< 100	< 100	< 100	< 100	< 10	< 100	< 1	5,500
M&P Xylene	< 10,000	< 500	< 100	< 100	< 500	< 100	< 100	< 100	< 100	< 10	< 100	< 1	1,200
O- Xylene	< 10,000	< 500	< 100	< 100	< 500	< 100	< 100	< 100	< 100	< 10	< 100	< 1	1,200
Styrene	< 10,000	< 500	< 100	< 100	< 500	< 100	< 100	< 100	< 100	< 10	< 100	< 1	NA

NOTES:

[1] - Indicates depth below ground surface.

[2] - Recommended Soil Cleanup Objectives referenced from NYSDEC Division Technical and Administrative Guidance Memorandum: Determination of Soil Cleanup Objectives and Cleanup Levels (4/95).

D - Indicates a secondary dilution factor used for analysis

NA - Recommended Soil Cleanup Objective not established

TABLE 4.1 (con't)

MACKENZIE CHEMICAL SITE

SOIL SAMPLES
VOLATILE ORGANIC COMPOUNDS - MOBILE LABORATORY

SAMPLE ID	SS-13			SS-14	SS-15		SS-17	SS-18	SS-20	SS-21	NYSDEC
DEPTH OF SAMPLE[1]	0-4ft	21ft	41ft	0-4ft	0-4ft	4-8ft	0-4ft	0-4ft	0-4ft	0-4ft	RSCO[2]
PARAMETERS - (ug/kg)											
Chloromethane	< 100	< 100	< 100	< 10	< 100	< 1,000	< 10	< 100	< 200	< 100	NA
Vinyl Chloride	< 100	< 100	< 100	< 10	< 100	< 1,000	< 10	< 100	< 200	< 100	200
Bromomethane	< 100	< 100	< 100	< 10	< 100	< 1,000	< 10	< 100	< 200	< 100	NA
Chloroethane	< 100	< 100	< 100	< 10	< 100	< 1,000	< 10	< 100	< 200	< 100	1,900
1,1-Dichloroethene	< 100	< 100	< 100	< 10	< 100	< 1,000	< 10	< 100	< 200	< 100	400
Methylene Chloride	< 100	< 100	< 100	< 10	< 100	< 1,000	< 10	< 100	< 200	< 100	100
trans-1,2-Dichloroethene	< 100	< 100	< 100	< 10	< 100	< 1,000	< 10	< 100	< 200	< 100	250
1,1-Dichloroethane	< 100	< 100	< 100	< 10	< 100	< 1,000	< 10	< 100	< 200	< 100	200
cis-1,2-Dichloroethene	< 100	< 100	< 100	< 10	< 100	< 1,000	< 10	< 100	< 200	< 100	250
Chloroform	< 100	< 100	< 100	< 10	< 100	< 1,000	< 10	< 100	< 200	< 100	300
1,1,1-Trichloroethane	< 100	< 100	< 100	41	< 100	< 1,000	< 10	< 100	< 200	< 100	800
Carbon Tetrachloride	< 100	< 100	< 100	< 10	< 100	< 1,000	< 10	< 100	< 200	< 100	600
1,2-Dichloroethane	< 100	< 100	< 100	< 10	< 100	< 1,000	< 10	< 100	< 200	< 100	100
Trichloroethene	< 100	< 100	< 100	< 10	< 100	< 1,000	< 10	< 100	< 200	< 100	700
1,2-Dichloropropane	< 100	< 100	< 100	< 10	< 100	< 1,000	< 10	< 100	< 200	< 100	NA
Bromodichloromethane	< 100	< 100	< 100	< 10	< 100	< 1,000	< 10	< 100	< 200	< 100	NA
cis-1,3-Dichloropropene	< 100	< 100	< 100	< 10	< 100	< 1,000	< 10	< 100	< 200	< 100	NA
trans-1,3-Dichloropropene	< 100	< 100	< 100	< 10	< 100	< 1,000	< 10	< 100	< 200	< 100	NA
1,1,2-Trichloroethane	< 100	< 100	< 100	< 10	< 100	< 1,000	< 10	< 100	< 200	< 100	NA
Tetrachloroethylene	< 100	< 100	< 100	16	< 100	< 1,000	18	2,340 D	< 200	< 100	1,400
Dibromochloromethane	< 100	< 100	< 100	< 10	< 100	< 1,000	< 10	< 100	< 200	< 100	NA
Bromoform	< 100	< 100	< 100	< 10	< 100	< 1,000	< 10	< 100	< 200	< 100	NA
1,1,2,2,-Tetrachloroethane	< 100	< 100	< 100	< 10	< 100	< 1,000	< 10	< 100	< 200	< 100	600
1,2,3-Trichloropropane	140 D	< 100	< 100	140	22,000 E	< 1,000	70	140 D	< 200	< 100	400
Acetone	< 100	< 100	< 100	< 10	< 100	< 1,000	< 10	< 100	< 200	< 100	200
MEK	< 100	< 100	< 100	< 10	< 100	< 1,000	< 10	< 100	< 200	< 100	300
Benzene	< 100	< 100	< 100	< 10	< 100	< 1,000	< 10	< 100	< 200	< 100	60
MIBK	< 100	< 100	< 100	< 10	< 100	< 1,000	< 10	< 100	< 200	< 100	NA
Toluene	< 100	< 100	< 100	70	< 100	< 1,000	240	< 100	< 200	< 100	1500
MBK	< 100	< 100	< 100	< 10	< 100	< 1,000	< 10	< 100	< 200	< 100	NA
Chlorobenzene	< 100	< 100	< 100	< 10	< 100	< 1,000	< 10	< 100	< 200	< 100	1,700
Ethylbenzene	< 100	< 100	< 100	27	140 D	< 1,000	< 10	< 100	< 200	< 100	5,500
M&P Xylene	< 100	< 100	< 100	89	120 D	< 1,000	< 10	< 100	< 200	< 100	1,200
O- Xylene	< 100	< 100	< 100	37	230 D	< 1,000	< 10	< 100	< 200	< 100	1,200
Styrene	< 100	< 100	< 100	< 10	< 100	< 1,000	< 10	< 100	< 200	< 100	NA

NOTES:

[1] - Indicates depth below ground surface.

[2] - Recommended Soil Cleanup Objectives referenced from NYSDEC Division Technical and Administrative Guidance Memorandum: Determination of Soil Cleanup Objectives and Cleanup Levels (4/95).

D - Indicates a secondary dilution factor used for analysis

NA - Recommended Soil Cleanup Objective not established

E - Indicates an estimate value, instrument calibration was exceeded.

TABLE 4.1.1

MACKENZIE CHEMICAL SITE

SOIL SAMPLES
VOLATILE ORGANIC COMPOUNDS

10-Aug-99

SAMPLE ID	SS-100	SS-200	SS-300	SS-400	NYSDEC RSCO[1]
PARAMETERS - (ug/kg)					
Dichlorodifluoromethane	<1	<1	<1	<1	NA
Chloromethane	<1	<1	<1	<1	NA
Vinyl Chloride	<1	<1	<1	<1	200
Bromomethane	<1	<1	<1	<1	NA
Chloroethane	<1	<1	<1	<1	1,900
1,1-Dichloroethene	<1	<1	<1	<1	400
Methylene Chloride	<1	<1	<1	<1	100
trans-1,2-Dichloroethene	<1	<1	<1	<1	250
1,1-Dichloroethane	<1	<1	<1	<1	200
2,2-Dichloropropane	<1	<1	<1	<1	NA
cis-1,2-Dichloroethene	<1	<1	<1	<1	250
Chloroform	<1	<1	<1	<1	300
Bromochloromethane	<1	<1	<1	<1	300
1,1,1-Trichloroethane	<1	<1	<1	<1	800
1,1-Dichloropropene	<1	<1	<1	<1	NA
Carbon Tetrachloride	<1	<1	<1	<1	600
1,2-Dichloroethane	<1	<1	<1	<1	100
Trichloroethene	<1	<1	<1	<1	700
1,2-Dichloropropane	<1	<1	<1	<1	NA
Bromodichloromethane	<1	<1	<1	<1	NA
Dibromomethane	<1	<1	<1	<1	NA
cis-1,3-Dichloropropene	<1	<1	<1	<1	NA
trans-1,3-Dichloropropene	<1	<1	<1	<1	NA
1,1,2-Trichloroethane	<1	<1	<1	<1	NA
1,3-Dichloropropane	<1	<1	<1	<1	300
Tetrachloroethene	<1	<1	<1	<1	1400
Dibromochloromethane	<1	<1	<1	<1	NA
Chlorobenzene	<1	<1	<1	<1	1700
1,1,1,2-Tetrachloroethane	<1	<1	<1	<1	600
Bromoform	<1	<1	<1	<1	NA
1,1,2,2-Tetrachloroethane	<1	<1	<1	<1	600
1,2,3-Trichloropropane	<1	<1	<1	<1	400
m-Dichlorobenzene	<1	<1	<1	<1	NA
p-Dichlorobenzene	<1	<1	<1	<1	NA
o-Dichlorobenzene	<1	<1	<1	<1	NA
1,2,4-Trichlorobenzene	<1	<1	<1	<1	3400
Hexachlorobutadadiene	<1	<1	<1	<1	NA
1,2,3-Trichlorobenzene	<1	<1	<1	<1	NA
Methyl tert Butyl ether	<1	<1	<1	<1	NA
Benzene	<1	<1	<1	<1	60
Toluene	<1	<1	<1	<1	1500
Ethylbenzene	<1	<1	<1	<1	5500
m-Xylene	<1	<1	<1	<1	NA
p-Xylene	<1	<1	<1	<1	NA
o-Xylene	<1	<1	<1	<1	NA
Stryene	<1	<1	<1	<1	NA
Isopropylbenzene (Cumene)	<1	<1	<1	<1	NA
n-Propylbenzene	<1	<1	<1	<1	NA
Bromobenzene	<1	<1	<1	<1	NA
1,3,5-Trimethylbenzene	<1	<1	<1	<1	NA
o-Chlorotoluene	<1	<1	<1	<1	NA
p-Chlorotoluene	<1	<1	<1	<1	NA
tert Butylbenzene	<1	<1	<1	<1	NA
1,2,4-Trimethylbenzene	<1	<1	<1	<1	NA
sec-Butylbenzene	<1	<1	<1	<1	NA
p-Isopropyltoluene (p-Cymene)	<1	<1	<1	<1	NA
n-Butylbenzene	<1	<1	<1	<1	NA
Napthalene	<1	<1	<1	<1	NA

NOTES:

[1] - Recommended Soil Cleanup Objectives referenced from NYSDEC Division Technical and Administrative Guidance Memorandum: Determination of Soil Cleanup Objectives and Cleanup Levels (4/95).

D - Indicates a secondary dilution factor used for analysis

NA - Recommended Soil Cleanup Objective not established

TABLE 4.1.2

MACKENZIE CHEMICAL SITE

SOIL SAMPLES
SEMI-VOLATILE ORGANIC COMPOUNDS

10-Aug-99

SAMPLE ID	SS-100		SS-200		SS-300		SS-400		NYSDEC RSCO[2]
PARAMETERS (ug/kg)									
Phenol	350	U	350	U	360	U	350	U	30 or MDL
bis(2-Chloroethyl)Ether	350	U	350	U	360	U	350	U	NA
2-Chlorophenol	350	U	350	U	360	U	350	U	800
1,3-Dichlorobenzene	350	U	350	U	360	U	350	U	NA
1,4-Dichlorobenzene	350	U	350	U	360	U	350	U	NA
1,2-Dichlorobenzene	350	U	350	U	360	U	350	U	NA
2-Methylphenol	350	U	350	U	360	U	350	U	100 or MDL
2,2'-oxybis(1-Chloropropane)	350	U	350	U	360	U	350	U	NA
4-Methylphenol	350	U	350	U	360	U	350	U	900
N-Nitroso-di-n-propylamine	350	U	350	U	360	U	350	U	NA
Hexachloroethane	350	U	350	U	360	U	350	U	NA
Nitrobenzene	350	U	350	U	360	U	350	U	200 or MDL
Isophorone	350	U	350	U	360	U	350	U	4,400
2-Nitrophenol	350	U	350	U	360	U	350	U	330 or MDL
2,4-Dimethylphenol	350	U	350	U	360	U	350	U	NA
bis(2-Chloroethoxy)Methane	350	U	350	U	360	U	350	U	NA
2,4-Dichlorophenol	350	U	350	U	360	U	350	U	400
1,2,4-Trichlorobenzene	350	U	350	U	360	U	350	U	NA
Naphthalene	350	U	350	U	360	U	350	U	13,000
4-Chloroaniline	350	U	350	U	360	U	350	U	220 or MDL
Hexachlorobutadiene	350	U	350	U	360	U	350	U	NA
4-Chloro-3-Methylphenol	350	U	350	U	360	U	350	U	240 or MDL
2-Methylnaphthalene	350	U	350	U	360	U	350	U	36,400
Hexachlorocyclopentadiene	350	U	350	U	360	U	350	U	NA
2,4,6-Trichlorophenol	350	U	350	U	360	U	350	U	NA
2,4,5-Trichlorophenol	880	U	880	U	900	U	880	U	100
2-Chloronaphthalene	350	U	350	U	360	U	350	U	NA
2-Nitroaniline	880	U	880	U	900	U	880	U	430 or MDL
Dimethylphthalate	350	U	350	U	360	U	350	U	2,000
Acenaphthylene	350	U	350	U	360	U	350	U	41,000
2,6-Dinitrotoluene	350	U	350	U	360	U	350	U	1,000
3-Nitroaniline	880	U	880	U	900	U	880	U	500 or MDL
Acenaphthene	350	U	350	U	360	U	350	U	50,000
2,4-Dinitrophenol	880	U	880	U	900	U	880	U	200 or MDL
4-Nitrophenol	880	U	880	U	900	U	880	U	100 or MDL
Dibenzofuran	350	U	350	U	360	U	350	U	6,200
2,4-Dinitrotoluene	350	U	350	U	360	U	350	U	NA
Diethylphthalate	350	U	350	U	360	U	350	U	7,100
4-Chlorophenyl-phenylether	350	U	350	U	360	U	350	U	NA
Fluorene	350	U	350	U	360	U	350	U	50,000
4-Nitroaniline	880	U	880	U	900	U	880	U	NA
4,6-Dinitro-2-Methylphenol	880	U	880	U	900	U	880	U	NA
N-Nitrosodiphenylamine	39	J	51	J	360	U	350	U	NA
4-Bromophenyl-phenylether	350	U	350	U	360	U	350	U	NA
Hexachlorobenzene	350	U	350	U	360	U	350	U	410
Pentachlorophenol	880	U	880	U	900	U	880	U	1000 or MDL
Phenanthrene	100	J	91	J	72	J	73	J	50,000
Anthracene	350	U	350	U	360	U	350	U	50,000
Carbazole	350	U	350	U	360	U	350	U	NA
Di-n-butylphthalate	350	U	350	U	360	U	350	U	8,100
Fluoranthene	210	J	200	J	220	J	160	J	50,000
Pyrene	160	J	170	J	190	J	120	J	50,000
Butylbenzylphthalate	54	J	43	J	360	U	350	U	50,000
3,3'-Dichlorobenzidine	350	U	350	U	360	J	350	U	NA
Benzo(a)anthracene	96	J	100	J	130	J	74	J	224 or MDL
Chrysene	150	J	150	J	180	J	110	J	400
bis(2-Ethylhexyl)phthalate	120	J	88	J	200	J	130	J	50,000
Di-n-octylphthalate	350	U	350	U	360	U	350	U	50,000
Benzo(b)fluoranthene	100	J	110	J	120	J	95	J	224 or MDL
Benzo(k)fluoranthene	100	J	99	J	120	J	75	J	224 or MDL
Benzo(a)pyrene	91	J	87	J	120	J	70	J	61 or MDL
Indeno(1,2,3-cd)pyrene	71	J	66	J	78	J	59	J	3,200
Dibenzo(a,h)anthracene	350	U	350	U	360	U	350	U	14 or MDL
Benzo(g,h,i)perylene	70	J	61	J	80	J	65	J	50,000

NOTES:

[1] - Indicates depth below ground surface

[2] - Recommended Soil Cleanup Objectives referenced from NYSDEC Division Technical and Administrative Guidance Memorandum Determination of Soil Cleanup Objectives and Cleanup Levels (4/95)

[3] - DS-XX represents blind duplicate of DS-13, 10 ft

J - Indicates an estimated value

D - Indicates a secondary dilution factor used for analysis

U - Indicates compound was analyzed for but not detected

NA - Soil Cleanup Objective not established

MDL - Method Detection Limit

TABLE 4.1.3

MACKENZIE CHEMICAL SITE

SOIL SAMPLES
TAL METALS

10-Aug-99

SAMPLE ID	SS-100		SS-200		SS-300		SS-400		CONCENTRATIONS OF CONCERN [1]	
									RSCO [A]	EUS BG [B]
PARAMETERS (mg/kg)										
Aluminum	8,010		9,210		10,300		8,550		SB	33,000
Antimony	0.76	U	0.76	U	0.78	U	0.76	U	SB	N/A
Arsenic	3.4		4.4		4.3		3.9		7.5 or SB	3 - 12
Barium	34.4		47.0		32.1		30.3		300 or SB	15 - 600
Beryllium	0.26	B	0.29	B	0.33	B	0.29	B	0.16 or SB	0 - 1.75
Cadmium	0.11	B	0.11	B	0.23	B	0.032	U	10	0.1 - 1
Calcium	363	B	679		849		557		SB	130 - 35,000
Chromium	10.9		16.7		11.8		11.5		50	1.5 - 40
Cobalt	3.9	B	18.7		3.7	B	6.5		30 or SB	2.5 - 60
Copper	9.4		22.5		23.8		10.7		25 or SB	1 - 50
Iron	8,980		10,500		12,100		9,280		2000 or SB	2,000 - 550,000
Lead	143		119		107		76.4		SB	200 - 500
Magnesium	774.0		837		886		790		SB	100 - 5,000
Manganese	87.9		93.7		94.9		113		SB	50 - 5,000
Mercury	0.21		0.89		0.15		0.16		0.1	0.001 - 0.2
Nickel	5.8		7.6		6.6		6.3		13 or SB	0.5 - 25
Potassium	286	B	337	B	361	B	342	B	SB	8,500 - 43,000
Selenium	0.52	B	0.64		0.99		0.66		2 or SB	0.1 - 3.9
Silver	0.063	U	0.085	B	0.065	U	0.063	U	SB	N/A
Sodium	47.7	B	50.8	B	54.0	U	59.2	B	SB	6,000 - 8,000
Thallium	0.23	U	0.23	U	0.24	U	0.23	U	SB	N/A
Vanadium	18.2		20.8		23.0		18.9		150 or SB	1 - 300
Zinc	63.6		105		145		64.5		20 or SB	9 - 50
Cyanide	NR		NR		NR		NR		SB	N/A

NOTES:

[1] - Recommended Soil Cleanup Objectives referenced from NYSDEC Division Technical and Administrative Guidance Memorandum: Determination of Soil Cleanup Objectives and Cleanup Levels (4/95).

[A] - Recommended Soil Cleanup Objective.

[B] - Eastern United States Background levels.

SB - Site Background, refer to EUS BG.

U - Indicates compound was analyzed for but not detected.

B - Indicates analyte was found in method blank.

R - Duplicate analysis not within control limits

N/A - Recommended Soil Cleanup Objective not established

NR - Analyte not required

TABLE 4.2

MACKENZIE CHEMICAL SITE

DRAINAGE STRUCTURES - SOIL SAMPLES
VOLATILE ORGANIC COMPOUNDS - MOBILE LABORATORY

SAMPLE ID	DS-2		DS-3		DS-6		DS-9		DS-11		NYSDEC
DEPTH OF SAMPLE[1]	25ft	40ft	25ft	40ft	25ft	40ft	14ft	40ft	25ft	40ft	RSCO[2]
PARAMETERS - (ug/kg)											
Chloromethane	< 200	< 100	< 100	< 100	< 100	< 100	< 1,000	< 100	< 100	< 100	NA
Vinyl Chloride	< 200	< 100	< 100	< 100	< 100	< 100	< 1,000	< 100	< 100	< 100	200
Bromomethane	< 200	< 100	< 100	< 100	< 100	< 100	< 1,000	< 100	< 100	< 100	NA
Chloroethane	< 200	< 100	< 100	< 100	< 100	< 100	< 1,000	< 100	< 100	< 100	1,900
1,1-Dichloroethene	< 200	< 100	< 100	< 100	< 100	< 100	< 1,000	< 100	< 100	< 100	400
Methylene Chloride	< 200	< 100	< 100	< 100	< 100	< 100	< 1,000	< 100	< 100	< 100	100
trans-1,2-Dichloroethene	< 200	< 100	< 100	< 100	< 100	< 100	< 1,000	< 100	< 100	< 100	250
1,1-Dichloroethane	< 200	< 100	< 100	< 100	< 100	< 100	< 1,000	< 100	< 100	< 100	200
cis-1,2-Dichloroethene	< 200	< 100	< 100	< 100	< 100	< 100	< 1,000	< 100	< 100	< 100	250
Chloroform	< 200	< 100	< 100	< 100	< 100	< 100	< 1,000	< 100	< 100	< 100	300
1,1,1-Trichloroethane	< 200	< 100	< 100	< 100	< 100	< 100	< 1,000	< 100	< 100	< 100	800
Carbon Tetrachloride	< 200	< 100	< 100	< 100	< 100	< 100	< 1,000	< 100	< 100	< 100	600
1,2-Dichloroethane	< 200	< 100	< 100	< 100	< 100	< 100	< 1,000	< 100	< 100	< 100	100
Trichloroethene	< 200	< 100	< 100	< 100	< 100	< 100	< 1,000	< 100	< 100	< 100	700
1,2-Dichloropropane	< 200	< 100	< 100	< 100	< 100	< 100	< 1,000	< 100	< 100	< 100	NA
Bromodichloromethane	< 200	< 100	< 100	< 100	< 100	< 100	< 1,000	< 100	< 100	< 100	NA
cis-1,3-Dichloropropene	< 200	< 100	< 100	< 100	< 100	< 100	< 1,000	< 100	< 100	< 100	NA
trans-1,3-Dichloropropene	< 200	< 100	< 100	< 100	< 100	< 100	< 1,000	< 100	< 100	< 100	NA
1,1,2-Trichloroethane	< 200	< 100	< 100	< 100	< 100	< 100	< 1,000	< 100	< 100	< 100	NA
Tetrachloroethylene	< 200	< 100	< 100	< 100	< 100	< 100	< 1,000	< 100	< 100	< 100	1,400
Dibromochloromethane	< 200	< 100	< 100	< 100	< 100	< 100	< 1,000	< 100	< 100	< 100	NA
Bromoform	< 200	< 100	< 100	< 100	< 100	< 100	< 1,000	< 100	< 100	< 100	NA
1,1,2,2,-Tetrachloroethane	< 200	< 100	< 100	< 100	< 100	< 100	< 1,000	< 100	< 100	< 100	600
1,2,3-Trichloropropane	< 200	< 100	< 100	< 100	< 100	< 100	20,400 D	< 100	< 100	< 100	400
Acetone	< 200	< 100	< 100	< 100	< 100	< 100	< 1,000	< 100	< 100	< 100	200
MEK	< 200	< 100	< 100	< 100	< 100	< 100	< 1,000	< 100	< 100	< 100	300
Benzene	< 200	< 100	< 100	< 100	< 100	< 100	< 1,000	< 100	< 100	< 100	60
MIBK	< 200	< 100	< 100	< 100	< 100	< 100	< 1,000	< 100	< 100	< 100	NA
Toluene	< 200	< 100	< 100	< 100	< 100	< 100	< 1,000	< 100	< 100	< 100	1500
MBK	< 200	< 100	< 100	< 100	< 100	< 100	< 1,000	< 100	< 100	< 100	NA
Chlorobenzene	< 200	< 100	< 100	< 100	< 100	< 100	< 1,000	< 100	< 100	< 100	1,700
Ethylbenzene	< 200	< 100	< 100	< 100	< 100	< 100	< 1,000	< 100	< 100	< 100	5,500
M&P Xylene	< 200	< 100	< 100	< 100	< 100	< 100	< 1,000	< 100	< 100	< 100	1,200
O- Xylene	< 200	< 100	< 100	< 100	< 100	< 100	< 1,000	< 100	< 100	< 100	1,200
Styrene	< 200	< 100	< 100	< 100	< 100	< 100	< 1,000	< 100	< 100	< 100	NA

NOTES:

[1] - Indicates depth below ground surface.

[2] - Referenced from NYSDEC Division Technical and Administrative Guidance Memorandum Determination of Soil Cleanup Objectives and Cleanup Levels (4/95)

NA - Recommended Soil Cleanup Objective not established

D - Indicates a secondary dilution factor used for analysis

TABLE 4.2 (con't)

MACKENZIE CHEMICAL SITE

DRAINAGE STRUCTURES - SOIL SAMPLES
VOLATILE ORGANIC COMPOUNDS - MOBILE LABORATORY

SAMPLE ID	DS-12		DS-13		DS-13X[3]	DS-14			DS-15		Field	NYSDEC
DEPTH OF SAMPLE[1]	25ft	40ft	25ft	40ft		8-12ft	21ft	41ft	25ft	40ft	Blank #3[4]	RSCO[2]
PARAMETERS - (ug/kg)												
Chloromethane	< 100	< 100	< 100	< 100	< 100	< 10,000	< 5	< 100	< 500	< 500	< 1	NA
Vinyl Chloride	< 100	< 100	< 100	< 100	< 100	< 10,000	< 5	< 100	< 500	< 500	< 1	200
Bromomethane	< 100	< 100	< 100	< 100	< 100	< 10,000	< 5	< 100	< 500	< 500	< 1	NA
Chloroethane	< 100	< 100	< 100	< 100	< 100	< 10,000	< 5	< 100	< 500	< 500	< 1	1,900
1,1-Dichloroethene	< 100	< 100	< 100	< 100	< 100	< 10,000	< 5	< 100	< 500	< 500	< 1	400
Methylene Chloride	< 100	< 100	< 100	< 100	< 100	< 10,000	< 5	< 100	< 500	< 500	< 1	100
trans-1,2-Dichloroethene	< 100	< 100	< 100	< 100	< 100	< 10,000	< 5	< 100	< 500	< 500	< 1	250
1,1-Dichloroethane	< 100	< 100	< 100	< 100	< 100	< 10,000	< 5	< 100	< 500	< 500	< 1	200
cis-1,2-Dichloroethene	< 100	< 100	< 100	< 100	< 100	< 10,000	< 5	< 100	< 500	< 500	< 1	250
Chloroform	< 100	< 100	< 100	< 100	< 100	< 10,000	< 5	< 100	< 500	< 500	< 1	300
1,1,1-Trichloroethane	< 100	< 100	< 100	< 100	< 100	< 10,000	< 5	< 100	< 500	< 500	< 1	800
Carbon Tetrachloride	< 100	< 100	< 100	< 100	< 100	< 10,000	< 5	100	< 500	< 500	< 1	600
1,2-Dichloroethane	< 100	< 100	< 100	< 100	< 100	< 10,000	< 5	< 100	< 500	< 500	< 1	100
Trichloroethene	< 100	< 100	< 100	< 100	< 100	< 10,000	< 5	< 100	< 500	< 500	< 1	700
1,2-Dichloropropane	< 100	< 100	< 100	< 100	< 100	< 10,000	< 5	< 100	< 500	< 500	< 1	NA
Bromodichloromethane	< 100	< 100	< 100	< 100	< 100	< 10,000	< 5	< 100	< 500	< 500	< 1	NA
cis-1,3-Dichloropropene	< 100	< 100	< 100	< 100	< 100	< 10,000	< 5	< 100	< 500	< 500	< 1	NA
trans-1,3-Dichloropropene	< 100	< 100	< 100	< 100	< 100	< 10,000	< 5	< 100	< 500	< 500	< 1	NA
1,1,2-Trichloroethane	< 100	< 100	< 100	< 100	< 100	< 10,000	< 5	< 100	< 500	< 500	< 1	NA
Tetrachloroethylene	< 100	< 100	< 100	< 100	< 100	< 10,000	< 5	< 100	< 500	< 500	< 1	1,400
Dibromochloromethane	< 100	< 100	< 100	< 100	< 100	< 10,000	< 5	< 100	< 500	< 500	< 1	NA
Bromoform	< 100	< 100	< 100	< 100	< 100	< 10,000	< 5	< 100	< 500	< 500	< 1	NA
1,1,2,2,-Tetrachloroethane	< 100	< 100	< 100	< 100	< 100	< 10,000	< 5	< 100	< 500	< 500	< 1	600
1,2,3-Trichloropropane	< 100	250 D	250 D	< 100	< 100	87,000 D	7 2	2,300 D	< 500	< 500	< 1	400
Acetone	< 100	< 100	< 100	< 100	< 100	< 10,000	< 5	< 100	< 500	< 500	< 1	200
MEK	< 100	< 100	< 100	< 100	< 100	< 10,000	< 5	< 100	< 500	< 500	< 1	300
Benzene	< 100	< 100	< 100	< 100	< 100	< 10,000	< 5	< 100	< 500	< 500	< 1	60
MIBK	< 100	< 100	< 100	< 100	< 100	< 10,000	< 5	< 100	< 500	< 500	< 1	NA
Toluene	< 100	< 100	< 100	< 100	< 100	< 10,000	< 5	< 100	< 500	< 500	< 1	1500
MBK	< 100	< 100	< 100	< 100	< 100	< 10,000	< 5	< 100	< 500	< 500	< 1	NA
Chlorobenzene	< 100	< 100	< 100	< 100	< 100	< 10,000	< 5	< 100	< 500	< 500	< 1	1,700
Ethylbenzene	< 100	< 100	< 100	< 100	< 100	< 10,000	< 5	< 100	< 500	< 500	< 1	5,500
M&P Xylene	< 100	< 100	< 100	< 100	< 100	< 10,000	< 5	< 100	< 500	< 500	< 1	1,200
O- Xylene	< 100	< 100	< 100	< 100	< 100	< 10,000	< 5	< 100	< 500	< 500	< 1	1,200
Styrene	< 100	< 100	< 100	< 100	< 100	< 10,000	< 5	< 100	< 500	< 500	< 1	NA

NOTES:

[1] - Indicates depth below ground surface.

[2] - Referenced from NYSDEC Division Technical and Administrative Guidance Memorandum. Determination of Soil Cleanup Objectives and Cleanup Levels (4/95)

[3] - DS-13X represents blind duplicate of DS-13, 40ft.

[4] - Field Blank #3 is an aqueous sample, reported in ug/l.

D - Indicates a secondary dilution factor used for analysis

NA - Recommended Soil Cleanup Objective not established

TABLE 4.3

MACKENZIE CHEMICAL SITE

DRAINAGE STRUCTURES - SOIL SAMPLES
VOLATILE ORGANIC COMPOUNDS - ANALYTICAL LABORATORY

SAMPLE ID	DS-2		DS-3		DS-6		DS-9		DS-11		DS-12		DS-13		DS-XX[3]		DS-14		DS-15		NYSDEC
DEPTH OF SAMPLE [1]	10-12ft		10-12ft		10-12ft		25-27ft		8-10ft		10-12ft		10-12ft				4-8ft		10-12ft		RSCO[2]
PARAMETERS (ug/kg)																					
Chloromethane	10	UJ	10	UJ	10	UJ	10	UJ	10	UJ	10	U	11	U	11	U	100	U	10	U	NA
Bromomethane	10	U	10	U	10	U	10	U	10	U	10	U	11	U	11	U	100	U	10	U	NA
Vinyl Chloride	10	U	10	U	10	U	10	U	10	U	10	U	11	U	11	U	100	U	10	U	200
Chloroethane	10	U	10	U	10	U	10	U	10	U	10	U	11	U	11	U	100	U	10	U	1,900
Methylene Chloride	10	U	10	U	10	U	10	U	10	U	10	U	11	U	11	U	100	U	10	U	100
Acetone	10	U	10	U	10	U	10	U	10	U	10	U	11	U	11	U	100	U	10	U	200
Carbon Disulfide	10	UJ	10	UJ	10	UJ	10	UJ	10	UJ	10	U	11	UJ	11	UJ	100	U	10	U	2,700
1,1-Dichloroethene	10	U	10	U	10	U	10	U	10	U	10	U	11	J	11	U	100	U	10	U	400
1,1-Dichloroethane	10	U	10	U	10	U	10	U	10	U	10	U	11	U	11	U	100	U	10	U	200
1,2-Dichloroethene (Total)	10	U	10	U	10	U	10	U	10	U	10	U	11	U	11	U	100	U	10	U	250
Chloroform	10	U	10	U	10	U	10	U	10	U	10	U	11	U	11	U	100	U	10	U	300
1,2-Dichloroethane	10	U	10	U	10	U	10	U	10	U	10	U	11	U	11	U	100	U	10	U	100
2-Butanone (MEK)	10	U	10	U	10	U	10	U	10	U	10	U	11	U	11	U	100	U	10	U	300
1,1,1-Trichloroethane	10	U	10	U	10	U	10	U	10	U	10	U	11	U	11	U	100	U	10	U	800
Carbon Tetrachloride	10	U	10	U	10	U	10	U	10	U	10	U	11	U	11	U	100	U	10	U	600
Bromodichloromethane	10	U	10	U	10	U	10	U	10	U	10	U	11	U	11	U	100	U	10	U	NA
1,2-Dichloropropane	10	U	10	U	10	U	10	U	10	U	10	U	11	U	11	U	100	U	10	U	NA
cis-1,3-Dichloropropene	10	U	10	U	10	U	10	U	10	U	10	U	11	U	11	U	100	U	10	U	NA
Trichloroethene (TCE)	10	U	3	J	10	U	10	U	10	U	10	U	11	U	11	U	100	U	10	U	700
Dibromochloromethane	10	U	10	U	10	U	10	U	10	U	10	U	11	U	11	U	100	U	10	U	NA
1,1,2-Trichloroethane	10	U	10	U	10	U	10	U	10	U	10	U	11	U	11	U	100	U	10	U	NA
Benzene	10	U	10	U	10	U	10	U	10	U	10	U	11	U	11	U	100	U	10	U	60
trans-1,3-Dichloropropene	10	U	10	U	10	U	10	U	10	U	10	U	11	U	11	U	100	U	10	U	NA
Bromoform	10	U	10	U	10	U	10	U	10	U	10	U	11	U	11	U	100	U	10	U	NA
4-Methyl-2-Pentanone	10	U	10	U	10	U	10	U	10	U	10	U	11	U	11	U	100	U	10	U	1,000
2-Hexanone	10	U	10	U	10	U	10	U	10	U	10	U	11	U	11	U	100	U	10	U	NA
Tetrachloroethene (PCE)	14		10	U	10	U	10	U	10	U	10	U	4	J	11	U	100	U	10	U	1,400
1,1,2,2-Tetrachloroethane	10	U	10	U	10	U	10	U	10	U	10	U	11	U	11	U	100	U	10	U	600
Toluene	10	U	10	U	10	U	10	U	10	U	10	U	11	J	1	J	100	U	10	U	1,500
Chlorobenzene	10	U	10	U	10	U	10	U	10	U	10	U	11	J	1	J	100	U	10	U	1,700
Ethylbenzene	10	U	10	U	10	U	10	U	10	U	10	U	11	U	11	U	100	U	10	U	5,500
Styrene	10	U	10	U	10	U	10	U	10	U	10	U	11	U	11	U	100	U	10	U	NA
Xylenes (Total)	10	U	10	U	10	U	10	U	10	U	10	U	11	U	11	U	100	U	10	U	1,200
1,2,3- Trichloropropane	10	NJ	10	U	10	U	10	U	10	U	150	NJ	10	U	10	U	10,000	NJ	10	U	400
TICs (Total Concentration)	134	NJ	64	NJ	130	NJ	49	NJ	33	NJ	90	NJ	120	NJ	130	NJ	23,360	NJ	14	NJ	NA

NOTES:

[1] - Indicates depth below ground surface

[2] - Recommended Soil Cleanup Objectives referenced from NYSDEC Division Technical and Administrative Guidance Memorandum: Determination of Soil Cleanup Objectives and Cleanup Levels (4/95)

[3] - DS-XX is a blind duplicate of sample DS-13, 10 ft.

U - Indicates compound was analyzed for but not detected

J - Indicates an estimated value

N - Indicates presumtavive evidence of a compound

NA - Recommended Soil Cleanup Objective not established

TABLE 4.4

MACKENZIE CHEMICAL SITE

DRAINAGE STRUCTURES - SOIL SAMPLES
SEMI-VOLATILE ORGANIC COMPOUNDS - ANALYTICAL LABORATORY

SAMPLE ID	DS-2	DS-3	DS-6	DS-9	DS-11	DS-12	DS-13	DS-XX[3]	DS-14	DS-15	NYSDEC
DEPTH OF SAMPLE [1]	10-12ft	10-12ft	10-12ft	25-27ft	8-10ft	10-12ft	10-12ft		4-8ft	10-12ft	RSCO[2]
PARAMETERS (ug/kg)											
Phenol	340 U	350 U	340 U	340 U	340 U	340 U	360 U	350 U	350 U	350 U	30 or MDL
bis(2-Chloroethyl)Ether	340 U	350 U	340 U	340 U	340 U	340 U	360 U	350 U	350 U	350 U	NA
2-Chlorophenol	340 U	350 U	340 U	340 U	340 U	340 U	360 U	350 U	350 U	350 U	800
1,3-Dichlorobenzene	340 U	350 U	340 U	340 U	340 U	340 U	360 U	350 U	350 U	350 U	NA
1,4-Dichlorobenzene	340 U	350 U	340 U	340 U	340 U	340 U	360 U	350 U	350 U	350 U	NA
1,2-Dichlorobenzene	340 U	350 U	340 U	340 U	340 U	340 U	360 U	350 U	350 U	350 U	NA
2-Methylphenol	83 J	350 U	340 U	340 U	340 U	340 U	360 U	350 U	350 U	350 U	100 or MDL
2,2'-oxybis(1-Chloropropane)	340 U	350 U	340 U	340 U	340 U	340 U	360 U	350 U	350 U	350 U	NA
4-Methylphenol	340 U	350 U	340 U	340 U	340 U	340 U	360 U	350 U	350 U	350 U	900
N-Nitroso-di-n-propylamine	340 U	350 U	340 U	340 U	340 U	340 U	360 U	350 U	350 U	350 U	NA
Hexachloroethane	340 U	350 U	340 U	340 U	340 U	340 U	360 U	350 U	350 U	350 U	NA
Nitrobenzene	340 U	350 U	340 U	340 U	340 U	340 U	360 U	350 U	350 U	350 U	200 or MDL
Isophorone	340 U	350 U	340 U	340 U	340 U	340 U	360 U	350 U	350 U	350 U	4,400
2-Nitrophenol	340 U	350 U	340 U	340 U	340 U	340 U	360 U	350 U	350 U	350 U	330 or MDL
2,4-Dimethylphenol	340 U	350 U	340 U	340 U	340 U	340 U	360 U	350 U	350 U	350 U	NA
bis(2-Chloroethoxy)Methane	340 U	350 U	340 U	340 U	340 U	340 U	360 U	350 U	350 U	350 U	NA
2,4-Dichlorophenol	340 U	350 U	340 U	340 U	340 U	340 U	360 U	350 U	350 U	350 U	400
1,2,4-Trichlorobenzene	340 U	350 U	340 U	340 U	340 U	340 U	360 U	350 U	350 U	350 U	NA
Naphthalene	340 U	350 U	340 U	340 U	340 U	340 U	360 U	350 U	350 U	350 U	13,000
4-Chloroaniline	340 U	350 U	340 U	340 U	340 U	340 U	360 U	350 U	350 U	350 U	220 or MDL
Hexachlorobutadiene	340 U	350 U	340 U	340 U	340 U	340 U	360 U	350 U	350 U	350 U	NA
4-Chloro-3-Methylphenol	340 U	350 U	340 U	340 U	340 U	340 U	360 U	350 U	350 U	350 U	240 or MDL
2-Methylnaphthalene	340 U	350 U	340 U	340 U	340 U	340 U	360 U	79 J	350 U	350 U	36,400
Hexachlorocyclopentadiene	340 U	350 U	340 U	340 U	340 U	340 U	360 U	350 U	350 U	350 UJ	NA
2,4,6-Trichlorophenol	340 U	350 U	340 U	340 U	340 U	340 U	360 U	350 U	350 U	350 U	NA
2,4,5-Trichlorophenol	850 U	870 U	850 U	860 U	850 U	850 U	890 U	890 U	870 U	860 U	100
2-Chloronaphthalene	340 U	350 U	340 U	340 U	340 U	340 U	360 U	350 U	350 U	350 U	NA
2-Nitroaniline	850 U	870 U	850 U	860 U	850 U	850 U	890 U	890 U	870 U	860 U	430 or MDL
Dimethylphthalate	340 U	350 U	340 U	340 U	340 U	340 U	360 U	350 U	350 U	350 U	2,000
Acenaphthylene	340 U	350 U	340 U	340 U	340 U	340 U	190 J	180 J	350 U	350 U	41,000
2,6-Dinitrotoluene	340 U	350 U	340 U	340 U	340 U	340 U	360 U	350 U	350 U	350 U	1,000
3-Nitroaniline	850 U	870 U	850 U	860 U	850 U	850 U	890 U	890 U	870 U	860 U	500 or MDL
Acenaphthene	340 U	350 U	340 U	340 U	340 U	340 U	320 J	1,200	350 U	350 U	50,000
2,4-Dinitrophenol	850 UJ	870 UJ	850 UJ	860 UJ	850 UJ	850 UJ	890 UJ	890 UJ	870 UJ	860 UJ	200 or MDL
4-Nitrophenol	850 U	870 U	850 U	860 U	850 U	850 U	890 U	890 U	870 U	860 U	100 or MDL
Dibenzofuran	340 U	350 U	340 U	340 U	340 U	340 U	72 J	690	350 U	350 U	6,200
2,4-Dinitrotoluene	340 U	350 U	340 U	340 U	340 U	340 U	360 U	350 U	350 U	350 U	NA
Diethylphthalate	340 U	350 U	340 U	340 U	340 U	340 U	360 U	350 U	350 U	350 U	7,100
4-Chlorophenyl-phenylether	340 U	350 U	340 U	340 U	340 U	340 U	360 U	350 U	350 U	350 U	NA
Fluorene	120 J	350 U	340 U	340 U	340 U	340 U	330 J	1,900	350 U	350 U	50,000
4-Nitroaniline	850 U	870 U	850 U	860 U	850 U	850 U	890 U	890 U	870 U	860 U	NA
4,6-Dinitro-2-Methylphenol	850 U	870 U	850 U	860 U	850 U	850 U	890 U	890 U	870 U	860 U	NA
N-Nitrosodiphenylamine	340 U	59 J	340 U	39 J	340 U	1,200	6,000 JD	1,400 JD	350 U	350 U	NA
4-Bromophenyl-phenylether	340 U	350 U	340 U	340 U	340 U	340 U	360 U	350 U	350 U	350 U	NA
Hexachlorobenzene	340 U	350 U	340 U	340 U	340 U	340 U	360 U	350 U	350 U	350 U	410
Pentachlorophenol	850 U	870 U	850 U	860 U	850 U	850 U	890 U	890 U	870 U	860 U	1000 or MDL
Phenanthrene	340 U	350 U	340 U	340 U	340 U	310 J	2,500	14,000 D	350 U	350 U	50,000
Anthracene	340 U	140 J	340 U	340 U	340 U	85 J	1,300	9,200 D	350 U	350 U	50,000
Carbazole	340 U	350 U	340 U	340 U	340 U	46 J	210 J	1,400	350 U	350 U	NA
Di-n-butylphthalate	45 J	350 U	340 U	340 U	340 U	340 U	360 U	350 U	350 U	350 U	8,100
Fluoranthene	74 J	350 U	340 U	340 U	340 U	450	30,000 D	36,000 D	350 U	350 U	50,000
Pyrene	130 J	350 U	340 U	340 U	340 U	420	25,000 D	27,000 D	63 J	350 U	50,000
Butylbenzylphthalate	340 U	350 U	340 U	340 U	340 U	37 J	7,000 U	7,000 U	350 U	350 U	50,000
3,3'-Dichlorobenzidine	340 U	350 U	340 U	340 U	340 U	340 U	7,000 U	7,000 U	350 U	350 U	NA
Benzo(a)anthracene	340 U	350 U	340 U	340 U	340 U	230 J	17,000 D	20,000 D	350 U	350 U	224 or MDL
Chrysene	54 J	350 U	340 U	340 U	340 U	250 J	14,000 D	16,000 D	350 U	350 U	400
bis(2-Ethylhexyl)phthalate	520 U	350 U	340 U	340 U	340 U	340 U	7,000 U	7,000 U	350 U	350 U	50,000
Di-n-octylphthalate	340 U	350 U	340 U	340 U	340 U	340 UJ	370 J	160 J	49 J	350 U	50,000
Benzo(b)fluoranthene	67 J	350 U	340 U	340 U	340 U	330 J	28,000 D	24,000 D	350 UJ	350 U	224 or MDL
Benzo(k)fluoranthene	56 J	350 U	340 U	340 U	340 U	240 J	11,000 D	10,000 D	350 UJ	350 U	224 or MDL
Benzo(a)pyrene	40 J	350 U	340 U	340 U	340 U	250 J	23,000 D	20,000 D	350 UJ	350 U	61 or MDL
Indeno(1,2,3-cd)pyrene	340 U	350 U	340 U	340 U	340 U	75 J	14,000 D	12,000 D	350 UJ	350 U	3,200
Dibenzo(a,h)anthracene	340 U	350 U	340 U	340 U	340 U	340 UJ	2,400	2,500 J	350 UJ	350 U	14 or MDL
Benzo(g,h,i)perylene	340 U	350 U	340 U	340 U	340 U	65 J	15,000 D	13,000 D	350 UJ	350 U	50,000

NOTES:

[1] - Indicates depth below ground surface.

[2] - Recommended Soil Cleanup Objectives referenced from NYSDEC Division Technical and Administrative Guidance Memorandum: Determination of Soil Cleanup Objectives and Cleanup Levels (4/95)

[3] - DS-XX represents blind duplicate of DS-13, 10 ft.

J - Indicates an estimated value

D - Indicates a secondary dilution factor used for analysis

U - Indicates compound was analyzed for but not detected

NA - Soil Cleanup Objective not established.

MDL - Method Detection Limit

TABLE 4.5

MACKENZIE CHEMICAL SITE

DRAINAGE STRUCTURES - SOIL SAMPLES
PESTICIDES/PCBs - ANALYTICAL LABORATORY

SAMPLE ID	DS-2	DS-3	DS-6	DS-9	DS-11	DS-12	DS-13	DS-14	DS-15	DS-XX[3]	NYSDEC
DEPTH OF SAMPLE[1]	10-12ft	10-12ft	10-12ft	25-27ft	8-10ft	10-12ft	10-12ft	4-8ft	10-12ft		RSCO[2]
PARAMETERS (ug/kg)											
alpha-BHC	1.7 U	1.7 U	1.7 U	1.7 U	1.7 U	1.7 U	1.8 U	1.7 U	1.7 U	1.8 U	110
beta-BHC	1.7 U	1.7 U	1.7 U	1.7 U	1.7 U	1.7 U	1.8 U	1.7 U	1.7 U	1.8 U	200
delta-BHC	1.7 U	1.7 U	1.7 U	1.7 U	1.7 U	1.7 U	1.8 U	1.7 U	1.7 U	1.8 U	300
gamma-BHC (Lindane)	1.7 U	1.7 U	1.7 U	1.7 U	1.7 U	1.7 U	1.8 U	1.7 U	1.7 U	1.8 U	60
Heptachlor	1.7 U	1.7 U	1.7 U	1.7 U	1.7 U	0.45 JP	1.8 U	1.7 U	1.7 U	1.8 U	100
Aldrin	1.7 U	1.7 U	1.7 U	1.7 U	1.7 U	1.7 U	1.8 U	1.7 U	1.7 U	1.8 U	41
Heptachlor Epoxide	1.7 U	1.7 U	1.7 U	1.7 U	1.7 U	1.7 U	1.8 U	1.7 U	1.7 U	1.8 U	20
Endosulfan I	1.7 U	1.7 U	1.7 U	1.7 U	1.3 J	1.7 U	1.8 U	1.7 U	1.7 U	1.8 U	900
Dieldrin	3.4 U	3.4 U	3.4 U	3.4 U	3.4 U	3.4 U	3.5 U	3.5 U	3.5 U	3.5 U	44
4,4'-DDE	3.4 U	1.6 J	3.4 U	3.4 U	3.4 U	3.4 U	3.5 U	3.5 U	3.5 U	3.5 U	2,100
Endrin	3.4 U	3.4 U	3.4 U	3.4 U	3.4 U	1.7 J	4.6	3.5 U	3.5 U	4.8 PJ	100
Endosulfan II	3.4 U	3.4 U	3.4 U	3.4 U	3.4 U	3.4 U	3.5 U	3.5 U	3.5 U	3.5 U	900
4,4'-DDD	3.4 U	1.2 J	3.4 U	3.4 U	3.4 U	5.4 PJ	3.5 U	4.0 U	3.5 U	3.5 U	2,900
Endosulfan Sulfate	3.4 U	3.4 U	3.4 U	3.4 U	3.4 U	3.4 U	3.5 U	3.5 U	3.5 U	3.5 U	1,000
4,4'-DDT	3.4 U	1.2 J	3.4 U	3.4 U	3.4 U	4.9	3.5 U	3.5 U	3.5 U	3.5 U	2,100
Methoxychlor	17 U	17 U	17 U	17 U	17 U	17 U	18 U	17 U	17 U	18 U	NA
Endrin Ketone	3.4 U	3.4 U	3.4 U	3.4 U	3.4 U	3.4 U	3.5 U	3.5 U	3.5 U	3.5 U	NA
Endrin Aldehyde	3.4 U	3.4 U	3.4 U	3.4 U	3.4 U	3.4 U	3.5 U	3.5 U	3.5 U	3.5 U	NA
alpha-Chlordane	1.7 U	1.7 U	1.7 U	1.7 U	1.7 U	21 NJ	6.9	1.7 U	1.7 U	1.8 U	NA
gamma-Chlordane	1.7 U	1.7 U	1.7 U	1.7 U	1.7 U	19	1.8 U	1.7 U	1.7 U	1.8 U	540
Toxaphene	170 U	170 U	170 U	170 U	170 U	170 U	180 U	170 U	170 U	180 U	NA
Aroclor-1016	34 U	34 U	34 U	34 U	34 U	34 U	35 U	35 U	35 U	35 U	10.0[4]
Aroclor-1221	67 U	69 U	68 U	69 U	68 U	69 U	71 U	70 U	69 U	71 U	10.0[4]
Aroclor-1232	34 U	34 U	34 U	34 U	34 U	34 U	35 U	35 U	35 U	35 U	10.0[4]
Aroclor-1242	34 U	34 U	34 U	34 U	34 U	34 U	35 U	35 U	35 U	35 U	10.0[4]
Aroclor-1248	34 U	34 U	34 U	34 U	34 U	34 U	35 U	35 U	35 U	35 U	10.0[4]
Aroclor-1254	34 U	34 U	34 U	34 U	34 U	34 U	35 U	35 UJ	35 U	35 U	10.0[4]
Aroclor-1260	34 U	34 U	34 U	34 U	34 U	34 U	35 U	35 U	35 U	35 U	10.0[4]

NOTES:

[1] - Indicates depth below ground surface

[2] - Recommended Soil Cleanup Objectives referenced from NYSDEC Division Technical and Administrative Guidance Memorandum Determination of Soil Cleanup

[3] - DS-XX represents blind duplicate of sample DS-13, 10ft

[4] - Recommended Soil Cleanup Objective reflects sum of all aroclors

U - Indicates compound was analyzed for but not detected

P - There is a greater than 25% difference for detected concentrations between the two GC columns
The lower of the two values is reported

J - Indicates an estimated value

N - Indicates presumtavive evidence of a compound

NA - Recommended Soil Cleanup Objective not established

TABLE 4.6

MACKENZIE CHEMICAL SITE

DRAINAGE STRUCTURE - SOIL SAMPLES
TAL METALS - ANALYTICAL LABORATORY

SAMPLE ID	DS-2		DS-3		DS-6		DS-9		DS-11		DS-12		DS-13		DS-14		DS-15		DS-XX [3]		CONCENTRATIONS OF CONCERN [2]	
DEPTH OF SAMPLE [1]	10ft		10ft		10ft		25ft		8ft		10ft		10ft		4-8ft		10ft				RSCO [A]	EUS BG [B]
PARAMETERS (mg/kg)																						
Aluminum	202		620		1,290		1,850		982		1,880		3,050		1,060		562		1,200		SB	33,000
Antimony	11.1	U	11.4	U	10.8	U	11.2	U	11.1	U	11.1	U	11.5	U	11.1	U	11.0	U	11.5	U	SB	N/A
Arsenic	0.34	U	0.35	U	0.35	B	0.34	U	0.35	U	0.60	BJ	0.46	B	0.38	UJ	0.34	UJ	0.37	U	7.5 or SB	3 - 12
Barium	10.7	B	8.5	B	4.6	B	9.9	B	10.0	B	27.9	B	33.3	B	8.1	B	7.6	B	15.2	B	300 or SB	15 - 600
Beryllium	0.08	U	0.08	U	0.07	U	0.08	U	0.08	U	0.08	U	0.23	B	0.08	U	0.08	U	0.08	U	0.16 or SB	0 - 1.75
Cadmium	0.90	B	0.90	U	0.86	U	1.0		0.88	U	0.88	U	0.92	B	0.88	U	0.87	U	0.91	U	10	0.1 - 1
Calcium	110	BJ	241	BJ	166	BJ	212	BJ	122	BJ	2,100	J	2,380	J	154	BJ	111	BJ	726	BJ	SB	130 - 35,000
Chromium	3.8		6.3		4.3		8.7		8.4	J	6.4		21.6		7.1		2.4		13.6		50	1.5 - 40
Cobalt	3.2	U	3.3	U	3.1	U	3.3	U	3.2	U	3.8	B	3.3	U	3.2	U	3.2	U	3.4	U	30 or SB	2.5 - 60
Copper	3.2	U	5.0		3.1	U	3.9	B	3.2	U	10.4		24.2		3.8	B	3.1	U	12.4		25 or SB	1 - 50
Iron	956		1,350		2,380		1,710		2,870		2,860		6,460		2,380		1,890		2,800		2000 or SB	2,000 - 550,000
Lead	65.0		2.6		2.7		19.8		20.8		27.1		32.7		2.5		2.2		16.4		SB	200 - 500
Magnesium	23.0	B	99.6	B	244	B	216	B	206	B	571	B	848	B	165	B	109	B	244	B	SB	100 - 5,000
Manganese	5.6		9.9		17.1		13.6		20.6		28.6	J	42.2		31.5	J	11.6	J	32.9		SB	50 - 5,000
Mercury	0.05	U	0.05	U	0.05	U	0.27		0.05	U	1.0	J	0.05	U	0.05	UR	0.05	UR	0.05	U	0.1	0.001 - 0.2
Nickel	5.6	U	5.7	U	5.4	U	5.6	U	5.6	U	5.6	U	8.7		5.6	U	5.5	U	5.8	U	13 or SB	0.5 - 25
Potassium	355	U	362	U	345	U	356	U	354	U	353	U	394	B	353	U	350	U	367	U	SB	8,500 - 43,000
Selenium	0.29	U	0.29	U	0.28	U	0.29	U	0.29	U	0.29	U	0.30	U	0.31	U	0.28	U	0.31	U	2 or SB	0.1 - 3.9
Silver	1.9	UJ	2.1	J	1.8	UJ	1.9	UJ	1.9	UJ	0.10	U	3.6	J	0.10	U	0.09	U	1.9	UJ	SB	N/A
Sodium	438	B	468	B	107	U	110	U	432	B	466	B	553	B	523	B	506	B	460	B	SB	6,000 - 8,000
Thallium	0.23	U	0.23	U	0.22	U	0.23	U	0.23	U	0.23	U	0.24	U	0.25	U	0.23	U	0.24	U	SB	N/A
Vanadium	2.5	U	2.5	U	3.1	B	5.2	B	3.1	B	3.7	B	7.4	B	3.2	B	2.4	U	3.5	B	150 or SB	1 - 300
Zinc	6.9	J	7.6	J	11.8	J	19.6	J	21.4	J	52.5		224	J	7.0		6.9		78.5	J	20 or SB	9 - 50
Cyanide	0.07	B	0.12	B	0.07	U	0.05	U	0.07	B	0.08	BJ	0.17	B	0.06	UJ	0.05	UJ	0.09	B	SB	N/A

NOTES:

[1] - Indicates depth below ground surface.

[2] - Recommended Soil Cleanup Objectives referenced from NYSDEC Division Technical and Administrative Guidance Memorandum: Determination of Soil Cleanup Objectives and Cleanup Levels (4/95).

[3] - DS-XX represents blind duplicate of DS-13, 10 ft.

[A] - Recommended Soil Cleanup Objective.

[B] - Eastern United States Background levels.

SB - Site Background, refer to EUS BG.

U - Indicates compound was analyzed for but not detected.

B - Indicates analyte was found in method blank.

R - Duplicate analysis not within control limits

N/A - Recommended Soil Cleanup Objective not established

TABLE 4.7

MACKENZIE CHEMICAL SITE

WASTE LAGOON - SOIL SAMPLES
VOLATILE ORGANIC COMPOUNDS - ANALYTICAL LABORATORY

SAMPLE ID	WL #1						WL #2						TRIP		NYSDEC
DEPTH OF SAMPLE [1]	8ft		25ft		40ft		8ft		25ft		40ft		BLANK		RSCO [2]
PARAMETERS (ug/kg)															
Chloromethane	10	U	11	U	10	U	10	U	10	U	10	U	10	U	NA
Bromomethane	10	U	11	U	10	U	10	U	10	U	10	U	10	U	NA
Vinyl Chloride	10	U	11	U	10	U	10	U	10	U	10	U	10	U	200
Chloroethane	10	U	11	U	10	U	10	U	10	U	10	U	10	U	1,900
Methylene Chloride	10	U	11	U	10	U	10	U	10	U	10	U	6	JB	100
Acetone	63	U	34	UJ	27	U	17	UJ	16	U	10	U	10	U	200
Carbon Disulfide	10	U	11	U	10	U	10	U	10	U	10	U	10	U	2,700
1,1-Dichloroethene	10	U	11	U	10	U	10	U	10	U	10	U	10	U	400
1,1-Dichloroethane	10	U	11	U	10	U	10	U	10	U	10	U	10	U	200
1,2-Dichloroethene (Total)	10	U	11	U	10	U	10	U	10	U	10	U	10	U	250
Chloroform	10	U	11	U	10	U	10	U	10	U	10	U	10	U	300
1,2-Dichloroethane	10	U	11	U	10	U	10	U	10	U	10	U	10	U	100
2-Butanone (MEK)	130		120		150		10	U	10	U	10	U	10	U	300
1,1,1-Trichloroethane	10	U	11	U	10	U	10	U	10	U	10	U	10	U	800
Carbon Tetrachloride	10	U	11	U	10	U	10	U	10	U	10	U	10	U	600
Bromodichloromethane	10	U	11	U	10	U	10	U	10	U	10	U	10	U	NA
1,2-Dichloropropane	10	U	11	U	10	U	10	U	10	U	10	U	10	U	NA
cis-1,3-Dichloropropene	10	U	11	U	10	U	10	U	10	U	10	U	10	U	NA
Trichloroethene (TCE)	10	U	11	U	10	U	10	U	10	U	10	U	10	U	700
Dibromochloromethane	10	U	11	U	10	U	10	U	10	U	10	U	10	U	NA
1,1,2-Trichloroethane	10	U	11	U	10	U	10	U	10	U	10	U	10	U	NA
Benzene	10	U	11	U	10	U	10	U	10	U	10	U	10	U	60
trans-1,3-Dichloropropene	10	U	11	U	10	U	10	U	10	U	10	U	10	U	NA
Bromoform	10	U	11	U	10	U	10	U	10	U	10	U	10	U	NA
4-Methyl-2-Pentanone	10	U	11	U	10	U	10	U	10	U	10	U	10	U	1,000
2-Hexanone	10	U	11	U	10	U	10	U	10	U	10	U	10	U	NA
Tetrachloroethene (PCE)	4	J	11	U	1	J	10	U	10	U	10	U	10	U	1,400
1,1,2,2-Tetrachloroethane	10	U	11	U	10	U	10	U	10	U	10	U	10	U	600
Toluene	3	J	11	U	3	J	10	U	10	U	10	U	10	U	1,500
Chlorobenzene	10	U	11	U	10	U	10	U	10	U	10	U	10	U	1,700
Ethylbenzene	10	U	11	U	10	U	10	U	10	U	10	U	10	U	5,500
Styrene	10	U	11	U	10	U	10	U	10	U	10	U	10	U	NA
Xylenes (Total)	10	U	11	U	10	U	10	U	10	U	10	U	10	U	1,200
1,2,3- Trichloropropane	>500	NJ	50	NJ	40	NJ	10	U	10	U	10	U	10	U	400
TICs (Total Concentration)	76	J	30	J	55	J	43	J	83	J	75	J	10	U	NA

NOTES:

[1] - Indicates depth below ground surface.

[2] - Recommended Soil Cleanup Objectives referenced from NYSDEC Division Technical and Administrative

U - Indicates compound was analyzed for but not detected.

J - Indicates an estimated value.

B - Indicates analyte was found in method blank.

NA - Recommended Soil Cleanup Objective not established

TABLE 4.8

MACKENZIE CHEMICAL SITE

WASTE LAGOON - SOIL SAMPLES
SEMI-VOLATILE ORGANIC COMPOUNDS - ANALYTICAL LABORATORY

SAMPLE ID DEPTH OF SAMPLE [1]	WL #1		WL #2		NYSDEC RSCO [2]
PARAMETERS (ug/kg)					
Phenol	350	U	350	U	30 or MDL
bis(2-Chloroethyl)Ether	350	U	350	U	NA
2-Chlorophenol	350	U	350	U	800
1,3-Dichlorobenzene	350	U	350	U	NA
1,4-Dichlorobenzene	350	U	350	U	NA
1,2-Dichlorobenzene	350	U	350	U	NA
2-Methylphenol	350	U	350	U	100 or MDL
2,2'-oxybis(1-Chloropropane)	350	U	350	U	NA
4-Methylphenol	350	U	350	U	900
N-Nitroso-di-n-propylamine	350	U	350	U	NA
Hexachloroethane	350	U	350	U	NA
Nitrobenzene	350	U	350	U	200 or MDL
Isophorone	350	U	350	U	4,400
2-Nitrophenol	350	U	350	U	330 or MDL
2,4-Dimethylphenol	350	U	350	U	NA
bis(2-Chloroethoxy)Methane	350	U	350	U	NA
2,4-Dichlorophenol	350	U	350	U	400
1,2,4-Trichlorobenzene	350	U	350	U	NA
Naphthalene	350	U	350	U	13,000
4-Chloroaniline	350	U	350	U	220 or MDL
Hexachlorobutadiene	350	U	350	U	NA
4-Chloro-3-Methylphenol	350	U	350	U	240 or MDL
2-Methylnaphthalene	350	U	350	U	36,400
Hexachlorocyclopentadiene	350	U	350	U	NA
2,4,6-Trichlorophenol	350	U	350	U	NA
2,4,5-Trichlorophenol	870	U	880	U	100
2-Chloronaphthalene	350	U	350	U	NA
2-Nitroaniline	950	U	880	U	430 or MDL
Dimethylphthalate	350	U	350	U	2,000
Acenaphthylene	350	U	350	U	41,000
2,6-Dinitrotoluene	350	U	350	U	1,000
3-Nitroaniline	870	U	880	U	500 or MDL
Acenaphthene	350	U	350	U	50,000
2,4-Dinitrophenol	870	UJ	880	UJ	200 or MDL
4-Nitrophenol	870	U	880	U	100 or MDL
Dibenzofuran	350	U	350	U	6,200
2,4-Dinitrotoluene	350	U	350	U	NA
Diethylphthalate	350	U	350	U	7,100
4-Chlorophenyl-phenylether	350	U	350	U	NA
Fluorene	120	J	350	U	50,000
4-Nitroaniline	870	U	880	U	NA
4,6-Dinitro-2-Methylphenol	870	U	880	U	NA
N-Nitrosodiphenylamine	25,000	D	1,700		NA
4-Bromophenyl-phenylether	350	U	350	U	NA
Hexachlorobenzene	350	U	350	U	410
Pentachlorophenol	870	U	880	U	1000 or MDL
Phenanthrene	50	J	120	J	50,000
Anthracene	350	U	350	U	50,000
Carbazole	350	U	350	U	NA
Di-n-butylphthalate	350	U	350	U	8,100
Fluoranthene	73	J	350	J	50,000
Pyrene	78	J	360		50,000
Butylbenzylphthalate	350	U	35	J	50,000
3,3'-Dichlorobenzidine	350	U	350	U	NA
Benzo(a)anthracene	350	U	170	J	224 or MDL
Chrysene	37	J	210	J	400
bis(2-Ethylhexyl)phthalate	350	U	350	U	50,000
Di-n-octylphthalate	18,000	U	350	U	50,000
Benzo(b)fluoranthene	18,000	U	300	J	224 or MDL
Benzo(k)fluoranthene	18,000	U	220	J	224 or MDL
Benzo(a)pyrene	18,000	U	240	J	61 or MDL
Indeno(1,2,3-cd)pyrene	18,000	U	88	J	3,200
Dibenzo(a,h)anthracene	18,000	U	350	U	14 or MDL
Benzo(g,h,i)perylene	18,000	U	78	J	50,000

NOTES:

[1] - Indicates depth below ground surface.

[2] - Recommended Soil Cleanup Objectives referenced from NYSDEC Division Technical and Administrative

U - Indicates compound was analyzed for but not detected

J - Indicates an estimated value

D - Indicates a secondary dilution factor used for analysis

NA - Soil Cleanup Objective not established

MDL - Method Detection Limit

TABLE 4.9

MACKENZIE CHEMICAL SITE

WASTE LAGOON - SOIL SAMPLES
PESTICIDES/PCBs - ANALYTICAL LABORATORY

SAMPLE ID DEPTH OF SAMPLE [1]	WL #1 8ft		WL #2 8ft		NYSDEC RSCO[2]
PARAMETERS (ug/kg)					
alpha-BHC	1.8	U	1.8	U	110
beta-BHC	1.8	U	1.8	U	200
delta-BHC	1.8	U	1.8	U	300
gamma-BHC (Lindane)	1.8	U	1.8	U	60
Heptachlor	1.8	U	1.0	JPN	100
Aldrin	1.8	U	1.1	J	41
Heptachlor Epoxide	1.8	U	1.8	U	20
Endosulfan I	1.8	U	1.8	U	900
Dieldrin	3.5	U	2.2	J	44
4,4'-DDE	3.5	U	1.9	JP	2,100
Endrin	3.5	U	2.4	J	100
Endosulfan II	3.5	U	3.5	U	900
4,4'-DDD	3.5	U	3.5	U	2,900
Endosulfan Sulfate	3.5	U	3.5	U	1,000
4,4'-DDT	3.5	U	4.0	PJ	2,100
Methoxychlor	18	U	18	U	NA
Endrin Ketone	3.5	U	3.5	U	NA
Endrin Aldehyde	3.5	U	3.5	U	NA
alpha-Chlordane	3.4	U	4.3	P	540
gamma-Chlordane	1.8	U	3.6	NJ	540
Toxaphene	180	U	180	U	NA
Aroclor-1016	35	U	35	U	10.0[3]
Aroclor-1221	70	U	70	U	10.0[3]
Aroclor-1232	35	U	35	U	10.0[3]
Aroclor-1242	35	U	35	U	10.0[3]
Aroclor-1248	35	U	35	U	10.0[3]
Aroclor-1254	35	U	35	U	10.0[3]
Aroclor-1260	35	U	35	U	10.0[3]

NOTES:

[1] - Indicates depth below ground surface.

[2] - Recommended Soil Cleanup Objectives referenced from NYSDEC Division Technical and Administrative Guidance Memorandum: Determination of Soil Cleanup Objectives and Cleanup Levels (4/95)

[3] - Recommended Soil Cleanup Objective reflects sum of all aroclors

U - Indicates compound was analyzed for but not detected

P - There is a greater than 25% difference for detected concentrations between the two GC columns. The lower of the two values is reported.

J - Indicates an estimated value.

N - Indicates presumtavive evidence of a compound

NA - Soil Cleanup Objective not established.

TABLE 4.10

MACKENZIE CHEMICAL SITE

WASTE LAGOON - SOIL SAMPLES
TAL METALS - ANALYTICAL LABORATORY

SAMPLE ID	WL #1		WL #2		CONCENTRATIONS OF CONCERN[2]	
DEPTH OF SAMPLE[1]	8ft		8ft		RSCO[A]	EUS BG[B]
PARAMETERS (mg/kg)						
Aluminum	1,490		2,640		SB	33,000
Antimony	10.3	UJ	10.4	UJ	SB	N/A
Arsenic	0.63	B	1.1	B	7.5 or SB	3 - 12
Barium	7.2	B	15.2	B	300 or SB	15 - 600
Beryllium	0.10	U	0.10	U	0.16 or SB	0 - 1.75
Cadmium	0.82	U	0.83	U	10	0.1 - 1
Calcium	6,350		22,700		SB	130 - 35,000
Chromium	6.2		13.8		50	1.5 - 40
Cobalt	2.4	U	2.7	B	30 or SB	2.5 - 60
Copper	5.8		15.3		25 or SB	1 - 50
Iron	2,050		4,010		2000 or SB	2,000 - 550,000
Lead	5.0		20.7		200 - 500	200 - 500
Magnesium	500	B	1,530		SB	100 - 5,000
Manganese	19.7		72.6		SB	50 - 5,000
Mercury	0.07	B	0.05	B	0.1	0.001 - 0.2
Nickel	2.2	U	3.4	B	13 or SB	0.5 - 25
Potassium	218	U	220	U	SB	8,500 - 43,000
Selenium	0.40	U	0.40	U	2 or SB	0.1 - 3.9
Silver	2.9		1.7	U	SB	N/A
Sodium	123	B	91.1	B	SB	6,000 - 8,000
Thallium	0.38	U	0.39	U	SB	N/A
Vanadium	3.8	B	5.8	B	150 or SB	1 - 300
Zinc	23.2		19.5		20 or SB	9 - 50
Cyanide	0.07	U	0.06	U	SB	N/A

NOTES:

[1] - Indicates depth below ground surface.

[2] - Recommended Soil Cleanup Objectives referenced from NYSDEC Division Technical and Administrative Guidance Memorandum: Determination of Soil Cleanup Objectives and Cleanup Levels (4/95)

[A] - Recommended Soil Cleanup Objective.

[B] - Eastern United States Background levels.

U - Indicates compound was analyzed for but not detected.

B - Indicates analyte was found in method blank.

N/A - Recommended Soil Cleanup Objective not established

TABLE 4.11

MACKENZIE CHEMICAL SITE

ON-SITE MONITORING WELLS - GROUNDWATER SAMPLES
VOLATILE ORGANIC COMPOUNDS - ANALYTICAL L. BORATORY

SAMPLE ID	MW-XX[2]		MCMW-1		MCMW-3		MCMW-4		MCMW-5		Field		NYSDEC GW STAND.[1]
PARAMETERS (ug/l)													
Chloromethane	10	U	10	U	10	U	10	U	10	U	10	U	NA
Bromomethane	10	U	10	U	10	U	10	U	10	U	10	U	5
Vinyl Chloride	10	U	10	U	10	U	10	U	10	U	10	U	2
Chloroethane	10	U	10	U	10	U	10	U	10	U	10	U	5
Methylene Chloride	10	U	10	U	10	U	10	U	10	U	7	JB	5
Acetone	10	U	10	U	10	U	10	U	10	U	10	U	NA
Carbon Disulfide	10	U	10	U	10	U	10	U	10	U	10	U	NA
1,1-Dichloroethene	10	U	10	U	10	U	10	U	1	U	10	U	5
1,1-Dichloroethane	10	U	10	U	10	U	10	U	10	U	10	U	5
1,2-Dichloroethene (Total)	10	U	10	U	10	U	10	U	10	U	10	U	NA
Chloroform	10	U	10	U	10	U	10	U	10	U	10	U	7
1,2-Dichloroethane	10	U	10	U	10	U	10	U	10	U	10	U	0.6
2-Butanone (MEK)	10	U	10	U	10	U	10	U	10	U	10	U	NA
1,1,1-Trichloroethane	10	U	10	U	10	U	10	U	10	U	10	U	5
Carbon Tetrachloride	10	U	10	U	10	U	10	U	10	U	10	U	5
Bromodichloromethane	10	U	10	U	10	U	10	U	10	U	10	U	NA
1,2-Dichloropropane	10	U	10	U	10	U	10	U	10	U	10	U	1
cis-1,3-Dichloropropene	10	U	10	U	10	U	10	U	10	U	10	U	0.4
Trichloroethene (TCE)	10	U	10	U	10	U	10	U	2	J	10	U	5
Dibromochloromethane	10	U	10	U	10	U	10	U	10	U	10	U	NA
1,1,2-Trichloroethane	10	U	10	U	10	U	10	U	10	U	10	U	1
Benzene	10	U	10	U	10	U	10	U	10	U	10	U	1
trans-1,3-Dichloropropene	10	U	10	U	10	U	10	U	10	U	10	U	0.4
Bromoform	10	U	10	U	10	U	10	U	10	U	10	U	NA
4-Methyl-2-Pentanone	10	U	10	U	10	U	10	U	10	U	10	U	NA
2-Hexanone	10	U	10	UJ	10	UJ	10	UJ	10	UJ	10	U	NA
Tetrachloroethene (PCE)	10	U	10	U	13		21		54		10	U	5
1,1,2,2-Tetrachloroethane	10	U	10	U	10	U	10	U	10	U	10	U	5
Toluene	10	U	10	U	10	U	10	U	10	U	10	U	5
Chlorobenzene	10	U	10	U	10	U	10	U	10	U	10	U	5
Ethylbenzene	10	U	10	U	10	U	10	U	10	U	10	U	5
Styrene	10	U	10	U	10	U	10	U	10	U	10	U	5
Xylenes (Total)	10	U	10	U	10	U	10	U	10	U	10	U	5
1,2,3-Trichloropropane	10	U	10	U	250	NJ	10	U	40	NJ	10	U	0.04
TICs (Total Concentration)	23	B	10	U	11	N	10	U	10	U	24	B	NA

NOTES:

[1] - Referenced from NYSDEC Final Express Terms for Amendments to Title 6, Chapter X Parts 700-706, 3/98.

[2] - MW-XX represents blind duplicate of MCMW-1.

U - Indicates compound was analyzed for but not detected.

J - Indicates an estimated value

B - Indicates analyte was found in method blank

N - Indicates presumtavive evidence of a compound

NA - Class GA Groundwater Standard not established

TABLE 4.12

MACKENZIE CHEMICAL SITE

ON-SITE MONITORING WELLS - GROUNDWATER SAMPLES
SEMI-VOLATILE ORGANIC COMPOUNDS - ANALYTICAL LABORATORY

SAMPLE ID	MW-XX[1]		MCMW-1		MCMW-3		MCMW-4		MCMW-5		Field Blank		NYSDEC GW STAND.[2]
PARAMETERS (ug/l)													
Phenol	13	U	12	U	12	U	13	U	12	U	13	U	1[3]
bis(2-Chloroethyl)Ether	13	U	12	U	12	U	13	U	12	U	13	U	NA
2-Chlorophenol	13	U	12	U	12	U	13	U	12	U	13	U	NA
1,3-Dichlorobenzene	13	U	12	U	12	U	13	U	12	U	13	U	3
1,4-Dichlorobenzene	13	U	12	U	12	U	13	U	12	U	13	U	3
1,2-Dichlorobenzene	13	U	12	U	12	U	13	U	12	U	13	U	3
2-Methylphenol	13	U	12	U	12	U	13	U	12	U	13	U	NA
2,2'-oxybis(1-Chloropropane)	13	U	12	U	12	U	13	U	12	U	13	U	NA
4-Methylphenol	13	U	12	U	12	U	13	U	12	U	13	U	NA
N-Nitroso-di-n-propylamine	13	U	12	U	12	U	13	U	12	U	13	U	NA
Hexachloroethane	13	U	12	U	12	U	13	U	12	U	13	U	5
Nitrobenzene	13	U	12	U	12	U	13	U	12	U	13	U	0.4
Isophorone	13	U	12	U	12	U	13	U	12	U	13	U	NA
2-Nitrophenol	13	U	12	U	12	U	13	U	12	U	13	U	NA
2,4-Dimethylphenol	13	U	12	U	12	U	13	U	12	U	13	U	1[3]
bis(2-Chloroethoxy)Methane	13	U	12	U	12	U	13	U	12	U	13	U	NA
2,4-Dichlorophenol	13	U	12	U	12	U	13	U	12	U	13	U	1[3]
1,2,4-Trichlorobenzene	13	U	12	U	12	U	13	U	12	U	13	U	5
Naphthalene	13	U	12	U	12	U	13	U	12	U	13	U	NA
4-Chloroaniline	13	U	12	U	12	U	13	U	12	U	13	U	5
Hexachlorobutadiene	13	U	12	U	12	U	13	U	12	U	13	U	0.5
4-Chloro-3-Methylphenol	13	U	12	U	12	U	13	U	12	U	13	U	1[3]
2-Methylnaphthalene	13	U	12	U	12	U	13	U	12	U	13	U	NA
Hexachlorocyclopentadiene	13	U	12	U	12	U	13	U	12	U	13	U	5
2,4,6-Trichlorophenol	13	U	12	U	12	U	13	U	12	U	13	U	1[3]
2,4,5-Trichlorophenol	32	U	31	U	30	U	32	U	30	U	32	U	1[3]
2-Chloronaphthalene	13	U	12	U	12	U	13	U	12	U	13	U	NA
2-Nitroaniline	32	U	31	U	30	U	32	U	14	J	32	U	5
Dimethylphthalate	13	U	12	U	12	U	13	U	12	U	13	U	NA
Acenaphthylene	13	U	12	U	12	U	13	U	12	U	13	U	NA
2,6-Dinitrotoluene	13	U	12	U	12	U	13	U	12	U	13	U	5
3-Nitroaniline	32	U	31	U	30	U	32	U	30	U	32	U	5
Acenaphthene	13	U	12	U	12	U	13	U	12	U	13	U	NA
2,4-Dinitrophenol	32	UJ	31	UJ	30	UJ	32	UJ	30	UJ	32	UJ	1[3]
4-Nitrophenol	32	U	31	U	30	U	32	U	30	U	32	U	1[3]
Dibenzofuran	13	U	12	U	12	U	13	U	12	U	13	U	NA
2,4-Dinitrotoluene	13	U	12	U	12	U	13	U	12	U	13	U	5
Diethylphthalate	13	U	12	U	12	U	13	U	12	U	13	U	NA
4-Chlorophenyl-phenylether	13	U	12	U	12	U	13	U	12	U	13	U	NA
Fluorene	13	U	12	U	12	U	13	U	12	U	13	U	NA
4-Nitroaniline	32	U	31	U	30	U	32	U	30	U	32	U	5
4,6-Dinitro-2-Methylphenol	32	U	31	U	30	U	32	U	30	U	32	U	NA
N-Nitrosodiphenylamine	13	U	12	U	12	U	13	U	12	U	13	U	NA
4-Bromophenyl-phenylether	13	U	12	U	12	U	13	U	12	U	13	U	NA
Hexachlorobenzene	13	U	12	U	12	U	13	U	12	U	13	U	0.04
Pentachlorophenol	32	U	31	U	30	U	32	U	30	U	32	U	1[3]
Phenanthrene	13	U	12	U	12	U	13	U	12	U	13	U	NA
Anthracene	13	U	12	U	12	U	13	U	12	U	13	U	NA
Carbazole	13	U	12	U	12	U	13	U	12	U	13	U	NA
Di-n-butylphthalate	13	U	12	U	12	U	13	U	12	U	13	U	NA
Fluoranthene	13	U	12	U	12	U	13	U	12	U	13	U	NA
Pyrene	13	U	12	U	12	U	13	U	12	U	13	U	NA
Butylbenzylphthalate	13	U	12	U	12	U	13	U	12	U	13	U	NA
3,3'-Dichlorobenzidine	13	U	12	U	12	U	13	U	12	U	13	U	5
Benzo(a)anthracene	13	U	12	U	12	U	13	U	12	U	13	U	NA
Chrysene	13	U	12	U	12	U	13	U	12	U	13	U	NA
bis(2-Ethylhexyl)phthalate	13	U	12	U	23	U	35		26	U	2	J	5
Di-n-octylphthalate	13	U	12	U	12	U	13	U	12	U	13	U	NA
Benzo(b)fluoranthene	13	U	12	U	12	U	13	U	12	U	13	U	NA
Benzo(k)fluoranthene	13	U	12	U	12	U	13	U	12	U	13	U	NA
Benzo(a)pyrene	13	U	12	U	12	U	13	U	12	U	13	U	ND
Indeno(1,2,3-cd)pyrene	13	U	12	U	12	U	13	U	12	U	13	U	NA
Dibenzo(a,h)anthracene	13	U	12	U	12	U	13	U	12	U	13	U	NA
Benzo(g,h,i)perylene	13	U	12	U	12	U	13	U	12	U	13	U	NA

NOTES:

[1] - MW-XX represents blind duplicate of MCMW-1

[2] - Referenced from NYSDEC 'Final Express Terms for Amendments to Title 6, Chapter X Parts 700-706', 3/98

[3] - 1 ug/l standard applies to the sum of all phenolic compounds.

U - Indicates compound was analyzed for but not detected

J - Indicates an estimated value

NA - Class GA Groundwater Standard not established

ND - Non-detectable

TABLE 4.13

MACKENZIE CHEMICAL SITE

ON-SITE MONITORING WELLS - GROUNDWATER SAMPLES
PESTICIDES/PCBs - ANALYTICAL LABORATORY

SAMPLE ID	MW-XX[2]		MCMW-1		MCMW-3		MCMW-4		MCMW-5		Field Blank		NYSDEC GW STAND[1]
PARAMETERS (ug/l)													
alpha-BHC	.057	U	.066	U	.062	U	.071	U	.071	U	.054	U	NA
beta-BHC	.057	U	.066	U	.062	U	.071	U	.071	U	.054	U	NA
delta-BHC	.057	U	.066	U	.062	U	.071	U	.071	U	.054	U	NA
gamma-BHC (Lindane)	.057	U	.066	U	.062	U	.071	U	.071	U	.054	U	NA
Heptachlor	.057	U	.066	U	.062	U	.071	U	.071	U	.054	U	NA
Aldrin	.057	U	.066	U	.062	U	.071	U	.071	U	.054	U	ND
Heptachlor Epoxide	.057	U	.066	U	.062	U	.071	U	.071	U	.054	U	0.03
Endosulfan I	.057	U	.066	U	.062	U	0.62	J	.071	U	.054	U	NA
Dieldrin	11	U	.13	U	.12	U	.14	U	.14	U	.11	U	0.004
4,4'-DDE	.11	U	.13	U	.12	U	.14	U	.14	U	.11	U	0.2
Endrin	.11	U	.13	U	.12	U	.14	U	.14	U	.11	U	ND
Endosulfan II	.11	U	.13	U	.12	U	.14	U	.14	U	.11	U	NA
4,4'-DDD	.11	U	.13	U	.12	U	.14	U	.14	U	.11	U	0.3
Endosulfan Sulfate	.11	U	.13	U	.12	U	.14	U	.14	U	.11	U	NA
4,4'-DDT	.11	U	.13	U	.12	U	.14	U	.14	U	.11	U	0.2
Methoxychlor	.57	U	.66	U	.62	U	.71	U	.71	U	.54	U	35
Endrin Ketone	.11	U	.13	U	.12	U	.14	U	.14	U	.11	U	5
Endrin Aldehyde	.11	U	.13	U	.12	U	.14	U	.14	U	.11	U	5
alpha-Chlordane	.057	U	.066	U	.062	U	.071	U	.071	U	.054	U	0.05
gamma-Chlordane	.057	U	.066	U	.062	U	.071	U	.071	U	.054	U	0.05
Toxaphene	5.7	U	6.6	U	6.2	U	7.1	U	7.1	U	5.4	U	0.06
Aroclor-1016	1.1	U	1.3	U	1.2	U	1.4	U	1.4	U	1.1	U	0.09[3]
Aroclor-1221	2.3	U	2.6	U	2.5	U	2.8	U	2.8	U	2.2	U	0.09[3]
Aroclor-1232	1.1	U	1.3	U	1.2	U	1.4	U	1.4	U	1.1	U	0.09[3]
Aroclor-1242	1.1	U	1.3	U	1.2	U	1.4	U	1.4	U	1.1	U	0.09[3]
Aroclor-1248	1.1	U	1.3	U	1.2	U	1.4	U	1.4	U	1.1	U	0.09[3]
Aroclor-1254	1.1	U	1.3	U	1.2	U	1.4	U	1.4	U	1.1	U	0.09[3]
Aroclor-1260	1.1	U	1.3	U	1.2	U	1.4	U	1.4	U	1.1	U	0.09[3]

NOTES:

[1] - Referenced from NYSDEC Final Express Terms for Amendments to Title 6, Chapter X Parts 700-706', 3/98.

[2] - MW-XX represents blind duplicate of MCMW-1.

[3] - Class GA Groundater Effluent Standard reflects sum of all aroclors

U - Indicates compound was analyzed for but not detected

NA - NYSDEC Class GA Water Quality Standard not established.

ND - Non-detectable

TABLE 4.14

MACKENZIE CHEMICAL SITE

ON-SITE MONITORING WELLS - GROUNDWATER SAMPLES
TAL METALS - ANALYTICAL LABORATORY

SAMPLE ID	MW-XX[2]		MCMW-1		MCMW-3		MCMW-4		MCMW-5		Field Blank		NYSDEC GW STANDARDS[1]
PARAMETERS (ug/l)													
Aluminum	4,210		3,688		6,270		4,270		3,710		126	U	NA
Antimony	53.8	U	53.8	U	53.8	U	53.8	U	53.8	U	53.8	U	3
Arsenic	2.6	U	2.6	U	25.2		2.7	B	29.5		2.6	U	25
Barium	139	B	160	B	159	B	129	B	233		3.5	U	1,000
Beryllium	0.50	U	0.50	U	0.50	U	1.5	B	0.50	U	0.50	U	NA
Cadmium	4.3	U	4.3	U	16.8		4.8	B	19.2		4.3	U	5
Calcium	11,000		12,200		24,900		13,300		30,300		120	U	NA
Chromium	6.6	U	6.6	U	12.9		17.1		242		6.6	U	50
Cobalt	12.6	U	12.6	U	136		331		136		12.6	U	NA
Copper	7.6	U	14.8	B	26.7		7.6	U	18.6	B	7.6	U	200
Iron	7,110		6,590		116,000		13,300		54,200		45.0	U	300
Lead	10.6		7.1		73.8		13.1		27.2		0.90	U	25
Magnesium	2,210	B	2,490	B	1,850	B	1,930	B	2,930	B	112	U	NA
Manganese	393		388		1,730		5,110		281		2.7	U	300
Mercury	0.09	U	0.09	U	0.09	U	0.09	U	0.09	U	0.09	U	0.7
Nickel	11.4	U	11.4	U	35.3	B	131		44.1		11.4	U	100
Potassium	1,220	B	2,200	B	5,700		9,240		3,510	B	1,140	U	NA
Selenium	2.1	U	2.1	U	2.1	U	2.1	U	2.1	UJ	2.1	U	10
Silver	8.6	UJ	8.6	UJ	8.6	UJ	8.6	UJ	8.6	UJ	8.6	U	50
Sodium	8,660		9,750		13,200		8,040		25,800		393	U	20,000
Thallium	0.80	U	0.80	U	0.80	U	0.80	U	0.80	U	0.80	U	NA
Vanadium	10.8	U	10.8	U	10.8	U	10.8	U	10.8	U	10.8	U	NA
Zinc	62.5	J	62	J	742		560		2,410		16.5	U	NA
Cyanide	1.4	UJ	1.4	UJ	1.4	UJ	1.4	UJ	1.4	UJ	1.4	UJ	200

NOTES:

[1] - Referenced from NYSDEC Final Express Terms for Amendments to Title 6, Chapter X Parts 700-706, 3/98.

[2] - MW-XX represents blind duplicate of MCMW-1.

U - Indicates compound was analyzed for but not detected.

B - Indicates analyte was found in method blank.

NA - Class GA Groundwater Standard not established

TABLE 4.15

MACKENZIE CHEMICAL SITE

VERTICAL PROFILE WELLS - GROUNDWATER SAMPLES
VOLATILE ORGANIC COMPOUNDS - MOBILE LABORATORY

SAMPLE ID	VP-1				VP-2				VP-3				VP-3X[3]	NYSDEC
DEPTH OF SAMPLE[1]	60ft	80ft	100ft	120ft	60ft	80ft	100ft	120ft	60ft	80ft	100ft	120ft		GW STAND.[2]
PARAMETERS - (ug/l)														
Chloromethane	< 5	< 5	< 5	< 5	< 1000	< 100	< 200	< 50	< 5	< 5	< 1	< 5	< 5	NA
Vinyl Chloride	< 5	< 5	< 5	< 5	< 1000	< 100	< 200	< 50	< 5	< 5	< 1	< 5	< 5	2
Bromomethane	< 5	< 5	< 5	< 5	< 1000	< 100	< 200	< 50	< 5	< 5	< 1	< 5	< 5	5
Chloroethane	< 5	< 5	< 5	< 5	< 1000	< 100	< 200	< 50	< 5	< 5	< 1	< 5	< 5	5
1,1-Dichloroethene	< 5	< 5	< 5	< 5	< 1000	< 100	< 200	< 50	< 5	< 5	< 1	< 5	< 5	5
Methylene Chloride	< 5	< 5	< 5	< 5	< 1000	< 100	< 200	< 50	< 5	< 5	< 1	< 5	< 5	5
trans-1,2-Dichloroethene	< 5	< 5	< 5	< 5	< 1000	< 100	< 200	< 50	< 5	< 5	< 1	< 5	< 5	5
1,1-Dichloroethane	< 5	< 5	< 5	< 5	< 1000	< 100	< 200	< 50	< 5	< 5	< 1	< 5	< 5	0 6
cis-1,2-Dichloroethene	< 5	< 5	< 5	< 5	< 1000	< 100	< 200	< 50	< 5	< 5	< 1	< 5	< 5	NA
Chloroform	< 5	< 5	< 5	< 5	< 1000	< 100	< 200	< 50	< 5	< 5	< 1	< 5	< 5	7
1,1,1-Trichloroethane	< 5	< 5	< 5	< 5	< 1000	< 100	< 200	< 50	< 5	< 5	< 1	< 5	< 5	5
Carbon Tetrachloride	< 5	< 5	< 5	< 5	< 1000	< 100	< 200	< 50	< 5	< 5	< 1	< 5	< 5	5
1,2-Dichloroethane	< 5	< 5	< 5	< 5	< 1000	< 100	< 200	< 50	< 5	< 5	< 1	< 5	< 5	0 6
Trichloroethene	< 5	< 5	< 5	< 5	< 1000	< 100	< 200	< 50	< 5	< 5	< 1	< 5	< 5	5
1,2-Dichloropropane	< 5	< 5	< 5	< 5	< 1000	< 100	< 200	< 50	< 5	< 5	< 1	< 5	< 5	1
Bromodichloromethane	< 5	< 5	< 5	< 5	< 1000	< 100	< 200	< 50	< 5	< 5	< 1	< 5	< 5	NA
cis-1,3-Dichloropropene	< 5	< 5	< 5	< 5	< 1000	< 100	< 200	< 50	< 5	< 5	< 1	< 5	< 5	0 4
trans-1,3-Dichloropropene	< 5	< 5	< 5	< 5	< 1000	< 100	< 200	< 50	< 5	< 5	< 1	< 5	< 5	0 4
1,1,2-Trichloroethane	< 5	< 5	< 5	< 5	< 1000	< 100	< 200	< 50	< 5	< 5	< 1	< 5	< 5	1
Tetrachloroethylene	< 5	< 5	< 5	< 5	< 1000	< 100	< 200	< 50	< 5	< 5	< 1	< 5	< 5	NA
Dibromochloromethane	< 5	< 5	< 5	< 5	< 1000	< 100	< 200	< 50	< 5	< 5	< 1	< 5	< 5	NA
Bromoform	< 5	< 5	< 5	< 5	< 1000	< 100	< 200	< 50	< 5	< 5	< 1	< 5	< 5	NA
1,1,2,2,-Tetrachloroethane	< 5	< 5	< 5	< 5	< 1000	< 100	< 200	< 50	< 5	< 5	< 1	< 5	< 5	5
1,2,3-Trichloropropane	< 5	< 5	< 5	< 5	34000 D	2200 D	5200 D	2200 D	6 7	< 5	< 1	160	6 8	0 04
Acetone	< 5	< 5	< 5	6 1	< 1000	< 100	< 200	< 50	< 5	< 5	< 1	15	< 5	NA
MEK	< 5	< 5	< 5	< 5	< 1000	< 100	< 200	< 50	< 5	< 5	< 1	< 5	< 5	NA
Benzene	< 5	< 5	< 5	< 5	< 1000	< 100	< 200	< 50	< 5	< 5	< 1	< 5	< 5	1
MIBK	< 5	< 5	< 5	< 5	< 1000	< 100	< 200	< 50	< 5	< 5	< 1	< 5	< 5	NA
Toluene	< 5	< 5	< 5	< 5	< 1000	< 100	< 200	< 50	< 5	< 5	< 1	< 5	< 5	5
MBK	< 5	< 5	< 5	< 5	< 1000	< 100	< 200	< 50	< 5	< 5	< 1	< 5	< 5	NA
Chlorobenzene	< 5	< 5	< 5	< 5	< 1000	< 100	< 200	< 50	< 5	< 5	< 1	< 5	< 5	5
Ethylbenzene	< 5	< 5	< 5	< 5	< 1000	< 100	< 200	< 50	< 5	< 5	< 1	< 5	< 5	5
M&P Xylene	< 5	< 5	< 5	< 5	< 1000	< 100	< 200	< 50	< 5	< 5	< 1	< 5	< 5	5
O- Xylene	< 5	< 5	< 5	< 5	< 1000	< 100	< 200	< 50	< 5	< 5	< 1	< 5	< 5	5
Styrene	< 5	< 5	< 5	< 5	< 1000	< 100	< 200	< 50	< 5	< 5	< 1	< 5	< 5	5

NOTES:

[1] - Indicates depth below ground surface

[2] - Referenced from NYSDEC 'Final Express Terms for Amendments to Title 6, Chapter X Parts 700-706', 3/98.

[3] - VP-3X is a blind duplicate of VP-3, 60' bgs

D - Indicates a secondary dilution factor used for analysis

NA - Class GA Groundwater Standard not established

TABLE 4.15 (con't.)

MACKENZIE CHEMICAL SITE

VERTICAL PROFILE WELLS - GROUNDWATER SAMPLES
VOLATILE ORGANIC COMPOUNDS - MOBILE LABORATORY

SAMPLE ID	VP-4			VP-5			VP-6			VP-7			NYSDEC
DEPTH OF SAMPLE[1]	80ft	100ft	120ft	60ft	80ft	100ft	60ft	80ft	100ft	60ft	80ft	100ft	GW STAND.[2]
PARAMETERS - (ug/l)													
Chloromethane	< 5	< 5	< 5	< 1	< 1	< 1	< 5	< 5	< 5	< 5	< 5	< 5	NA
Vinyl Chloride	< 5	< 5	< 5	< 1	< 1	< 1	< 5	< 5	< 5	< 5	< 5	< 5	2
Bromomethane	< 5	< 5	< 5	< 1	< 1	< 1	< 5	< 5	< 5	< 5	< 5	< 5	5
Chloroethane	< 5	< 5	< 5	< 1	< 1	< 1	< 5	< 5	< 5	< 5	< 5	< 5	5
1,1-Dichloroethene	< 5	< 5	< 5	< 1	< 1	< 1	< 5	< 5	< 5	< 5	< 5	< 5	5
Methylene Chloride	< 5	< 5	< 5	< 1	< 1	< 1	< 5	< 5	< 5	< 5	< 5	< 5	5
trans-1,2-Dichloroethene	< 5	< 5	< 5	< 1	< 1	< 1	< 5	< 5	< 5	< 5	< 5	< 5	0.6
1,1-Dichloroethane	< 5	< 5	< 5	< 1	< 1	< 1	< 5	< 5	< 5	< 5	< 5	< 5	NA
cis-1,2-Dichloroethene	< 5	< 5	< 5	< 1	< 1	< 1	< 5	< 5	< 5	< 5	< 5	< 5	7
Chloroform	< 5	< 5	< 5	< 1	< 1	< 1	< 5	< 5	< 5	< 5	< 5	< 5	5
1,1,1-Trichloroethane	< 5	< 5	< 5	< 1	< 1	< 1	< 5	< 5	< 5	< 5	< 5	< 5	5
Carbon Tetrachloride	< 5	< 5	< 5	< 1	< 1	< 1	< 5	< 5	< 5	< 5	< 5	< 5	0.6
1,2-Dichloroethane	< 5	< 5	< 5	< 1	< 1	< 1	< 5	< 5	< 5	< 5	< 5	< 5	5
Trichloroethene	< 5	< 5	< 5	< 1	< 1	< 1	< 5	< 5	< 5	< 5	< 5	< 5	1
1,2-Dichloropropane	< 5	< 5	< 5	< 1	< 1	< 1	< 5	< 5	< 5	< 5	< 5	< 5	NA
Bromodichloromethane	< 5	< 5	< 5	< 1	< 1	< 1	< 5	< 5	< 5	< 5	< 5	< 5	0.4
cis-1,3-Dichloropropene	< 5	< 5	< 5	< 1	< 1	< 1	< 5	< 5	< 5	< 5	< 5	< 5	0.4
trans-1,3-Dichloropropene	< 5	< 5	< 5	< 1	< 1	< 1	< 5	< 5	< 5	< 5	< 5	< 5	1
1,1,2-Trichloroethane	< 5	< 5	< 5	< 1	< 1	< 1	< 5	< 5	< 5	< 5	< 5	< 5	NA
Tetrachloroethylene	< 5	< 5	< 5	< 1	< 1	< 1	< 5	< 5	< 5	< 5	< 5	< 5	NA
Dibromochloromethane	< 5	< 5	< 5	< 1	< 1	< 1	< 5	< 5	< 5	< 5	< 5	< 5	NA
Bromoform	< 5	< 5	< 5	< 1	< 1	< 1	< 5	< 5	< 5	< 5	< 5	< 5	5
1,1,2,2,-Tetrachloroethane	< 5	< 5	< 5	< 1	< 1	< 1	< 5	< 5	< 5	< 5	< 5	< 5	0.04
1,2,3-Trichloropropane	< 5	< 5	< 5	< 1	< 1	< 1	< 5	< 5	< 5	110	22	< 5	NA
Acetone	< 5	71	< 5	14	< 1	< 1	< 5	< 5	< 5	< 5	< 5	< 5	NA
MEK	< 5	< 5	< 5	< 1	< 1	< 1	< 5	< 5	< 5	< 5	< 5	< 5	1
Benzene	< 5	< 5	< 5	< 1	< 1	< 1	< 5	< 5	< 5	< 5	< 5	< 5	NA
MIBK	< 5	< 5	< 5	< 1	< 1	< 1	< 5	< 5	< 5	< 5	< 5	< 5	5
Toluene	< 5	< 5	< 5	< 1	< 1	< 1	< 5	< 5	< 5	< 5	< 5	< 5	NA
MBK	< 5	< 5	< 5	< 1	< 1	< 1	< 5	< 5	< 5	< 5	< 5	< 5	5
Chlorobenzene	< 5	< 5	< 5	< 1	< 1	< 1	< 5	< 5	< 5	< 5	< 5	< 5	5
Ethylbenzene	< 5	< 5	< 5	< 1	< 1	< 1	< 5	< 5	< 5	< 5	< 5	< 5	5
M&P Xylene	< 5	< 5	< 5	< 1	< 1	< 1	< 5	< 5	< 5	< 5	< 5	< 5	5
O- Xylene	< 5	< 5	< 5	< 1	< 1	< 1	< 5	< 5	< 5	< 5	< 5	< 5	5
Styrene	< 5	< 5	< 5	< 1	< 1	< 1	< 5	< 5	< 5	< 5	< 5	< 5	5

NOTES:

[1] - Indicates depth below ground surface.

[2] - Referenced from NYSDEC 'Final Express Terms for Amendments to Title 6, Chapter X Parts 700-706', 3/98

NA - Class GA Groundwater Standard not established

TABLE 4.15 (con't.)

MACKENZIE CHEMICAL SITE

VERTICAL PROFILE WELLS - GROUNDWATER SAMPLES
VOLATILE ORGANIC COMPOUNDS - MOBILE LABORATORY

SAMPLE ID	VP-8			VP-9			VP-9X[3]	VP-10			NYSDEC
DEPTH OF SAMPLE[1]	60ft	80ft	100ft	60ft	80ft	100ft		60ft	80ft	100ft	GW STAND.[2]
PARAMETERS - (ug/l)											
Chloromethane	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 10	< 10	< 10	NA
Vinyl Chloride	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 10	< 10	< 10	2
Bromomethane	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 10	< 10	< 10	5
Chloroethane	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 10	< 10	< 10	5
1,1-Dichloroethene	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 10	< 10	< 10	5
Methylene Chloride	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 10	< 10	< 10	5
trans -1,2-Dichloroethene	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 10	< 10	< 10	5
1,1-Dichloroethane	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 10	< 10	< 10	0 6
cis -1,2-Dichloroethene	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 10	< 10	< 10	NA
Chloroform	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 10	< 10	< 10	7
1,1,1-Trichloroethane	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 10	< 10	< 10	5
Carbon Tetrachloride	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 10	< 10	< 10	5
1,2-Dichloroethane	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 10	< 10	< 10	0 6
Trichloroethene	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 10	< 10	< 10	5
1,2-Dichloropropane	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 10	< 10	< 10	1
Bromodichloromethane	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 10	< 10	< 10	NA
cis -1,3-Dichloropropene	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 10	< 10	< 10	0 4
trans -1,3-Dichloropropene	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 10	< 10	< 10	0 4
1,1,2-Trichloroethane	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 10	< 10	< 10	1
Tetrachloroethylene	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 10	< 10	< 10	NA
Dibromochloromethane	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 10	< 10	< 10	NA
Bromoform	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 10	< 10	< 10	NA
1,1,2,2,-Tetrachloroethane	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 10	< 10	< 10	5
1,2,3-Trichloropropane	< 5	< 5	< 5	< 5	< 5	< 5	< 5	15	< 10	36	0 04
Acetone	< 1	< 5	< 5	< 5	< 5	< 5	< 5	< 10	< 10	< 10	NA
MEK	< 1	< 5	< 5	< 5	< 5	< 5	< 5	< 10	< 10	< 10	NA
Benzene	< 1	< 5	< 5	< 5	< 5	< 5	< 5	< 10	< 10	< 10	1
MIBK	< 1	< 5	< 5	< 5	< 5	< 5	< 5	< 10	< 10	< 10	NA
Toluene	< 1	< 5	< 5	< 5	< 5	< 5	< 5	< 10	< 10	< 10	5
MBK	< 1	< 5	< 5	< 5	< 5	< 5	< 5	< 10	< 10	< 10	NA
Chlorobenzene	< 1	< 5	< 5	< 5	< 5	< 5	< 5	< 10	< 10	< 10	5
Ethylbenzene	< 1	< 5	< 5	< 5	< 5	< 5	< 5	< 10	< 10	< 10	5
M&P Xylene	< 1	< 5	< 5	< 5	< 5	< 5	< 5	< 10	< 10	< 10	5
O- Xylene	< 1	< 5	< 5	< 5	< 5	< 5	< 5	< 10	< 10	< 10	5
Styrene	< 1	< 5	< 5	< 5	< 5	< 5	< 5	< 10	< 10	< 10	5

NOTES:

[1] - Indicates depth below ground surface

[2] - Referenced from NYSDEC Final Express Terms for Amendments to Title 6, Chapter X Parts 700-706', 3/98

[3] - VP-9X is a blind duplicate of VP-9, 100' bgs

NA - Class GA Groundwater Standard not established

TABLE 4.15 (con't.)

MACKENZIE CHEMICAL SITE

VERTICAL PROFILE WELLS - GROUNDWATER SAMPLES
VOLATILE ORGANIC COMPOUNDS - MOBILE LABORATORY

SAMPLE ID	VP-11			VP-11X[3]	Field Blank	Field Blank	NYSDEC
DATE / DEPTH OF SAMPLE[1]	60ft	80ft	100ft		12-Nov	13-Nov	GW STAND.[2]
PARAMETERS - (ug/l)							
Chloromethane	< 500	< 500	< 500	< 500	< 1	< 1	NA
Vinyl Chloride	< 500	< 500	< 500	< 500	< 1	< 1	2
Bromomethane	< 500	< 500	< 500	< 500	< 1	< 1	5
Chloroethane	< 500	< 500	< 500	< 500	< 1	< 1	5
1,1-Dichloroethene	< 500	< 500	< 500	< 500	< 1	< 1	5
Methylene Chloride	< 500	< 500	< 500	< 500	< 1	< 1	5
trans -1,2-Dichloroethene	< 500	< 500	< 500	< 500	< 1	< 1	5
1,1-Dichloroethane	< 500	< 500	< 500	< 500	< 1	< 1	0.6
cis -1,2-Dichloroethene	< 500	< 500	< 500	< 500	< 1	< 1	NA
Chloroform	< 500	< 500	< 500	< 500	< 1	< 1	7
1,1,1-Trichloroethane	< 500	< 500	< 500	< 500	< 1	< 1	5
Carbon Tetrachloride	< 500	< 500	< 500	< 500	< 1	< 1	5
1,2-Dichloroethane	< 500	< 500	< 500	< 500	< 1	< 1	0.6
Trichloroethene	< 500	< 500	< 500	< 500	< 1	< 1	5
1,2-Dichloropropane	< 500	< 500	< 500	< 500	< 1	< 1	1
Bromodichloromethane	< 500	< 500	< 500	< 500	< 1	< 1	NA
cis -1,3-Dichloropropene	< 500	< 500	< 500	< 500	< 1	< 1	0.4
trans -1,3-Dichloropropene	< 500	< 500	< 500	< 500	< 1	< 1	0.4
1,1,2-Trichloroethane	< 500	< 500	< 500	< 500	< 1	< 1	1
Tetrachloroethylene	5,600 D	< 500	< 500	< 500	< 1	< 1	NA
Dibromochloromethane	< 500	< 500	< 500	< 500	< 1	< 1	NA
Bromoform	< 500	< 500	< 500	< 500	< 1	< 1	NA
1,1,2,2-Tetrachloroethane	< 500	< 500	< 500	< 500	< 1	< 1	5
1,2,3-Trichloropropane	570 D	9,300 D	2,000 D	< 500	< 1	< 1	0.04
Acetone	< 500	< 500	< 500	< 500	< 1	< 1	NA
MEK	< 500	< 500	< 500	< 500	< 1	< 1	NA
Benzene	< 500	< 500	< 500	< 500	< 1	< 1	1
MIBK	< 500	< 500	< 500	< 500	< 1	< 1	NA
Toluene	< 500	< 500	< 500	< 500	< 1	< 1	5
MBK	< 500	< 500	< 500	< 500	< 1	< 1	NA
Chlorobenzene	< 500	< 500	< 500	< 500	< 1	< 1	5
Ethylbenzene	< 500	< 500	< 500	< 500	< 1	< 1	5
M&P Xylene	< 500	< 500	< 500	< 500	< 1	< 1	5
O- Xylene	< 500	< 500	< 500	< 500	< 1	< 1	5
Styrene	< 500	< 500	< 500	< 500	< 1	< 1	5

NOTES:

[1] - Indicates depth below ground surface

[2] - Referenced from NYSDEC Final Express Terms for Amendments to Title 6, Chapter X Parts 700-706', 3/98.

[3] - VP-11X is a blind duplicate of VP-11, 100' bgs.

D - Indicates a secondary dilution factor used for analysis

NA - Class GA Groundwater Standard not established

TABLE 4.16

MACKENZIE CHEMICAL SITE

VERTICAL PROFILE WELLS - GROUNDWATER SAMPLES
VOLATILE ORGANIC COMPOUNDS - ANALYTICAL LABORATORY

SAMPLE ID	VP-2		DUP[3]		VP-3		VP-4		VP-6		VP-8		VP-10		TB		TB		FB		FB		NYSDEC
DATE/DEPTH OF SAMPLE[1]	80ft				60ft		120ft		80ft		80ft		100ft		24-Nov		12-Nov		12-Nov		24-Nov		GW STAND.[2]
PARAMETERS (ug/l)																							
Chloromethane	10	U	10	U	10	U	10	U	10	U	10	U	10	U	10	U	10	U	10	U	10	U	NA
Bromomethane	10	U	10	U	10	U	10	U	10	U	10	U	10	U	10	U	10	U	10	U	10	U	5
Vinyl Chloride	10	U	10	U	10	U	10	U	10	U	10	U	10	UJ	10	U	10	U	10	U	10	U	2
Chloroethane	10	U	10	U	10	U	10	U	10	U	10	U	10	U	10	U	10	U	10	U	10	U	5
Methylene Chloride	10	U	10	U	10	U	10	U	10	U	10	U	10	U	10	U	2	JB	2	JB	10	U	5
Acetone	10	U	10	U	10	U	10	U	10	U	10	U	10	U	10	U	10	U	10	U	10	U	NA
Carbon Disulfide	10	UJ	10	UJ	10	UJ	10	UJ	10	UJ	10	UJ	10	U	10	U	10	U	10	U	10	U	NA
1,1-Dichloroethene	10	U	10	U	10	U	10	U	10	U	10	U	10	UJ	10	U	10	U	10	U	10	U	5
1,1-Dichloroethane	10	U	10	U	10	U	10	U	10	U	10	U	10	U	10	U	10	U	10	U	10	U	5
1,2-Dichloroethene (Total)	10	U	10	U	10	U	10	U	10	U	10	U	1	J	10	U	10	U	10	U	10	U	NA
Chloroform	10	U	10	U	10	U	10	U	10	U	10	U	10	U	10	U	10	U	10	U	10	U	7
1,2-Dichloroethane	10	U	10	U	10	U	10	U	10	U	10	U	10	U	10	U	10	U	10	U	10	U	0.6
2-Butanone (MEK)	10	U	10	U	10	U	10	U	10	U	10	U	10	U	10	U	10	U	10	U	10	U	NA
1,1,1-Trichloroethane	10	U	10	U	10	U	10	U	10	U	10	U	10	U	10	U	10	U	10	U	10	U	5
Carbon Tetrachloride	10	U	10	U	10	U	10	U	10	U	10	U	10	U	10	U	10	U	10	U	10	U	5
Bromodichloromethane	10	U	10	U	10	U	10	U	10	U	10	U	10	U	10	U	10	U	10	U	10	U	NA
1,2-Dichloropropane	10	U	10	U	10	U	10	U	10	U	10	U	10	U	10	U	10	U	10	U	10	U	1
cis-1,3-Dichloropropene	10	U	10	U	10	U	10	U	10	U	10	U	10	U	10	U	10	U	10	U	10	U	0.4
Trichloroethene (TCE)	10	U	10	U	10	U	10	U	10	U	10	U	10	U	10	U	10	U	10	U	10	U	5
Dibromochloromethane	10	U	10	U	10	U	10	U	10	U	10	U	10	U	10	U	10	U	10	U	10	U	NA
1,1,2-Trichloroethane	10	U	10	U	10	U	10	U	10	U	10	U	10	U	10	U	10	U	10	U	10	U	1
Benzene	10	U	10	U	10	U	10	U	10	U	10	U	10	U	10	U	10	U	10	U	10	U	1
trans-1,3-Dichloropropene	10	U	10	U	10	U	10	U	10	U	10	U	10	U	10	U	10	U	10	U	10	U	0.4
Bromoform	10	U	10	U	10	U	10	U	10	U	10	U	10	U	10	U	10	U	10	U	10	U	NA
4-MethylL-2-Pentanone	10	U	10	U	10	U	10	U	10	U	10	U	10	U	10	U	10	U	10	U	10	U	NA
2-Hexanone	10	U	10	U	10	U	10	U	10	U	10	U	10	U	10	U	10	U	10	U	10	U	NA
Tetrachloroethene (PCE)	10	U	10	U	2	J	10	U	10	U	10	U	10	U	10	U	10	U	10	U	10	U	5
1,1,2,2-Tetrachloroethane	10	U	10	U	10	U	10	U	10	U	10	U	10	U	10	U	10	U	10	U	10	U	5
Toluene	10	U	10	U	10	U	10	U	10	U	10	U	10	U	10	U	10	U	10	U	10	U	5
Chlorobenzene	10	U	10	U	10	U	10	U	10	U	10	U	10	U	10	U	10	U	10	U	10	U	5
Ethylbenzene	10	U	10	U	10	U	10	U	10	U	10	U	10	U	10	U	10	U	10	U	10	U	5
Styrene	10	U	10	U	10	U	10	U	10	U	10	U	10	U	10	U	10	U	10	U	10	U	5
Xylenes (Total)	10	U	10	U	10	U	10	U	10	U	10	U	10	U	10	U	10	U	10	U	10	U	5
1,2,3- Trichloropropane	<500	NJ	<500	NJ	10	NJ	10	U	10	U	10	U	10	NJ	10	U	10	U	10	U	10	U	0.04
TICs (Total Concentration)	10	U	10	U	12	NJ	21	NJ	10	U	18	NJ	10	U	10	U	10	U	10	U	10	U	NA

NOTES:

[1] - Indicates depth below ground surface.

[2] - Referenced from NYSDEC Final Express Terms for Amendments to Title 6, Chapter X Parts 700-706, 3/98.

[3] - DUP represents blind duplicate of VP-2, 80 ft.

U - Indicates compound was analyzed for but not detected.

J - Indicates an estimated value.

B - Indicates analyte was found in method blank.

N - Indicates presumtavive evidence of a compound.

TABLE 4.17

MACKENZIE CHEMICAL SITE

VERTICAL PROFILE WELLS - GROUNDWATER SAMPLES
SEMI-VOLATILE ORGANIC COMPOUNDS - ANALYTICAL LABORATORY

SAMPLE ID	VP-2		DUP[4]		VP-3		VP-4		VP-6		VP-8		VP-10		FB		FB		NYSDEC
DATE/DEPTH OF SAMPLE[1]	80ft				60ft		120ft		80ft		80ft		100ft		24-Nov		12-Nov		GW STAND.[2]
PARAMETERS (ug/l)																			
Phenol	10	U	10	U	10	U	11	U	10	U	11	U	11	U	11	UJ	10	U	1[3]
bis(2-Chloroethyl)Ether	10	U	10	U	10	U	11	U	10	U	11	U	11	U	11	UJ	10	U	NA
2-Chlorophenol	10	U	10	U	10	U	11	U	10	U	11	U	11	U	11	UJ	10	U	NA
1,3-Dichlorobenzene	10	U	10	U	10	U	11	U	10	U	11	U	11	U	11	UJ	10	U	3
1,4-Dichlorobenzene	10	U	10	U	10	U	11	U	10	U	11	U	11	U	11	UJ	10	U	3
1,2-Dichlorobenzene	10	U	10	U	10	U	11	U	10	U	11	U	11	U	11	UJ	10	U	3
2-Methylphenol	10	U	10	U	10	U	11	U	10	U	11	U	11	U	11	UJ	10	U	NA
2,2'-oxybis(1-Chloropropane)	10	U	10	U	10	U	11	U	10	U	11	U	11	U	11	UJ	10	U	NA
4-Methylphenol	10	U	10	U	10	U	11	U	10	U	11	U	11	U	11	UJ	10	U	NA
N-Nitroso-di-n-propylamine	10	U	10	U	10	U	11	U	10	U	11	U	11	U	11	UJ	10	U	NA
Hexachloroethane	10	U	10	U	10	U	11	U	10	U	11	U	11	U	11	UJ	10	U	5
Nitrobenzene	10	U	10	U	10	U	11	U	10	U	11	U	11	U	11	UJ	10	U	0.4
Isophorone	10	U	10	U	10	U	11	U	10	U	11	U	11	U	11	UJ	10	U	NA
2-Nitrophenol	10	U	10	U	10	U	11	U	10	U	11	U	11	U	11	UJ	10	U	NA
2,4-Dimethylphenol	10	U	10	U	10	U	11	U	10	U	11	U	11	U	11	UJ	10	U	1[3]
bis(2-Chloroethoxy)Methane	10	U	10	U	10	U	11	U	10	U	11	U	11	U	11	UJ	10	U	NA
2,4-Dichlorophenol	10	U	10	U	10	U	11	U	10	U	11	U	11	U	11	UJ	10	U	1[3]
1,2,4-Trichlorobenzene	10	U	10	U	10	U	11	U	10	U	11	U	11	U	11	UJ	10	U	5
Naphthalene	10	U	10	U	10	U	11	U	10	U	11	U	11	U	11	UJ	10	U	NA
4-Chloroaniline	10	U	10	U	10	U	11	U	10	U	11	U	11	U	11	UJ	10	U	5
Hexachlorobutadiene	10	U	10	U	10	U	11	U	10	U	11	U	11	U	11	UJ	10	U	0.5
4-Chloro-3-Methylphenol	10	U	10	U	10	U	11	U	10	U	11	U	11	U	11	UJ	10	U	1[3]
2-Methylnaphthalene	10	U	10	U	10	U	11	U	10	U	11	U	11	U	11	UJ	10	U	NA
Hexachlorocyclopentadiene	10	U	10	U	10	U	11	U	10	U	11	U	11	UJ	11	UJ	10	U	5
2,4,6-Trichlorophenol	10	U	10	U	10	U	11	U	10	U	11	U	11	U	11	UJ	10	U	1[3]
2,4,5-Trichlorophenol	25	U	25	U	25	U	28	U	25	U	27	U	29	U	28	UJ	25	U	1[3]
2-Chloronaphthalene	10	U	10	U	10	U	11	U	10	U	11	U	11	U	11	UJ	10	U	NA
2-Nitroaniline	25	U	25	U	25	U	28	U	25	U	27	U	29	U	28	UJ	25	U	5
Dimethylphthalate	10	U	10	U	10	U	11	U	10	U	11	U	11	U	11	UJ	10	U	NA
Acenaphthylene	10	U	10	U	10	U	11	U	10	U	11	U	11	U	11	UJ	10	U	NA
2,6-Dinitrotoluene	10	U	10	U	10	U	11	U	10	U	11	U	11	U	11	UJ	10	U	5
3-Nitroaniline	25	U	25	U	25	U	28	U	25	U	27	U	29	U	28	UJ	25	U	5
Acenaphthene	10	U	10	U	10	U	11	U	10	U	11	U	11	U	11	UJ	10	U	NA
2,4-Dinitrophenol	25	UJ	25	UJ	25	UJ	28	UJ	25	UJ	27	UJ	29	UJ	28	UJ	25	UJ	1[3]
4-Nitrophenol	25	U	25	U	25	U	28	U	25	U	27	U	29	U	28	UJ	25	U	1[3]
Dibenzofuran	10	U	10	U	10	U	11	U	10	U	11	U	11	U	11	UJ	10	U	NA
2,4-Dinitrotoluene	10	U	10	U	10	U	11	U	10	U	11	U	11	U	11	UJ	10	U	5
Diethylphthalate	10	U	10	U	280	D	11	U	10	U	11	U	11	U	11	UJ	10	U	NA
4-Chlorophenyl-phenylether	10	U	10	U	10	U	11	U	10	U	11	U	11	U	11	UJ	10	U	NA
Fluorene	10	U	10	U	10	U	11	U	10	U	11	U	11	U	11	UJ	10	U	NA
4-Nitroaniline	25	U	25	U	25	U	28	U	25	U	27	U	29	U	28	UJ	25	U	5
4,6-Dinitro-2-Methylphenol	25	U	25	U	25	U	28	U	25	U	27	U	29	U	28	UJ	25	U	NA
N-Nitrosodiphenylamine	10	U	10	U	10	U	11	U	10	U	11	U	11	U	11	UJ	10	U	NA
4-Bromophenyl-phenylether	10	U	10	U	10	U	11	U	10	U	11	U	11	U	11	UJ	10	U	NA
Hexachlorobenzene	10	U	10	U	10	U	11	U	10	U	11	U	11	U	11	UJ	10	U	0.04
Pentachlorophenol	25	U	25	U	25	U	28	U	25	U	27	U	29	U	28	UJ	25	U	1[3]
Phenanthrene	10	U	10	U	10	U	11	U	10	U	11	U	11	U	11	UJ	10	U	NA
Anthracene	10	U	10	U	10	U	11	U	10	U	11	U	11	U	11	UJ	10	U	NA
Carbazole	10	U	10	U	10	U	11	U	10	U	11	U	11	U	11	UJ	10	U	NA
Di-n-butylphthalate	10	U	10	U	1	J	11	U	10	U	11	U	11	U	11	UJ	2	J	NA
Fluoranthene	10	U	10	U	10	U	11	U	10	U	11	U	11	U	11	UJ	10	U	NA
Pyrene	10	U	10	U	10	U	11	U	10	U	11	U	11	U	11	UJ	10	U	NA
Butylbenzylphthalate	10	U	10	U	10	U	1	J	10	U	11	U	11	U	11	UJ	10	U	NA
3,3'-Dichlorobenzidine	10	U	10	U	10	U	11	U	10	U	11	U	11	U	11	UJ	10	U	5
Benzo(a)anthracene	10	U	10	U	10	U	11	U	10	U	11	U	11	U	11	UJ	10	U	NA
Chrysene	10	U	10	U	10	U	11	U	10	U	11	U	11	U	11	UJ	10	U	NA
bis(2-Ethylhexyl)phthalate	10	U	10	U	10	U	11	U	10	U	11	U	11	U	11	UJ	2	JB	5
Di-n-octylphthalate	10	U	10	U	10	U	1	JB	10	U	11	U	11	U	11	UJ	10	U	NA
Benzo(b)fluoranthene	10	U	10	U	10	U	11	U	10	U	11	U	11	U	11	UJ	10	U	NA
Benzo(k)fluoranthene	10	U	10	U	10	U	11	U	10	U	11	U	11	U	11	UJ	10	U	NA
Benzo(a)pyrene	10	U	10	U	10	U	11	U	10	U	11	U	11	U	11	UJ	10	U	ND
Indeno(1,2,3-cd)pyrene	10	U	10	U	10	U	11	U	10	U	11	U	11	U	11	UJ	10	U	NA
Dibenz(a,h)anthracene	10	U	10	U	10	U	11	U	10	U	11	U	11	U	11	UJ	10	U	NA
Benzo(g,h,i)perylene	10	U	10	U	10	U	11	U	10	U	11	U	11	U	11	UJ	10	U	NA

NOTES:

[1] - Indicates depth below ground surface

[2] - Referenced from NYSDEC 'Final Express Terms for Amendments to Title 6, Chapter X Parts 700-706', 3/98

[3] - 1 ug/l standard applies to the sum of all phenolic compounds

[4] - DUP represents blind duplicate of VP-2, 80 ft.

U - Indicates compound was analyzed for but not detected

J - Indicates an estimated value

D - Indicates a secondary dilution factor used for analysis

B - Indicates analyte was found in method blank.

NA - Class GA Groundwater Standard not established

ND - Non-detectable

TABLE 4.18

MACKENZIE CHEMICAL SITE

VERTICAL PROFILE WELLS - GROUNDWATER SAMPLES
PESTICIDES/PCBs - ANALYTICAL LABORATORY

SAMPLE ID	VP-2	DUP[4]	VP-3	VP-4	VP-6	VP-7	VP-10	FB	FB	NYSDEC
DATE / DEPTH OF SAMPLE[1]	80ft		60ft	120ft	80ft	80ft	100ft	24-Nov	12-Nov	GW STAND[2]
PARAMETERS (ug/l)										
alpha-BHC	0.053 U	0.05 U	0.052 U	0.053 U	0.053 U	0.054 UJ	0.059 U	0.057 UJ	0.051 U	NA
beta-BHC	0.053 U	0.05 U	0.052 U	0.053 U	0.053 U	0.054 UJ	0.059 U	0.057 UJ	0.051 U	NA
delta-BHC	0.053 U	0.05 U	0.052 U	0.053 U	0.053 U	0.054 UJ	0.059 U	0.057 UJ	0.051 U	NA
gamma-BHC (Lindane)	0.053 U	0.05 U	0.052 U	0.053 U	0.053 U	0.054 UJ	0.059 U	0.057 UJ	0.051 U	NA
Heptachlor	0.053 U	0.05 U	0.052 U	0.053 U	0.053 U	0.054 UJ	0.059 U	0.057 UJ	0.051 U	NA
Aldrin	0.053 U	0.05 U	0.052 U	0.053 U	0.053 U	0.054 UJ	0.059 U	0.057 UJ	0.051 U	ND
Heptachlor Epoxide	0.053 U	0.05 U	0.052 U	0.053 U	0.053 U	0.054 UJ	0.059 U	0.057 UJ	0.051 U	0.03
Endosulfan I	0.053 U	0.05 U	0.052 U	0.053 U	0.053 U	0.054 UJ	0.059 U	0.057 UJ	0.051 U	NA
Dieldrin	0.11 U	0.10 U	0.10 U	0.11 U	0.11 U	0.11 UJ	0.12 U	0.11 UJ	0.10 U	0.004
4,4'-DDE	0.11 U	0.10 U	0.10 U	0.11 U	0.11 U	0.11 UJ	0.12 U	0.11 UJ	0.10 U	0.2
Endrin	0.11 U	0.10 U	0.10 U	0.11 U	0.11 U	0.11 UJ	0.12 U	0.11 UJ	0.10 U	ND
Endosulfan II	0.11 U	0.10 U	0.10 U	0.11 U	0.11 U	0.11 UJ	0.12 U	0.11 UJ	0.10 U	NA
4,4'-DDD	0.11 U	0.10 U	0.10 U	0.11 U	0.11 U	0.11 UJ	0.12 U	0.11 UJ	0.10 U	0.3
Endosulfan Sulfate	0.11 U	0.10 U	0.10 U	0.11 U	0.11 U	0.11 UJ	0.12 U	0.11 UJ	0.10 U	NA
4,4'-DDT	0.11 U	0.10 U	0.10 U	0.11 U	0.11 U	0.11 UJ	0.12 U	0.11 UJ	0.10 U	0.2
Methoxychlor	0.53 U	0.50 U	0.52 U	0.53 U	0.53 U	0.54 UJ	0.59 U	.57 UJ	0.51 U	35
Endrin Ketone	0.11 U	0.10 U	0.10 U	0.11 U	0.11 U	0.11 UJ	0.12 U	0.11 UJ	0.10 U	5
Endrin Aldehyde	0.11 U	0.10 U	0.10 U	0.11 U	0.11 U	0.11 UJ	0.12 U	0.11 UJ	0.10 U	5
alpha-Chlordane	0.053 U	0.05 U	0.052 U	0.053 U	0.053 U	0.054 UJ	0.059 U	0.057 UJ	0.051 U	0.05
gamma-Chlordane	0.053 U	0.05 U	0.052 U	0.053 U	0.053 U	0.054 UJ	0.059 U	0.057 UJ	0.051 U	0.05
Toxaphene	5.3 U	5.0 U	5.2 U	5.3 U	5.3 U	5.4 UJ	5.9 U	5.7 UJ	5.1 U	0.06
Aroclor-1016	1.1 U	1.0 U	1.0 U	1.1 U	1.1 U	1.1 UJ	1.2 U	1.1 UJ	1.0 U	0.09[3]
Aroclor-1221	2.1 U	2.0 U	2.1 U	2.1 U	2.1 U	2.2 UJ	2.4 U	2.3 UJ	2.0 U	0.09[3]
Aroclor-1232	1.1 U	1.0 U	1.0 U	1.1 U	1.1 U	1.1 UJ	1.2 U	1.1 UJ	1.0 U	0.09[3]
Aroclor-1242	1.1 U	1.0 U	1.0 U	1.1 U	1.1 U	1.1 UJ	1.2 U	1.1 UJ	1.0 U	0.09[3]
Aroclor-1248	1.1 U	1.0 U	1.0 U	1.1 U	1.1 U	1.1 UJ	1.2 U	1.1 UJ	1.0 U	0.09[3]
Aroclor-1254	1.1 U	1.0 U	1.0 U	1.1 U	1.1 U	1.1 UJ	1.2 U	1.1 UJ	1.0 U	0.09[3]
Aroclor-1260	1.1 U	1.0 U	1.0 U	1.1 U	1.1 U	1.1 UJ	1.2 U	1.1 UJ	1.0 U	0.09[3]

NOTES:

[1] - Indicates depth below ground surface

[2] - Referenced from NYSDEC 'Final Express Terms for Amendments to Title 6, Chapter X Parts 700-706', 3/98.

[3] - Class GA Groundater Effluent Standard reflects sum of all aroclors

[4] - DUP represents blind duplicate of VP-2, 80 ft

U - Indicates compound was analyzed for but not detected

J - Indicates an estimated value

NA - NYSDEC Class GA Water Quality Standard not established.

ND - Non-detectable

TABLE 4.19

MACKENZIE CHEMICAL SITE

VERTICAL PROFILE WELLS - GROUNDWATER SAMPLES
TAL METALS - ANALYTICAL LABORATORY

SAMPLE ID	VP-2		DUP[3]		VP-3		VP-4		VP-6		VP-8		VP-10		FB		FB		NYSDEC GW
DATE / DEPTH OF SAMPLE	80ft				60ft		120ft		80ft		80ft		100ft		24-Nov		12-Nov		STANDARDS[2]
PARAMETERS (ug/l)																			
Aluminum	2,410	J	971	J	12,300	J	10,100	J	23,800	J	16,400	J	8,090	J	182	U	182	U	NA
Antimony	58.1	U	58.1	U	60.3		58.1	U	58.1	U	58.1	U	58.1	U	58.1	U	58.1	U	3
Arsenic	1.8	U	1.8	U	2.0	B	3.0	B	12.0		12.9		34.7		1.8	U	1.8	U	25
Barium	619	J	1,090	J	495	J	484	J	1,010	J	426	J	425	J	40.3	B	2.8	U	1,000
Beryllium	0.48	B	0.40	U	0.89	B	0.60	B	1.6	B	0.97	B	1.3	B	0.40	U	0.40	U	NA
Cadmium	4.6	UJ	4.6	UJ	4.6	UJ	4.6	UJ	4.6	UJ	4.6	UJ	4.6	UJ	4.6	U	4.6	U	5
Calcium	23,500		25,600		25,100		23,300		20,900		13,300		16,400		632	B	70.0	U	NA
Chromium	260	J	613	J	1,150	J	412	J	1,510	J	1,000	J	836	J	9.1	U	10.6		50
Cobalt	34.8	B	56.6		39.4	B	22.3	B	60.4		27.7	B	36.2	B	16.9	U	16.9	U	NA
Copper	32.5	J	44.4	J	44.6	J	31.3	J	186	J	47.7	J	40.5		24.3	B	16.6	U	200
Iron	75,500		114,000		137,000		77,700		184,000		160,000		177,000		99.4	B	31.8	B	500[4]
Lead	10.4	J	1.8	BJ	18.9	J	11.7	J	12.6	J	11.0	J	59.2	J	1.5	B	0.90	U	25
Magnesium	3,840	BJ	3,860	BJ	5,440	J	9,880	J	6,260	J	5,090	J	3,900	BJ	83.1	U	83.1	U	NA
Manganese	1,280		2,060		1,370		1,960		14,700		2,960		9,180		15.2		6.6	U	500[4]
Mercury	0.23		0.29		0.10	U	0.10	U	0.22		0.11	B	0.1	U	0.10	U	0.10	U	0.7
Nickel	41.6		69.1		137		48.1		248		155		79.4		29.2	U	29.2	U	100
Potassium	4,600	B	6,090		6,200		8,470		7,340		6,880		9,280		1,850	U	1,850	U	NA
Selenium	1.5	U	1.5	U	1.5	UJ	1.5	UJ	1.5	UJ	1.5	U	1.5	UJ	1.5	U	1.5	U	10
Silver	9.7	U	9.7	U	9.7	U	9.7	U	9.7	U	9.7	U	9.7	U	0.50	U	9.7	U	50
Sodium	56,200		58,100		25,600		29,500		18,700		25,500		27,100		3,810	B	574	U	20,000
Thallium	1.2	U	1.2	U	1.2	U	1.2	U	1.2	U	1.2	U	6	U	1.2	U	1.2	U	NA
Vanadium	12.9	U	12.9	U	27.6	B	21.8	B	21.8	B	31.9	B	18.9	B	12.9	U	12.9	U	NA
Zinc	157	J	205		129	J	132	J	1,480		219		106		16.6	U	16.6	U	NA
Cyanide	1.4	U	1.4	U	1.4	U	1.4	U	1.4	U	1.4	U	1.6	B	1.4	U	1.4	U	200

NOTES:

[1] - Indicates depth below ground surface.

[2] - Referenced from NYSDEC 'Final Express Terms for Amendments to Title 6, Chapter X Parts 700-706', 3/98.

[3] - DUP represents blind duplicate of VP-2, 80 ft.

[4] - 500 mg/l groundwater standard applies to sum of Iron and Manganese.

U - Indicates compound was analyzed for but not detected.

B - Indicates analyte was found in method blank.

NA - Class GA Groundwater Standard not established

TABLE 4.20

MACKENZIE CHEMICAL SITE

HYDROPUNCH TEMPORARY WELLPOINTS - GROUNDWATER SAMPLES
VOLATILE ORGANIC COMPOUNDS - ANALYTICAL LABORATORY

SAMPLE ID	HP-1			HP-2					HP-3		HP-4			NYSDEC
DEPTH OF SAMPLE [1]	120ft	140ft	160ft	80ft	100ft	120ft	140ft	160ft	140ft	160ft	120ft	140ft	160ft	GW STAND.[2]
PARAMETERS (ug/l)														
Chloromethane	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	NA
Bromomethane	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	5
Vinyl Chloride	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	2
Chloroethane	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	5
Methylene Chloride	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	5
1,1-Dichloroethene	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	5
1,1-Dichloroethane	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	5
1,2-Dichloroethene (Total)	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	NA
Chloroform	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	7
1,2-Dichloroethane	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	0 6
1,1,1-Trichloroethane	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	5
Carbon Tetrachloride	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	5
Bromodichloromethane	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	NA
1,2-Dichloropropane	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	1
trans -1,3-Dichloropropene	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	0 4
Trichloroethene (TCE)	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	5
Dibromochloromethane	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	NA
1,1,2-Trichloroethane	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	1
cis -1,3-Dichloropropene	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	0 4
Benzene	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	1
Bromoform	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	NA
1,1,2,2-Tetrachloroethane	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	5
Tetrachloroethene (PCE)	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	5
Toluene	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	5
Chlorobenzene	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	5
Ethylbenzene	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	5
Xylenes (Total)	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	5
Acetone	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	NA
2-Butanone (MEK)	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	NA
4-Methyl-2-Pentanone (MIBK)	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	NA
Carbon Disulfide	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	NA
2-Hexanone	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	NA
Styrene	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	5
1,2,3- Trichloropropane	< 10	< 10	< 10	43 NJ	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	0 04

NOTES:

[1] - Indicates depth below ground surface

[2] - Referenced from NYSDEC Final Express Terms for Amendments to Title 6, Chapter X Parts 700-706, 3/98

NA - Class GA Groundwater Standard not established

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TABLE 4.21

MACKENZIE CHEMICAL SITE
January 1999
OFF-SITE MONITORING WELLS - GROUNDWATER SAMPLES
VOLATILE ORGANIC COMPOUNDS - ANALYTICAL LABORATORY

SAMPLE ID / DEPTH OF SAMPLE [1]	OS-1D	OS-2S	OS-2I	OS-2D	OS-3S	OS-3I	OS-3D	OS-4D	OS-5S	OS-5D	Field	NYSDEC GW STAND.[2]
PARAMETERS (ug/l)												
Chloromethane	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	NA
Bromomethane	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	5
Vinyl Chloride	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	2
Chloroethane	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	5
Methylene Chloride	12 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	7 JB	5
Acetone	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	NA
Carbon Disulfide	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	NA
1,1-Dichloroethene	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	5
1,1-Dichloroethane	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	5
1,2-Dichloroethene (Total)	10 U	1 J	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	NA
Chloroform	10 U	10 U	10 U	10 U	10 U	1 J	10 U	10 U	1 J	3 J	10 U	7
1,2-Dichloroethane	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	0.6
2-Butanone (MEK)	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	NA
1,1,1-Trichloroethane	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	5
Carbon Tetrachloride	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	5
Bromodichloromethane	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	1 J	10 U	NA
1,2-Dichloropropane	10 U	10 U	10 U	10 U	9 J	10 U	10 U	10 U	10 U	10 U	10 U	1
cis-1,3-Dichloropropene	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	0.4
Trichloroethene (TCE)	10 U	10 U	10 U	10 U	9 J	10 U	10 U	10 U	10 U	10 U	10 U	5
Dibromochloromethane	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	NA
1,1,2-Trichloroethane	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	1
Benzene	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	1
trans-1,3-Dichloropropene	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	0.4
Bromoform	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	NA
4-Methyl-2-Pentanone	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	NA
2-Hexanone	10 UJ	10 U	10 UJ	10 UJ	10 UJ	10 UJ	10 UJ	10 U	10 U	10 U	10 U	NA
Tetrachloroethene (PCE)	10 U	10 U	3 J	10 U	6 J	10 U	10 U	10 U	10 U	10 U	10 U	5
1,1,2,2-Tetrachloroethane	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	5
Toluene	2 J	1 J	10 U	1 J	1 J	10 U	10 U	10 U	10 U	1 J	10 U	5
Chlorobenzene	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	5
Ethylbenzene	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	5
Styrene	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	5
Xylenes (Total)	10 U	10 U	10 U	10 U	4 J	10 U	10 U	10 U	10 U	10 U	10 U	5
1,2,3- Trichloropropane	10 U	10 U	10 NJ	10 U	>>1000 NJ	10 NJ	150 NJ	10 U	10 U	10 U	10 U	0.04
TICs (Total Concentration)	10 U	150 B	10 U	10 U	379 N	10 U	10 U	10 U	10 U	10 U	24 JB	NA

NOTES:

[1] - Indicates depth below ground surface.

[2] - Referenced from NYSDEC Final Express Terms for Amendments to Title 6, Chapter X Parts 700-706, 3/98.

U - Indicates compound was analyzed for but not detected

J - Indicates an estimated value.

B - Indicates analyte was found in method blank.

N - Indicates presumtavive evidence of a compound

NA - Class GA Groundwater Standard not established

TABLE 4.22

MACKENZIE CHEMICAL SITE
August 1999
OFF-SITE MONITORING WELLS - GROUNDWATER SAMPLES
VOLATILE ORGANIC COMPOUNDS

SAMPLE ID	OS-1D		OS-2S		OS-2I		OS-2D		OS-3S		OS-3I		OS-3D		OS-4D		OS-5S		OS-5D		NYSDEC [1]
PARAMETERS (ug/l)																					
Dichlorodifluoromethane	1	U	1	U	1	U	1	U	50	U	1	U	1	U	1	U	1	U	1	U	5
Chloromethane	1	U	1	U	1	U	1	U	50	U	1	U	1	U	1	U	1	U	1	U	5
Vinyl Chloride	1	U	1	U	1	U	1	U	50	U	1	U	1	U	1	U	1	U	1	U	2
Bromomethane	1	U	1	U	1	U	1	U	50	U	1	U	1	U	1	U	1	U	1	U	5
Chloroethane	1	U	1	U	1	U	1	U	50	U	1	U	1	U	1	U	1	U	1	U	5
1,1-Dichloroethene	1	U	1	U	1	U	1	U	50	U	1	U	1	U	1	U	1	U	1	U	5
Methylene Chloride	1	U	1	U	1	U	1	U	50	U	1	U	1	U	1	U	1	U	1	U	5
trans-1,2-Dichloroethene	1	U	1	U	1	U	1	U	50	U	1	U	1	U	1	U	1	U	1	U	5
1,1-Dichloroethane	1	U	1	U	1	U	1	U	50	U	1	U	1	U	1	U	1	U	1	U	5
2,2-Dichloropropane	1	U	1	U	1	U	1	U	50	U	1	U	1	U	1	U	1	U	1	U	1
cis-1,2-Dichloroethene	1	U	1	U	1	U	1	U	50	U	1	U	1	U	1	U	1	U	1	U	5
Chloroform	1	U	1	U	1	U	1	U	50	U	1	U	1	U	1	U	1	U	1	U	7
Bromochloromethane	1	U	1	U	1	U	1	U	50	U	1	U	1	U	1	U	1	U	1	U	5
1,1,1-Trichloroethane	1	U	1	U	1	U	1	U	50	U	1	U	1	U	1	U	1	U	1	U	5
1,1-Dichloropropene	1	U	1	U	1	U	1	U	50	U	1	U	1	U	1	U	1	U	1	U	NA
Carbon Tetrachloride	1	U	1	U	1	U	1	U	50	U	1	U	1	U	1	U	1	U	1	U	5
1,2-Dichloroethane	1	U	1	U	1	U	1	U	50	U	1	U	1	U	1	U	1	U	1	U	0.6
Trichloroethene	1	U	1	U	1	U	1	U	50	U	1	U	1	U	1	U	1	U	1	U	5
1,2-Dichloropropane	1	U	1	U	1	U	6	U	50	U	1	U	1	U	1	U	1	U	1	U	1
Bromodichloromethane	1	U	1	U	1	U	1	U	50	U	1	U	1	U	1	U	1	U	1	U	NA
Dibromomethane	1	U	1	U	1	U	1	U	50	U	1	U	1	U	1	U	1	U	1	U	5
cis-1,3-Dichloropropene	1	U	1	U	1	U	1	U	50	U	1	U	1	U	1	U	1	U	1	U	NA
trans-1,3-Dichloropropene	1	U	1	U	1	U	1	U	50	U	1	U	1	U	1	U	1	U	1	U	NA
1,1,2-Trichloroethane	1	U	1	U	1	U	1	U	50	U	1	U	1	U	1	U	1	U	1	U	1
1,3-Dichloropropane	1	U	1	U	1	U	1	U	50	U	1	U	1	U	1	U	1	U	1	U	5
Tetrachloroethene	1	U	1	U	1	U	1	U	50	U	1	U	1	U	1	U	1	U	1	U	5
Dibromochloromethane	1	U	1	U	1	U	1	U	50	U	1	U	1	U	1	U	1	U	1	U	NA
Chlorobenzene	1	U	1	U	1	U	1	U	50	U	1	U	1	U	1	U	1	U	1	U	5
1,1,1,2-Tetrachloroethane	1	U	1	U	1	U	1	U	50	U	1	U	1	U	1	U	1	U	1	U	5
Bromoform	1	U	1	U	1	U	1	U	50	U	1	U	1	U	1	U	1	U	1	U	NA
1,1,2,2-Tetrachloroethane	1	U	1	U	1	U	1	U	50	U	1	U	1	U	1	U	1	U	1	U	5
1,2,3-Trichloropropane	220	D	2		6		160	D	3000		4		1	U	490	D	24		90	D	0.04
m-Dichlorobenzene	1	U	1	U	1	U	1	U	50	U	1	U	1	U	1	U	1	U	1	U	NA
p-Dichlorobenzene	1	U	1	U	1	U	1	U	50	U	1	U	1	U	1	U	1	U	1	U	NA
o-Dichlorobenzene	1	U	1	U	1	U	1	U	50	U	1	U	1	U	1	U	1	U	1	U	NA
1,2,4-Trichlorobenzene	1	U	1	U	1	U	1	U	50	U	1	U	1	U	1	U	1	U	1	U	5
Hexachlorobutadadiene	1	U	1	U	1	U	1	U	50	U	1	U	1	U	1	U	1	U	1	U	0.5
1,2,3-Trichlorobenzene	1	U	1	U	1	U	1	U	50	U	1	U	1	U	1	U	1	U	1	U	5
Methyl tert Butyl ether	1	U	1	U	1	U	1	U	50	U	1	U	1	U	1	U	1	U	1	U	NA
Benzene	1	U	1	U	1	U	1	U	50	U	1	U	1	U	1	U	1	U	1	U	1
Toluene	1	U	1	U	1	U	1	U	50	U	1	U	1	U	1	U	1	U	1	U	5
Ethylbenzene	1	U	1	U	1	U	1	U	50	U	1	U	1	U	1	U	1	U	1	U	5
m-Xylene	1	U	1	U	1	U	1	U	50	U	1	U	1	U	1	U	1	U	1	U	NA
p-Xylene	1	U	1	U	1	U	1	U	50	U	1	U	1	U	1	U	1	U	1	U	NA
o-Xylene	1	U	1	U	1	U	1	U	50	U	1	U	1	U	1	U	1	U	1	U	NA
Stryene	1	U	1	U	1	U	1	U	50	U	1	U	1	U	1	U	1	U	1	U	5
Isopropylbenzene (Cumene)	1	U	1	U	1	U	1	U	50	U	1	U	1	U	1	U	1	U	1	U	5
n-Propylbenzene	1	U	1	U	1	U	1	U	50	U	1	U	1	U	2		1	U	1	U	5
Bromobenzene	1	U	1	U	1	U	1	U	50	U	1	U	1	U	1	U	1	U	1	U	5
1,3,5-Trimethylbenzene	1	U	1	U	1	U	1	U	50	U	1	U	1	U	1	U	1	U	1	U	5
o-Chlorotoluene	1	U	1	U	1	U	1	U	50	U	1	U	1	U	1	U	1	U	1	U	NA
p-Chlorotoluene	1	U	1	U	1	U	1	U	50	U	1	U	1	U	1	U	1	U	1	U	NA
tert. Butylbenzene	1	U	1	U	1	U	1	U	50	U	1	U	1	U	1	U	1	U	1	U	5
1,2,4-Trimethylbenzene	1	U	1	U	1	U	1	U	50	U	1	U	1	U	1	U	1	U	1	U	5
sec-Butylbenzene	1	U	1	U	1	U	1	U	50	U	1	U	1	U	1	U	1	U	1	U	5
p-Isopropyltoluene (p-Cymene)	1	U	1	U	1	U	1	U	50	U	1	U	1	U	1	U	1	U	1	U	NA
n-Butylbenzene	1	U	1	U	1	U	1	U	50	U	1	U	1	U	1	U	1	U	1	U	5
Napthalene	1	U	1	U	1	U	1	U	50	U	1	U	1	U	1	U	1	U	1	U	NA

NOTES:

[1] - Ground Water Standard Referenced from NYSDEC Final Express Terms for Amendments to Title 6, Chapter X Parts 700-706, 3/98.

U - Indicates compound was analyzed for but not detected.

J - Indicates an estimated value.

B - Indicates analyte was found in method blank.

N - Indicates presumtavive evidence of a compound

NA - Class GA Groundwater Standard not established

TABLE 4.23

MACKENZIE CHEMICAL SITE
February 2000
OFF-SITE MONITORING WELLS - GROUNDWATER SAMPLES
VOLATILE ORGANIC COMPOUNDS - ANALTYICAL LABORATORY

SAMPLE ID	OS-1D		OS-2S		OS-2I		OS-2D		OS-3S		OS-3I		OS-3D		OS-4D		OS-5S		OS-5D		FIELD		NYSDEC
DEPTH OF SAMPLE[1]	160 ft.		60 ft.		130 ft.		160 ft.		60 ft.		120 ft.		158 ft.		155 ft.		60 ft		150 ft.		BLANK		GW STAND.[2]
PARAMETERS (ug/l)																							
Chloromethane	10	U	10	U	10	U	10	U	50	U	10	U	10	U	10	U	10	U	10	U	10	U	NA
Bromomethane	10	U	10	U	10	U	10	U	50	U	10	U	10	U	10	U	10	U	10	U	10	U	5
Vinyl Chloride	10	U	10	U	10	U	10	U	50	U	10	U	10	U	10	U	10	U	10	U	10	U	2
Chloroethane	10	U	10	U	10	U	10	U	50	U	10	U	10	U	10	U	10	U	10	U	10	U	5
Methylene Chloride	10	U	10	U	10	U	15	U	50	U	10	U	10	U	2	JB	2	JB	2	JB	2	JB	5
Acetone	10	U	10	U	10	U	10	U	50	U	10	U	2	J	10	U	10	U	10	U	10	U	NA
Carbon Disulfide	10	U	10	U	10	U	10	U	50	U	10	U	10	U	10	U	10	U	10	U	10	U	NA
1,1-Dichloroethene	10	U	10	U	10	U	10	U	50	U	10	U	10	U	10	U	10	U	10	U	10	U	5
1,1-Dichloroethane	10	U	10	U	10	U	10	U	50	U	10	U	10	U	10	U	10	U	10	U	10	U	5
1,2-Dichloroethene (Total)	10	U	10	U	10	U	10	U	50	U	10	U	10	U	10	U	10	U	10	U	10	U	NA
Chloroform	10	U	2	J	10	U	10	U	50	U	10	U	10	U	10	U	10	U	10	U	10	U	7
1,2-Dichloroethane	10	U	10	U	10	U	10	U	50	U	10	U	10	U	10	U	10	U	10	U	10	U	0.6
2-Butanone (MEK)	10	U	10	U	10	U	3	J	50	U	10	U	10	U	10	U	10	U	10	U	10	U	NA
1,1,1-Trichloroethane	10	U	10	U	10	U	10	U	50	U	10	U	10	U	1	J	10	U	10	U	10	U	5
Carbon Tetrachloride	10	U	10	U	10	U	10	U	50	U	10	U	10	U	10	U	10	U	10	U	10	U	5
Bromodichloromethane	10	U	10	U	10	U	10	U	50	U	10	U	10	U	10	U	10	U	10	U	10	U	NA
1,2-Dichloropropane	10	U	10	U	10	U	10	U	50	U	10	U	10	U	10	U	10	U	10	U	10	U	1
cis-1,3-Dichloropropene	10	U	10	U	10	U	10	U	50	U	10	U	10	U	10	U	10	U	10	U	10	U	0.4
Trichloroethene (TCE)	10	U	10	U	10	U	10	U	50	U	10	U	10	U	10	U	10	U	10	U	10	U	5
Dibromochloromethane	10	U	10	U	10	U	10	U	50	U	10	U	10	U	10	U	10	U	10	U	10	U	NA
1,1,2-Trichloroethane	10	U	10	U	10	U	10	U	50	U	10	U	10	U	10	U	10	U	10	U	10	U	1
Benzene	10	U	10	U	1	J	10	U	110	D	10	U	10	U	10	U	10	U	10	U	10	U	1
trans-1,3-Dichloropropene	10	U	10	U	10	U	10	U	50	U	10	U	10	U	10	U	10	U	10	U	10	U	0.4
Bromoform	10	U	10	U	10	U	10	U	50	U	10	U	10	U	10	U	10	U	10	U	10	U	NA
4-Methyl-2-Pentanone	10	U	10	U	10	U	10	U	50	U	10	U	10	U	10	U	10	U	10	U	10	U	NA
2-Hexanone	10	U	10	U	10	U	10	U	50	U	10	U	10	UJ	10	U	10	U	10	U	10	U	NA
Tetrachloroethene (PCE)	10	U	10	U	10	U	10	U	50	U	10	U	10	U	10	U	10	U	10	U	10	U	5
1,1,2,2-Tetrachloroethane	10	U	10	U	10	U	10	U	50	U	10	U	10	U	10	U	10	U	10	U	10	U	5
Toluene	10	J	10	U	3	J	10	U	50	U	10	U	10	U	10	U	10	U	10	U	10	U	5
Chlorobenzene	10	U	10	U	10	U	10	U	50	U	10	U	10	U	10	U	10	U	10	U	10	U	5
Ethylbenzene	10	U	10	U	10	U	10	U	50	U	10	U	10	U	10	U	10	U	10	U	10	U	5
Styrene	10	U	10	U	10	U	10	U	50	U	10	U	10	U	10	U	10	U	10	U	10	U	5
Xylenes (Total)	10	U	10	U	10	U	10	U	50	U	10	U	10	U	10	U	10	U	10	U	10	U	5
1,2,3-Trichloropropane	69	J	10	U	4	J	1	J	8900	J	6	J	10	UJ	26	J	10	UJ	10	UJ	10	U	0.04
TICs (Total Concentration)																							NA

Notes:

[1] - Indicates depth below ground surface

[2] - Referenced from NYSDEC Final Express Terms for Amendments to Title 6, Chapter X Parts 700-706, 3/98

U - Indicates compound was analyzed for but not detected.

J - Indicates as estimated value.

B - Indicates analyte was found in method blank.

N - Indicates presumtavive evidence of a compound

NA - Class GA Groundwater Standard not established

TABLE 4.24

MACKENZIE CHEMICAL SITE
January 1999
OFF-SITE MONITORING WELLS - GROUNDWATER SAMPLES
SEMI-VOLATILE ORGANIC COMPOUNDS - ANALYTICAL LABORATORY

SAMPLE ID	OS-1D		OS-2S		OS-2I		OS-2D		OS-3S		OS-3I		OS-3D		NYSDEC
DEPTH OF SAMPLE[1]	160ft		60ft		130ft		160ft		60ft		120ft		158ft		GW STAND.[2]
PARAMETERS (ug/l)															
Phenol	12	U	12	U	12	U	11	U	12	U	13	U	12	U	1[3]
bis(2-Chloroethyl)Ether	12	U	12	U	12	U	11	U	12	U	13	U	12	U	NA
2-Chlorophenol	12	U	12	U	12	U	11	U	12	U	13	U	12	U	NA
1,3-Dichlorobenzene	12	U	12	U	12	U	11	U	8	J	13	U	12	U	3
1,4-Dichlorobenzene	12	U	12	U	12	U	11	U	6	J	13	U	12	U	3
1,2-Dichlorobenzene	12	U	12	U	12	U	11	U	10	J	13	U	12	U	3
2-Methylphenol	12	U	12	U	12	U	11	U	12	U	13	U	12	U	NA
2,2'-oxybis(1-Chloropropane)	12	U	12	U	12	U	11	U	12	U	13	U	12	U	NA
4-Methylphenol	12	U	12	U	12	U	11	U	12	U	13	U	12	U	NA
N-Nitroso-di-n-propylamine	12	U	12	U	12	U	11	U	12	U	13	U	12	U	NA
Hexachloroethane	12	U	12	U	12	U	11	U	12	U	13	U	12	U	5
Nitrobenzene	12	U	12	U	12	U	11	U	12	U	13	U	12	U	0.4
Isophorone	12	U	12	U	12	U	11	U	12	U	13	U	12	U	NA
2-Nitrophenol	12	U	12	U	12	U	11	U	12	U	13	U	12	U	NA
2,4-Dimethylphenol	12	U	12	U	12	U	11	U	12	U	13	U	12	U	1[3]
bis(2-Chloroethoxy)Methane	12	U	12	U	12	U	11	U	12	U	13	U	12	U	NA
2,4-Dichlorophenol	12	U	12	U	12	U	11	U	12	U	13	U	12	U	1[3]
1,2,4-Trichlorobenzene	12	U	12	U	12	U	11	U	12	U	13	U	12	U	5
Naphthalene	12	U	12	U	12	U	11	U	6	J	13	U	12	U	NA
4-Chloroaniline	12	U	12	U	12	U	11	U	12	U	13	U	12	U	5
Hexachlorobutadiene	12	U	12	U	12	U	11	U	12	U	13	U	12	U	0.5
4-Chloro-3-Methylphenol	12	U	12	U	12	U	11	U	12	U	13	U	12	U	1[3]
2-Methylnaphthalene	12	U	12	U	12	U	11	U	20		13	U	12	U	NA
Hexachlorocyclopentadiene	12	U	12	U	12	U	11	U	12	UJ	13	U	12	U	5
2,4,6-Trichlorophenol	12	U	12	U	12	U	11	U	12	UJ	13	U	12	U	1[3]
2,4,5-Trichlorophenol	29	U	30	U	29	U	29	U	30	UJ	32	U	29	U	1[3]
2-Chloronaphthalene	12	U	12	U	12	U	11	U	12	UJ	13	U	12	U	NA
2-Nitroaniline	29	U	30	U	29	U	29	U	30	UJ	32	U	29	U	5
Dimethylphthalate	12	U	12	U	12	U	11	U	12	UJ	13	U	12	U	NA
Acenaphthylene	12	U	12	U	12	U	11	U	12	UJ	13	U	12	U	NA
2,6-Dinitrotoluene	12	U	12	U	12	U	11	U	12	UJ	13	U	12	U	5
3-Nitroaniline	29	U	30	U	29	U	29	U	30	UJ	32	U	29	U	5
Acenaphthene	12	U	12	U	12	U	11	U	12	UJ	13	U	12	U	NA
2,4-Dinitrophenol	29	UJ	30	UJ	29	UJ	29	UJ	30	UJ	32	UJ	29	UJ	1[3]
4-Nitrophenol	29	U	30	U	29	U	29	U	30	UJ	32	U	29	U	1[3]
Dibenzofuran	12	U	12	U	12	U	11	U	12	UJ	13	U	12	U	NA
2,4-Dinitrotoluene	12	U	12	U	12	U	11	U	12	UJ	13	U	12	U	5
Diethylphthalate	12	U	12	U	12	U	11	U	12	UJ	13	U	12	U	NA
4-Chlorophenyl-phenylether	12	U	12	U	12	U	11	U	12	UJ	13	U	12	U	NA
Fluorene	12	U	12	U	12	U	11	U	4	J	13	U	12	U	NA
4-Nitroaniline	29	U	30	U	29	U	29	U	30	UJ	32	U	29	U	5
4,6-Dinitro-2-Methylphenol	29	U	30	U	29	U	29	U	30	U	32	U	29	U	NA
N-Nitrosodiphenylamine	12	U	12	U	12	U	11	U	12	U	13	U	12	U	NA
4-Bromophenyl-phenylether	12	U	12	U	12	U	11	U	12	U	13	U	12	U	NA
Hexachlorobenzene	12	U	12	U	12	U	11	U	12	U	13	U	12	U	0.04
Pentachlorophenol	29	U	30	U	29	U	29	U	30	U	32	U	29	U	1[3]
Phenanthrene	12	U	12	U	12	U	11	U	12	U	13	U	12	U	NA
Anthracene	12	U	12	U	12	U	11	U	12	U	13	U	12	U	NA
Carbazole	12	U	12	U	12	U	11	U	12	U	13	U	12	U	NA
Di-n-butylphthalate	12	U	12	U	12	U	11	U	12	U	13	U	12	U	NA
Fluoranthene	12	U	12	U	12	U	11	U	12	U	13	U	12	U	NA
Pyrene	12	U	12	U	12	U	11	U	12	U	13	U	12	U	NA
Butylbenzylphthalate	12	U	12	U	12	U	11	U	12	U	13	U	12	U	NA
3,3'-Dichlorobenzidine	12	U	12	U	12	U	11	U	12	U	13	U	12	U	5
Benzo(a)anthracene	12	U	12	U	12	U	11	U	12	U	13	U	12	U	NA
Chrysene	12	U	12	U	12	U	11	U	12	U	13	U	12	U	NA
bis(2-Ethylhexyl)phthalate	12	U	12	U	12	U	40		12	U	13	U	12	U	5
Di-n-octylphthalate	12	U	12	U	12	U	11	U	12	U	13	U	12	U	NA
Benzo(b)fluoranthene	12	U	12	U	12	U	11	U	12	U	13	U	12	U	NA
Benzo(k)fluoranthene	12	U	12	U	12	U	11	U	12	U	13	U	12	U	NA
Benzo(a)pyrene	12	U	12	U	12	U	11	U	12	U	13	U	12	U	ND
Indeno(1,2,3-cd)pyrene	12	U	12	U	12	U	11	U	12	U	13	U	12	U	NA
Dibenzo(a,h)anthracene	12	U	12	U	12	U	11	U	12	U	13	U	12	U	NA
Benzo(g,h,i)perylene	12	U	12	U	12	U	11	U	12	U	13	U	12	U	NA

NOTES:

[1] - Indicates depth below ground surface.

[2] - Referenced from NYSDEC 'Final Express Terms for Amendments to Title 6, Chapter X Parts 700-706', 3/98.

[3] - 1 ug/l standard applies to the sum of all phenolic compounds.

U - Indicates compound was analyzed for but not detected

J - Indicates an estimated value.

NA - Class GA Groundwater Standard not established

ND - Non-detectable

TABLE 4.24 (con't.)

MACKENZIE CHEMICAL SITE
January 1999
OFF-SITE MONITORING WELLS - GROUNDWATER SAMPLES
SEMI-VOLATILE ORGANIC COMPOUNDS - ANALYTICAL LABORATORY

SAMPLE ID	OS-4D		OS-5S		OS-5D		Field		NYSDEC
DEPTH OF SAMPLE[1]	155ft		60ft		150ft		Blank		GW STAND.[2]
PARAMETERS (ug/l)									
Phenol	11	U	12	U	12	U	15	U	1[3]
bis(2-Chloroethyl)Ether	11	U	12	U	12	U	15	U	NA
2-Chlorophenol	11	U	12	U	12	U	15	U	NA
1,3-Dichlorobenzene	11	U	12	U	12	U	15	U	3
1,4-Dichlorobenzene	11	U	12	U	12	U	15	U	3
1,2-Dichlorobenzene	11	U	12	U	12	U	15	U	3
2-Methylphenol	11	U	12	U	12	U	15	U	NA
2,2'-oxybis(1-Chloropropane)	11	U	12	U	12	U	15	U	NA
4-Methylphenol	11	U	12	U	12	U	15	U	NA
N-Nitroso-di-n-propylamine	11	U	12	U	12	U	15	U	NA
Hexachloroethane	11	U	12	U	12	U	15	U	5
Nitrobenzene	11	U	12	U	12	U	15	U	0.4
Isophorone	11	U	12	U	12	U	15	U	NA
2-Nitrophenol	11	U	12	U	12	U	15	U	NA
2,4-Dimethylphenol	11	U	12	U	12	U	15	U	1[3]
bis(2-Chloroethoxy)Methane	11	U	12	U	12	U	15	U	NA
2,4-Dichlorophenol	11	U	12	U	12	U	15	U	1[3]
1,2,4-Trichlorobenzene	11	U	12	U	12	U	15	U	5
Naphthalene	11	U	12	U	12	U	15	U	NA
4-Chloroaniline	11	U	12	U	12	U	15	U	5
Hexachlorobutadiene	11	U	12	U	12	U	15	U	0.5
4-Chloro-3-Methylphenol	11	U	12	U	12	U	15	U	1[3]
2-Methylnaphthalene	11	U	12	U	12	U	15	U	NA
Hexachlorocyclopentadiene	11	U	12	U	12	U	15	U	5
2,4,6-Trichlorophenol	11	U	12	U	12	U	15	U	1[3]
2,4,5-Trichlorophenol	28	U	31	U	30	U	38	U	1[3]
2-Chloronaphthalene	11	U	12	U	12	U	15	U	NA
2-Nitroaniline	28	U	31	U	30	U	38	U	5
Dimethylphthalate	11	U	12	U	12	U	15	U	NA
Acenaphthylene	11	U	12	U	12	U	15	U	NA
2,6-Dinitrotoluene	11	U	12	U	12	U	15	U	5
3-Nitroaniline	28	U	31	U	30	U	38	U	5
Acenaphthene	11	U	12	U	12	U	15	U	NA
2,4-Dinitrophenol	28	UJ	31	UJ	30	UJ	38	UJ	1[3]
4-Nitrophenol	28	U	31	U	30	U	38	U	1[3]
Dibenzofuran	11	U	12	U	12	U	15	U	NA
2,4-Dinitrotoluene	11	U	12	U	12	U	15	U	5
Diethylphthalate	11	U	12	U	12	U	15	U	NA
4-Chlorophenyl-phenylether	11	U	12	U	12	U	15	U	NA
Fluorene	11	U	12	U	12	U	15	U	NA
4-Nitroaniline	28	U	31	U	30	U	38	U	5
4,6-Dinitro-2-Methylphenol	28	U	31	U	30	U	38	U	NA
N-Nitrosodiphenylamine	11	U	12	U	12	U	15	U	NA
4-Bromophenyl-phenylether	11	U	12	U	12	U	15	U	NA
Hexachlorobenzene	11	U	12	U	12	U	15	U	0.04
Pentachlorophenol	28	U	31	U	30	U	38	U	1[3]
Phenanthrene	11	U	12	U	12	U	15	U	NA
Anthracene	11	U	12	U	12	U	15	U	NA
Carbazole	11	U	12	U	12	U	15	U	NA
Di-n-butylphthalate	11	U	12	U	12	U	15	U	NA
Fluoranthene	11	U	12	U	12	U	15	U	NA
Pyrene	11	U	12	U	12	U	15	U	NA
Butylbenzylphthalate	11	U	12	U	12	U	15	U	NA
3,3'-Dichlorobenzidine	11	U	12	U	12	U	15	U	5
Benzo(a)anthracene	11	U	12	U	12	U	15	U	NA
Chrysene	11	U	12	U	12	U	15	U	NA
bis(2-Ethylhexyl)phthalate	11	U	12	U	12	U	15	J	5
Di-n-octylphthalate	11	U	12	U	12	U	15	U	NA
Benzo(b)fluoranthene	11	U	12	U	12	U	15	U	NA
Benzo(k)fluoranthene	11	U	12	U	12	U	15	U	NA
Benzo(a)pyrene	11	U	12	U	12	U	15	U	ND
Indeno(1,2,3-cd)pyrene	11	U	12	U	12	U	15	U	NA
Diberizo(a,h)anthracene	11	U	12	U	12	U	15	U	NA
Benzo(g,h,i)perylene	11	U	12	U	12	U	15	U	NA

NOTES:

[1] - Indicates depth below ground surface.
[2] - Referenced from NYSDEC 'Final Express Terms for Amendments to Title 6, Chapter X Parts 700-706', 3/98.
[3] - 1 ug/l standard applies to the sum of all phenolic compounds.
U - Indicates compound was analyzed for but not detected
J - Indicates an estimated value.
NA - Class GA Groundwater Standard not established
ND - Non-detectable

TABLE 4.25

MACKENZIE CHEMICAL SITE
January 1999
OFF-SITE MONITORING WELLS - GROUNDWATER SAMPLES
PESTICIDES/PCBs - ANALYTICAL LABORATORY

SAMPLE ID	OS-1D	OS-2S	OS-2I	OS-2D	OS-3S	OS-3I	OS-3D	OS-4D	OS-5S	OS-5D	Field	NYSDEC
DEPTH OF SAMPLE [1]	160ft	60ft	130ft	160ft	60ft	120ft	158ft	155ft	60ft	150ft	Blank	GW STAND[2]
PARAMETERS (ug/l)												
alpha-BHC	.071 U	.059 U	.064 U	.067 U	.062 U	.071 U	.062 U	.068 U	.058 UJ	.06 U	.054 U	NA
beta-BHC	.071 U	.059 U	.064 U	.067 U	.062 U	.071 U	.062 U	.068 U	.058 UJ	.06 U	.054 U	NA
delta-BHC	.071 U	.059 U	.064 U	.067 U	.062 U	.071 U	.062 U	.068 U	.058 UJ	.06 U	.054 U	NA
gamma-BHC (Lindane)	.071 U	.059 U	.064 U	.067 U	.062 U	.071 U	.062 U	.068 U	.058 UJ	.06 U	.054 U	NA
Heptachlor	.071 U	.059 U	.064 U	.067 U	.062 U	.071 U	.062 U	.068 U	.058 UJ	.06 U	.054 U	NA
Aldrin	.071 U	.059 U	.064 U	.067 U	.062 U	.071 U	.062 U	.068 U	.058 UJ	.06 U	.054 U	ND
Heptachlor Epoxide	.071 U	.059 U	.064 U	.067 U	.062 U	.071 U	.062 U	.068 U	.058 UJ	.06 U	.054 U	0.03
Endosulfan I	.071 U	.059 U	.064 U	.067 U	.062 U	.071 U	.062 U	.068 U	.058 UJ	.06 U	.054 U	NA
Dieldrin	.14 U	.12 U	.13 U	.13 U	.12 U	.14 U	.12 U	.14 U	.12 UJ	.12 U	.11 U	0.004
4,4'-DDE	.14 U	.12 U	.13 U	.13 U	.12 U	.14 U	.12 U	.14 U	.12 UJ	.12 U	.11 U	0.2
Endrin	.14 U	.12 U	.13 U	.13 U	.12 U	.14 U	.12 U	.14 U	.12 UJ	.12 U	.11 U	ND
Endosulfan II	.14 U	.12 U	.13 U	.13 U	.12 U	.14 U	.12 U	.14 U	.12 UJ	.12 U	.11 U	NA
4,4'-DDD	.14 U	.12 U	.13 U	.13 U	.12 U	.14 U	.12 U	.14 U	.12 UJ	.12 U	.11 U	0.3
Endosulfan Sulfate	.14 U	.12 U	.13 U	.13 U	.12 U	.14 U	.12 U	.14 U	.12 UJ	.12 U	.11 U	NA
4,4'-DDT	.14 U	.12 U	.13 U	.13 U	.12 U	.14 U	.12 U	.14 U	.12 UJ	.12 U	.11 U	0.2
Methoxychlor	.71 U	.59 U	.64 U	.67 U	.62 U	.71 U	.62 U	.68 U	.58 UJ	.60 U	.54 U	35
Endrin Ketone	.14 U	.12 U	.13 U	.13 U	.12 U	.14 J	.0071 J	.14 U	.12 UJ	.12 U	.11 U	5
Endrin Aldehyde	.14 U	.12 U	.13 U	.13 U	.12 U	.14 U	.12 U	.14 U	.12 UJ	.12 U	.11 U	5
alpha-Chlordane	.071 U	.059 U	.064 U	.067 U	.062 U	.071 U	.062 U	.068 U	.058 UJ	.06 U	.054 U	0.05
gamma-Chlordane	.071 U	.059 U	.064 U	.067 U	.062 U	.071 U	.062 U	.068 U	.058 UJ	.06 U	.054 U	0.05
Toxaphene	7.1 U	5.9 U	6.4 U	6.7 U	6.2 U	7.1 U	6.2 U	6.8 U	5.8 UJ	6.0 U	5.4 U	0.06
Aroclor-1016	1.4 U	1.2 U	1.3 U	1.3 U	1.2 U	1.4 U	1.2 U	1.4 U	1.2 UJ	1.2 U	1.1 U	0.09[3]
Aroclor-1221	2.8 U	2.4 U	2.6 U	2.7 U	2.5 U	2.8 U	2.5 U	2.7 U	2.3 UJ	2.4 U	2.2 U	0.09[3]
Aroclor-1232	1.4 U	1.2 U	1.3 U	1.3 U	1.2 U	1.4 U	1.2 U	1.4 U	1.2 UJ	1.2 U	1.1 U	0.09[3]
Aroclor-1242	1.4 U	1.2 U	1.3 U	1.3 U	1.2 U	1.4 U	1.2 U	1.4 U	1.2 UJ	1.2 U	1.1 U	0.09[3]
Aroclor-1248	1.4 U	1.2 U	1.3 U	1.3 U	1.2 U	1.4 U	1.2 U	1.4 U	1.2 UJ	1.2 U	1.1 U	0.09[3]
Aroclor-1254	1.4 U	1.2 U	1.3 U	1.3 U	1.2 U	1.4 U	1.2 U	1.4 U	1.2 UJ	1.2 U	1.1 U	0.09[3]
Aroclor-1260	1.4 U	1.2 U	1.3 U	1.3 U	1.2 U	1.4 U	1.2 U	1.4 U	1.2 UJ	1.2 U	1.1 U	0.09[3]

NOTES:

[1] - Indicates depth below ground surface.

[2] - Referenced from NYSDEC 'Final Express Terms for Amendments to Title 6, Chapter X Parts 700-706', 3/98.

[3] - Class GA Groundater Effluent Standard reflects sum of all aroclors

U - Indicates compound was analyzed for but not detected

NA - NYSDEC Class GA Water Quality Standard not established.

ND - Non-detectable

TABLE 4.26

MACKENZIE CHEMICAL SITE
January 1999
OFF-SITE MONITORING WELLS - GROUNDWATER SAMPLES
TAL METALS - ANALYTICAL LABORATORY

SAMPLE ID	OS-1D		OS-2S		OS-2I		OS-2D		OS-3S		OS-3I		OS-3D		OS-4D		OS-5S		OS-5D		Field		NYSDEC GW
DEPTH OF SAMPLE[1]	160ft		60ft		130ft		160ft		60ft		120ft		158ft		155ft		60ft		150ft		Blank		STANDARDS[2]
PARAMETERS (ug/l)																							
Aluminum	126	U	2,070		193	B	574		31,200		127	B	186	B	126	U	20,400		818		126	U	NA
Antimony	53.8	U	53.8	U	53.8	U	53.8	U	53.8	U	53.8	U	53.8	U	53.8	U	53.8	U	53.8	U	53.8	U	3
Arsenic	2.6	U	2.6	U	2.6	U	2.6	U	18.2		2.6	U	2.6	U	2.6	UJ	15.1		2.6	U	2.6	U	25
Barium	11.0	B	80.1	B	30.8	B	71.7	B	386		16.8	B	31.1	B	19.9	B	416		24.0	B	3.5	U	1,000
Beryllium	0.50	U	0.50	U	0.50	U	0.50	U	0.71	B	0.50	U	0.50	U	0.50	U	0.50	U	0.50	U	0.50	U	NA
Cadmium	4.3	U	4.3	U	4.3	U	4.3	U	10.4		4.3	U	4.3	U	4.3	U	6.7		4.3	U	4.3	U	5
Calcium	17,100		5,940		21,000		342,000		37,000		21,900		23,400		20,500		37,100		15,200		125	U	NA
Chromium	6.6	U	6.6	U	6.6	U	124		54.5		6.6	U	6.6	U	6.6	U	43.6		102		6.6	U	50
Cobalt	12.6	U	12.6	U	12.6	U	12.6	U	89.8		12.6	U	12.6	U	12.6	U	17.9	B	12.6	U	12.6	U	NA
Copper	10.8	B	7.6	U	7.6	U	7.6	U	107		7.6	U	7.6	U	7.6	U	38.1		7.6	U	7.6	U	200
Iron	347		3,800		450		857		45,200		349		513		102		40,200		652		45.0	U	300
Lead	1.9	B	5.8		5.3		30.3		35.3		6.9		2.7	B	1.4	B	25.6		2.7	B	0.36	U	25
Magnesium	1,950	B	1,220	B	5,440		398	B	6,990		3,760	B	4,290	B	3,250	B	9,700		4,390	B	33.7	U	NA
Manganese	191		278		104		10.5	B	5,200		51.3		655		646		2,630		113		2.7	U	300
Mercury	0.09	U	0.09	U	0.09	U	0.09	U	0.14	B	0.09	U	0.09	U	0.09	U	0.18	B	0.09	U	0.09	U	0.7
Nickel	11.4	U	11.4	U	11.4	U	11.4	U	46.8		11.4	U	11.4	U	11.4	U	31.5	B	11.4	U	11.4	U	100
Potassium	1,140	U	1,140	U	1,140	U	7,380		8,060		1,140	U	1140	U	1,150	B	6,770		44,600		3.39	U	NA
Selenium	2.1	U	2.1	U	2.1	U	2.1	UJ	10.5	U	2.1	U	2.1	U	2.1	U	2.1	U	2.1	UJ	2.1	U	10
Silver	8.6	UJ	8.6	UJ	8.6	UJ	8.6	UJ	8.6	UJ	8.6	UJ	8.6	UJ	8.6	UJ	8.6	UJ	8.6	UJ	8.6	UJ	50
Sodium	6,050		7,130		13,100		20,000		14,800		11,300		11,800		9,120		78,600		29,200		393	U	20,000
Thallium	0.80	U	0.80	U	0.80	U	0.80	U	4.0	U	0.80	U	0.80	U	0.80	U	0.80	U	0.80	U	0.80	U	NA
Vanadium	10.8	U	10.8	U	10.8	U	10.8	U	49.4	B	10.8	U	10.8	U	10.8	U	47.0	B	10.8	U	10.8	U	NA
Zinc	20.6	J	33.3	J	100		16.5	UJ	295		64.3	J	195		322		199		28.0	J	16.5	U	NA
Cyanide	1.4	UJ	1.4	UJ	5.8	BJ	1.4	UJ	1.4	UJ	20	J	1.4	UJ	1.4	UJ	1.4	UJ	1.4	UJ	1.4	UJ	200

NOTES:

[1] - Indicates depth below ground surface.

[2] - Referenced from NYSDEC 'Final Express Terms for Amendments to Title 6, Chapter X Parts 700-706', 3/98.

U - Indicates compound was analyzed for but not detected.

B - Indicates analyte was found in method blank.

NA - Class GA Groundwater Standard not established

TABLE 4.27

MACKENZIE CHEMICAL SITE

MISCELLANEOUS LIQUID SAMPLES
VOLATILE ORGANIC COMPOUNDS - MOBILE LABORATORY

SAMPLE ID	DS-5	DS-12 PIPE	NYSDEC GW STAND.[1]
PARAMETERS - (ug/l)			
Chloromethane	< 2,500	<25,000	NA
Vinyl Chloride	< 2,500	<25,000	2
Bromomethane	< 2,500	<25,000	5
Chloroethane	< 2,500	<25,000	5
1,1-Dichloroethene	< 2,500	<25,000	5
Methylene Chloride	< 2,500	<25,000	5
trans-1,2-Dichloroethene	< 2,500	<25,000	5
1,1-Dichloroethane	< 2,500	<25,000	0.6
cis-1,2-Dichloroethene	< 2,500	<25,000	NA
Chloroform	< 2,500	<25,000	7
1,1,1-Trichloroethane	< 2,500	<25,000	5
Carbon Tetrachloride	< 2,500	<25,000	5
1,2-Dichloroethane	< 2,500	<25,000	0.6
Trichloroethene	< 2,500	<25,000	5
1,2-Dichloropropane	< 2,500	<25,000	1
Bromodichloromethane	< 2,500	<25,000	NA
cis-1,3-Dichloropropene	< 2,500	<25,000	0.4
trans-1,3-Dichloropropene	< 2,500	<25,000	0.4
1,1,2-Trichloroethane	< 2,500	<25,000	1
Tetrachloroethylene	< 2,500	<25,000	NA
Dibromochloromethane	< 2,500	<25,000	NA
Bromoform	< 2,500	<25,000	NA
1,1,2,2,-Tetrachloroethane	< 2,500	<25,000	5
1,2,3-Trichloropropane	3,900 D	11,000,000 E	0.04
Acetone	< 2,500	<25,000	NA
MEK	< 2,500	<25,000	NA
Benzene	< 2,500	<25,000	1
MIBK	< 2,500	<25,000	NA
Toluene	< 2,500	<25,000	5
MBK	< 2,500	<25,000	NA
Chlorobenzene	< 2,500	<25,000	5
Ethylbenzene	< 2,500	<25,000	5
M&P Xylene	< 2,500	<25,000	5
O- Xylene	< 2,500	<25,000	5
Styrene	< 2,500	<25,000	5

NOTES:

[1] - Referenced from NYSDEC 'Final Express Terms for Amendments to Title 6, Chapter X Parts 700-706', 3/98.

D - Indicates a secondary dilution factor used for analysis

E - Indicates an estimated value, instrument calibration exceeded.

NA - Recommended Soil Cleanup Objective not established

TABLE 4.28

MACKENZIE CHEMICAL SITE

ON-SITE SOIL GAS SAMPLES
VOLATILE ORGANIC COMPOUNDS - ANALYTICAL LABORATORY

SAMPLE ID	AS#1			AS#2			AS#3			AS#4					OSHA	OSHA
DEPTH OF SAMPLE[1]	5 ft	10 ft	15 ft	5 ft	10 ft	15 ft	5 ft	10 ft	15 ft	5 ft	10 ft	15 ft	SGC[2]	AGC[3]	PEL[4]	CPEL[5]
PARAMETERS (ug/m³)																
Chloromethane	<2	<2	<2	<2	14	<2	<2	30	<2	<2	<2	<2	22,000	770	NA	NA
Dichlorofluoromethane	19	16	30	11	15	30	16	20	40	11	150	90	NA	NA	NA	NA
Bromomethane	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	NA	NA	NA	NA
Vinyl Chloride	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	1,300	0.02	2,600	13,000
Methylene Chloride	<2	<2	<2	<2	<2	6	<2	<2	<2	<2	<2	<2	NA	NA	1,765,000	NA
Trichlorofluoromethane	<2	<2	5	4	7	8	22	12	20	<2	50	40	560,000	700	NA	NA
1,1-Dichloroethene	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	NA	NA	NA	NA
1,1-Dichloroethane	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	190,000	500	400,000	NA
Chloroethane	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	NA	NA	NA	NA
Chloroform	7	5	<2	10	5	10	13	o	3	<2	<2	2	980	23	240,000	NA
1,2-Dichloroethane	<2	<2	<2	15	13	12	<2	<2	3	<2	3	<2	950	0.039	NA	NA
1,1,1-Trichloroethane	<2	4	15	4	8	20	<2	4	16	<2	3	3	NA	NA	NA	NA
Carbon Tetrachloride	<2	<2	<2	<2	<2	3	<2	<2	<2	<2	<2	<2	1,300	0.07	63,900	159,750
Bromodichloromethane	<2	<2	<2	<2	4	<2	3	<2	<2	3	<2	<2	NA	0.02	NA	NA
1,2-Dichloropropane	<2	<2	<2	3	7	10	<2	4	9	7	16	10	83,000	0.15	NA	NA
2/4-Chlorotoluene	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	NA	NA	NA	NA
4-Isopropyltoluene	3	3	3	<2	4	<2	4	<2	<2	<2	<2	<2	NA	NA	NA	NA
trans-1,3-Dichloropropene	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	NA	NA	NA	NA
Trichloroethene	50	60	150	140	220	300 E	30	60	170	3	7	13	33,000	0.45	100,000	200,000
Dibromochloromethane	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	NA	NA	NA	NA
1,1,2-Trichloroethane	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	13,000	0.06	45,000	NA
cis-1,3-Dichloropropene	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	NA	NA	NA	NA
Benzene	<2	<2	<2	<2	<2	<2	<2	4	<2	<2	3	<2	30	0.12	3,250	16,250
Bromoform	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	1,200	12	NA	NA
1,1,2,2-Tetrachloroethane	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	1,600	0.02	NA	NA
Tetrachloroethene	70	120	400 E	140	400 E	600 E	140	210	500 E	60	80	90	81,000	0.075	100,000	200,000
Toluene	3	4	3	3	3	4	<2	6	<2	<2	3	3	89,000	2,000	766,000	1,149,000
Chlorobenzene	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	11,000	20	350,000	NA
Ethylbenzene	<2	<2	<2	<2	<2	<2	<2	3	<2	<2	<2	<2	100,000	1,000	435,000	NA
Acetone	50	40	40	<2	70	<2	<2	50	20	<2	<2	40	140,000	14,000	2,400,000	NA
1,2-Dichlorobenzene	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	NA	NA	NA	NA
1,4-Dichlorobenzene	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	NA	NA	450,000	NA
1,3-Dichlorobenzene	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	NA	NA	NA	NA
4-Methyl-2-Pentanone	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	NA	NA	NA	NA
2-Butanone (MEK)	16	23	16	<2	20	<2	<2	<2	<2	<2	<2	7	NA	NA	590,000	NA
Carbon Disulfide	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	710	7	63,200	94,800
2-Hexanone	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	NA	NA	440,000	NA
Styrene	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	51,000	510	433,000	860,000
Bromobenzene	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	NA	NA	NA	NA
n-Butylbenzene	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	NA	NA	NA	NA
sec-Butylbenzene	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	2	<2	NA	NA	NA	NA
tert-Butylbenzene	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	NA	NA	NA	NA
1,2-Dibromo-3-Chloropropane	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	NA	NA	9.83	NA
1,2-Dibromoethane	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	38	0.004	NA	NA
Dibromomethane	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	2	NA	NA	NA	NA
cis-1,2-Dichloroethene	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	2	190,000	1,900	NA	NA
trans-1,2-Dichloroethene	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	NA	360	NA	NA
1,3-Dichloropropane	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	NA	NA	NA	NA
2,2-Dichloropropane	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	NA	NA	NA	NA
1,1-Dichloropropane	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	NA	NA	NA	NA
Hexachlorobutadiene	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	50	0.05	NA	NA
Isopropylbenzene	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	2	NA	NA	NA	NA
Naphthalene	<2	<2	<2	<2	<2	<2	2	<2	<2	<2	<2	<2	12,000	120	50,000	NA
n-Propylbenzene	<2	<2	<2	<2	<2	2	<2	<2	<2	<2	<2	<2	NA	0.1	NA	NA
1,1,1,2-Tetrachloroethane	2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	NA	NA	NA	NA
1,2,3-Trichlorobenzene	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	NA	NA	NA	NA
1,2,4-Trichlorobenzene	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	2	<2	50	1.2	NA	NA
1,2,3-Trichloropropane	90	60	500 E	1200 E	1700 E	2100 E	1500 E	1900 E	1500 E	1900 E	2000 E	2200 E	NA	NA	300,000	NA
1,2,4-Trimethylbenzene	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	29,000	290	NA	NA
1,3,5-Trimethylbenzene	<2	3	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	29,000	290	NA	NA
M/P-Xylene	<2	3	<2	<2	<2	<2	<2	3	<2	<2	<2	<2	100,000	NA	435,000	NA
O-Xylene	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	100,000	700	435,000	NA

NOTES:

[1] - Indicates depth below ground surface.

[2] - Short-term Guidance Concentration

[3] - Annual Guidance Concentration

[4] - OSHA PEL values represent time weighed average permissable exposure limits based upon an 8 hour workday, during a 40 hour workweek.

[5] - OSHA CPEL values represent maximum ceiling values of permissable exposure limits which should not be exceeded at any time.

E - Indicates an estimated value, instrument calibration exceeded.

NA - OSHA permissable exposure limits not established

TABLE 4.29

MACKENZIE CHEMICAL SITE

OFF-SITE SOIL GAS SAMPLES
VOLATILE ORGANIC COMPOUNDS - ANALYTICAL LABORATORY

SAMPLE ID	AS#5			AS#6			AS#7			AS#8					OSHA	OSHA
DEPTH OF SAMPLE[1]	5 ft	10 ft	15 ft	5 ft	10 ft	15 ft	5 ft	10 ft	15 ft	5 ft	10 ft	15 ft	SGC[2]	AGC[3]	PEL[4]	CPEL[5]
PARAMETERS (ug/m³)																
Chloromethane	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	22,000	770	NA	NA
Dichlorofluomethane	11	16	57	8	15	22	17	5	12	6	<2	15	NA	NA	NA	NA
Bromomethane	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	NA	NA	NA	NA
Vinyl Chloride	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	1,300	0.02	2,600	13,000
Methylene Chloride	<2	<2	11	<2	<2	<2	<2	<2	<2	<2	<2	<2	NA	NA	1,765,000	NA
Trichlorofluoromethane	15	5	15	<2	3	5	13	<2	6	<2	<2	4	560,000	700	NA	NA
1,1-Dichloroethene	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	NA	NA	NA	NA
1,1-Dichloroethane	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	190,000	500	400,000	NA
Chloroethane	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	NA	NA	NA	NA
Chloroform	2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	980	23	240,000	NA
1,2-Dichloroethane	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	950	0.039	NA	NA
1,1,1-Trichloroethane	<2	<2	6	<2	2	7	6	8	20	<2	<2	5	NA	NA	NA	NA
Carbon Tetrachloride	<2	<2	<2	<2	<2	<2	<2	<2	3	<2	<2	<2	1,300	0.07	63,900	159,750
Bromodichloromethane	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	NA	0.02	NA	NA
1,2-Dichloropropane	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	83,000	0.15	NA	NA
2/4-Chlorotoluene	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	NA	NA	NA	NA
4-Isopropyltoluene	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	NA	NA	NA	NA
trans-1,3-Dichloropropene	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	NA	NA	NA	NA
Trichloroethene	<2	<2	6	<2	<2	11	<2	7	4	<2	<2	3	33,000	0.45	100,000	200,000
Dibromochloromethane	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	NA	NA	NA	NA
1,1,2-Trichloroethane	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	13,000	0.06	45,000	NA
cis-1,3-Dichloropropene	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	NA	NA	NA	NA
Benzene	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	6	<2	30	0.12	3,250	16,250
Bromoform	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	1,200	12	NA	NA
1,1,2,2-Tetrachloroethane	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	1,600	0.02	NA	NA
Tetrachloroethene	31	21	75	42	48	150	100	220	330	18	22	180	81,000	0.075	100,000	200,000
Toluene	9	6	14	11	3	13	5	7	4	<2	2	8	89,000	2,000	766,000	1,149,000
Chlorobenzene	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	11,000	20	350,000	NA
Ethylbenzene	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	100,000	1,000	435,000	NA
Acetone	27	<2	110	26	12	33	39	<2	<2	<2	<2	95	140,000	14,000	2,400,000	NA
1,2-Dichlorobenzene	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	NA	NA	NA	NA
1,4-Dichlorobenzene	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	NA	NA	450,000	NA
1,3-Dichlorobenzene	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	NA	NA	NA	NA
4-Methyl-2-Pentanone	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	NA	NA	NA	NA
2-Butanone (MEK)	<2	<2	<2	<2	<2	11	<2	2	<2	<2	25	39	NA	NA	590,000	NA
Carbon Disulfide	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	710	7	63,200	94,800
2-Hexanone	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	4	<2	NA	NA	440,000	NA
Styrene	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	51,000	510	433,000	860,000
Bromobenzene	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	2	<2	NA	NA	NA	NA
n-Butylbenzene	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	NA	NA	NA	NA
sec-Butylbenzene	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	NA	NA	NA	NA
tert-Butylbenzene	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	NA	NA	NA	NA
1,2-Dibromo-3-Chloropropane	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	NA	NA	9.83	NA
1,2-Dibromoethane	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	38	0.004	NA	NA
Dibromomethane	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	NA	NA	NA	NA
cis-1,2-Dichloroethene	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	190,000	1,900	NA	NA
trans-1,2-Dichloroethene	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	NA	360	NA	NA
1,3-Dichloropropane	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	NA	NA	NA	NA
2,2-Dichloropropane	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	NA	NA	NA	NA
1,1-Dichloropropane	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	NA	NA	NA	NA
Hexachlorobutadiene	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	50	0.05	NA	NA
Isopropylbenzene	<2	<2	<2	<2	<2	<2	2	<2	<2	<2	<2	<2	NA	NA	NA	NA
Naphthalene	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	12,000	120	50,000	NA
n-Propylbenzene	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	NA	0.1	NA	NA
1,1,1,2-Tetrachloroethane	<2	<2	2	<2	<2	<2	<2	<2	<2	<2	<2	<2	NA	NA	NA	NA
1,2,3-Trichlorobenzene	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	NA	NA	NA	NA
1,2,4-Trichlorobenzene	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	50	1.2	NA	NA
1,2,3-Trichloropropane	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	NA	NA	300,000	NA
1,2,4-Trimethylbenzene	<2	<2	<2	<2	<2	<2	<2	<2	5	<2	<2	8	29,000	290	NA	NA
1,3,5-Trimethylbenzene	<2	<2	<2	<2	<2	<2	<2	<2	4	<2	<2	6	29,000	290	NA	NA
M/P-Xylene	5	<2	<2	4	<2	<2	<2	<2	<2	<2	<2	<2	100,000	NA	435,000	NA
O-Xylene	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	100,000	700	435,000	NA

NOTES:

[1] - Indicates depth below ground surface.

[2] - Short-term Guidance Concentration

[3] - Annual Guidance Concentration

[4] - OSHA PEL values represent time weighed average permissable exposure limits based upon an 8 hour workday, during a 40 hour workweek.

[5] - OSHA CPEL values represent maximum ceiling values of permissable exposure limits which should not be exceeded at any time.

E - Indicates an estimated value, instrument calibration exceeded

NA - OSHA permissable exposure limits not established

TABLE 4.29 (con't.)

MACKENZIE CHEMICAL SITE

OFF-SITE SOIL GAS SAMPLES
VOLATILE ORGANIC COMPOUNDS - ANALYTICAL LABORATORY

SAMPLE ID	AS#9			AS#10			AS#11			AS#12					OSHA	OSHA
DEPTH OF SAMPLE[1]	5 ft	10 ft	15 ft	5 ft	10 ft	15 ft	5 ft	10 ft	15 ft	5 ft	10 ft	15 ft	SGC[2]	AGC[3]	PEL[4]	CPEL[5]
PARAMETERS (ug/m^3)																
Chloromethane	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	22,000	770	NA	NA
Dichlorofluomethane	13	6	2	12	8	22	88	110	220	8	22	56	NA	NA	NA	NA
Bromomethane	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	NA	NA	NA	NA
Vinyl Chlonde	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	1,300	0.02	2,600	13,000
Methylene Chlonde	<2	<2	<2	<2	<2	8	<2	<2	<2	<2	<2	<2	NA	NA	1,765,000	NA
Trichlorofluoromethane	<2	<2	2	11	4	9	14	18	35	2	4	11	560,000	700	NA	NA
1,1-Dichloroethene	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	NA	NA	NA	NA
1,1-Dichloroethane	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	190,000	500	400,000	NA
Chloroethane	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	NA	NA	NA	NA
Chloroform	8	<2	<2	10	<2	<2	<2	<2	<2	<2	<2	<2	980	23	240,000	NA
1,2-Dichloroethane	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	950	0.039	NA	NA
1,1,1-Trichloroethane	<2	<2	<2	3	4	9	3	5	9	<2	<2	10	NA	NA	NA	NA
Carbon Tetrachlonde	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	1,300	0.07	63,900	159,750
Bromodichloromethane	4	<2	<2	2	<2	<2	<2	<2	<2	<2	<2	<2	NA	0.02	NA	NA
1,2-Dichloropropane	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	83,000	0.15	NA	NA
2/4-Chlorotoluene	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	NA	NA	NA	NA
4-Isopropyltoluene	<2	<2	<2	<2	<2	<2	<2	<2	4	<2	<2	<2	NA	NA	NA	NA
trans-1,3-Dichloropropene	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	NA	NA	NA	NA
Trichloroethene	<2	<2	<2	<2	<2	4	<2	<2	4	<2	<2	9	33,000	0.45	100,000	200,000
Dibromochloromethane	<2	<2	<2	20	<2	<2	<2	<2	<2	<2	<2	<2	NA	NA	NA	NA
1,1,2-Trichloroethane	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	13,000	0.06	45,000	NA
cis-1,3-Dichloropropene	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	NA	NA	NA	NA
Benzene	<2	<2	4	<2	<2	<2	<2	<2	<2	<2	<2	<2	30	0.12	3,250	16,250
Bromoform	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	1,200	12	NA	NA
1,1,2,2-Tetrachloroethane	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	1,600	0.02	NA	NA
Tetrachloroethene	34	<2	49	33	67	200	54	34	65	25	43	140	81,000	0.075	100,000	200,000
Toluene	4	2	10	45	4	3	14	7	19	71	15	16	89,000	2,000	766,000	1,149,000
Chlorobenzene	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	11,000	20	350,000	NA
Ethylbenzene	<2	<2	<2	<2	<2	<2	2	<2	5	4	<2	<2	100,000	1,000	435,000	NA
Acetone	42	6	<2	28	48	66	19	61	280	19	24	26	140,000	14,000	2,400,000	NA
1,2-Dichlorobenzene	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	NA	NA	NA	NA
1,4-Dichlorobenzene	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	NA	NA	450,000	NA
1,3-Dichlorobenzene	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	NA	NA	NA	NA
4-Methyl-2-Pentanone	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	NA	NA	NA	NA
2-Butanone (MEK)	<2	11	88	<2	5	33	5	19	39	<2	5	8	NA	NA	590,000	NA
Carbon Disulfide	<2	<2	<2	<2	<2	<2	<2	<2	2	<2	<2	<2	710	7	63,200	94,800
2-Hexanone	<2	22	<2	<2	<2	<2	28	<2	<2	<2	<2	<2	NA	NA	440,000	NA
Styrene	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	51,000	510	433,000	860,000
Bromobenzene	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	NA	NA	NA	NA
n-Butylbenzene	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	NA	NA	NA	NA
sec-Butylbenzene	<2	<2	<2	<2	<2	<2	<2	<2	3	<2	<2	<2	NA	NA	NA	NA
tert-Butylbenzene	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	NA	NA	NA	NA
1,2-Dibromo-3-Chloropropane	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	NA	NA	9.83	NA
1,2-Dibromoethane	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	38	0.004	NA	NA
Dibromomethane	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	NA	NA	NA	NA
cis-1,2-Dichloroethene	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	190,000	1,900	NA	NA
trans-1,2-Dichloroethene	<2	<2	<2	<2	<2	<2	2	<2	<2	<2	<2	<2	NA	360	NA	NA
1,3-Dichloropropane	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	NA	NA	NA	NA
2,2-Dichloropropane	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	NA	NA	NA	NA
1,1-Dichloropropane	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	NA	NA	NA	NA
Hexachlorobutadiene	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	50	0.05	NA	NA
Isopropylbenzene	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	NA	NA	NA	NA
Naphthalene	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	12,000	120	50,000	NA
n-Propylbenzene	<2	<2	<2	<2	<2	<2	<2	<2	5	<2	<2	<2	NA	0.1	NA	NA
1,1,1,2-Tetrachloroethane	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	NA	NA	NA	NA
1,2,3-Trichlorobenzene	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	NA	NA	NA	NA
1,2,4-Trichlorobenzene	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	50	1.2	NA	NA
1,2,3-Trichloropropane	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	NA	NA	300,000	NA
1,2,4-Trimethylbenzene	<2	<2	<2	<2	<2	3	6	5	41	<2	<2	<2	29,000	290	NA	NA
1,3,5-Trimethylbenzene	<2	<2	<2	<2	<2	3	8	5	42	<2	<2	<2	29,000	290	NA	NA
M/P-Xylene	<2	<2	<2	<2	<2	<2	9	<2	19	14	4	<2	100,000	NA	435,000	NA
O-Xylene	<2	<2	<2	<2	<2	<2	3	<2	7	3	<2	<2	100,000	700	435,000	NA

NOTES:

[1] - *Indicates depth below ground surface*

[2] - Short-term Guidance Concentration

[3] - Annual Guidance Concentration

● OSHA PEL values represent time weighed average permissable exposure limits based upon an 8 hour workday, during a 40 hour workweek.

[5] - OSHA CPEL values represent maximum ceiling values of permissable exposure limits which should not be exceeded at any time.

E - Indicates an estimated value, instrument calibration exceeded.

NA - OSHA permissable exposure limits not established

TABLE 4.29 (con't.)

MACKENZIE CHEMICAL SITE

OFF-SITE SOIL GAS SAMPLES
VOLATILE ORGANIC COMPOUNDS - ANALYTICAL LABORATORY

SAMPLE ID	AS#13			AS#14			AS#15			AS#16					OSHA	OSHA
DEPTH OF SAMPLE[1]	5 ft	10 ft	15 ft	5 ft	10 ft	15 ft	5 ft	10 ft	15 ft	5 ft	10 ft	15 ft	SGC[2]	AGC[3]	PEL[4]	CPEL[5]
PARAMETERS (ug/m³)																
Chloromethane	<2	<2	<2	<2	<2	<2	<2	<2	<10	<2	<2	5	22,000	770	NA	NA
Dichlorofluomethane	30	40	67	<2	<2	58	9	80	9	9	23	9	NA	NA	NA	NA
Bromomethane	<2	<2	<2	<2	<2	<2	<2	<2	<10	<2	<2	<2	NA	NA	NA	NA
Vinyl Chlonde	<2	<2	<2	<2	<2	<2	<2	<2	<10	<2	<2	<2	1,300	0.02	2,600	13,000
Methylene Chlonde	<2	<2	<2	<2	<2	4	<2	<2	<10	<2	<2	<2	NA	NA	1,765,000	NA
Trichlorofluoromethane	5	7	10	<2	<2	9	<2	<2	3	<2	3	3	560,000	700	NA	NA
1,1-Dichloroethene	<2	<2	4	<2	<2	<2	<2	<2	<10	<2	<2	<2	NA	NA	NA	NA
1,1-Dichloroethane	<2	<2	<2	<2	<2	<2	<2	<2	<10	<2	<2	<2	190,000	500	400,000	NA
Chloroethane	<2	<2	<2	<2	<2	<2	<2	<2	<10	<2	<2	<2	NA	NA	NA	NA
Chloroform	19	<2	<2	<2	<2	<2	2	<2	<10	8	<2	<2	980	23	240,000	NA
1,2-Dichloroethane	<2	<2	<2	<2	<2	<2	<2	<2	<10	<2	<2	<2	950	0.039	NA	NA
1,1,1-Trichloroethane	8	11	17	<2	<2	19	<2	<2	<10	<2	<2	<2	NA	NA	NA	NA
Carbon Tetrachlonde	<2	<2	4	<2	<2	3	<2	<2	<10	<2	<2	<2	1,300	0.07	63,900	159,750
Bromodichloromethane	4	<2	<2	<2	<2	<2	<2	<2	<10	3	<2	<2	NA	0.02	NA	NA
1,2-Dichloropropane	<2	<2	<2	<2	<2	<2	<2	<2	<10	<2	<2	<2	83,000	0.15	NA	NA
2/4-Chlorotoluene	<2	<2	<2	<2	<2	<2	<2	<2	<10	<2	<2	<2	NA	NA	NA	NA
4-Isopropyltoluene	<2	<2	<2	<2	<2	<2	<2	<2	<10	<2	<2	<2	NA	NA	NA	NA
trans-1,3-Dichloropropene	<2	<2	<2	<2	<2	<2	<2	<2	<10	<2	<2	<2	NA	NA	NA	NA
Trichloroethene	<2	<2	19	<2	<2	8	<2	<2	4	<2	<2	<2	33,000	0.45	100,000	200,000
Dibromochloromethane	<2	<2	<2	<2	<2	<2	<2	<2	<10	<2	<2	<2	NA	NA	NA	NA
1,1,2-Trichloroethane	<2	<2	<2	<2	<2	<2	<2	<2	<10	<2	<2	<2	13,000	0.06	45,000	NA
cis-1,3-Dichloropro[illegible]e	<2	<2	<2	2	<2	<2	<2	<2	<10	<2	<2	<2	NA	NA	NA	NA
Benzene	4	5	<2	<2	<2	<2	<2	<2	4	<2	4	3	30	0.12	3,250	16,250
Bromoform	<2	<2	<2	<2	<2	<2	<2	<2	<10	<2	<2	<2	1,200	12	NA	NA
1,1,2,2-Tetrachloroethane	<2	<2	<2	<2	<2	<2	<2	<2	<10	<2	<2	<2	1,600	0.02	NA	NA
Tetrachloroethene	130	170	270	4	14	300	13	12	11	41	30	39	81,000	0.075	100,000	200,000
Toluene	5	12	42	4	3	67	3	3	20	21	10	40	89,000	2,000	766,000	1,149,000
Chlorobenzene	<2	<2	<2	<2	<2	<2	<2	<2	<10	<2	<2	<2	11,000	20	350,000	NA
Ethylbenzene	<2	<2	9	<2	<2	2	<2	<2	<10	<2	<2	<2	100,000	1,000	435,000	NA
Acetone	80	46	160	<2	<2	48	47	23	35	12	320	40	140,000	14,000	2,400,000	NA
1,2-Dichlorobenzene	<2	<2	<2	<2	<2	<2	<2	<2	<10	<2	<2	<2	NA	NA	NA	NA
1,4-Dichlorobenzene	<2	<2	<2	<2	<2	<2	<2	<2	<10	<2	<2	<2	NA	NA	450,000	NA
1,3-Dichlorobenzene	<2	<2	<2	<2	<2	<2	<2	<2	<10	<2	<2	<2	NA	NA	NA	NA
4-Methyl-2-Pentanone	<2	<2	<2	<2	<2	<2	<2	<2	<10	<2	<2	<2	NA	NA	NA	NA
2-Butanone (MEK)	8	31	23	<2	<2	28	<2	<2	65	3	33	6	NA	NA	590,000	NA
Carbon Disulfide	<2	<2	<2	<2	<2	<2	<2	<2	<10	<2	3	<2	710	7	63,200	94,800
2-Hexanone	<2	4	<2	<2	<2	4	<2	<2	<10	<2	<2	<2	NA	NA	440,000	NA
Styrene	<2	<2	<2	<2	<2	<2	2	<2	<10	<2	<2	<2	51,000	510	433,000	860,000
Bromobenzene	<2	<2	<2	<2	<2	<2	<2	<2	<10	<2	<2	<2	NA	NA	NA	NA
n-Butylbenzene	<2	<2	<2	<2	<2	<2	2	<2	<10	<2	<2	<2	NA	NA	NA	NA
sec-Butylbenzene	<2	<2	<2	<2	<2	<2	<2	<2	<10	<2	<2	<2	NA	NA	NA	NA
tert-Butylbenzene	<2	<2	<2	<2	<2	<2	<2	<2	<10	<2	<2	<2	NA	NA	NA	NA
1,2-Dibromo-3-Chloropropane	<2	<2	<2	<2	<2	<2	<2	<2	<10	<2	<2	<2	NA	NA	9.83	NA
1,2-Dibromoethane	<2	<2	<2	<2	<2	<2	2	<2	<10	<2	<2	<2	38	0.004	NA	NA
Dibromomethane	<2	<2	<2	<2	<2	<2	<2	<2	<10	<2	<2	<2	NA	NA	NA	NA
cis-1,2-Dichloroethene	<2	<2	<2	<2	<2	<2	<2	<2	<10	<2	<2	<2	190,000	1,900	NA	NA
trans-1,2-Dichloroethene	<2	<2	<2	<2	<2	<2	2	<2	<10	<2	<2	<2	NA	360	NA	NA
1,3-Dichloropropane	<2	<2	<2	<2	<2	<2	<2	<2	<10	<2	<2	<2	NA	NA	NA	NA
2,2-Dichloropropane	<2	<2	<2	<2	<2	<2	2	<2	<10	<2	<2	<2	NA	NA	NA	NA
1,1-Dichloropropane	<2	<2	<2	<2	<2	<2	2	<2	<10	<2	<2	<2	NA	NA	NA	NA
Hexachlorobutadiene	<2	<2	<2	<2	<2	<2	<2	<2	<10	<2	<2	<2	50	0.05	NA	NA
Isopropylbenzene	<2	<2	<2	<2	<2	<2	2	<2	<10	<2	<2	<2	NA	NA	NA	NA
Naphthalene	<2	<2	<2	<2	2	<2	2	<2	<10	<2	2	<2	12,000	120	50,000	NA
n-Propylbenzene	<2	<2	3	<2	<2	<2	<2	<2	<10	<2	<2	<2	NA	0.1	NA	NA
1,1,1,2-Tetrachloroethane	<2	<2	<2	<2	<2	<2	<2	<2	<10	<2	2	<2	NA	NA	NA	NA
1,2,3-Trichlorobenzene	<2	<2	<2	<2	<2	<2	<2	<2	<10	<2	2	2	NA	NA	NA	NA
1,2,4-Trichlorobenzene	<2	<2	<2	<2	<2	<2	<2	<2	<10	<2	<2	2	50	1.2	NA	NA
1,2,3-Trichloropropane	<2	<2	<2	<2	<2	<2	<2	<2	<10	<2	<2	<2	NA	NA	300,000	NA
1,2,4-Trimethylbenzene	<2	<2	22	<2	<2	16	<2	<2	<10	<2	<2	<2	29,000	290	NA	NA
1,3,5-Trimethylbenzene	<2	<2	25	<2	<2	14	<2	<2	<10	<2	<2	<2	29,000	290	NA	NA
M/P-Xylene	<2	<2	32	<2	<2	8	<2	<2	<10	<2	<2	<2	100,000	NA	435,000	NA
O-Xylene	<2	<2	12	<2	<2	3	<2	<2	<10	<2	<2	<2	100,000	700	435,000	NA

NOTES:

[1] - Indicates depth below ground surface.

[2] - Short-term Guidance Concentration

[3] - Annual Guidance Concentration

[4] - OSHA PEL values represent time weighed average permissable exposure limits based upon an 8 hour workday, during a 40 hour workweek.

[5] - OSHA CPEL values represent maximum ceiling values of permissable exposure limits which should not be exceeded at any time.

E - Indicates an estimated value, instrument calibration exceeded.

NA - OSHA permissable exposure limits not established

TABLE 6.1

MacKenzie Chemical Site

Groundwater Flow Velocities

Year	Days	Feet Traveled
1	365	329
2	730	657
3	1,095	986
4	1,460	1,314
5	1,825	1,643
6	2,190	1,971
7	2,555	2,300
8	2,920	2,628
9	3,285	2,957
10	3,650	3,285
11	4,015	3,614
12	4,380	3,942
13	4,745	4,271
14	5,110	4,599
15	5,475	4,928
16	5,840	5,256
17	6,205	5,585
18	6,570	5,913
19	6,935	6,242
20	7,300	6,570
21	7,665	6,899
22	8,030	7,227
23	8,395	7,556
24	8,760	7,884
25	9,125	8,213
26	9,490	8,541
27	9,855	8,870
28	10,220	9,198
29	10,585	9,527
30	10,950	9,855

Notes:

Groundwater Flow Velocity Estimated by following formula:

$$GWFV = \frac{\text{Hydraulic Conductivity (K) x Gradient}}{\text{Porosity}}$$

K = 270 ft/day

Gradient = 0.1 ft/90ft = 0.001 feet/foot

Porosity - 0.30 (30 percent)

Therefore $GWFV = \frac{270 \text{ ft/day} \times 0.001 \text{ ft/ft}}{0.3}$

GWFV = 0.9 ft/day

TABLE 7.1

MACKENZIE CHEMICAL SITE

Functional Exposure Pathway Evaluation

Functional Exposure Pathway	Contaminant Source	Release Mechanism	Transport Mechanism	Pathway Complete
Ingestion of contaminated soil.	Yes	Yes	Yes	Yes
Inhalation of vapors.	Yes	Yes	Yes	Yes
Inhalation of potentially contaminated dust during remediation activities.	Yes	Yes	Yes	Yes
Direct contact with potentially contaminated runoff water.	Yes	No	NA	No
Ingestion of contaminated groundwater.	Yes	Yes	Yes	No
Dermal absorption of contaminants via direct contact with contaminated soil.	Yes	Yes	Yes	Yes
Dermal absorption of contaminants via direct contact with contaminated groundwater.	Yes	Yes	Yes	Yes

Table 7.2

MacKenzie Chemical Site

Potential Downgradient Receptors

Well Number[1]	Well Field Name[2]	Aquifer	Completion Depth[3]	Rated Capacity	Abandoned	Annual Reported Pumpage[4]												
						1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997
S012143	BANANA ST #1	GLACIAL	116	700	Yes	0	0	0	0	0	0	0	0	0	0	0	0	0
S013558	BANANA ST #2	GLACIAL	116	700	Yes	0	0	0	0	0	0	0	0	0	0	0	0	0
S022494	BANANA ST #3	GLACIAL	120	1,000	Yes	163,608	0	0	0	0	0	0	0	0	0	0	0	0
S039531	BANANA ST #4	MAGOTHY	289	1,200	No	0	111,600	91,300	31,274	0	0	17,607	7,390	38,402	86,049	100,407	0	0
S054957	BANANA ST #5	MAGOTHY	378	1,400	No	0	44,200	56,200	43,470	183,177	199,550	189,926	174,215	132,386	140,108	131,322	141,815	125,730
S019565	BELLMORE AVE #1	GLACIAL	119	1,000	No	91,574	87,500	8,000	55,511	44,398	89,904	67,761	56,196	99,846	134,189	64,032	45,937	0
S020479	BELLMORE AVE #2	GLACIAL	128	1,000	No	90,879	133,800	165,200	153,033	159,375	93,097	85,553	104,765	115,192	128,706	134,752	74,839	97,366
S027533	BELLMORE AVE #3	MAGOTHY	700	1,200	No	136,620	189,100	265,100	238,780	196,362	126,968	160,961	197,848	160,095	180,793	141,731	161,205	177,058
S069024	BELLMORE AVE #4	MAGOTHY	721	1,300	No	150,030	213,700	233,200	251,672	193,862	135,188	190,122	135,602	134,967	124,348	141,314	87,848	180,743
S067197	CARLETON AVE #1	MAGOTHY	763	1,300	No	72,800	100,200	98,100	206,660	155,190	77,674	91,820	110,770	180,830	142,750	120,062	79,090	81,575
S035033	FISHER AVE #1	MAGOTHY	317	1,200	No	68,372	96,400	126,800	152,204	229,882	212,902	176,200	132,787	191,540	186,706	194,986	244,891	286,610
S037140	FISHER AVE #2	GLACIAL	330	1,200	No	71,701	96,200	116,900	130,162	162,373	237,359	170,489	149,872	204,636	186,991	200,322	24 ,585	291,470
S042827	FISHER AVE #3	MAGOTHY	663	1,400	No	77,527	100,500	106,600	156,731	161,105	236,309	212,311	153,741	188,636	75,095	84,819	34,522	33,834
S020603	FORTY FIRST ST #1	GLACIAL	0	1,000	Yes	0	0	0	0	0	0	0	0	0	0	0	0	0
S026490	FORTY FIRST ST #2	GLACIAL	110	1,000	Yes	0	0	0	0	0	0	0	0	0	0	0	0	0
S039406	FORTY FIRST ST #3	GLACIAL	106	1,200	Yes	0	0	0	0	0	0	0	0	0	0	0	0	0
S045839	FORTY FIRST ST #4	MAGOTHY	726	1,400	No	256,970	354,300	162,000	336,757	44,841	126,078	246,714	256,431	330,963	283,170	317,960	423,202	376,493
S064847	FORTY FIRST ST #5	MAGOTHY	634	1,300	No	238,930	327,000	189,200	331,483	110,747	270,912	220,641	256,967	307,323	248,108	264,104	367,844	333,002

Notes:

[1] NYSDEC Identification Number. All data from NYSDEC.

[2] All wells are owned and operated by the Suffolk County Water Authority.

[3] All depths are in feet below ground surface.

[4] Data is in thousands of gallons.

TABLE 7.3

MACKENZIE CHEMICAL SITE

Qualitative Risk Characterization

Functional Exposure Pathway	Potential Receptor Population	Qualitative Potential Risk
Ingestion of Contaminated Soil	On-Site Workers	High
	Trespassers	Moderate
	Area Residents	Low
	Remedial Workers	Low
Inhalation of Vapors	On-Site Workers	High
	Trespassers	High
	Area Residents	Moderate
	Remedial Workers	Low
Inhalation of Contaminated Dust During Remediation Activities	On-Site Workers	High
	Trespassers	Low
	Area Residents	Low
	Remedial Workers	Low
Direct Contact with Runoff Water	On-Site Workers	Low
	Trespassers	Low
	Area Residents	Low
	Remedial Workers	Low
Ingestion of Contaminated Groundwater	On-Site Workers	Low
	Trespassers	Low
	Area Residents	Low
	Remedial Workers	Low
Dermal Absorption of Contaminants in Soil	On-Site Workers	High
	Trespassers	Moderate
	Area Residents	Low
	Remedial Workers	Low
Dermal Absorption of Contaminants in Groundwater	On-Site Workers	Low
	Trespassers	Low
	Area Residents	Low
	Remedial Workers	Low

Table 8-1
Identification and Preliminary Screening of Remedial Technologies
MacKenzie Chemical Site
Islip, Suffolk County, New York

REMEDIAL ALTERNATIVE	TREATMENT PROCESS	EVALUATION/COMMENTS	RETAIN OR ELIM NATE
Groundwater:			
Containment	Slurry Walls/Sheet Piling to contain the groundwater plume	Not feasible due to relatively large areal extent of the plume and depth to which the plume extends in the aquifer below ground surface.	Eliminated
In-Situ Biological Treatment	Decomposition of organic contaminants via the use of microorganisms into nontoxic byproducts.	Because 1,23-TCP and PCE degrades anaerobically, this remedial action alternative will not be considered further.	Eliminated
In-Situ Chemical Oxidation-Reduction Reactions	Addition of a strong oxidizer or reducing chemical to render contaminants non-hazardous/non-toxic (chlorinated hydrocarbons into carbon dioxide, water and free chloride radicals).	This is an innovative technology that is being extensively tested. Has been shown to be effective on petroleum-based hydrocarbons and on chlorinated hydrocarbons in both saturated soils and groundwater.	Retained
In-Situ Chemical Treatment: Reactive Treatment Wall	Curtain wall constructed with a reactive media (ferrous iron) at or near the downgradient edge of plume. Oxidation of VOCs occur while passing through the wall with groundwater flow.	Not feasible due to relatively large areal extent of the plume and depth to which the plume extends in the aquifer below ground surface.	Eliminated
In-Situ Physical Treatment: In-Well Stripping	Aeration of groundwater by introducing air through the well bore. Groundwater is drawn into the well by density driven convection, or with the use of a pump, and treated by volatilizing VOC's	Potentially Applicable	Retained
In-Situ Physical Treatment: Air Sparging	Injection of pressurized air below the water table to increase the rate of volatilization of VOCs in the saturated zone	Air sparging has proven to be an effective method for removing VOCs from groundwater. However, the depth at which contaminants exist in groundwater may limit the effectiveness of this treatment technology. Also, 1,2,3-TCP has a relatively low Henry's Law Constant and vapor pressure	Retained

Table 8-1
Identification and Preliminary Screening of Remedial Technologies
MacKenzie Chemical Site
Islip, Suffolk County, New York

REMEDIAL ALTERNATIVE	TREATMENT PROCESS	EVALUATION/COMMENTS	RETAIN OR ELIMINATE
Groundwater (Continued):			
Groundwater Extraction, Treatment, Discharge	Pump, Treat, Discharge Groundwater On- or Off-site	Technology Potentially Applicable	Retained
Ex-Situ Biological Treatment	Use of microorganisms to breakdown contaminants in soil into non-hazardous substances. Controlled environment to enhance the growth of microorganisms using activated sludge systems, trickling filters or rotating biological reactors	Not feasible because 1,2,3-TCP degrades anaerobically. Also not feasible due to the low levels (relative to this treatment method) of 1,2,3-trichloropropane in groundwater.	Eliminated
Ex-Situ Chemical Precipitation (Coagulation & Flocculation)	Coagulants are added to the water to react with contaminants to form a precipitate that can be removed via settling	Technology not effective in the removal of VOCs	Eliminated
Ex-Situ Physical Treatment: UV Oxidation	Uses UV radiation to act as a catalyst for the oxidation reaction of dissolved VOCs to produce carbon dioxide and water.	Potentially Applicable	Retained
Ex-Situ Reverse Osmosis	Segregation of groundwater and contaminants via the use of a membrane	Technology is applicable for metals treatment and not applicable for VOCs	Eliminated
Ex-Situ Sedimentation	Removal of particulate matter via the use of settling tanks	Technology not effective in the removal of VOCs	Eliminated
Ex-Situ Ion Exchange	Removal of contaminants by passing groundwater through a chemical adsorptive resin	Technology is applicable for metals treatment and not applicable for VOCs	Eliminated
Ex-Situ Filtration	Removal of suspended matter via the use of porous filters	Technology not effective in the removal of VOCs	Eliminated
Ex-Situ Physical Treatment: Carbon Adsorption	Contaminant adsorption via activated carbon	Potentially Applicable	Retained
Ex-Situ Physical Treatment: Air Stripping	Transfer of contaminants from liquid phase to air phase by counter-current air flow	Potentially Applicable	Retained
No Action	Monitoring Only	Not effective, but must be retained in accordance with the NCP.	Retained

Table 8-1
Identification and Preliminary Screening of Remedial Technologies
MacKenzie Chemical Site
Islip, Suffolk County, New York

REMEDIAL ALTERNATIVE	TREATMENT PROCESS	EVALUATION/COMMENTS	RETAIN OR ELIMINATE
Soil:			
Excavation and Disposal	Removal of the drywell structures, waste lagoons, and/or impacted subsurface soils. Excavated soils would be transported for off-site disposal at permitted disposal facility.	Potentially applicable since most of the impacted soil is shallower than 15 feet. Conventional excavation equipment can be used, however, sheeting/shoring will be required. At one location, however, impacted soils extend to approx. 41 feet below grade.	Retained
Biological Treatment	Use of microorganisms to breakdown contaminants in soil into non-hazardous substances. Controlled environment to enhance the growth of microorganisms using activated sludge systems, trickling filters or rotating biological reactors	Perchlorinated alkanes (of which 1,2,3-TCP is considered) would be treated anaerobically. Also, chlorinated aliphatic compounds can be toxic to bacteria. Not effective in the treatment of low levels (relative to this treatment method) of 1,2,3-trichloropropane in soil.	Eliminated
Mobilization	Flushing of contaminants in soil via the use of chemical flushing agents.	Relatively unproven treatment alternative	Eliminated
Immobilization	The use of precipitation, chelation, and/or polymerization to modify contaminants into a less mobile form	Relatively unproven treatment alternative	Eliminated
Detoxification	Uses the processes of oxidation, reduction, neutralization and hydrolysis to alter the contaminants into a less toxic form	Relatively unproven treatment alternative	Eliminated
Stabilization / Solidification	Uses products such as silicate, organic polymer, thermoplastics, cement, and/or molten glass to chemically or physically stabilize contaminants into a solid matrix.	Potentially Applicable	Retained

Table 8-1
Identification and Preliminary Screening of Remedial Technologies
MacKenzie Chemical Site
Islip, Suffolk County, New York

REMEDIAL ALTERNATIVE	TREATMENT PROCESS	EVALUATION/COMMENTS	RETAIN OR ELIMINATE
Soil:			
Soil Vapor Extraction (SVE)	Air is extracted through the impacted soil in the unsaturated zone. Contaminants that are sorbed onto soil particles volatilize into the air stream, and are removed. Thermal enhancement may be necessary due to the relatively low Henry's Law Constant of 1,2,3-TCP.	Potentially applicable. Generally more effective at sites with relatively permeable geologic media. Thermal enhancement lowers the viscosity and increases vapor pressure to enhance the flow of contaminants to extraction points	Retained
Institutional Controls	. A deed restriction is a covenant incorporated into a property deed that limits the way the property can be used or developed.	Not effective. While a deed restriction can limit how a site can be developed (e.g., industrial or residential) it can not control the activities that is conducted on the site that may result in direct contact exposure (e.g., excavation).	Eliminated
No Action	Monitoring Only	Not effective, but must be retained in accordance with the NCP.	Retained

Table 8-2
Development and Screening of Remedial Action Alternatives
MacKenzie Chemical Site
Islip, Suffolk County, New York

Remedial Alternative	Remedial Technology/ Process Options	Effectiveness	Implementability	Retain or Eliminate for Detailed Analysis
Soil:				
No. 1 - No Further Action with Continued Groundwater Monitoring	Monitoring well sampling & analysis.	VOCs in soils continue to act as a source of groundwater contamination. This alternative *does not provide long-term* protection to groundwater.	Easily implementable.	Retain - Required by NCP.
No. 2 - Excavation and Disposal	Impacted soil removal.	Excavation would be an effective alternative to remove impacted soils.	Uses conventional construction equipment to remove soils. Due to the presence of site structures and the depth of excavations sheeting would be required to stabilize excavations.	Retain
No. 3 - In-Situ Solidification and Stabilization/Chemical Fixation	Chemicals are mixed into the soil to fixate the contaminants within the soil column	Little to no research done to develop chemicals required to fixate primary contaminant of concern, 1,2,3-TCP.	Specialty equipment and chemistry is required to implement. Vendors offering technology are limited.	Eliminate
No. 4 - Soil Vapor Extraction (with thermal enhancements)	Contaminated air is extracted through the impacted soil	Soil vapor extraction has proven to be effective in removing VOCs from soil. Due to low volatility associated with 1,2,3-TCP, thermal enhancements would be required.	Installation of the system would use conventional construction techniques and readily available equipment (e.g., vacuum blower, heat exchange, steam generator, air cooler, vapor phase GAC).	Retain

Table 8-2
Development and Screening of Remedial Action Alternatives
MacKenzie Chemical Site
Islip, Suffolk County, New York

Remedial Alternative	Remedial Technology/ Process Options	Effectiveness	Implementability	Retain or Eliminate for Detailed Analysis
Groundwater:				
No. 1 - No Further Action with Continued Groundwater Monitoring	Monitoring well sampling & analysis.	VOCs in groundwater continue to be in contravention of standards. This alternative does not provide long-term protection to the supply wells located downgradient of the site.	Easily implementable.	Retain - Required by NCP.
No. 2 - Groundwater Treatment by In-Situ Air Sparging with Ozone Injection	Air Sparge Points with ozone injection and vapor recovery if warrented.	Since the plume has migrated beneath residential properties, two treatment curtains would need to be created to intercept the plume. There is a lack of remediation histories associated with the primary compound of concern, 1,2,3-TCP.	Uses conventional installation techniques and equipment (i.e., air compressors, vacuum blowers, etc.). However, permission from private landowners, or from the town to perform the work in the right-of-way would be required.	Retain
No. 3 - Groundwater Treatment by In-Well Stripping	Groundwater Recirculation Wells - Option A - Density Driven Convection (DDC)-Type System	Technology is suitable for site hydrogeology. However, the primary contaminant of concern, 1,2,3-TCP, has a low Henry's constant and would not be readily removed from the groundwater table.	DDC-type wells are patented systems; commercially available through Wasatch Engineering and No VOCs. Actual installation methods and equipment are conventional.	Eliminate
No. 4 - Groundwater Extraction with Treatment and Discharge	Groundwater collection using two extraction wells.	Extraction wells will be effective in capturing contaminated groundwater for treatment.	Uses conventional well installation techniques. However, permission from private landowners, or from the town to perform the work in the right-of-way would be required.	Retain

Table 8-2
Development and Screening of Remedial Action Alternatives
MacKenzie Chemical Site
Islip, Suffolk County, New York

Remedial Alternative	Remedial Technology/ Process Options	Effectiveness	Implementability	Retain or Eliminate for Detailed Analysis
4A	Liquid Phase Granular Activated Carbon	This treatment technology is an effective and proven method for removal of VOCs from groundwater	Equipment is readily available, with little to no inherent difficulties in the design of the system.	Retain
4B	Groundwater Treatment Option A - Air Stripping with Vapor Phase Granular Activated Carbon	This treatment technology is an effective and proven methods for removal of VOCs from groundwater	Equipment is readily available, with little to no inherent difficulties in the design of the system.	Retain
4C	Groundwater Treatment Option B - UV-Oxidation	This treatment technology is an effective and proven methods for removal of VOCs from groundwater. However, the primary contaminant of concern 1,2,3-TCP would need significant retention time to be treated.	Equipment is readily available, however, size of system to treat 1,2,3-TCP makes system not cost effective.	Eliminate
	Groundwater Recharge - Dry Wells	Drywells systems are commonly used on Long Island and can be designed and constructed to accommodate the anticipated flow rates from the pump-and-treat system	Uses conventional construction techniques.	Retain
No. 5 - In-situ Chemical Oxidation	Injection of hydrogen peroxide, acid and iron to create a strong oxidizer to create environment for Fenton's Reaction to occur.	The treatment technology has proven effective for the oxidation of VOCs in groundwater. However, there is a lack of remediation histories associated with the primary compound of concern, 1,2,3-TCP.	Uses conventional construction techniques. Several vendors have patented methods of injecting chemistry into the aquifer.	Retain

Table 8-3
Detailed Evaluation of Remedial Action Alternatives
MacKenzie Chemical Site
Islip, Suffolk County, New York

Evaluation Criteria	Soil & Groundwater Alternative No. 1: No Further Action With Monitoring	Soil Alternative No. 2: Excavation and Disposal	Soil Alternative No. 4 Soil Vapor Extraction (with thermal enhancements)	Groundwater Alternative No. 2: In-situ Air Sparging with Ozone Injection	Groundwater Alternative No. 4: Groundwater Pump and Treat	Groundwater Alternative No. 5: In-Situ Chemical Oxidation
Short Term Effectiveness						
Protection of Workers and Residents	Workers and area residents would be adequately protected during well sampling. Soil contamination is limited to site soils below grade. Potential direct contact exposure to soils is minimal.	Workers and area residents could potentially be exposed to dust during excavation activities. Administrative and engineering controls would provide sufficient protection.	Construction activities would be limited to on-site. Dust exposure during well installation would be controlled through administrative and engineering controls.	Construction activities may be temporarily disruptive to the community. Health risks to workers and residents are minimal.	Well installation activities may be temporarily disruptive to the community. Health risks to workers and residents are minimal.	Well installation activities may be temporarily disruptive to the community. Injection and use of the process chemistry in a residential area, as well as exothermic reaction in groundwater would need to be further evaluated.
Environmental Impact	Groundwater quality continues to be above Class GA Groundwater Quality Standards and NYS Drinking Water Standards (MCLs). Impacted groundwater will eventually impact public supply wells.	Excavation and disposal off-site offers the quickest remedial alternative to complete. Through the removal of impacted soil, continued impacts to groundwater would be eliminated.	Soil vapor extraction induces air flow through the impacted unsaturated zone. Thermal enhancements increase the volatility of 1,2,3-TCP. Soil gases can be captured for treatment prior to discharge.	Circulation technology creates horizontal and vertical groundwater movement within the aquifer, enhancing the flushing of contaminants from the saturated soil and distributing ozone. Ozone oxidizes contaminants in the groundwater. Soil vapors can be captured for treatment.	Would capture groundwater in area of highest VOC concentrations (on and near the site), and also would prevent further spreading of the contaminant plume.	Would remediate contaminants in the groundwater by oxidizing contaminants. Inorder to create environment for reaction in groundwater, pH and iron concentration must be adjusted prior to injection of hydrogen peroxide.
Long-Term Effectiveness and Permanence						
Adequacy, Reliability of Controls, and Permanence	Leave site in present condition. VOCs in groundwater and soil would continue to be in contravention of standards. This alternative may not provide long-term protection to the supply wells located downgradient of the plume. Does not provide any additional protection to human health or the environment.	Excavation activities are easily implemented. It is a permanent solution since contaminants are removed in their existing state and media.	Technology is reliable, although remedial histories with compound of concern, 1,2,3-TCP, are limited. Technology is well suited for geology on-site. It is considered a permanent solution.	Technology is relatively new, but appears to be reliable. No case histories available associated with treatment of 1,2,3-TCP. Has been shown to be effective with similar VOC contaminants and aquifer conditions. Due to the extent of the plume treatment curtain would be set up to treat contaminants. Is considered a permanent solution since contaminants will be removed from the groundwater media.	Treatment alternative is effective and proven for the removal of VOCs from groundwater. Is considered a permanent solution since contaminants will be removed from the groundwater media.	Technology is suited for the treatment of VOCs and site aquifer conditions. No case histories available for 1,2,3-TCP remediation. Due to the extent of the plume treatment curtain would be set up to treat contaminants. Is considered a permanent solution since contaminants will be removed from the groundwater media.

Table 8-3
Detailed Evaluation of Remedial Action Alternatives
MacKenzie Chemical Site
Islip, Suffolk County, New York

Evaluation Criteria	Soil & Groundwater Alternative No. 1: No Further Action With Monitoring	Soil Alternative No. 2 Excavation and Disposal	Soil Alternative No. 4 Soil Vapor Extraction (with thermal enhancements)	Groundwater Alternative No. 2: In-situ Air Sparging with Ozone Injection	Groundwater Alternative No. 4: Groundwater Pump and Treat	Groundwater Alternative No. 5: In-Situ Chemical Oxidation
Reduction of Toxicity, Mobility, and Volume						
Treatment Process Used and Materials Treated	Not Applicable	Contaminants are removed in their existing media and transported off-site for treatment.	Removal of contaminants from the subsurface soils by extracting air. Inorder to increase the volatility of 1,2,3-TCP heat would be injected into the treatment area. Air discharge is treated via vapor phase carbon.	Transfer of VOCs from groundwater to air using patented in-situ sparge well, contamination is then oxidized with ozone in groundwater. VOCs can be removed from the off-gas using vapor-phase carbon.	Removal of VOCs from groundwater using air stripping technology and liquid phase carbon. Removal of VOCs from off-gas using vapor-phase carbon.	Oxidation of contaminants in the groundwater. Generates heat and carbon dioxide during treatment.
Reductions in Toxicity, Mobility, and Volume	None	No contaminant transformations occur because contaminants are removed in their current state.	Effective at removal of VOCs form the unsaturated zone. Only limitation may be the low volatility of 1,2,3-TCP. Pilot testing to ensure treatability is recommended.	Treats groundwater contaminants effectively; removes and eliminates VOCs from groundwater using sparge wells with ozone injection. Only limitation may be the low Henry's constant with 1,2,3-TCP. Pilot testing to ensure treatability is recommended	Total groundwater extraction rate is estimated at 65 gallons per minute (using 2 extraction wells). One system will capture groundwater on and immediately off-site. The second system will be located at downgradient edge of plume. Expect greater than 99% removal for VOCs.	Treats groundwater contaminants effectively; removes VOCs from groundwater through the injection of chemistry into the groundwater table.
Degree of Irreversibility	Not Applicable	Irreversible	Irreversible	Irreversible	Irreversible	Irreversible
Type and Quantity of Residuals Remaining	Not Applicable	Capable of remediating soils to ARARs, with the exception of any soils located beneath site structures	Remove VOCs from the unsaturated soils on-site, preventing contaminants from continuing to act as a source of groundwater contamination.	Remove VOCs from groundwater and prevent further migration of contaminant plume to potential downgradient receptors (i.e., public supply wells).	Treated groundwater will meet NYS Groundwater Discharge Standards.	Removes VOCs from groundwater and prevent further migration of contaminant plume to potential downgradient receptors (i.e., public supply wells).

Table 8-3
Detailed Evaluation of Remedial Action Alternatives
MacKenzie Chemical Site
Islip, Suffolk County, New York

Evaluation Criteria	Soil & Groundwater Alternative No. 1: No Further Action With Monitoring	Soil Alternative No. 2 Excavation and Disposal	Soil Alternative No. 4 Soil Vapor Extraction (with thermal enhancements)	Groundwater Alternative No. 2: In-situ Air Sparging with Ozone Injection	Groundwater Alternative No. 4: Groundwater Pump and Treat	Groundwater Alternative No. 5: In-Situ Chemical Oxidation
Implementability						
Ability to Construct and Operate	Not Applicable	Not Applicable	Readily installed. Will require routine operation, maintenance and monitoring.	Readily installed, and low O&M required.	Readily installed. Will require routine operation, maintenance and monitoring.	Injection wells can be readily installed. Would need periodic (3 times/year) injections of chemistry.
Ease of Site Preparation	Not Applicable	Pre-remedial site activities would be limited to the installation of shoring adjacent to site structures and in areas of deep excavations.	Treatment equipment is readily installed.	Wells and treatment systems are readily installed. However, land access is required from property owner and/or the Town to construct system on private property or public right-of-ways. NYSDEC will need to identify land for construction of system.	Treatment equipment is readily installed. However, land access is required from property owner and/or the Town to construct recovery wells on private property or public right-of-ways. NYSDEC will need to identify land for construction of system.	Wells are readily installed However, land access is required from property owner and/or the Town to construct wells on private property or public right-of-ways. NYSDEC will need to identify land for construction of system.
Ease of Undertaking Additional Remedial Actions	Not Applicable	Can increase size and areal extent of excavated areas easily	Can add additional SVE wells to expand treatment area. Can increase thermal loading to subsurface if warranted	Can add additional wells to expand treatment area, or modify operational parameters to improve treatment efficiency	Can add additional process units onto treatment train.	Can add additional injection wells to expand treatment area
Ability to Monitor Effectiveness	Groundwater monitoring would be conducted to detect changes in groundwater quality, can be readily implemented	Post excavation soil samples would be collected to confirm ability to meet remedial objectives.	Sampling of treatment system influent will determine mass loading to system.	Sampling of groundwater upgradient and downgradient of cone of influence to monitor for system performance.	Sampling of influent and effluent to monitor treatment system performance.	Sampling of groundwater upgradient and downgradient of treatment zones to monitor for system performance
Ability to Obtain Approval From Other Agencies	Not Applicable	May require local permits	Must obtain permit for air emissions.	May need permit for air emissions.	Must obtain permit for discharge of treated water and air emissions.	May require permit to inject process chemistry into groundwater.
Availability of Materials	Not Applicable	Readily available	Materials for treatment system construction are readily available.	Materials for well construction are readily available. System is patented and therefore, must be obtained from licensed vendors	Readily available.	Well installation methods are conventional, but require stainless steel to withstand exothermic reaction. Patented system; must purchase from licensed-vendors.

Table 8-3
Detailed Evaluation of Remedial Action Alternatives
MacKenzie Chemical Site
Islip, Suffolk County, New York

Evaluation Criteria	Soil & Groundwater Alternative No. 1: No Further Action With Monitoring	Soil Alternative No. 2: Excavation and Disposal	Soil Alternative No. 4 Soil Vapor Extraction (with thermal enhancements)	Groundwater Alternative No. 2: In-situ Air Sparging with Ozone Injection	Groundwater Alternative No. 4: Groundwater Pump and Treat	Groundwater Alternative No. 5: In-Situ Chemical Oxidation
Compliance with NYS Standards, Criteria, and Guidelines						
Compliance with Standards, Criteria, and Guidance (SCGs)	VOCs at on-site and off-site locations will continue to exceed RSCOs, NYS Class GA Groundwater Quality Standards and NYS MCLs.	Soils would be removed until soil quality meets the RSCOs.	SVE system should be capable of achieving the RSCOs.	Groundwater treatment would achieve ARARs (i.e., meet NYS Groundwater Discharge Standards for treated groundwater, and NYS Air Guide 1 guidance for air emissions).	Groundwater treatment would achieve ARARs (treated groundwater would meet NYS Groundwater Discharge Standards, and air emissions from strippers off-gas will meet NYS Air Guide 1 guidance levels).	Groundwater treatment would achieve ARARs (i.e., meet NYS Groundwater Discharge Standards for treated groundwater).
Compliance with other criteria, waivers laws, and guidance	Does not meet SCGs, and does not meet long-tern remedial action objectives.	Would meet NYS SCGs/ARARs, complies with NYS and EPA Superfund guidance.	Would meet NYS SCGs/ARARs, complies with NYS and EPA Superfund guidance.	Would meet NYS SCGs/ARARs, complies with NYS and EPA Superfund guidance.	Would meet NYS SCGs/ARARs, complies with NYS and EPA Superfund guidance.	Would meet NYS SCGs/ARARs, complies with NYS and EPA Superfund guidance.
Overall Protection of Human Health and the Environment	There is currently no risk to public health since all residents within the plume area are connected to public water provided by public water supply. This alternative, however, does not provide long-term protection to the well field located approximately 3,100 feet downgradient of the site.	Protective of human health and the environment. This remedial alternative targets the source of the contamination on-site. Through remediation, future groundwater impacts are eliminated.	Protective of human health and the environment. This remedial alternative targets the source of the contamination on-site. Through remediation, future groundwater impacts are eliminated.	Protective of human health and the environment. This remedial alternative targets the groundwater contaminant plume and reduces the potential for further migration of contaminates in the direction of the public well field.	Protective of human health and the environment. This remedial alternative targets the groundwater contaminant plume and reduces the potential for further migration of contaminates in the direction of the public well field.	Protective of human health and the environment. This remedial alternative targets the groundwater contaminant plume and reduces the potential for further migration of contaminates in the direction of the public well field.
Cost					Treatment 4A - Liquid GAC	
Capital Cost	$0	$1,457,960	$588,630	$444,571	$818,400	$351,100
Annual O&M Costs	$30,000	$0	$98,400	$89,800	$171,600	$263,000
Present Worth (5%)	$311,391	$1,457,960	$1,017,556	$1,138,007	$2,599,557	$2,050,922
					Treatment 4B-Air Stripping	
Capital Cost					$837,000	
Annual O&M Costs					$155,000	
Present Worth (5%)					$2,445,854	

Table 8-4
Order of Magnitude Cost Estimate
Soil Alternative No. 1 - No Further Action
MacKenzie Chemical Site
Islip, Suffolk County, New York

I. **Capital Cost:**	Unit Cost	Quantity	Cost
None			$ -
		Subtotal Capital Cost:	**$ -**

II. **Annual Operating Costs**	Unit Cost	Quantity	Cost
Quarterly Sampling Event	$ 7,500 /event	4 events/yr.	$ 30,000
		Subtotal Estimated Annual Operating Cost:	**$ 30,000**

III. **Present Worth Capital Costs and Annual Operating Costs**	
Total Estimated Capital Cost	NA
Total Estimated Annual Operating Cost	$ 30,000
Present Worth (15 yrs., 5%)	$ 311,391
Present Worth (Capital & Operating)	**$ 311,391**

Notes:
These Cost Estimates represent our opinion as design professionals of probable order of magnitude construction and operating costs and are provided for general guidance in the evaluation of alternatives. Actual contractor bids or cost to the client are a function of final design, competitive bidding and market conditions.

Operating costs are assumed for 15 years.

Table 8-5
Order of Magnitude Cost Estimate
Soil Alternative 2 - Excavation and Disposal
MacKenzie Chemical Site
Islip, Suffolk County, New York

I. **Capital Costs:**	Unit Price	Quantity	Cost
a. Excavation and Disposal of Soil in Areas 1, 2, 3 & 4 to maximum depth of 20' below grade			
- Excavation	$ 1,500 /day	13 days	$ 19,500
- Shoring	$ 30 / sf	3,840 sf	$ 115,200
- Backfilling and Grading	$ 30 / cy	4,050 cy	$ 121,500
			$ 256,200
Soil Disposal			
- Dispose of Soil (Non-Haz., 4,050 cy)	$ 70 /ton	6,500 tons	$ 455,000
b. Excavation at Area 1 from 20' to 45' below grade			
- Excavation	$ 3,000 /day	10 days	$ 30,000
- Shoring	$ 30 / sf	6,600 sf	$ 198,000
- Backfilling and Grading	$ 35 / cy	700 cy	$ 24,500
			$ 252,500
Soil Disposal Options			
- Dispose of Soil (Non-Haz., 700 cy)	$ 70 /ton	1,110 tons	$ 77,700
		Subtotal Estimated Capital Cost:	**$ 1,041,400**

Total Costs Assuming Non-Hazardous Soil Disposal

Subtotal:	$ 1,041,400
Administration (10%):	$ 104,140
Engineering (10%):	$ 104,140
Contingency (20%):	$ 208,280
Subtotal Estimated Capital Cost:	**$ 1,457,960**

Notes:

1. Soil density of approximately 1.6 tons/cy was assumed.
2. These Cost Estimates represent our opinion as design professionals of probable order of magnitude construction and operating costs and are provided for general guidance in the evaluation of alternatives. Actual contractor bids or cost to the client are a function of final design, competitive bidding and market conditions.

Table 8-6
Order of Magnitude Cost Estimate
Soil Alternative 4 - Soil Vapor Extraction (Thermal Enhancement)
MacKenzie Chemical Site
Islip, Suffolk County, New York

I. Capital Costs	Unit Cost		Quantity	Cost
Pilot Test/Design				
Workplan, HASP	$ 5,000	ea.	1	$ 5,000
Wells	$ 3,000	ea.	5	$ 15,000
Portable Steam Generator, GAC	$ 5,000	ea.	1	$ 5,000
Field Testing	$ 8,000	ea.	1	$ 8,000
Air Monitoring & Analysis	$ 5,000	ea.	1	$ 5,000
				$ 38,000
Extraction				
Extraction Wells	$ 3,000	ea.	8	$ 24,000
Trenching	$ 20	/LF	400 LF	$ 8,000
Piping	$ 10	/LF	600 LF	$ 6,000
Vaults	$ 2,000	ea.	7	$ 14,000
				$ 52,000
Treatment				
Treatment Building & Slab	$ 25,000	ea.	1	$ 25,000
Process Equipment	$ 35,000	ea.	1	$ 35,000
Vapor Phase Carbon	$ 10,000	ea.	2	$ 20,000
Power Source	$ 15,000	ea.	1	$ 15,000
Process Piping & Valves	$ 10,000	ea.	1	$ 10,000
System Control	$ 20,000	ea.	1	$ 20,000
Air Cooler	$ 20,000	ea.	1	$ 20,000
Electrical	$ 8,000	ea.	1	$ 8,000
				$ 153,000
Thermal Enhancement System				
Wells	$ 6,000	ea.	16	$ 96,000
Trenching	$ 40	/LF	400 LF	$ 16,000
Piping (Steam)	$ 30	/LF	600 LF	$ 18,000
Water Supply	$ 20	/LF	300 LF	$ 6,000
Steam Boiler including Manifolds	$ 25,000	ea.	1 unit	$ 25,000
Heat Exchanger	$ 7,000	ea.	1 unit	$ 7,000
				$ 168,000
Soil Excavation and Disposal at DS-13				
Excavation	$ 1,500	/day	1 days	$ 1,500
Backfilling and Grading	$ 30	/ cy	55 cy	$ 1,650
Disposal (non-Haz., 55 cy)	$ 70	/ ton	90 tons	$ 6,300
				$ 9,450
			Subtotal for SVE System Capital	$ 420,450
			Admin./Constr. Mgmt. (20%):	$ 42,045
			Engineering (10%):	$ 42,045
			Contingency (20%):	$ 84,090
			Subtotal Estimated Capital Cost :	**$ 588,630**

II. Annual Operating Costs	Unit Cost		Quantity	Cost
a. General O & M	$ 2,000	/month	12 months/yr	$ 24,000
b. Electricity ($0.15 KW HR)	$ 4,500	/month	12 months/yr	$ 54,000
c. GAC Replacement	$ 800	/month	12 months/yr	$ 9,600
d. Air Monitoring	$ 900	/month	12 months/yr	$ 10,800
			Subtotal Estimated Annual Operating Cost:	**$ 98,400**

III. Present Worth Capital Costs and Annual Operating Costs	
Total Estimated Capital Cost	$ 588,630
Total Estimated Annual Operating Cost	$ 98,400
Present Worth (5 yrs., 5%)	$ 428,926
Present Worth (Total Capital & Operating)	**$ 1,017,556**

Notes:

1 These Cost Estimates represent our opinion as design professionals of probable order of magnitude construction and operating costs and are provided for general guidance in the evaluation of alternatives. Actual contractor bids or cost to the client are a function of final design, competitive bidding and market conditions.

2 Operating (monitoring) costs are assumed for 5 years.

Table 8-7
Order of Magnitude Cost Estimate
Groundwater Alternative No. 1 - No Further Action
MacKenzie Chemical Site
Islip, Suffolk County, New York

I. **Capital Cost:**	Unit Cost	Quantity	Cost
None			$ -
		Subtotal Capital Cost:	**$ -**

II. **Annual Operating Costs**	Unit Cost	Quantity	Cost
Quarterly Sampling Event	$ 7,500 /event	4 events/yr.	$ 30,000
		Subtotal Estimated Annual Operating Cost:	**$ 30,000**

III. **Present Worth Capital Costs and Annual Operating Costs**	
Total Estimated Capital Cost	NA
Total Estimated Annual Operating Cost	$ 30,000
Present Worth (15 yrs., 5%)	$ 311,391
Present Worth (Capital & Operating)	**$ 311,391**

Notes:
These Cost Estimates represent our opinion as design professionals of probable order of magnitude construction and operating costs and are provided for general guidance in the evaluation of alternatives. Actual contractor bids or cost to the client are a function of final design, competitive bidding and market conditions.
Operating costs are assumed for 15 years.

Table 8-8
Order of Magnitude Cost Estimate
Groundwater Alternative No. 2 - In-situ Air Sparge with Ozone Injection
MacKenzie Chemical Site
Islip, Suffolk County, New York

I. **Capital & Installation Costs:**	Unit Cost		Quantity		Cost
Brightside Avenue and South Raod					
Installation of Wells	$ 6,000	ea.	8	wells	$ 48,000
Installation of Sparge Points	$ 5,000	ea.	6	wells	$ 30,000
Palletized Sparge System (Brightside Ave)	$ 40,100	ea.	1	unit	$ 40,100
Wall Mount Sparge System (South Rd)	$ 16,700	ea.	1	unit	$ 16,700
In-well Unit	$ 2,875	ea.	8	units	$ 23,000
Below Well Unit	$ 575	ea.	8	units	$ 4,600
Spargepoints	$ 500	ea.	6	units	$ 3,000
Oxygen Source with Controller	$ 3,500	ea.	1	unit	$ 3,500
Well Head Assembly	$ 450	ea.	12	units	$ 5,400
Miscellaneous Parts	$ 10,000	ea.	1		$ 10,000
State License and Fees	$ 13,300	ea.	1		$ 13,300
Vapor Control Unit	$ 3,220	ea.	1	unit	$ 3,220
Vaccum Extraction Pump	$ 5,000	ea.	1	unit	$ 5,000
Piping (PVC)	$ 15	LF	300	LF	$ 4,500
Preconstruction Activities	$ 1,500	ea.	1		$ 1,500
Field Testing	$ 15,000	ea.	1	week	$ 15,000
Buildings	$ 15,000	ea.	2	ea.	$ 30,000
Rental of Field Analytical Equipment (startup)	$ 5,000	ea.	1		$ 5,000
Labor and Expense (System Start-up)	$ 15,000	ea.	1		$ 15,000
Electrical	$ 10,000	ea.	1		$ 10,000
					$ 286,820
Subtotal					$ 286,820
Contingency (20%)					$ 57,364
Engineering (15%)					$ 43,023
Admin./Constr. Mgmt. (20%)					$ 57,364
	Subtotal Estimated Capital Cost:				**$ 444,571**

II. **Annual Operating Costs**	Unit Cost		Quantity		Cost
Electricity	$ 400	Month	12	Months	$ 4,800
System Engineer	$ 80	/hr.	150	hours	$ 12,000
System Operator	$ 70	/hr.	400	hours	$ 28,000
Vapor Phase Carbon	$ 500	/drum	4	drums	$ 2,000
Maintenance Materials	$ 10,000	L.S.	1	Units	$ 10,000
System Performance Monitoring	$ 15,000		1	L.S.	$ 15,000
Semi-Annual Groundwater Monitoring	$ 9,000	/event	2	events/yr.	$ 18,000
	Subtotal Estimated Annual Operating Cost:				**$ 89,800**

III. **Present Worth Capital Costs and Annual Operating Costs**	
Total Estimated Capital Cost	$ 444,571
Total Estimated Annual Operating Cost	$ 89,800
Present Worth (10 yrs., 5%)	$ 693,436
Present Worth (Capital & Operating)	**$ 1,138,007**

Operating costs are assumed for 10 years.
NYSDEC may need to acquire land for installation/construction of treatment system.

These Cost Estimates represent our opinion as design professionals of probable order of magnitude construction and operating costs and are provided for general guidance in the evaluation of alternatives. Actual contractor bids or cost to the client are a function of final design, competitive bidding and market conditions.

Table 8-9
Order of Magnitude Cost Estimate
Groundwater Alternative No. 4A - Pump and Treat with Liquid Phase Carbon
MacKenzie Chemical Site
Islip, Suffolk County, New York

I. **Capital & Installation Costs:**	Unit Cost	Quantity	Cost
Extraction			
Extraction Wells	$ 15,000 ea.	2	$ 30,000
Pump System	$ 6,000 ea.	2	$ 12,000
Utility Vault	$ 7,000 ea.	2	$ 14,000
Transmission Pipe/Conduit (LF)	$ 40 /LF	1,000 LF	$ 40,000
			$ 96,000
Treatment (Air Stripping with Liquid Phase Carbon)			
Treatment Building	$ 70,000 ea.	1 Units	$ 70,000
Eqpt. Foundation	$ 25,000 ea.	1 Units	$ 25,000
Power Sources	$ 15,000 ea.	1 Units	$ 15,000
Process Piping & Valves	$ 45,000 ea.	1 Units	$ 45,000
System Controls	$ 45,000 ea.	1 System	$ 45,000
Clear Well	$ 30,000 ea.	1 Units	$ 30,000
Additional Pumps	$ 5,000 ea.	2 Units	$ 10,000
Liquid Phase Carbon Units	$ 20,000 ea.	2 Units	$ 40,000
			$ 280,000
Reinjection			
Drywells	$ 5,000 ea.	24	$ 120,000
Drainage Piping	$ 40 /LF	800 LF	$ 32,000
			$ 152,000
Subtotal			$ 528,000
Contingency (20%)			$ 105,600
Engineering (15%)			$ 79,200
Admin./Constr. Mgmt. (20%)			$ 105,600
		Subtotal Estimated Capital Cost:	**$ 818,400**

II. **Annual Operating Costs**	Unit Cost	Quantity	Cost
Electricity	$ 800 Month	12 Months	$ 9,600
System Engineer	$ 80 /hr.	200 hours	$ 16,000
System Operator	$ 70 /hr.	400 hours	$ 28,000
Maintenance Materials	$ 30,000 /year	1 year	$ 30,000
Liquid Phase Carbon Changeout[1]	$ 50,000 /year	1 year	$ 50,000
Solids Disposal	$ 250 /drum	20 drums	$ 5,000
System Performance Monitoring	$ 15,000 /year	1 year	$ 15,000
Semi-Annual Groundwater Monitoring	$ 9,000 /event	2 events/yr.	$ 18,000
		Subtotal Estimated Annual Operating Cost:	**$ 171,600**

III. **Present Worth Capital Costs and Annual Operating Costs**	
Total Estimated Capital Cost	$ 818,400
Total Estimated Annual Operating Cost	$ 171,600
Present Worth (15 yrs., 5%)	$ 1,781,157
Present Worth (Capital & Operating)	**$ 2,599,557**

These Cost Estimates represent our opinion as design professionals of probable order of magnitude construction and operating costs and are provided for general guidance in the evaluation of alternatives. Actual contractor bids or cost to the client are a function of final design, competitive bidding and market conditions.
Operating costs are assumed for 15 years.
NYSDEC may need to acquire land for installation/construction of treatment system.
[1] Cost presented represents the average estimated annual carbon consumption for 15 years of operation.

Table 8-10
Order of Magnitude Cost Estimate
Groundwater Alternative No. 4B - Pump and Treat with Air Stripping and Carbon Polishing
MacKenzie Chemical Site
Islip, Suffolk County, New York

I. **Capital & Installation Costs:**	Unit Cost	Quantity	Cost
Extraction			
Extraction Wells	$ 15,000 ea.	2	$ 30,000
Pump System	$ 6,000 ea.	2	$ 12,000
Utility Vault	$ 7,000 ea.	2	$ 14,000
Transmission Pipe/Conduit (LF)	$ 40 /LF	1,000 LF	$ 40,000
			$ 96,000
Treatment (Air Stripping with Carbon Polishing)			
Treatment Building	$ 70,000 ea.	1 Units	$ 70,000
Eqpt. Foundation	$ 25,000 ea.	1 Units	$ 25,000
Air Stripping Units	$ 30,000 ea.	1 Units	$ 30,000
Booster Blower	$ 2,000 ea.	1 Units	$ 2,000
Power Sources	$ 15,000 ea.	1 Units	$ 15,000
Process Piping & Valves	$ 45,000 ea.	1 Units	$ 45,000
System Controls	$ 45,000 ea.	1 System	$ 45,000
Clear Well	$ 30,000 ea.	1 Units	$ 30,000
Additional Pumps	$ 5,000 ea.	2 Units	$ 10,000
Liquid Phase Carbon Units	$ 10,000 ea.	2 Units	$ 20,000
			$ 292,000
Reinjection			
Drywells	$ 5,000 ea.	24	$ 120,000
Drainage Piping	$ 40 /LF	800 LF	$ 32,000
			$ 152,000
Subtotal			$ 540,000
Contingency (20%)			$ 108,000
Engineering (15%)			$ 81,000
Admin./Constr. Mgmt. (20%)			$ 108,000
		Subtotal Estimated Capital Cost:	**$ 837,000**

II. **Annual Operating Costs**	Unit Cost	Quantity	Cost
Electricity	$ 1,000 Month	12 Months	$ 12,000
System Engineer	$ 80 /hr.	250 hours	$ 20,000
System Operator	$ 70 /hr.	500 hours	$ 35,000
Maintenance Materials	$ 40,000 /year	1 year	$ 40,000
Liquid Phase Carbon Changeout[1]	$ 10,000 /year	1 year	$ 10,000
Solids Disposal	$ 250 /drum	20 drums	$ 5,000
System Performance Monitoring	$ 15,000 /year	1 year	$ 15,000
Semi-Annual Groundwater Monitoring	$ 9,000 /event	2 events/yr.	$ 18,000
		Subtotal Estimated Annual Operating Cost:	**$ 155,000**

III. **Present Worth Capital Costs and Annual Operating Costs**	
Total Estimated Capital Cost	$ 837,000
Total Estimated Annual Operating Cost	$ 155,000
Present Worth (15 yrs., 5%)	$ 1,608,854
Present Worth (Capital & Operating)	**$ 2,445,854**

These Cost Estimates represent our opinion as design professionals of probable order of magnitude construction and operating costs and are provided for general guidance in the evaluation of alternatives. Actual contractor bids or cost to the client are a function of final design, competitive bidding and market conditions.
Operating costs are assumed for 15 years.
NYSDEC may need to acquire land for installation/construction of treatment system.
[1] Cost presented represents the average estimated annual carbon consumption for 15 years of operation.

Table 8-11
Order of Magnitude Cost Estimate
Groundwater Alternative No. 5 - In-situ Chemical Oxidation
MacKenzie Chemical Site
Islip, Suffolk County, New York

I. **Capital & Installation Costs:**	Unit Cost	Quantity	Cost
Phase I - Bench Scale Testing Phase			
Sample Collection and Analysis	$ 3,000 ea.	1	$ 3,000
Bench Scale Testing	$ 3,000 ea.	1	$ 3,000
Post Treatment Sample Analysis	$ 3,000 ea.	1	$ 3,000
			$ 9,000
Phase II - Pilot Transitory Phase			
Work Plan/HASP/Approvals	$ 5,000 ea.	1 Units	$ 5,000
Well Installation	$ 8,000 ea.	4 Wells	$ 32,000
Pre-pilot Sample Collection and Analaysis	$ 3,700 ea.	1 Units	$ 3,700
Process Chemical Injection	$ 65,000 ea.	1 Units	$ 65,000
Post-pilot sample Collection & Analysis	$ 3,700 Round	2 Rounds	$ 7,400
Report & Work Plan Development	$ 5,000 ea.	1 Units	$ 5,000
			$ 118,100
Full Scale Remediation Phase			
Well Installation	$ 8,000 ea.	28 Wells	$ 224,000
	Subtotal Estimated Capital Cost:		**$ 351,100**

II. **Annual Operating Costs**	Unit Cost	Quantity	Cost
Process Chemicals	$ 75,000 ea.	3 /year	$ 225,000
Semi-Annual Groundwater Monitoring	$ 9,000 /event	2 /year	$ 18,000
System Performance Monitoring	$ 20,000 /year	1 /year	$ 20,000
	Subtotal Estimated Annual Operating Cost:		$ 263,000

III. **Present Worth Capital Costs and Annual Operating Costs**	
Total Estimated Capital Cost	$ 351,100
Total Estimated Annual Operating Cost	$ 263,000
Present Worth (8 yrs., 5%)	$ 1,699,822
Present Worth (Capital & Operating)	**$ 2,050,922**

These Cost Estimates represent our opinion as design professionals of probable order of magnitude construction and operating costs and are provided for general guidance in the evaluation of alternatives. Actual contractor bids or cost to the client are a function of final design, competitive bidding and market conditions.
Operating costs are assumed for 8 years.
NYSDEC may need to acquire land for installation/construction of treatment system.

Table 8-12
Summary of Remedial Action Costs
MacKenzie Chemical Site
Islip, Suffolk County, New York

Estimated Costs	Soil & Groundwater Alternative No. 1: No Further Action with Monitoring	Soil Alternative No. 2: Excavation and Disposal	Soil Alternative No. 4: SVE (thermally enhanced)	Groundwater Alternative No. 2: In-Situ Air Sparge with Ozone Injection	Groundwater Alternative No. 4A: Pump and Treat with Liquid GAC	Groundwater Alternative No. 4B: Pump and Treat with Air Stripping	Groundwater Alternative No. 5: In-situ Chemical Oxidation
Capital Cost:	$0	$1,457,960	$588,630	$444,571	$818,400	$837,000	$351,100
Annual O&M Costs:	$30,000	$0	$98,400	$89,800	$171,600	$155,000	$263,000
Total Present Worth: (1)	$311,391	$1,457,960	$1,017,566	$1,138,007	$2,599,557	$2,445,854	$2,050,922
Period for Implementation: (2)	NA	3 - 6 Months	6 to 9 Months	9 to 12 Months	6 to 9 Months	6 to 9 Months	9 to 12 Months

Notes:

(1) - Present worth costs are based on period of remediation and 5% interest rate.

(2) - Does not include timeframe for gaining access or permission from land owner to install the treatment system.

APPENDIX A

Data Validation Summary Report

Data Validation Services

120 Cobble Creek Road P. O. Box 208
North Creek, N. Y. 12853
Phone 518-251-4429

April 23, 1999

Michael Gentils
H2M Group
575 Broad Hollow Rd.
Melville, NY 11747

RE: Validation of MacKenzie Chemical data packages
Accredited Case Nos. 2457, 2473, 2506, 2541, 2573, 3058, and 3192

Dear Mr. Gentils:

Review has been completed for the above-mentioned data packages generated by Accredited Laboratories, pertaining to samples collected at the MacKenzie Chemical Site between November 1998 and January 1999. Twenty two aqueous and twelve soil samples were processed for full 1995 NYSDEC ASP CLP TCL/TAL parameters, and four soil samples were processed for volatiles by 95-1. Volatile analyses included an after-the-fact search for the target analyte 1,2,3-trichloropropane. Field and trip blanks, and sample matrix spikes/duplicates were also analysed.

Data validation was performed with guidance from the most current editions of the USEPA CLP National Functional Guidelines for Organic and Inorganic Data Review and the USEPA SOPs HW-2 and HW-6. The following items were reviewed:

* Data Completeness
* Custody Documentation
* Holding Times
* Surrogate and Internal Standard Recoveries
* Matrix Spike Recoveries/Duplicate Correlations
* Field Duplicate Correlations
* Preparation/Calibration Blanks
* Control Spike/Laboratory Control Samples
* Instrumental Tunes
* Calibration Standards
* Instrument IDLs
* Method Compliance
* Sample Result Verification

Copies of laboratory case narratives are attached to this narrative, and should be reviewed in conjunction with this narrative. A summary analysis chart and copies of the laboratory NYSDEC Sample Analytical Requirement Summary Forms are also included with this report. The edits and qualifications noted in the following text will be applied as red ink edits to hardcopies of client results tables (when received) and submitted under separate cover.

In summary, samples were primarily processed in compliance with protocol requirements, and most results are usable as reported, with numerous qualifications. Although there were instances of noncompliant processing (i.e. cyanide holding time violations, pesticide/PCB baseline response, etc.), only those affecting sample reported results will be detailed within this report.

Data Completeness

The data packages were not generated according to NYSDEC ASP Superfund or Category B deliverables. Most information needed to perform validation was provided. Please see the attached resubmission communications for other requested data.

One of the items requested for resubmission were the Inorganic Cover Pages required by the ASP. Although these were provided upon request, they were not signed by laboratory personnel.

Soil samples processed in early January 1999 were reported with matrix spike/duplicate associations from project samples from November 1998.

Volatile Analyses

Following the reporting of five of the seven project delivery groups, evaluation for analyte 1,2,3-trichloropropane was requested. Because the request occured after analysis (and after a viable holding time), the evaluation was not performed as a target compound analysis, in that this compound was not included in the standard processing. The evaluation was performed by specific laboratory review of each sample's data by the analyst, and reported as a Tentatively Identified Compound (TIC) when detected. Therefore the identification is tentative, and the reported quantitative values are not accurate. TIC values are always estimated, although those for this project were not properly flagged as such by the laboratory (see below).

Only the resubitted TIC forms for the volatile analyses should be used for groups 2457, 2473, 2506, 2541, and 2573. These were revised by the laboratory to show evaluation for 1,2,3-trichloropropane, and sent by facsimile transmission from the laboratory to H2M Group on 1/14/99). These forms, and those provided with groups 3192 and 3058, should also include the following edits and corrections, determined during validation:

Due to the fact that this compound elutes very closely to one of the surrogate standards present in each sample, the peak response resulting from this compound was not properly evaluated by the TIC software. Some possible detections were not noted by the analyst, and some of the reported values when detected were significantly lower than actual. Upon validation review, the chromatograms were reviewed for response, and the following additional information is provided:

1. All reported 1,2,3-trichloropropane values are considered tentative ("N" qualifier) in identification, and greatly estimated ("J") due to the assumptions present in the TIC quantitative algorithm.
2. *Potential* 1,2,3-trichloropropane detections not reported (these can be verified or eliminated by additional laboratory review) are the following:

Sample ID	Approximate Concentration (based upon TIC algorithm)
VP-3-60	10 ug/L
VP-10	10 ug/L
DS-2B	10 ug/Kg
DS-12	150 ug/Kg
Waste Lagoon #1-8	>500 ug/Kg
Waste Lagoon #1-25	50 ug/Kg

table continued next page

cont'd

Sample ID	Approximate Concentration (based upon TIC algorithm)
Waste Lagoon #1-40	40 ug/Kg
MCMW#3	250 ug/L
MCMW#5	40 ug/L
OS#2I	10 ug/L
OS#3D	150 ug/L
OS#3I	10 ug/L
VP360	10 ug/L

3. Reported values of 1,2,3-trichloropropane not properly determined:

Sample ID	Approximate Concentration (based upon TIC algorithm)
VP-2-80	> 500 ug/L
DUPLICATE	> 500 ug/L
OS#3S*	>> 1,000 ug/L*

* The response from this analyte saturated the electronmultiplier, preventing the possibility of determining the actual approximate concentration.

Due to poor spectral quality (nonsubtractive interferences), the detection of chloromethane in VP680 is rejected, and the result edited to nondetection at the CRDL ("10U").

Tentatively Identified Compounds (TICs) were incorrectly flagged by the laboratory. All TIC values should have shown the "J" (estimated value) qualifier (none were applied). **Only** those identified, and showing a CAS number, should have been flagged with the "N" (tentative identification) qualifier (all were flagged as "N"). Those also present in associated blanks should show the "B" qualifier (this was not done consistently).

TICs which are named "siloxanes" are usually artifacts of the analytical system, and should not be considered sample components ("R" validation qualifier).

TICs which show the "B" flag should also be rejected as sample components. TIC concentrations should have been reported only to one significant figure.

The TICs at about 9.3' in the aqueous samples received 1/22/99 in Case No. 3192 are freons, and are also detected in associated blanks (they should have been flagged as "B" by the laboratory). They should be disregarded as sample components.

Methylene chloride and acetone were detected in certain of the method blanks, trip blanks, and field blanks at concentrations similar to those of the samples, indicating contamination contribution. The sample reported methylene chloride and acetone results for all project samples showing detection should be edited to reflect nondetection ("U") at either the CRDL, or at the originally reported value, whichever is greater.

Aqueous matrix spikes were performed on VP-4-120, VP-10, and OS#4D, and soil matrix spikes were performed on DS-11,8, DS-12, and Waste Lagoon #2-40. All accuracy and precision values were acceptable.

Field duplicate correlations for DS-13(0-10)/DS-XX, VP-2-80/DUPLICATE, and MCMW#1/MW-XX were acceptable.

Standard responses met protocol requirements. However, some exceeded validation action levels. The following analyte values should be considered estimated ("J") due to low standard responses (or outlying elevated responses with associated sample detections) exceeding 30%RSD or 25%D, but less than 90%D:

Carbon disulfide in VP-2-80, DUPLICATE, DS-9,25, DS-11,8, DS-3B, DS-XX, DS-2B, DS-13B, VP-3-60, VP-4-120, DS-6,10, VP-6,80, and VP-8,80

Acetone in Waste Lagoons #2-8 and #1-25.

Vinyl chloride and 1,1-dichloroethene in VP-10

Chloromethane in DS-9,25, DS-11,8, DS-3B, DS-6,10and DS-2B

2-Hexanone in OS#4D, OS#1D, OS#2I, OS#2D, OS#3S, OS#3D, OS#3I, MCMW#1, MCMW#3, MCMW#4, and MCMW#5

Contrary to NYSDEC ASP requirements, calibration standard processing involved manual integrations which were not explained or initialed by the analyst.

Instrument Detection Limits (IDLs) were not provided for the instrument used for these samples, and those provided are outdated. Reporting limit acceptance is based upon system/standard performance.

Many of the standard summary Forms 5 and 6 show incorrect purge temperature/matrix notations (Y or N).

Semivolatile Analyses

Sample analyte values flagged as "E" should be derived from the dilution analyses. Unless noted specifically within this text, all other analyte values should be derived from the initial analyses of the samples.

Some of the samples exhibited low recoveries of internal standards, indicating possible matrix effect. The results for these samples should be edited as follows:

Waste Lagoon #1-8 --results for analytes associated with internal standard d12-perylene (13% recovery) should be derived only from the dilution analysis, thus having elevated detection limits. The affected analytes are the last seven on the Forms 1.

DS-13B --results for analytes associated with internal standards d12-chrysene and d12-perylene (20% and 6% recoveries) should be derived only from the dilution analysis, thus having elevated detection limits. The affected analytes are the last thirteen on the Forms 1.

DS-XX --results for analytes associated with internal standards d12-chrysene and d12-perylene (19% and 6% recoveries) should be derived only from the dilution analysis, thus having elevated detection limits. The affected analytes are the last thirteen on the Forms 1.

DS-12 --only the initial analysis (**not** "-DL") should be used. Results for those analytes associated with internal standard d12-perylene (30% recovery) are considered estimated ("J").

DS-14--only the initial analysis (**not** "-DL") should be used. Results for those analytes associated with internal standard d12-perylene (30% recovery) are considered estimated ("J").

OS#3S --only the initial analysis (**not** "-DL") should be used. Results for those analytes associated with internal standard d10-acenaphthene (28% recovery) are considered estimated ("J").

Bis(2-ethylhexyl)phthalate was detected in certain of the method and field blanks at concentrations similar to those of the samples, indicating contamination contribution. This analyte was not properly flagged as "B" in many of the samples. The sample reported results for this analyte in all project samples showing detection should be edited to reflect nondetection ("U") at either the CRDL, or at the originally reported value, whichever is greater. The exceptions are samples OS#2D and MCMW#4, which showed concentrations slightly above the validation action levels. Detections of that analyte in those two samples should be regarded with caution.

Low level detections of di-n-butylphthalate and butylbenzylphthalate should be regarded with caution due to potential contamination (due to presence in spiked blanks).

The "B" flag was misapplied by the laboratory to the di-n-octylphthalate result of VP-4-120. It was not present in the associated method blank.

The extraction holding time was exceeded for the Field Blank in Case 2573 (six days from VTSR, ten days from collection). Results for that field blank should therefore be considered estimated, possibly biased low.

Standard responses met protocol requirements. However, some exceeded validation action levels. The following analyte values should be considered estimated ("J") due to low standard responses (or outlying elevated responses with associated sample detections) exceeding 30%RSD or 25%D, but less than 90%D:

2,4-dinitrophenol in all project samples
Hexachlorocyclopentadiene in VP-10 and DS-15
Di-ethylphthalate in VP-3-60

Tentatively Identified Compounds (TICs) were incorrectly flagged by the laboratory. All TIC values should show the "J" qualifier (none were applied). Only those identified, and showing a CAS number, should be flagged with the "N" qualifier (all were flagged as "N"). Those also present in associated blanks should show the "B" qualifier (this was not done consistently).

Tentatively Identified Compounds (TICs) which are "aldol condensates" should have been flagged with the "A" qualifier. These are artifacts of the extraction, and should not be considered sample components. All TICs reported with the "B" laboratory flag should be disregarded as sample components due to copresence in associated blanks.

TICs should have been reported with the dilution analyses of the samples, but were not. In most cases the dilution analyses would have provided better characterization and quantitative accuracy.

The TIC #5 in VP-4-120 should have been identified as "aldol condensate", not the TIC #6.

TICs at 30.04' and 5.10' in sample DUPLICATE are rejected from consideration as sample constituents due to copresence in the associated field blank.

Some of the semivolatile TICs appear to be 1,2,3-trichloropropane, confirming the presence in the volatile fractions.

TIC concentrations should be reported to only one significant figure.

Aqueous matrix spikes were performed on VP-4-120 and OS#4D, and soil matrix spikes were performed on DS-11,8. All accuracy and precision values were within recommended ranges, or showed slightly outlying values not indicating qualification of associated sample data.

Field duplicate correlations for DS-13(0-10)/DS-XX, VP-2-80/DUPLICATE, and MCMW#1/MW-XX were acceptable.

Multiple elevated acid surrogate recoveries present in samples VP-6,80 and VP-8,80 did not impact the sample reported results, which were nondetection.

Chromatograms were not normalized to response beyond the solvent elution. Injection logs are not properly documented. IDLs are outdated.

Some of the report Forms 1 and 4 show soils done at medium level, which is not correct. All were done with the low level extraction, although some should have been medium level.

Pesticide/PCB Analyses

Sample detections exhibiting poor dual column correlation ("P" laboratory flag) may be interferences, and results are to be edited as follows. Some values are considered estimated ("J"), some identifications are considered tentative ("N"), and some detections are rejected (edit to "U").:

Sample ID	Analyte	Qualifier/Edit
Waste Lagoon #1-8	a-chlordane	add "U"
Waste Lagoon #2-8	heptachlor	add "N"
	4,4-DDT	add "J"
	a-chlordane	add "NJ"
DS-XX	endrin	add "J"
	methoxychlor	add "U"
DS-2B	4,4-DDE	add "U"
DS-13B	methoxychlor	edit to "18 U"
DS-12	4,4'-DDD	add "J"
	a-chlordane	add "NJ"
	dieldrin	edit to "3.4 U"
	4,4-DDE	edit to "3.4 U"
	endosulfan II	edit to "3.4 U"
DS-14	4,4'-DDD	edit to "U"
	4,4'-DDT	edit to "3.5 U"

Due to low surrogate DCB recoveries (25% to 29%), results for OS#5S and VP-8-80 are considered estimated ("J"), possibly biased low.

The Aroclor 1254 reported detection limit for DS-14 is considered estimated ("J") due to intereferences masking the potential presence of this analyte.

Aqueous matrix spikes were performed on VP-4-120 and OS#4D, and soil matrix spikes were performed on DS-11,8. All accuracy and precision values were within recommended ranges, or showed slightly outlying values not indicating qualification of associated sample data.

Field duplicate correlations for DS-13(0-10)/DS-XX, VP-2-80/DUPLICATE, and MCMW#1/MW-XX were acceptable.

The extraction holding time was exceeded for the Field Blank in Case 2573 (six days from VTSR, ten days from collection). Results for that field blank should therefore be considered estimated, possibly biased low. This sample also exhibited excessive background, also indicating qualification of reported results.

Chromatograms do not meet the protocol requirements for relative background response. Many analyses included excessive background, including method blank analyses, and many analyses showed unacceptable negative baseline responses.

Metals/CN Analyses

Cyanide results for all samples in Case No. 3192 **except** OS#2I and OS#3I should be edited to show the "U" flag for nondetection. The laboratory misreported these with the "B" flag. Additionally, see the following comments regarding additional qualification:

Holding times were exceeded for cyanide analysis in the aqueous samples received 1/22/99 (Case No. 3192) and 11/24/98 (Case 2573). They were processed at 15 and 17 days from VTSR, respectively, beyond the 12 day limit. All cyanide results for samples in these groups are therefore considered estimated ("J"), possibly biased low. These should have been discussed in the case narratives.

Additionally, no cyanide bottles were received for the samples in 3192, and analysis was performed by using initially unpreserved aliquots from the BNA and pesticide/PCB fractions. This results is an even greater bias to those samples, indicating borderline usability for those cyanide results.

Due to copresence in the associated Field Blank (15.2 ug/L), the results for manganese in the samples DS-12, DS-14, and DS-15 should be qualified as estimated ("J").

Aqueous matrix spikes/duplicates were performed on VP-4-120 and OS#4D, and soil matrix spikes/duplicates were performed on Waste Lagoon #1-8, DS-11,8, and DS-12. All accuracy and precision values did not require qualification, except in the following cases:

Cadmium is estimated in samples VP-2-80, DUPLICATE, VP-10, VP-3-60, VP-4-120, VP-6-80, and VP-8-80 due to low (73%) recovery in the spike of VP-4-120

Silver results are estimated for DS-9,25, DS-11,8, DS-3B, DS-XX, DS-2B, and DS-13B due to elevated recovery (143%) in the spike of DS-11,8 and/or noncompliant low response (-2.7 mg/kg) in the method blank

Zinc results are estimated for DS-9,25, DS-11,8, DS-3B, DS-XX, DS-2B, DS-13B, and DS-6-10 due to outlying duplicate correlation for DS-11,8 (>2X+-CRDL).

Field duplicate correlations for aqueous samples MCMW#1/MW-XX were acceptable. Those for DS-13(0-10)/DS-XX showed outlying correlation for calcium (>2X+-CRDL). Results for calcium in the soil samples of this matrix should be considered estimated ("J"). Field duplicate correlation for VP-2-80/ DUPLICATE produced outlying values for aluminum, barium, chromium, and lead (exceed 50%RPD or >+-CRDL). These element values should be considered estimated in the aqueous samples of similar matrix.

Due to outlying recoveries of standards at low concentrations (CRI/CRA), the following results should be considered estimated ("J"):

Cadmium and copper VP-2-80, DUPLICATE, VP-3-60, VP-4-120, VP-6-80, and VP-8-80
Antimony in Waste Lagoon #1-8 and Waste Lagoon #2-8
Chromium in DS-11,8
Silver in all samples in Case No. 3192 (rec. 1/22/99)
Zinc in OS31D, OS#5D, OS#2S, OS#2D, OS#3I,. MCMW#1, MC#XX
Arsenic in DS-12, DS-14, and DS-15

Due to negative recovery for mercury in the CRA standard in Case No. 2573, the mercury results (nondetection) for DS-14 and DS-15 are to be rejected ("R"), and the result for DS-12 is to be considered estimated ("J"). Laboratory corrective action was not required, but instrumentation sensitivity does not support low level reported results.

Due to noncompliant response (-20.3 ug/L) for zinc in a blank, the result for zinc in associated samples VP-2-80, VP-3-60, and VP-4-120 should be considered estimated ("J").

Due to noncompliant response (-2.74 mg/kg) for silver in a method blank, the result for this analyte in DS-6-10 is considered estimated ("J"), possibly biased low.

Serial dilution determinations for VP-4-120, Waste Lagoon #108, DS-11,8, OS#4D, DS-12, produced acceptable correlation not requiring qualification, with the following exceptions:

Magnesium in VP-2-80, DUPLICATE, VP-10, VP-3-60, VP-4-120, VP-6-80, and VP-8-80 due to elevated value in VP-4-120 (11%D).

Post-digest spike recovery outliers indicate the following qualifications as estimated ("J"):

Sample ID	Element	% PDS Recovery
VP-10	selenium	80%
OS#4D	arsenic	116
OS#5S	selenium	56
OS#2D	selenium	68
MCMW#5	selenium	78
VP-6-80	selenium	79
VP-3-60	selenium	81
VP-4-120	selenium	67

Cyanide raw data should have included instrumental tracings.

The receive date on the metals Forms 1 for samples in Case No. 3058 should reflect the date of 1/8/99, not 1/19/99.

Field blank results should not have been flagged with laboratory qualifiers from soil evaluations..

Please do not hesitate to contact me if questions or comments arise during your review of this report.

Very truly yours,

Judy Harry

ANALYSIS SUMMARY CHART

Project: H2M Group --Mackenzie Chemical Co.

SDG Nos.: Accredited Case Nos. 2473, 2541, 2506, 2573, 2457, 3058, and 3192

Protocol: 1995 NYSDEC ASP CLP

Rec. Date	Sample ID	Matrix	VOA	BNA	Pest/PCB	Metals/CN
11-12-98	TB	Aqueous	OK	NR	NR	NR
11-12-98	FB	Aqueous	OK	OK	OK	OK
11-12-98	VP-2-80'	Aqueous	OK	OK	OK	OK
11-12-98	DUP	Aqueous	OK	OK	OK	OK
11-13-98	VP-3-60'	Aqueous	OK	OK	OK	OK
11-13-98	VP-4-120'	Aqueous	OK	OK	OK	OK
11-18-98	VP-6,80	Aqueous	OK	OK	OK	OK
11-18-98	VP-8,80	Aqueous	OK	OK	OK	OK
11-18-98	DS-6-10	Soil	OK	OK	OK	OK
11-20-98	DS-9,25	Soil	OK	OK	OK	OK
11-20-98	DS-11,8	Soil	OK	OK	OK	OK
11-20-98	VP-10	Aqueous	OK	OK	OK	OK
11-20-98	DS-3B	Soil	OK	OK	OK	OK
11-20-98	DS-XX	Soil	OK	OK	OK	OK
11-20-98	DS-2B	Soil	OK	OK	OK	OK
11-20-98	DS-13B	Soil	OK	OK	OK	OK
11-24-98	TB	Aqueous	OK	NR	NR	NR
11-24-98	FB	Aqueous	OK	OK	OK	OK
11-24-98	DS-12	Soil	OK	OK	OK	OK
11-24-98	DS-15	Soil	OK	OK	OK	OK
11-24-98	DS-14-4-8'	Soil	OK	OK	OK	OK
01-08-99	TB	Aqueous	OK	NR	NR	NR
01-08-99	Waste Lag. 1-8'	Soil	OK	OK	OK	OK
01-08-99	Waste Lag. 1-25'	Soil	OK	NR	NR	NR
01-08-99	Waste Lag. 1-40'	Soil	OK	NR	NR	NR
01-08-99	Waste Lag. 2-8'	Soil	OK	OK	OK	OK
01-08-99	Waste Lag. 2-25'	Soil	OK	NR	NR	NR
01-08-99	Waste Lag. 2-40'	Soil	OK	NR	NR	NR
01-22-99	FB	Aqueous	OK	OK	OK	OK
01-22-99	MCMW#1	Aqueous	OK	OK	OK	OK
01-22-99	MCMW#3	Aqueous	OK	OK	OK	OK
01-22-99	MCMW#4	Aqueous	OK	OK	OK	OK
01-22-99	MCMW#5	Aqueous	OK	OK	OK	OK
01-22-99	MCMW#XX	Aqueous	OK	OK	OK	OK
01-22-99	OS#1D	Aqueous	OK	OK	OK	OK
01-22-99	OS#2D	Aqueous	OK	OK	OK	OK
01-22-99	OS#2I	Aqueous	OK	OK	OK	OK
01-22-99	OS#2S	Aqueous	OK	OK	OK	OK
01-22-99	OS#3D	Aqueous	OK	OK	OK	OK
01-22-99	OS#3I	Aqueous	OK	OK	OK	OK
01-22-99	OS#3S	Aqueous	OK	OK	OK	OK
01-22-99	OS#4D	Aqueous	OK	OK	OK	OK
01-22-99	OS#5D	Aqueous	OK	OK	OK	OK
01-22-99	OS#5S	Aqueous	OK	OK	OK	OK
01-22-99	TB	Aqueous	OK	NR	NR	NR

OK Analysis performed and reported
NR Analysis not required

Data Validation Services

120 Cobble Creek Road P. O. Box 208
North Creek, NY 12853
Phone and Fax (518) 251-4429

March 15, 1999

Theodore Gaydos
Accredited Laboratories, Inc.
20 Pershing Ave.
Carteret, NJ 07008

RE: H2M Group -MacKenzie Chemical
Project DEC 9801
Accredited Case Nos. 2473, 2504, 2541, 2573, 3058, and 3192

Dear Mr. Gaydos:

Review of the above-mentioned data packages is in progress. The following items are needed to complete the validation of the data:

1. The NYSDEC ASP deliverables require a "Cover Page" pertaining to the metals analysis (see section B of the ASP for specifics). Please provide completed forms for these project data packages.
2. ASP requires that the quant ion used for the volatile and semivolatile analyses be printed on the quant reports. They were not. Please provide example standard quant reports for each analysis fraction and instrument to show the quant ions used.
3. Please clarify the injection volume for the BNA analyses. These are not stated on the raw instrument logs.
4. ASP requires that sample pHs be noted on the metals and cyanide prep logs, but these were not. Please provide the documentation showing the measure sample pHs.
5. Regarding the cyanide results reported for samples in Case 3192:
Please discuss what your IDL is for this instrument during this analysis. It is observed that blanks and samples with no detection are reported as detects flagged as "B", indicating value above the IDL.
6. Please clarify the cyanide final volumes used. These are not noted on the raw instrument logs.

Thank you for your prompt attention to this matter. Replies to the fax number above are appreciated, and please send copies of all communications to Michael Gentils at H2M Group.

Very truly yours,

Judy Harry

Data Validation Services

120 Cobble Creek Road P. O. Box 208
North Creek, NY 12853
Phone and Fax (518) 251-4429

March 15, 1999

Theodore Gaydos
Accredited Laboratories, Inc.
20 Pershing Ave.
Carteret, NJ 07008

RE: H2M Group -MacKenzie Chemical
Project DEC 9801
Accredited Case Nos. 2473, 2504, 2541, 2573, 3058, and 3192

Dear Mr. Gaydos:

Review of the above-mentioned data packages is in progress. The following items are needed to complete the validation of the data:

1. The NYSDEC ASP deliverables require a "Cover Page" pertaining to the metals analysis (see section B of the ASP for specifics). Please provide completed forms for these project data packages.
2. ASP requires that the quant ion used for the volatile and semivolatile analyses be printed on the quant reports. They were not. Please provide example standard quant reports for each analysis fraction and instrument to show the quant ions used.
3. Please clarify the injection volume for the BNA analyses. These are not stated on the raw instrument logs.
4. ASP requires that sample pHs be noted on the metals and cyanide prep logs, but these were not. Please provide the documentation showing the measure sample pHs
5. Regarding the cyanide results reported for samples in Case 3192:
   Please discuss what your IDL is for this instrument during this analysis It is observed that blanks and samples with no detection are reported as detects flagged as "B", indicating value above the IDL.
6. Please clarify the cyanide final volumes used. These are not noted on the raw instrument logs.

Thank you for your prompt attention to this matter. Replies to the fax number above are appreciated, and please send copies of all communications to Michael Gentils at H2M Group.

Very truly yours,

Judy Harry

ACCREDITED LABORATORIES, INC.
Implementing Tomorrow's Technology, Today™...

3/17/99

Data Validation Services
120 Cobble Creek Road
PO Box 208
North Creek, NY 12853

Dear Judy Harry,

The H2M Group-MacKenzie Chemical project

The BNA injection volume is 2 micro-liter as per the method.

Sincerely,

Theodore C. Gaydos
President/Tech Dir

(732) 541-2025

CORPORATE OFFICES
20 Pershing Avenue
Carteret, New Jersey 07008

FAX (732) 541-1383

U.S. EPA - CLP

COVER PAGE - INORGANIC ANALYSES DATA PACKAGE

Lab Name: ACCREDITED_LABS_INC._____ Contract: _____

Lab Code: _____ Case No.: 2473_ SAS No.: _____ SDG No.:VP280_

SOW No.: ILM03.0

EPA Sample No.	Lab Sample ID
_DUP_____	_9813120_____
_FB_____	_9813119_____
_VP-10_____	_9813513_____
_VP280_____	_9813118_____
_VP360_____	_9813150_____
_VP4120_____	_9813151_____
_VP4120D_____	_9813151D_____
_VP4120S_____	_9813151S_____
_VP4120S_____	_9813151SD_____
_VP680_____	_9813380_____
_VP880_____	_9813381_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____

Were ICP interelement corrections applied ? Yes/No YES

Were ICP background corrections applied ? Yes/No YES
If yes - were raw data generated before application of background corrections ? Yes/No NO_

Comments:

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Signature: _____ Name: _____

Date: _____ Title: _____

U.S. EPA - CLP

COVER PAGE - INORGANIC ANALYSES DATA PACKAGE

Lab Name: ACCREDITED_LABS_INC._____ Contract: _____

Lab Code: _____ Case No.: 2506_ SAS No.: _____ SDG No.:VP680_

SOW No.: ILM03.0

EPA Sample No.	Lab Sample ID
_DUP_____	_9813120_____
_FB_____	_9813119_____
_VP-10_____	_9813513_____
_VP280_____	_9813118_____
_VP360_____	_9813150_____
_VP4120_____	_9813151_____
_VP4120D_____	_9813151D_____
_VP4120S_____	_9813151S_____
_VP4120S_____	_9813151SD_____
_VP680_____	_9813380_____
_VP880_____	_9813381_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____

Were ICP interelement corrections applied ? Yes/No YES

Were ICP background corrections applied ? Yes/No YES
If yes - were raw data generated before application of background corrections ? Yes/No NO_

Comments:

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Signature: _____ Name: _____

Date: _____ Title: _____

U.S. EPA - CLP

COVER PAGE - INORGANIC ANALYSES DATA PACKAGE

Lab Name: ACCREDITED_LABS_INC._____ Contract: _____

Lab Code: _____ Case No.: 2506_ SAS No.: _____ SDG No.:VF580_

SOW No.: ILM03.0

EPA Sample No.	Lab Sample ID
_DS-XX_____	_9813515_____
_DS-11,8_____	_9813512_____
_DS-11,8_____	_9813512D_____
_DS-11,8_____	_9813512S_____
_DS-11,8_____	_9813512SD_____
_DS-13B_____	_9813517_____
_DS-2B_____	_9813516_____
_DS-3B_____	_9813514_____
_DS-9,25_____	_9813511_____
_DS610_____	_9813382_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____

Were ICP interelement corrections applied ? Yes/No YES

Were ICP background corrections applied ? Yes/No YES
If yes - were raw data generated before application of background corrections ? Yes/No NO_

Comments:

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Signature: _____ Name: _____

Date: _____ Title: _____

U.S. EPA - CLP

COVER PAGE - INORGANIC ANALYSES DATA PACKAGE

Lab Name: ACCREDITED_LABS_INC._____ Contract: _____

Lab Code: _____ Case No.: 2541A SAS No.: _____ SDG No.:VP680_

SOW No.: ILM03.0

EPA Sample No.	Lab Sample ID
_DUP	_9813120
_FB	_9813119
_VP-10	_9813513
_VP280	_9813118
_VP360	_9813150
_VP4120	_9813151
_VP4120D	_9813151D
_VP4120S	_9813151S
_VP4120S	_9813151SD
_VP680	_9813380
_VP880	_9813381

Were ICP interelement corrections applied ? Yes/No YES

Were ICP background corrections applied ? Yes/No YES
If yes - were raw data generated before application of background corrections ? Yes/No NO

Comments:

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Signature: _____ Name: _____

Date: _____ Title: _____

U.S. EPA - CLP

COVER PAGE - INORGANIC ANALYSES DATA PACKAGE

Lab Name: ACCREDITED_LABS_INC._____ Contract: _____

Lab Code: _____ Case No.: 2541A SAS No.: _____ SDG No.:VP680_

SOW No.: ILM02.1

EPA Sample No.	Lab Sample ID
VP-10	9813513
VP-10D	9813513D
VP-10S	9813513S
VP-10SD	9813513SD
VP4120	9813151
VP4120D	9813151D
VP4120S	9813151S
VP4120S	9813151SD

Were ICP interelement corrections applied ? Yes/No YES

Were ICP background corrections applied ? Yes/No YES
If yes - were raw data generated before application of background corrections ? Yes/No NO

Comments: Iron Cyanide * only

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Signature: _____ Name: _____

Date: _____ Title: _____

U.S. EPA - CLP

COVER PAGE - INORGANIC ANALYSES DATA PACKAGE

Lab Name: ACCREDITED_LABS_INC._____ Contract: _____

Lab Code: _____ Case No.: 2541_ SAS No.: _____ SDG No.:VP680_

SOW No.: ILM03.0

EPA Sample No.	Lab Sample ID
_DS-XX_____	_9813515_____
_DS-11,8_____	_9813512_____
_DS-11,8_____	_9813512D_____
_DS-11,8_____	_9813512S_____
_DS-11,8_____	_9813512SD_____
_DS-13B_____	_9813517_____
_DS-2B_____	_9813516_____
_DS-3B_____	_9813514_____
_DS-9,25_____	_9813511_____
_DS610_____	_9813382_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____

Were ICP interelement corrections applied ? Yes/Nc YES

Were ICP background corrections applied ? Yes/No YES
If yes - were raw data generated before application of background corrections ? Yes/No NO

Comments:

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Signature: _____ Name: _____

Date: _____ Title: _____

U.S. EPA - CLP

COVER PAGE - INORGANIC ANALYSES DATA PACKAGE

Lab Name: ACCREDITED_LABS_INC._____ Contract: _____

Lab Code: _____ Case No.: 2573_ SAS No.: _____ SDG No.:DS-12_

SOW No.: ILM03.0

EPA Sample No.	Lab Sample ID
_DS-12_____	_9813717_____
_DS-12D_____	_9813717D_____
_DS-12S_____	_9813717S_____
_DS-14_____	_9813719_____
_DS-15_____	_9813718_____
_FB_____	_9813716_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____

Were ICP interelement corrections applied ? Yes/No YES

Were ICP background corrections applied ? Yes/No YES
If yes - were raw data generated before application of background corrections ? Yes/No NO

Comments:

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Signature: _____ Name: _____

Date: _____ Title: _____

U.S. EPA - CLP

COVER PAGE - INORGANIC ANALYSES DATA PACKAGE

Lab Name: ACCREDITED_LABS_INC._____ Contract: _____

Lab Code: _____ Case No.: 3058_ SAS No.: _____ SDG No.:#1-8__

SOW No.: ILM03.0

EPA Sample No.	Lab Sample ID
_#1-8_____	_9900196_____
_#1-8D_____	_9900196D_____
_#1-8S_____	_9900196S_____
_#2-8_____	_9900199_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____

Were ICP interelement corrections applied ? Yes/No YES

Were ICP background corrections applied ? Yes/No YES
If yes - were raw data generated before application of background corrections ? Yes/No NO

Comments:

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Signature: _____ Name: _____

Date: _____ Title: _____

U.S. EPA - CLP

COVER PAGE - INORGANIC ANALYSES DATA PACKAGE

Lab Name: ACCREDITED_LABS_INC._____ Contract: _____

Lab Code: _____ Case No.: 3192A SAS No.: _____ SDG No.:OS#4D_

SOW No.: ILM03.0

EPA Sample No.	Lab Sample ID
FB	9900663
MCMW#1	9900660
MCMW#3	9900659
MCMW#4	9900661
MCMW#5	9900662
MW#XX	9900652
OS#1D	9900649
OS#2D	9900655
OS#2I	9900654
OS#2S	9900653
OS#3D	9900657
OS#3I	9900658
OS#3S	9900656
OS#4D	9900648
OS#4DD	9900648D
OS#4DS	9900648S
OS#4DSD	9900648SD
OS#5D	9900651
OS#5S	9900650

Were ICP interelement corrections applied ? Yes/No YES

Were ICP background corrections applied ? Yes/No YES
If yes - were raw data generated before application of background corrections ? Yes/No NO

Comments:

_____

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Signature: _____ Name: _____

Date: _____ Title: _____

SAMPLE RECEIPT CHECKLIST
(Lab Internal Use Only)

ALI Case# 3192

Date 1/22/99

1 Chain of custody filled out properly:

Yes ( ) No (✓) (if not) TAT, Del'd, Qty. = (5) [no Cn]

2. Proper containers and volumes:

Yes (✓) No ( ) (if not) no Cn containers

3. Received via:

Field Services( ) Hand Delivered(✓) Fed Ex( ) UPS( ) Airborne( ) US Postal( ) Other _____

4. Received within holding time(s):

Yes (✓) No ( ) (if not) _____

5. Preservation:

required to pH<2	Yes(✓)	No ( )	N/A ( )
required to pH>9	Yes( )	No ( )	N/A (✓)
required to pH>12	Yes( )	No (✓)	N/A ( )
Aromatic VO with HCl	Yes(✓)	No ( )	N/A (✓)
MeOH	Yes( )	No ( )	N/A (✓)

6. Received as:

ambient (✓) chilled (✓) temperature (C) _____

7. Extra containers not included on chain of custody:

_____

Comments:

per T.G. (15:00 1/22/99) use portion of BNA & Test/PCB container for Cn

per B.C. per M.E. (AM 1/22/99) add FBS TB

SAMPLE RECEIPT OFFICER

pH<2: COD, Hardness, Metals, NH3-N, NO3-N, NO2-N, TKN, O&G, P total, Phenols, TOC, TPHC
pH>9: Sulfide
pH>12: Cyanide

NEW YORK STATE DEPARTMENT OF ENVIRONMENTAL CONSERVATION

SAMPLE PREPARATION AND ANALYSIS SUMMARY
VOLATILE (VOA)
ANALYSES

ALI Case #2457

Laboratory Sample ID	Matrix	Date Collected	Date Rec'd at Lab	Date Extracted	Date Analyzed
9813120	Aqueous	11/10/98	11/12/98	-	11/17/98
9213119	Aqueous	11/11/98	11/12/98	-	11/17/98
9213117	Aqueous	11/11/98	11/12/98	-	11/17/98
9213118	Aqueous	11/10/98	11/12/98	-	11/17/98

To be included with all lab data and with each workplan

NEW YORK STATE DEPARTMENT OF ENVIRONMENTAL CONSERVATION

SAMPLE IDENTIFICATION AND ANALYTICAL REQUIREMENT SUMMARY

ALI Case # 2473

Customer Sample Code	Laboratory Sample Code	Analytical Requirements					
		*VOA GC/MS Method #	*BNA GC/MS Method #	*VOA GC Method #	*Pest PCBs Method #	*Metals	*Other
VP-X-C	9813150	CLP	CLP		CLP	TAL	Cyanide
VP4120	9813151	CLP	CLP		CLP	TAL	Cyanide

To be included with all lab data and with each workplan

NEW YORK STATE DEPARTMENT OF ENVIRONMENTAL CONSERVATION

SAMPLE IDENTIFICATION AND ANALYTICAL REQUIREMENT SUMMARY

ALI Case # 25010

Customer Sample Code	Laboratory Sample Code	Analytical Requirements					
		*VOA GC/MS Method #	*BNA GC/MS Method #	*VOA GC Method #	*Pest PCBs Method #	*Metals	*Other
D5G1C	9213382	CLP	CLP		CLP	TAL	Cyanide
VP6EC	9213380	CLP	CLP		CLP	TAL	Cyanide
VP2EC	9213381	CLP	CLP		CLP	TAL	Cyanide

To be included with all lab data and with each workplan

NEW YORK STATE DEPARTMENT OF ENVIRONMENTAL CONSERVATION

SAMPLE IDENTIFICATION AND ANALYTICAL REQUIREMENT SUMMARY

ALI Case #9354

Customer Sample Code	Laboratory Sample Code	Analytical Requirements					
		*VOA GC/MS Method #	*BNA GC/MS Method #	*VOA GC Method #	*Pest PCBs Method #	*Metals	*Other
DS XX	9213515	CLP	CLP		CLP	TAL	Cyanide
DS-11,E	9213512	CLP	CLP		CLP	TAL	Cyanide
DS 13B	9213517	CLP	CLP		CLP	TAL	Cyanide
DS 2B	9213516	CLP	CLP		CLP	TAL	Cyanide
DS 3B	9213514	CLP	CLP		CLP	TAL	Cyanide
DS-9,2S	9213511	CLP	CLP		CLP	TAL	Cyanide
VP 1C	9213513	CLP	CLP		CLP	TAL	Cyanide

To be included with all lab data and with each workplan

NEW YORK STATE DEPARTMENT OF ENVIRONMENTAL CONSERVATION

SAMPLE IDENTIFICATION AND ANALYTICAL REQUIREMENT SUMMARY

ALI Case #2593

Customer Sample Code	Laboratory Sample Code	Analytical Requirements					
		*VOA GC/MS Method #	*BNA GC/MS Method #	*VOA GC Method #	*Pest PCBs Method #	*Metals	*Other
DS-12	9813217	CLP	CLP		CLP	TAL	Cyanide
DS-14	9813219	CLP	CLP		CLP	TAL	Cyanide
DS-15	9813218	CLP	CLP		CLP	TAL	Cyanide
FB	9813216	CLP	CLP		CLP	TAL	Cyanide
TB	9813215	CLP					

To be included with all lab data and with each workplan

NEW YORK STATE DEPARTMENT OF ENVIRONMENTAL CONSERVATION

SAMPLE IDENTIFICATION AND ANALYTICAL REQUIREMENT SUMMARY

Customer Sample Code	Laboratory Sample Code	Analytical Requirements					
		*VOA GC/MS Method #	*BNA GC/MS Method #	*VOA GC Method #	*Pest PCBs Method #	*Metals	*Other
#1-2	[illegible]	CLP	CLP		CLP	CLP	Cyanide
#1-[illegible]	[illegible]	CLP					
#1-[illegible]	[illegible]	CLP					
#2-2	[illegible]	CLP	CLP		CLP	CLP	Cyanide
#2-[illegible]	[illegible]	CLP					
#2-[illegible]	[illegible]	CLP					
TB	[illegible]	CLP					

To be included with all lab data and with each workplan

NEW YORK STATE DEPARTMENT OF ENVIRONMENTAL CONSERVATION

SAMPLE IDENTIFICATION AND ANALYTICAL REQUIREMENT SUMMARY

C-3192

Customer Sample Code	Laboratory Sample Code	Analytical Requirements					
		*VOA GC/MS Method #	*BNA GC/MS Method #	*VOA GC Method #	*Pest PCBs Method #	*Metals	*Other
FB	9900663	CLP	CLP		CLP	TAL	Cyanide
MCMW#1	9900660	CLP	CLP		CLP	TAL	Cyanide
MCMW#3	9900659	CLP	CLP		CLP	TAL	Cyanide
MCMW#4	9900661	CLP	CLP		CLP	TAL	Cyanide
MCMW#5	9900662	CLP	CLP		CLP	TAL	Cyanide
MW#XX	9900652	CLP	CLP		CLP	TAL	Cyanide
OS#1D	9900649	CLP	CLP		CLP	TAL	Cyanide
OS#2D	9900655	CLP	CLP		CLP	TAL	Cyanide
OS#2I	9900654	CLP	CLP		CLP	TAL	Cyanide
OS#2S	9900653	CLP	CLP		CLP	TAL	Cyanide
OS#3D	9900657	CLP	CLP		CLP	TAL	Cyanide
OS#3I	9900658	CLP	CLP		CLP	TAL	Cyanide
OS#3S	9900656	CLP	CLP		CLP	TAL	Cyanide
OS#4D	9900648	CLP	CLP		CLP	TAL	Cyanide
OS#5D	9900651	CLP	CLP		CLP	TAL	Cyanide
OS#5S	9900650	CLP	CLP		CLP	TAL	Cyanide
TB	9900664	CLP					

SDG NARRATIVE

Accredited Labs received 4 aqueous samples (Project: DECS 9801; ALI Case #2457) from H2M Group on 11/12/98 for the analyses of CLP Volatile Organics, CLP Base Neutral Acid Extractable Organics, CLP Pesticides/PCBs, TAL Metals and Cyanide.

All analyses were performed within the required holding time.

"I certify that this data package is in compliance with the terms and conditions of the contract, both technically and for completeness, for other than the conditions detailed above. Release of the data contained in this hard copy data package has been authorized by the Laboratory Manager or his designee, as verified by the following signature."

Theodore C. Gaydos
Technical Director

SDG NARRATIVE

Accredited Labs received 2 aqueous samples (Project: DECS 9801; ALI Case #2473) from H2M Group on 11/13/98 for the analyses of CLP Volatile Organics, CLP Base Neutral Acid Extractable Organics, CLP Pesticides/PCBs, TAL Metals and Cyanide.

All analyses were performed within the required holding time.

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Theodore C. Gaydos
Technical Director

SDG NARRATIVE

Accredited Labs received 2 aqueous samples and 1 soil sample (Project: DECS 9801; ALI Case #2506) from H2M Group on 11/18/98 for the analyses of CLP Volatile Organics, CLP Base Neutral Acid Extractable Organics, CLP Pesticides/PCBs, TAL Metals and Cyanide.

All analyses were performed within the required holding time.

All soil analyses were reported on a dry weight basis.

In the BNA analyses, two surrogates (2-Fluorophenol and Phenol-d5) for ALI Sample #9813380 were out of criteria. The sample was reanalyzed and the surrogates were again out of the required criteria. Three surrogates (Phenol-d5, 2-Fluorophenol and 2,4,6-Tribromophenol) for ALI Sample #9813381 were out of criteria. The sample was reanalyzed and two surrogates (Phenol-d5 and 2-Fluorophenol) were again recovered out of the required criteria.

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Theodore C. Gaydos
Technical Director

SDG NARRATIVE

Accredited Labs received 1 aqueous sample and 6 soil samples (Project: Mackenzie Chemical Co.; ALI Case #2541) from H2M Group on 11/20/98 for the analyses of CLP Volatile Organics, CLP Base Neutral Acid Extractable Organics, CLP Pesticides/PCBs, TAL Metals and Cyanide.

All analyses were performed within the required holding time.

All soil analyses were reported on a dry weight basis.

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Theodore C. Gaydos
Technical Director

SDG NARRATIVE

Accredited Labs received 2 aqueous samples and 3 soil samples (Project: DECS 9801; ALI Case #2573) from H2M Group on 11/24/98 for the analyses of CLP Volatile Organics, CLP Base Neutral Acid Extractable Organics, CLP Pesticides/PCBs, TAL Metals and Cyanide.

All analyses were performed within the required holding time.

All soil analyses were reported on a dry weight basis.

In the Volatile Organic analysis, the MDL levels were elevated for ALI Sample #9813719 due to matrix interference.

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Theodore C. Gaydos
Technical Director

SDG NARRATIVE

Accredited Labs received 6 soil samples and 1 trip blank sample (Project: DECS 9801; ALI Case #3058) from H2M Group on 1/8/99 for the analyses of CLP Volatile Organics plus 1,2,3-Trichloropropane, CLP Base Neutral Acid Extractable Organics, CLP Pesticides/PCBs, TAL Metals and Cyanide.

All analyses were performed within the required holding time.

All analyses were reported on a dry weight basis except for the trip blank.

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Theodore C. Gaydos
Technical Director

SDG NARRATIVE

Accredited Labs received 17 aqueous samples (Project: DECS 9801; ALI Case #3192) from H2M Group on 1/22/99 for the analyses of CLP Volatile Organics, 1,2,3-Trichloropropane, CLP Base Neutral Acid Extractable Organics, CLP Pesticides/PCBs, TAL Metals and Cyanide.

All analyses were performed within the required holding time.

"I certify that this data package is in compliance with the terms and conditions of the contract, both technically and for completeness, for other than the conditions detailed above. Release of the data contained in this hard copy data package has been authorized by the Laboratory Manager or his designee, as verified by the following signature."

Theodore C. Gaydos
Technical Director

APPENDIX B

Field Data Sheets

H2M GROUP

GROUNDWATER SAMPLING/DEVELOPMENT SHEET

Client:	N.Y.S.D.E.C.	Total Well Depth*:	160'	Vol./ft of casing:	gal/ft
Site:	Mackenzie Chemical	Well Diameter:	2"	Vol./ft of borehole:	
Job#:	DECS 9801	Borehole Diameter:		Waste:	
Well ID:	OS #10	Volume Removed:	58 gallons		Discharge to Mackenzie Chemical Site Property

Date:	1/21/1999	Static Water Level*:	42.12	Develop Method:	Submersible Pump
		Standing Water Column:	117.88	Presamp Purge Method:	Whale Pump / Bailer
		Amnt of One Well Vol:	19.21	Sampling Method:	Disposable Bailer
		Total Water to be Pumped:	57.64 gallons	Field Tech:	MPE/EJG

* All measurements taken from: X Top of Casing; ___ Protective Casing; ___ Ground Level

TIME	AMOUNT PURGED (GAL)	FIELD PARAMETER MEASURED						COMMENTS
		EC (uS)	pH	TEMP (C)	TURB (NTU)	ORP (mV)	DO (mg/L)	
17:30	initial	120	7.21	13.8	6.8	NM	NM	NM = Not Measured
	30	161	7.19	13.8	6.9	NM	NM	Sample Time: 17:30
	60	180	7.20	13.8	5.4	NM	NM	
								Michael C. Eagle
								Eric Dean

1999gws

H2M GROUP

GROUNDWATER SAMPLING/DEVELOPMENT SHEET

Client:	N.Y.S.D.E.C.	Total Well Depth*:	60'	Vol./ft of casing:	gal/ft
Site:	Mackenzie Chemical	Well Diameter:	2"	Vol./ft of borehole:	
Job#:	DECS 9801	Borehole Diameter:		Waste:	
Well ID:	05#25	Volume Removed:	10 gallons		Discharge to Mackenzie Chemical Site Property

Date:	1/21/1999	Static Water Level*:	40.18	Develop Method:	Submersible Pump
		Standing Water Column:	19.82	Presamp Purge Method:	Whale Pump / Bailer
		Amnt of One Well Vol:	3.23	Sampling Method:	Disposable Bailer
		Total Water to be Pumped:	9.69 gallons	Field Tech:	MPE/EJG

* All measurements taken from: X Top of Casing; ___ Protective Casing; ___ Ground Level

TIME	AMOUNT PURGED (GAL)	FIELD PARAMETER MEASURED						COMMENTS
		EC (uS)	pH	TEMP (C)	TURB (NTU)	ORP (mV)	DO (mg/L)	
16:00	initial	161	5.97	15.1	28.1	NM	NM	NM = Not Measured
	4	172	6.01	14.9	19.1	NM	NM	Sample Time: 16:00
	10	181	5.96	15.1	5.8	NM	NM	
								Michael E. Engstrom
								Eng Trom

H2M GROUP

GROUNDWATER SAMPLING/DEVELOPMENT SHEET

Client:	N.Y.S.D.E.C.	Total Well Depth*:	130'	Vol./ft of casing:	gal/ft
Site:	Mackenzie Chemical	Well Diameter:	2"	Vol./ft of borehole:	
Job#:	DECS 9801	Borehole Diameter:		Waste:	
Well ID:	OS #2I	Volume Removed:	45 gallons		Discharge to Mackenzie Chemical Site Property

Date:	1/21/1999	Static Water Level*:	40.31	Develop Method:	Submersible Pump
		Standing Water Column:	89.69	Presamp Purge Method:	Whale Pump / Bailer
		Amnt of One Well Vol:	14.61	Sampling Method:	Disposable Bailer
		Total Water to be Pumped:	43.85 gallons	Field Tech:	MPE/EJG

* All measurements taken from: X Top of Casing; ___ Protective Casing; ___ Ground Level

TIME	AMOUNT PURGED (GAL)	FIELD PARAMETER MEASURED						COMMENTS
		EC (uS)	pH	TEMP (C)	TURB (NTU)	ORP (mV)	DO (mg/L)	
16:30	initial	481	6.97	16.1	39.8	NM	NM	NM = Not Measured
	20	681	7.01	15.8	24.1	NM	NM	Sample Time: 16:30
	45	700	7.21	15.4	16.1	NM	NM	

Richard P. Snyder
Eric Gross

1999gws

H2M GROUP

GROUNDWATER SAMPLING/DEVELOPMENT SHEET

Client:	N.Y.S.D.E.C.	Total Well Depth*:	160'	Vol./ft of casing:	gal/ft
Site:	Mackenzie Chemical	Well Diameter:	2"	Vol./ft of borehole:	
Job#:	DECS 9801	Borehole Diameter:		Waste:	
Well ID:	OS#2D	Volume Removed:	60 gallons		Discharge to Mackenzie Chemical Site Property

Date: 1/21/1999	Static Water Level*:	41.20	Develop Method: Submersible Pump
	Standing Water Column:	118.80	Presamp Purge Method: Whale Pump / Bailer
	Amnt of One Well Vol:	19.36	Sampling Method: Disposable Bailer
	Total Water to be Pumped:	58.09	Field Tech: MPE/EJG

* All measurements taken from: X Top of Casing; ___ Protective Casing; ___ Ground Level

TIME	AMOUNT PURGED (GAL)	FIELD PARAMETER MEASURED EC (uS)	pH	TEMP (C)	TURB (NTU)	ORP (mV)	DO (mg/L)	COMMENTS
16:45	initial	182	7.01	16.0	6.8	NM	NM	NM = Not Measured
	30	161	6.97	15.8	3.1	NM	NM	Sample Time: 16:45
	60	161	6.97	15.1	3.8	NM	NM	
								Michael L. Engler
								Eric Jones

H2M GROUP

GROUNDWATER SAMPLING/DEVELOPMENT SHEET

Client:	N.Y.S.D.E.C.	Total Well Depth*:	60'	Vol./ft of casing:	gal/ft
Site:	Mackenzie Chemical	Well Diameter:	2"	Vol./ft of borehole:	
Job#:	DECS 9801	Borehole Diameter:		Waste:	
Well ID:	OS#35	Volume Removed:	8 gallons		Discharge to Mackenzie Chemical Site Property

Date:	1/21/1999	Static Water Level*:	48.86	Develop Method:	Submersible Pump
		Standing Water Column:	13.14	Presamp Purge Method:	Whale Pump / Bailer
		Amnt of One Well Vol:	2.14	Sampling Method:	Disposable Bailer
		Total Water to be Pumped:	6.42 gallons	Field Tech:	MPE/EJG

* All measurements taken from: X Top of Casing; ___ Protective Casing; ___ Ground Level

TIME	AMOUNT PURGED (GAL)	FIELD PARAMETER MEASURED						COMMENTS
		EC (uS)	pH	TEMP (C)	TURB (NTU)	ORP (mV)	DO (mg/L)	
14:45	initial	181	5.97	12.9	15.0	NM	NM	NM = Not Measured
	4	181	6.01	13.5	11.9	NM	NM	Sample Time: 14:45
	8	181	5.98	13.8	4.3	NM	NM	

Michael P. Engleman

Eric Dean

1999gws

H2M GROUP

GROUNDWATER SAMPLING/DEVELOPMENT SHEET

Client:	N.Y.S.D.E.C.	Total Well Depth*:	120'	Vol./ft of casing:	gal/ft
Site:	Mackenzie Chemical	Well Diameter:	2"	Vol./ft of borehole:	
Job#:	DECS 9801	Borehole Diameter:		Waste:	
Well ID:	OS#3I	Volume Removed:	40 gallons		Discharge to Mackenzie Chemical Site Property

Date:	1/21/1999	Static Water Level*:	46.86'	Develop Method:	Submersible Pump
		Standing Water Column:	73.14	Presamp Purge Method:	Whale Pump / Bailer
		Amnt of One Well Vol:	11.92	Sampling Method:	Disposable Bailer
		Total Water to be Pumped:	35.76 gallons	Field Tech:	MPE/EJG

* All measurements taken from: X Top of Casing; ___ Protective Casing; ___ Ground Level

TIME	AMOUNT PURGED (GAL)	FIELD PARAMETER MEASURED						COMMENTS
		EC (uS)	pH	TEMP (C)	TURB (NTU)	ORP (mV)	DO (mg/L)	
15:00	initial	182	5.62	14.3	17.8	NM	NM	NM = Not Measured
	20	181	5.42	14.1	5.9	NM	NM	Sample Time: 15:00
	40	181	5.55	14.1	3.1	NM	NM	
								Michael C. Hayden
								Eric Jones

H2M GROUP

GROUNDWATER SAMPLING/DEVELOPMENT SHEET

Client:	N.Y.S.D.E.C.	Total Well Depth*:	158'	Vol./ft of casing:	gal/ft
Site:	Mackenzie Chemical	Well Diameter:	2"	Vol./ft of borehole:	
Job#:	DECS 9801	Borehole Diameter:		Waste:	
Well ID:	05#3D	Volume Removed:	60 gallons		Discharge to Mackenzie Chemical Site Property

Date:	1/21/1999	Static Water Level*:	46.96	Develop Method:	Submersible Pump
		Standing Water Column:	111.04	Presamp Purge Method:	Whale Pump / Bailer
		Amnt of One Well Vol:	18.09	Sampling Method:	Disposable Bailer
		Total Water to be Pumped:	54.29 gallons	Field Tech:	MPE/EJG

* All measurements taken from: X Top of Casing; ___ Protective Casing; ___ Ground Level

TIME	AMOUNT PURGED (GAL)	FIELD PARAMETER MEASURED						COMMENTS
		EC (uS)	pH	TEMP (C)	TURB (NTU)	ORP (mV)	DO (mg/L)	
15:15	initial	192	5.71	15.3	23.8	NM	NM	NM = Not Measured
	30	172	5.75	15.1	18.9	NM	NM	Sample Time: 15:15
	60	176	6.00	15.1	17.6	NM	NM	

1999gws

H2M GROUP

GROUNDWATER SAMPLING/DEVELOPMENT SHEET

Client:	N.Y.S.D.E.C.	Total Well Depth*:	155'	Vol./ft of casing:	gal/ft
Site:	Mackenzie Chemical	Well Diameter:	2"	Vol./ft of borehole:	
Job#:	DECS 9801	Borehole Diameter:		Waste:	
Well ID:	OS #40	Volume Removed:	60 gallons		Discharge to Mackenzie Chemical Site Property

Date:	1/21/1999	Static Water Level*:	39.27	Develop Method:	Submersible Pump
		Standing Water Column:	115.73	Presamp Purge Method:	Whale Pump / Bailer
		Amnt of One Well Vol:	18.86	Sampling Method:	Disposable Bailer
		Total Water to be Pumped:	56.59 gallons	Field Tech:	MPE/EJG

* All measurements taken from: X Top of Casing; ___ Protective Casing; ___ Ground Level

TIME	AMOUNT PURGED (GAL)	FIELD PARAMETER MEASURED						COMMENTS
		EC (uS)	pH	TEMP (C)	TURB (NTU)	ORP (mV)	DO (mg/L)	
17:00	initial	161	7.32	14.1	39.1	NM	NM	NM = Not Measured
	30	161	7.28	13.8	36.9	NM	NM	Sample Time: 17:00
	60	158	7.27	13.9	3.1	NM	NM	
								MS/MSD collected here
								Michael L. Taylor
								Eric Hansen

H2M GROUP

GROUNDWATER SAMPLING/DEVELOPMENT SHEET

Client:	N.Y.S.D.E.C.	Total Well Depth*:	60'	Vol./ft of casing:	gal/ft
Site:	Mackenzie Chemical	Well Diameter:	2"	Vol./ft of borehole:	
Job#:	DECS 9801	Borehole Diameter:		Waste:	
Well ID:	05#55	Volume Removed:	6 gallons		Discharge to Mackenzie Chemical Site Property

Date:	1/21/1999	Static Water Level*:	48.90	Develop Method:	Submersible Pump
		Standing Water Column:	11.1	Presamp Purge Method:	Whale Pump / Bailer
		Amnt of One Well Vol:	1.80	Sampling Method:	Disposable Bailer
		Total Water to be Pumped:	5.42 gallons	Field Tech:	MPE/EJG

* All measurements taken from: X Top of Casing; ___ Protective Casing; ___ Ground Level

TIME	AMOUNT PURGED (GAL)	FIELD PARAMETER MEASURED						COMMENTS
		EC (uS)	pH	TEMP (C)	TURB (NTU)	ORP (mV)	DO (mg/L)	
14:00	initial	281	5.61	13.9	23.1	NM	NM	NM = Not Measured
	3	181	6.01	14.5	18.9	NM	NM	Sample Time: 14:00
	6	181	5.97	14.3	16.1	NM	NM	
								Michael M. Lyle
								Erin Flynn

1999gws

H2M GROUP

GROUNDWATER SAMPLING/DEVELOPMENT SHEET

Client:	N.Y.S.D.E.C.	Total Well Depth*:	150'	Vol./ft of casing:	gal/ft
Site:	Mackenzie Chemical	Well Diameter:	2"	Vol./ft of borehole:	
Job#:	DECS 9801	Borehole Diameter:		Waste:	
Well ID:		Volume Removed:	50 gallons		Discharge to Mackenzie Chemical Site Property

Date:	1/21/1999	Static Water Level*:	48.79	Develop Method:	Submersible Pump
		Standing Water Column:	101.21	Presamp Purge Method:	Whale Pump / Bailer
		Amnt of One Well Vol:	16.49	Sampling Method:	Disposable Bailer
		Total Water to be Pumped:	49.49 gallons	Field Tech:	MPE/EJG

* All measurements taken from: X Top of Casing; ___ Protective Casing; ___ Ground Level

TIME	AMOUNT PURGED (GAL)	FIELD PARAMETER MEASURED						COMMENTS
		EC (uS)	pH	TEMP (C)	TURB (NTU)	ORP (mV)	DO (mg/L)	
14:30	initial	384	4.97	14.1	28.9	NM	NM	NM = Not Measured
	25	381	5.01	13.9	16.0	NM	NM	Sample Time: 14:30
	50	386	5.06	13.8	16.0	NM	NM	

Michael P. Eyl
Eric Jacobs

H2M GROUP

GROUNDWATER SAMPLING/DEVELOPMENT SHEET

Client:	N.Y.S.D.E.C.	Total Well Depth*:	65'	Vol./ft of casing:	gal/ft
Site:	Mackenzie Chemical	Well Diameter:	4"	Vol./ft of borehole:	
Job#:	DECS 9801	Borehole Diameter:		Waste:	Discharge to Mackenzie Chemical Site Property
Well ID:	MCMW-1	Volume Removed:	30 gallons		

Date:	1/21/1999	Static Water Level*:	51.76	Develop Method:	Submersible Pump
		Standing Water Column:	13.24	Presamp Purge Method:	Whale Pump / Bailer
		Amnt of One Well Vol:	8.64	Sampling Method:	Disposable Bailer
		Total Water to be Pumped:	25.93 gallons	Field Tech:	MPE/EJG

* All measurements taken from: _X_ Top of Casing; ___ Protective Casing; ___ Ground Level

TIME	AMOUNT PURGED (GAL)	FIELD PARAMETER MEASURED						COMMENTS
		EC (uS)	pH	TEMP (C)	TURB (NTU)	ORP (mV)	DO (mg/L)	
	initial	258	5.06	13.5	16.0	NM	NM	NM = Not Measured
	15	252	5.12	13.4	6.8	NM	NM	Sample Time:
	30	248	5.14	13.2	3.9	NM	NM	Blind Duplicate Collected Here Called MW-XX

1999gws

H2M GROUP

GROUNDWATER SAMPLING/DEVELOPMENT SHEET

Client:	N.Y.S.D.E.C.	Total Well Depth*:		Vol./ft of casing:	gal/ft
Site:	Mackenzie Chemical	Well Diameter:		Vol./ft of borehole:	
Job#:	DECS 9801	Borehole Diameter:		Waste:	
Well ID:	MCMW-2	Volume Removed:		Discharge to Mackenzie Chemical Site Property	

Date:	1/21/1999	Static Water Level*:		Develop Method:	Submersible Pump
		Standing Water Column:		Presamp Purge Method:	Whale Pump / Bailer
		Amnt of One Well Vol:		Sampling Method:	Disposable Bailer
		Total Water to be Pumped:		Field Tech:	MPE/EJG

* All measurements taken from: _X_ Top of Casing; ___ Protective Casing; ___ Ground Level

TIME	AMOUNT PURGED (GAL)	FIELD PARAMETER MEASURED						COMMENTS
		EC (uS)	pH	TEMP (C)	TURB (NTU)	ORP (mV)	DO (mg/L)	
						NM	NM	NM = Not Measured
						NM	NM	Sample Time:
						NM	NM	
								☆ Well NOT Located
								- suspect covering
								by debris, tried
								to use magnetometer
								Mike H. Ryan
								Engineer

1999gws

H2M GROUP

GROUNDWATER SAMPLING/DEVELOPMENT SHEET

Client:	N.Y.S.D.E.C.	Total Well Depth*:	65'	Vol./ft of casing:	gal/ft
Site:	Mackenzie Chemical	Well Diameter:	4"	Vol./ft of borehole:	
Job#:	DECS 9801	Borehole Diameter:		Waste:	
Well ID:	MCMW-3	Volume Removed:	40 gallons		Discharge to Mackenzie Chemical Site Property

Date:	1/21/1999	Static Water Level*:	48.14	Develop Method:	Submersible Pump
		Standing Water Column:	16.86	Presamp Purge Method:	Whale Pump / Bailer
		Amnt of One Well Vol:	11.01	Sampling Method:	Disposable Bailer
		Total Water to be Pumped:	33.02 gallons	Field Tech:	MPE/EJG

* All measurements taken from: _X_ Top of Casing; ___ Protective Casing; ___ Ground Level

TIME	AMOUNT PURGED (GAL)	FIELD PARAMETER MEASURED						COMMENTS
		EC (uS)	pH	TEMP (C)	TURB (NTU)	ORP (mV)	DO (mg/L)	
9:50	Initial	194	5.61	13.6	48.1	NM	NM	NM = Not Measured
	20	190	5.67	13.5	39.8	NM	NM	Sample Time: 9:50
	40	188	5.54	13.4	5.6	NM	NM	

Michael P. Symons
Eric Thom

1999gws

H2M GROUP

GROUNDWATER SAMPLING/DEVELOPMENT SHEET

Client:	N.Y.S.D.E.C.	Total Well Depth*:	65'	Vol./ft of casing:	gal/ft
Site:	Mackenzie Chemical	Well Diameter:	4"	Vol./ft of borehole:	
Job#:	DECS 9801	Borehole Diameter:		Waste:	
Well ID:	MCMW-4	Volume Removed:	30 gallons		Discharge to Mackenzie Chemical Site Property

Date:	1/21/1999	Static Water Level*:	50.93	Develop Method:	Submersible Pump
		Standing Water Column:	14.07	Presamp Purge Method:	Whale Pump / Bailer
		Amnt of One Well Vol:	9.18	Sampling Method:	Disposable Bailer
		Total Water to be Pumped:	27.56 gallons	Field Tech:	MPE/EJG

* All measurements taken from: X Top of Casing; ___ Protective Casing; ___ Ground Level

TIME	AMOUNT PURGED (GAL)	FIELD PARAMETER MEASURED						COMMENTS
		EC (uS)	pH	TEMP (C)	TURB (NTU)	ORP (mV)	DO (mg/L)	
10:45	initial	245	4.82	14.1	32.0	NM	NM	NM = Not Measured
	15	242	4.91	14.0	18.6	NM	NM	Sample Time: 10:45
	30	231	4.90	13.8	4.7	NM	NM	
								Michael S. Epple
								Eric Dunn

H2M GROUP

GROUNDWATER SAMPLING/DEVELOPMENT SHEET

Client:	N.Y.S.D.E.C.	Total Well Depth*:	65'	Vol./ft of casing:	gal/ft
Site:	Mackenzie Chemical	Well Diameter:	4"	Vol./ft of borehole:	
Job#:	DECS 9801	Borehole Diameter:		Waste:	
Well ID:	MCMW-5	Volume Removed:	30 gallons		Discharge to Mackenzie Chemical Site Property

Date:	1/21/1999	Static Water Level*:	49.83	Develop Method:	Submersible Pump
		Standing Water Column:	15.17	Presamp Purge Method:	Whale Pump / Bailer
		Amnt of One Well Vol:	9.90	Sampling Method:	Disposable Bailer
		Total Water to be Pumped:	29.71 gallons	Field Tech:	MPE/EJG

* All measurements taken from: X Top of Casing; ___ Protective Casing; ___ Ground Level

TIME	AMOUNT PURGED (GAL)	FIELD PARAMETER MEASURED						COMMENTS
		EC (uS)	pH	TEMP (C)	TURB (NTU)	ORP (mV)	DO (mg/L)	
11:15	initial	322	5.36	14.1	49.3	NM	NM	NM = Not Measured
	15	321	5.42	14.1	38.7	NM	NM	Sample Time: 11:15
	30	354	5.41	13.8	11.9	NM	NM	

1999gws

APPENDIX C

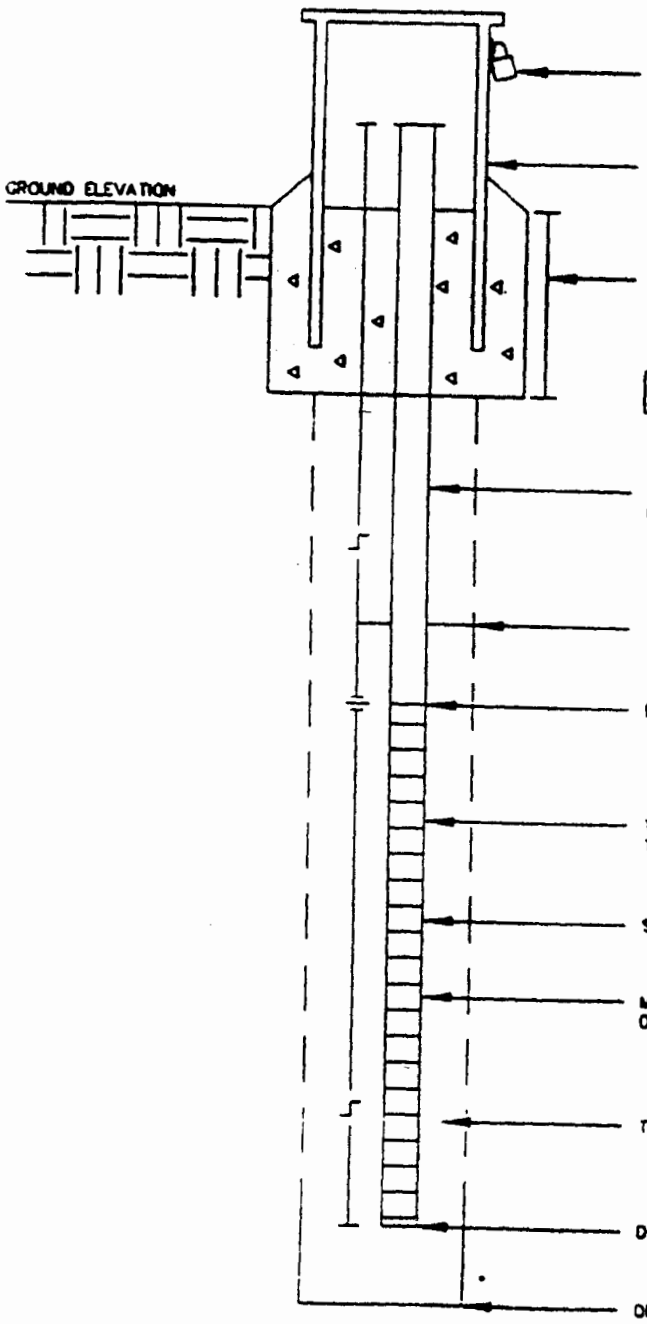
Well Construction Boring Logs

GROUNDWATER MONITORING WELL REPORT

SITE: Mackensie Chemical Corp. INSTALLATION DATE: 12/10/98 PROJECT NO.: DECS9801

WELL NO.: OS #1D LOCATION: Carleton Ave. / Clayton St → parking lot of old Firehouse

DRILLER: American Auger HYDROGEOLOGIST: Michael P. Engelmann



DRILLING METHOD	hollow stem auger
PADLOCK ID NUMBER	3252
PROTECTIVE CASING	flush mount 18"
	DIAMETER (I.D.) LENGTH
THICKNESS OF SURFACE SEAL/CONCRETE	3'
[INDICATE ALL SCALE SHOWING DEPTH THICKNESS AND TYPE]	
MATERIAL OF MANUFACTURE AND INSIDE DIAMETER OF RISER PIPE	2" well PVC Schedule 40
	MATERIAL DIAMETER (I.D.)
TYPE OF SUBSURFACE SEAL/GROUT	bentonite seal
DEPTH OF BOTTOM OF RISER	150'
TYPE OF POINT OR SCREEN (PIPE SIZE TELESCOPING) AND MANUFACTURE	
SCREEN CAGE OR SIZE OF OPENINGS	#10 slot
MATERIAL OF MANUFACTURE AND DIAMETER OF WELLPOINT/SCREEN	2" PVC schedule 40
TYPE OF BACKFILL	filterpack sand
DEPTH OF BOTTOM OF SCREEN	160'
DEPTH OF BOTTOM OF BOREHOLE	162'

(L1) LENGTH OF RISER 150' (L2) LENGTH OF SCREEN 10' CASING ELEVATION _____ STANDPIPE ELEV.: _____

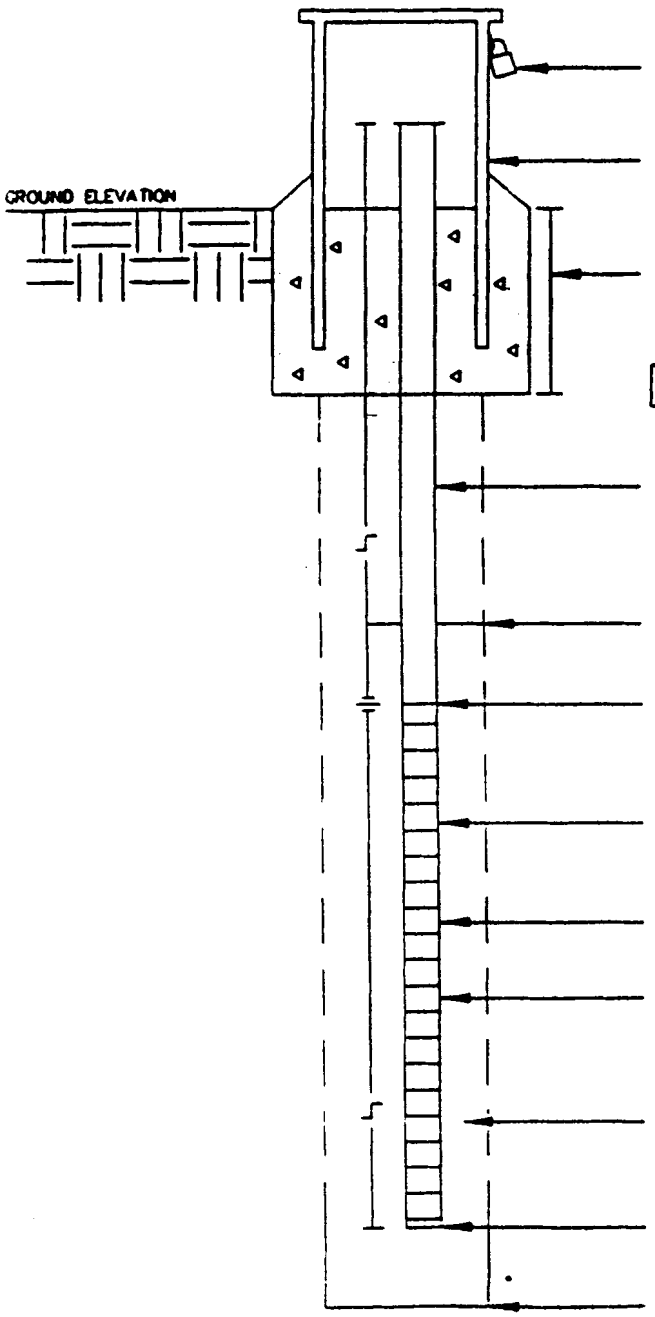
ACTUAL ELEVATIONS – WHERE AVAILABLE

GROUNDWATER MONITORING WELL REPORT

SITE: MacKensie Chemical Corp INSTALLATION DATE: 12/23/98 PROJECT NO.: DECS 9801

WELL NO.: OS#2S LOCATION: South Rd. / off Hazel St.

DRILLER: American Auger HYDROGEOLOGIST: Michael P. Engelmann



DRILLING METHOD	hollow stem auger
PADLOCK ID NUMBER	3252
PROTECTIVE CASING	flush mount 18" (DIAMETER (I.D.) LENGTH)
THICKNESS OF SURFACE SEAL/CONCRETE	3'
[INDICATE ALL SCALE SHOWING DEPTH THICKNESS AND TYPE]	
MATERIAL OF MANUFACTURE AND INSIDE DIAMETER OF RISER PIPE	2" well: PVC schedule 40 (MATERIAL DIAMETER (I.D.))
TYPE OF SUBSURFACE SEAL/GROUT	bentonite seal
DEPTH OF BOTTOM OF RISER	50'
TYPE OF POINT OR SCREEN (PIPE SIZE TELESCOPING) AND MANUFACTURE	
SCREEN CAGE OR SIZE OF OPENINGS	#10 slot
MATERIAL OF MANUFACTURE AND DIAMETER OF WELLPOINT/SCREEN	2" PVC schedule 40
TYPE OF BACKFILL	filter pack sand
DEPTH OF BOTTOM OF SCREEN	60'
DEPTH OF BOTTOM OF BOREHOLE	62'

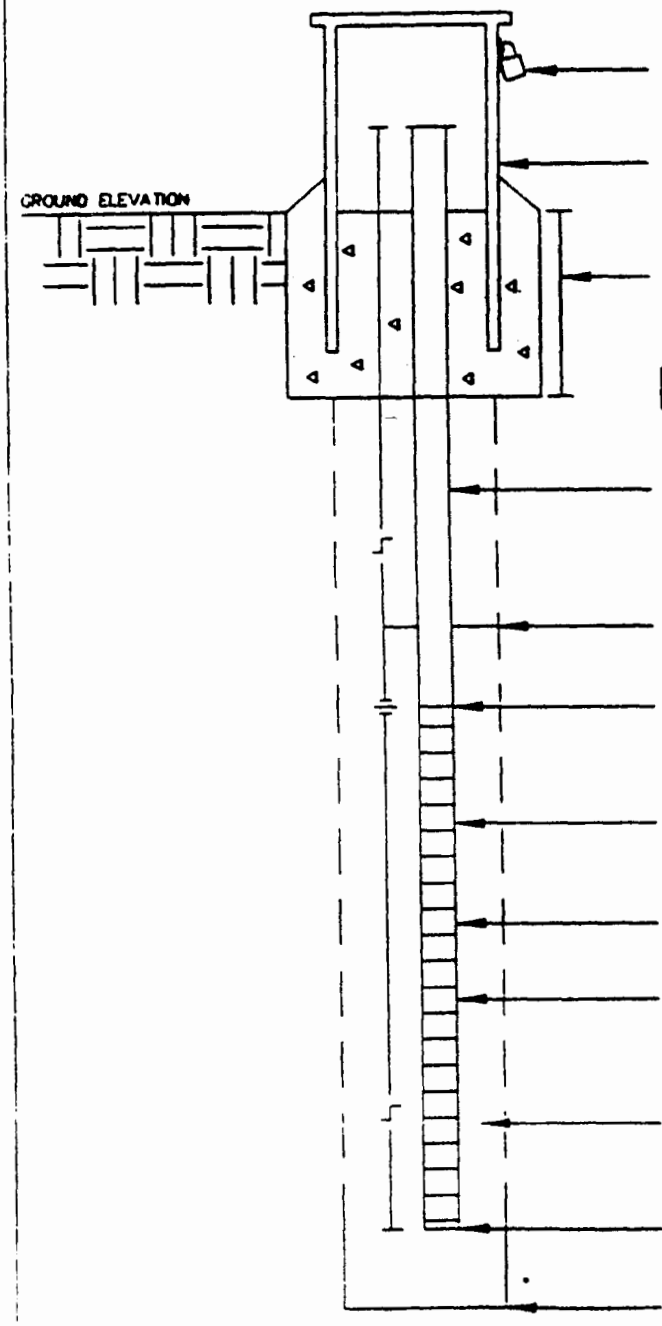
(L1) LENGTH OF RISER 50' (L2) LENGTH OF SCREEN 10' CASING ELEVATION _____ STANDPIPE ELEV.: _____
ACTUAL ELEVATIONS - WHERE AVAILABLE

GROUNDWATER MONITORING WELL REPORT

SITE: Mackensie Chemical Corp. INSTALLATION DATE: 1/5/99 PROJECT NO.: DEC598001

WELL NO.: OS#a1 LOCATION: South Rd./Carleton Ave. cluster

DRILLER: American Auger HYDROGEOLOGIST: Michael P. Engelmann



DRILLING METHOD	hollow stem auger
PADLOCK ID NUMBER	3252
PROTECTIVE CASING	flush mount 18"
	DIAMETER (I.D.) LENGTH
THICKNESS OF SURFACE SEAL/CONCRETE	3'
[INDICATE ALL SCALE SHOWING DEPTH THICKNESS AND TYPE]	
	2" well
MATERIAL OF MANUFACTURE AND INSIDE DIAMETER OF RISER PIPE	PVC schedule #40
	MATERIAL DIAMETER (I.D.)
TYPE OF SUBSURFACE SEAL/GROUT	benonite seal
DEPTH OF BOTTOM OF RISER	120'
TYPE OF POINT OR SCREEN (PIPE SIZE TELESCOPING) AND MANUFACTURE	
SCREEN CAGE OR SIZE OF OPENINGS	#10 slot
MATERIAL OF MANUFACTURE AND DIAMETER OF WELLPOINT/SCREEN	2" PVC schedule 40
TYPE OF BACKFILL	filter pack sand
DEPTH OF BOTTOM OF SCREEN	130'
DEPTH OF BOTTOM OF BOREHOLE	132'

(L1) LENGTH OF RISER 120' (L2) LENGTH OF SCREEN 10' CASING ELEVATION _____ STANDPIPE ELEV.: _____

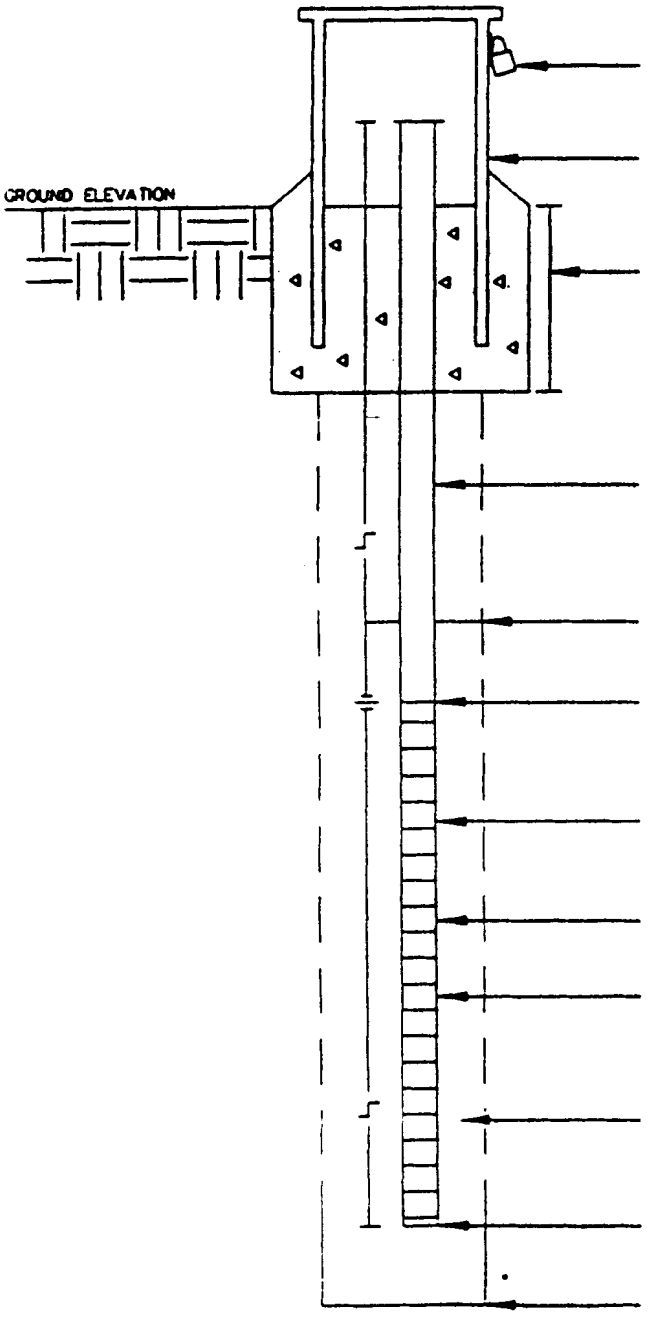
ACTUAL ELEVATIONS - WHERE AVAILABLE

GROUNDWATER MONITORING WELL REPORT

SITE: Mackensie Chemical Corp. INSTALLATION DATE: 12/15/98 PROJECT NO.: _____

WELL NO.: OS #2D LOCATION: South St. off of Hazel St.

DRILLER: American Auger HYDROGEOLOGIST: Michael P. Engelmann



DRILLING METHOD: hollow stem auger

PADLOCK ID NUMBER: 3252

PROTECTIVE CASING: flush mount 18" (DIAMETER (I.D.)) (LENGTH)

THICKNESS OF SURFACE SEAL/CONCRETE: 3'

[INDICATE ALL SCALE SHOWING DEPTH, THICKNESS AND TYPE]

MATERIAL OF MANUFACTURE AND INSIDE DIAMETER OF RISER PIPE: 2" well PVC schedule 40 (MATERIAL) (DIAMETER (I.D.))

TYPE OF SUBSURFACE SEAL/GROUT: bentonite seal

DEPTH OF BOTTOM OF RISER: 150'

TYPE OF POINT OR SCREEN (PIPE SIZE TELESCOPING) AND MANUFACTURE: _____

SCREEN CAGE OR SIZE OF OPENINGS: #10 slot

MATERIAL OF MANUFACTURE AND DIAMETER OF WELLPOINT/SCREEN: 2" PVC schedule 40

TYPE OF BACKFILL: filter pack sand

DEPTH OF BOTTOM OF SCREEN: 160'

DEPTH OF BOTTOM OF BOREHOLE: 162'

(L1) LENGTH OF RISER 150' (L2) LENGTH OF SCREEN 10' CASING ELEVATION _____ STANDPIPE ELEV.: _____

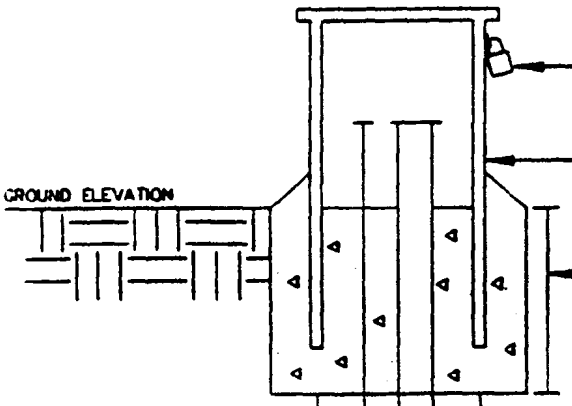
ACTUAL ELEVATIONS - WHERE AVAILABLE

GROUNDWATER MONITORING WELL REPORT

SITE: MacKensie Chemical Corp. INSTALLATION DATE: 1/7/99 PROJECT NO.: DEC9801

WELL NO.: DS #35 LOCATION: Brightside Drive Cluster

DRILLER: American Auger HYDROGEOLOGIST: Michael P. Engelmann



DRILLING METHOD	hollow stem auger
PADLOCK ID NUMBER	3252
PROTECTIVE CASING	flush mount 18" (DIAMETER (I.D.) LENGTH)
THICKNESS OF SURFACE SEAL/CONCRETE	3'
[INDICATE ALL SCALE SHOWING DEPTH THICKNESS AND TYPE]	
MATERIAL OF MANUFACTURE AND INSIDE DIAMETER OF RISER PIPE	2" well; PVC schedule 40 (MATERIAL DIAMETER (I.D.))
TYPE OF SUBSURFACE SEAL/GROUT	bentonite seal
DEPTH OF BOTTOM OF RISER	50'
TYPE OF POINT OR SCREEN (PIPE SIZE TELESCOPING) AND MANUFACTURE	
SCREEN CAGE OR SIZE OF OPENINGS	#10 slot
MATERIAL OF MANUFACTURE AND DIAMETER OF WELLPOINT/SCREEN	2" PVC schedule 40
TYPE OF BACKFILL	filter pack sand
DEPTH OF BOTTOM OF SCREEN	60'
DEPTH OF BOTTOM OF BOREHOLE	62'

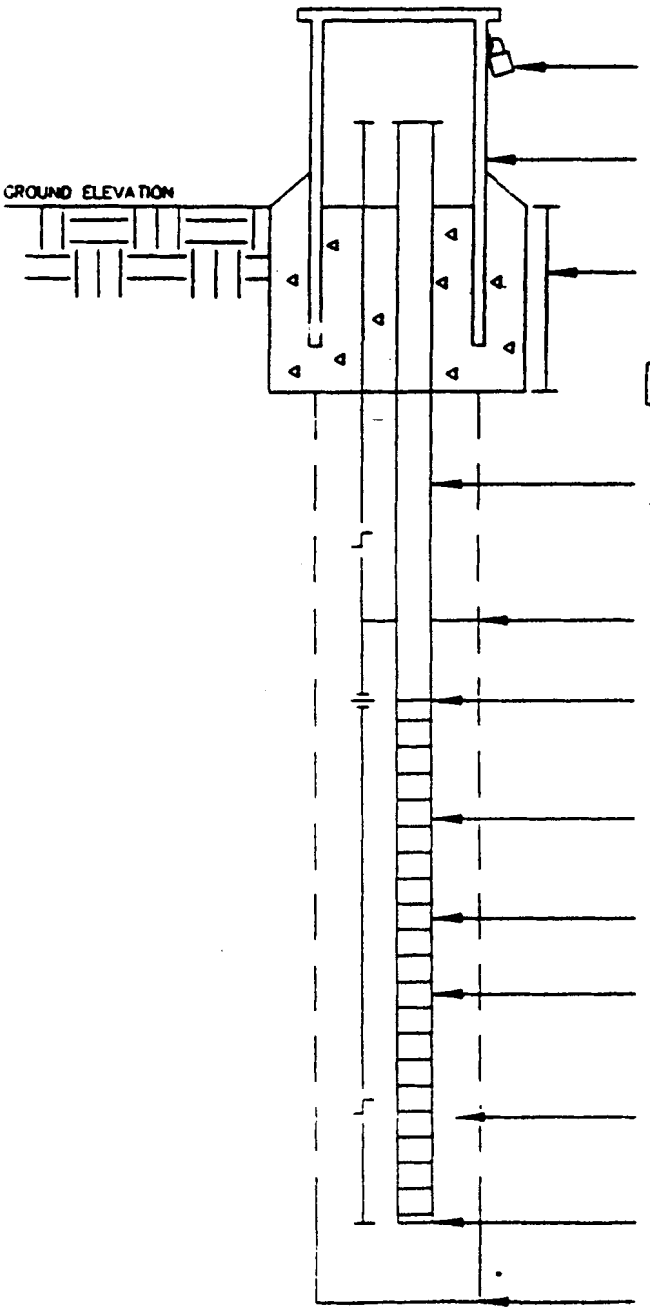
(L1) LENGTH OF RISER 50' (L2) LENGTH OF SCREEN 10' CASING ELEVATION _____ STANDPIPE ELEV.: _____
ACTUAL ELEVATIONS - WHERE AVAILABLE

GROUNDWATER MONITORING WELL REPORT

SITE: Mackensie Chemical Corp. INSTALLATION DATE: 1/4/99 PROJECT NO.: DEC98B01

WELL NO.: OS#31 LOCATION: Brightside Drive cluster

DRILLER: American Auger HYDROGEOLOGIST: Michael P. Engelmann



DRILLING METHOD	hollowstem auger
PADLOCK ID NUMBER	3252
PROTECTIVE CASING	flushmount 18"
	DIAMETER (I.D.) LENGTH
THICKNESS OF SURFACE SEAL/CONCRETE	3'
[INDICATE ALL SCALE SHOWING DEPTH THICKNESS AND TYPE]	
MATERIAL OF MANUFACTURE AND INSIDE DIAMETER OF RISER PIPE	2" well PVC schedule 40
	MATERIAL DIAMETER (I.D.)
TYPE OF SUBSURFACE SEAL/GROUT	bentonite seal
DEPTH OF BOTTOM OF RISER	110'
TYPE OF POINT OR SCREEN (PIPE SIZE TELESCOPING) AND MANUFACTURE	
SCREEN CAGE OR SIZE OF OPENINGS	#10 slot
MATERIAL OF MANUFACTURE AND DIAMETER OF WELLPOINT/SCREEN	2" PVC schedule 40
TYPE OF BACKFILL	filter pack sand
DEPTH OF BOTTOM OF SCREEN	120'
DEPTH OF BOTTOM OF BOREHOLE	122'

(L1) LENGTH OF RISER 110' (L2) LENGTH OF SCREEN 10' CASING ELEVATION _____ STANDPIPE ELEV.: _____

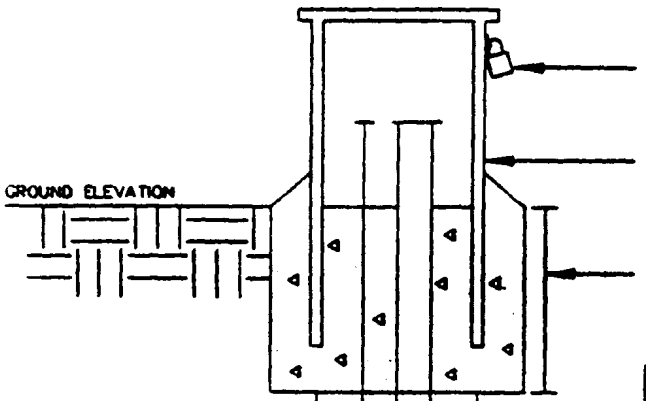
ACTUAL ELEVATIONS - WHERE AVAILABLE

GROUNDWATER MONITORING WELL REPORT

SITE: Mackensie Chemical Corp. INSTALLATION DATE: 12/16/98 PROJECT NO.: DEC598B01

WELL NO.: OS #3C LOCATION: Brightside Drive → same as VP-2

DRILLER: American Auger HYDROGEOLOGIST: Michael P. Engelmann



DRILLING METHOD	hollow stem auger
PADLOCK ID NUMBER	3252
PROTECTIVE CASING	flush mount 18" (DIAMETER (I.D.) LENGTH)
THICKNESS OF SURFACE SEAL/CONCRETE	3'
[INDICATE ALL SCALE SHOWING DEPTH THICKNESS AND TYPE]	
MATERIAL OF MANUFACTURE AND INSIDE DIAMETER OF RISER PIPE	2" well: PVC schedule 40 (MATERIAL DIAMETER (I.D.))
TYPE OF SUBSURFACE SEAL/GROUT	bentonite seal
DEPTH OF BOTTOM OF RISER	148'
TYPE OF POINT OR SCREEN (PIPE SIZE TELESCOPING) AND MANUFACTURE	
SCREEN CAGE OR SIZE OF OPENINGS	#10 slot
MATERIAL OF MANUFACTURE AND DIAMETER OF WELLPOINT/SCREEN	2" PVC schedule 40
TYPE OF BACKFILL	filter pack sand
DEPTH OF BOTTOM OF SCREEN	158'
DEPTH OF BOTTOM OF BOREHOLE	160'

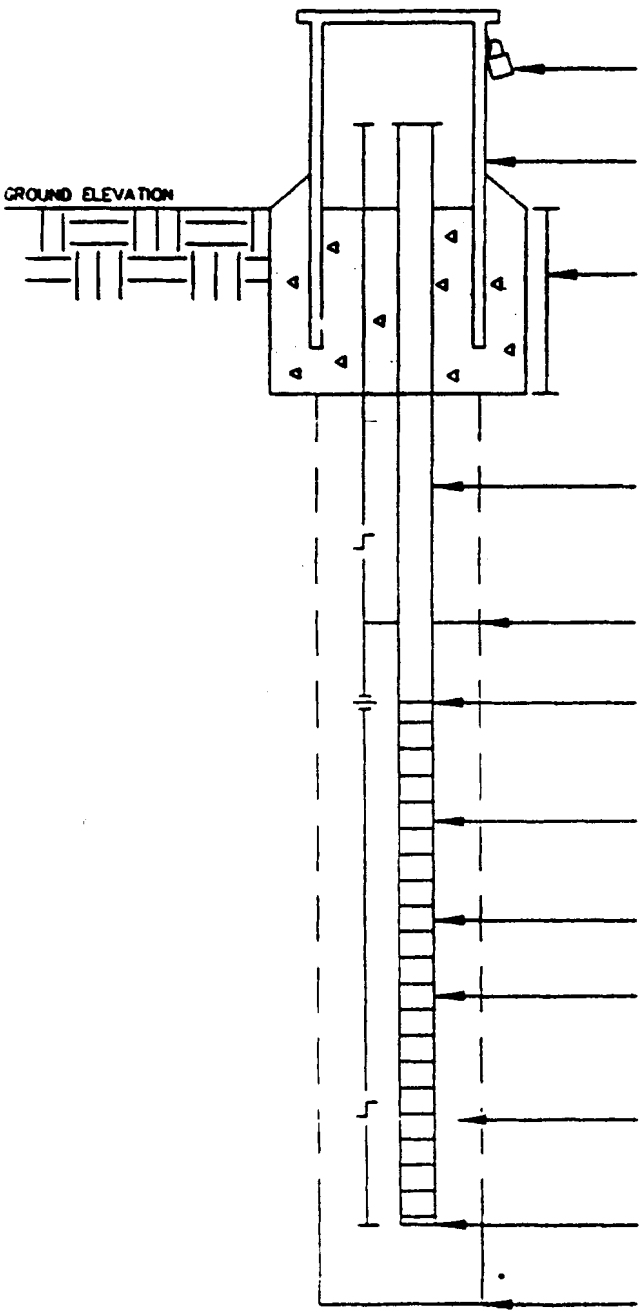
(L1) LENGTH OF RISER 148' (L2) LENGTH OF SCREEN 10' CASING ELEVATION _____ STANDPIPE ELEV.: _____
ACTUAL ELEVATIONS – WHERE AVAILABLE

GROUNDWATER MONITORING WELL REPORT

SITE: Mackensie Chemical Corp. INSTALLATION DATE: 12/22/98 PROJECT NO.: DECS9801

WELL NO.: OS #4D LOCATION: St. Johns Ave / Carleton Ave. near #285 Public Parking

DRILLER: American Auger HYDROGEOLOGIST: Michael P. Engelmann



DRILLING METHOD	hollow stem auger
PADLOCK ID NUMBER	3252
PROTECTIVE CASING	flush mount 18" (DIAMETER (I.D.) LENGTH)
THICKNESS OF SURFACE SEAL/CONCRETE	3'
[INDICATE ALL SCALE SHOWING DEPTH THICKNESS AND TYPE]	2" well
MATERIAL OF MANUFACTURE AND INSIDE DIAMETER OF RISER PIPE	PVC schedule 40 (MATERIAL DIAMETER (I.D.))
TYPE OF SUBSURFACE SEAL/GROUT	bentonite seal
DEPTH OF BOTTOM OF RISER	145'
TYPE OF POINT OR SCREEN (PIPE SIZE TELESCOPING) AND MANUFACTURE	
SCREEN CAGE OR SIZE OF OPENINGS	#10 slot
MATERIAL OF MANUFACTURE AND DIAMETER OF WELLPOINT/SCREEN	2" PVC schedule 40
TYPE OF BACKFILL	filterpack sand
DEPTH OF BOTTOM OF SCREEN	155'
DEPTH OF BOTTOM OF BOREHOLE	157'

(L1) LENGTH OF RISER 145' (L2) LENGTH OF SCREEN 10' CASING ELEVATION _____ STANDPIPE ELEV.: _____

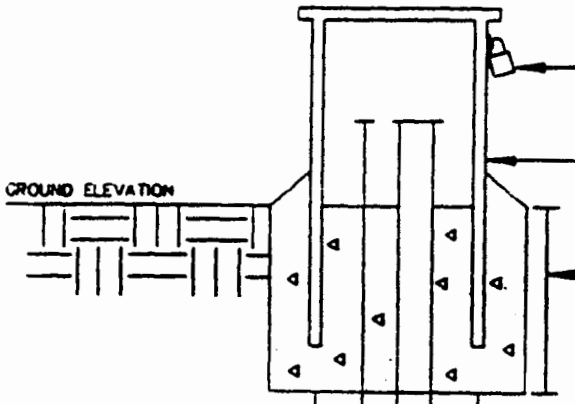
ACTUAL ELEVATIONS - WHERE AVAILABLE

GROUNDWATER MONITORING WELL REPORT

SITE: Mackensie Chemical Corp. INSTALLATION DATE: 1/7/98 PROJECT NO.: DECS9801

WELL NO.: OS+5S LOCATION: upgradient → Kaufman Furniture

DRILLER: American Auger HYDROGEOLOGIST: Michael P. Engelmann



DRILLING METHOD	hollow stem auger
PADLOCK ID NUMBER	3252
PROTECTIVE CASING	flush mount 18"
	DIAMETER (I.D.) LENGTH
THICKNESS OF SURFACE SEAL/CONCRETE	3'
[INDICATE ALL SCALE SHOWING DEPTH THICKNESS AND TYPE]	
MATERIAL OF MANUFACTURE AND INSIDE DIAMETER OF RISER PIPE	2" PVC schedule 40
	MATERIAL DIAMETER (I.D.)
TYPE OF SUBSURFACE SEAL/GROUT	bentonite seal
DEPTH OF BOTTOM OF RISER	50'
TYPE OF POINT OR SCREEN (PIPE SIZE TELESCOPING) AND MANUFACTURE	
SCREEN CAGE OR SIZE OF OPENINGS	#10 slot
MATERIAL OF MANUFACTURE AND DIAMETER OF WELLPOINT/SCREEN	2" PVC schedule 40
TYPE OF BACKFILL	filter pack sand
DEPTH OF BOTTOM OF SCREEN	60'
DEPTH OF BOTTOM OF BOREHOLE	62'

(L1) LENGTH OF RISER 50' (L2) LENGTH OF SCREEN 10' CASING ELEVATION _____ STANDPIPE ELEV.: _____

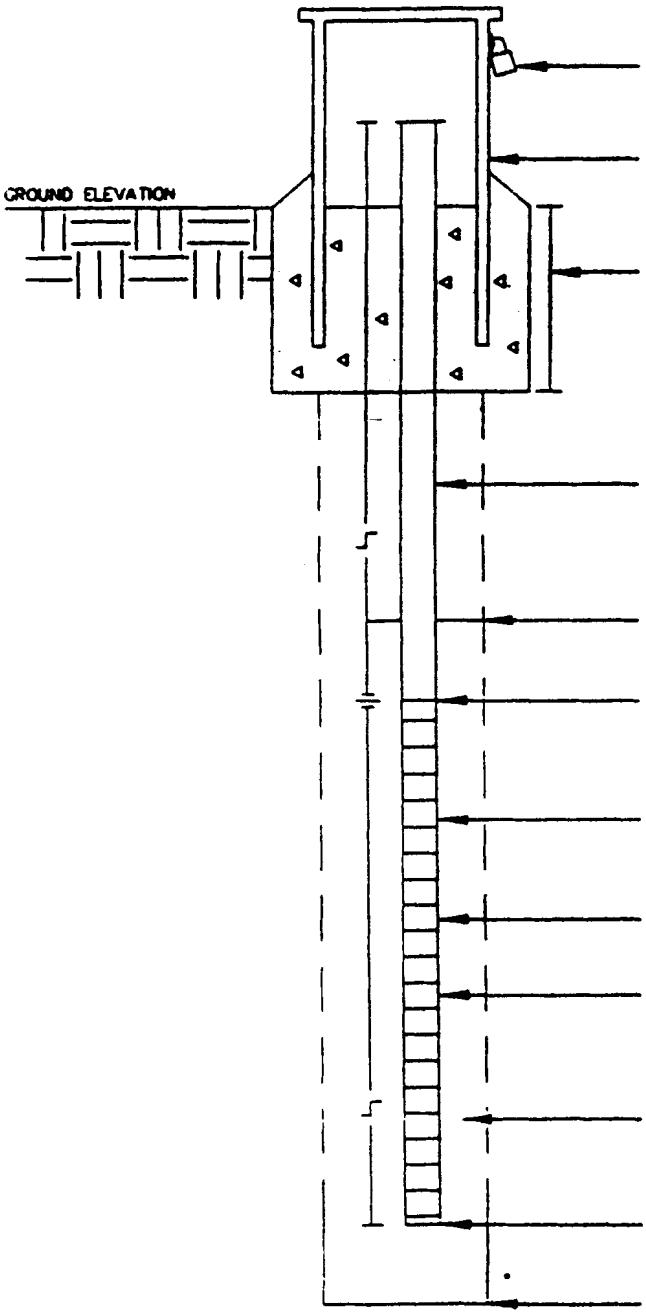
ACTUAL ELEVATIONS - WHERE AVAILABLE

GROUNDWATER MONITORING WELL REPORT

SITE: Mackenzie Chemical Corp. INSTALLATION DATE: 1/6/99 PROJECT NO.: DECS980c

WELL NO.: OS #5D LOCATION: upgradient → Kaufman Furniture

DRILLER: American Auger HYDROGEOLOGIST: Michael P. Engelmann



DRILLING METHOD: hollow stem auger

PADLOCK ID NUMBER: 3252

PROTECTIVE CASING: flush mount 18" (DIAMETER (I.D.) LENGTH)

THICKNESS OF SURFACE SEAL/CONCRETE: 3'

MATERIAL OF MANUFACTURE AND INSIDE DIAMETER OF RISER PIPE: 2" well PVC schedule #40 (MATERIAL DIAMETER (I.D.))

TYPE OF SUBSURFACE SEAL/GROUT: bentonite seal

DEPTH OF BOTTOM OF RISER: 140'

TYPE OF POINT OR SCREEN (PIPE SIZE TELESCOPING) AND MANUFACTURE:

SCREEN CAGE OR SIZE OF OPENINGS: #10 slot

MATERIAL OF MANUFACTURE AND DIAMETER OF WELLPOINT/SCREEN: 2" PVC schedule 40

TYPE OF BACKFILL: filter pack sand

DEPTH OF BOTTOM OF SCREEN: 150'

DEPTH OF BOTTOM OF BOREHOLE: 152'

(L1) LENGTH OF RISER 140' (L2) LENGTH OF SCREEN 10' CASING ELEVATION _____ STANDPIPE ELEV.: _____ (ACTUAL ELEVATIONS - WHERE AVAILABLE)

APPENDIX D

Field Notes

CONTENTS

Reference Page Index

2 Location Brightside Drive Date 11/9/98

Project / Client DECSQ201

Mackenzie Chemical (MPE)

job # DECSQ201

site: Mackenzie Chemical, 1 Cordello Drive
Superfund site Islip, NY

date: Monday, November 9, 1998

site weather: cloudy, cool slight NW breeze 55°

field crew: Michael P. Engelman (MPE)

On site: MPE - 7:45 (HazW)
Bee Robert Filkins (DEC)
8:30 - MPE (HazW)
9:00 - Chuck Mayer (LMS)
Bret MacDonald (LMS)
8:45 - MPE back at HazW

9:10 - MPE conducts tailgate meeting
sign Health & Safety Plan

objective: commence field activities of offsite
vertical profile wells via geoprobe

9:20 1st location - Brightside Drive / Cordello Ave.

Location _____ Date 11/9/98 3

Project / Client DECSQ201

Mackenzie Chemical (MPE)

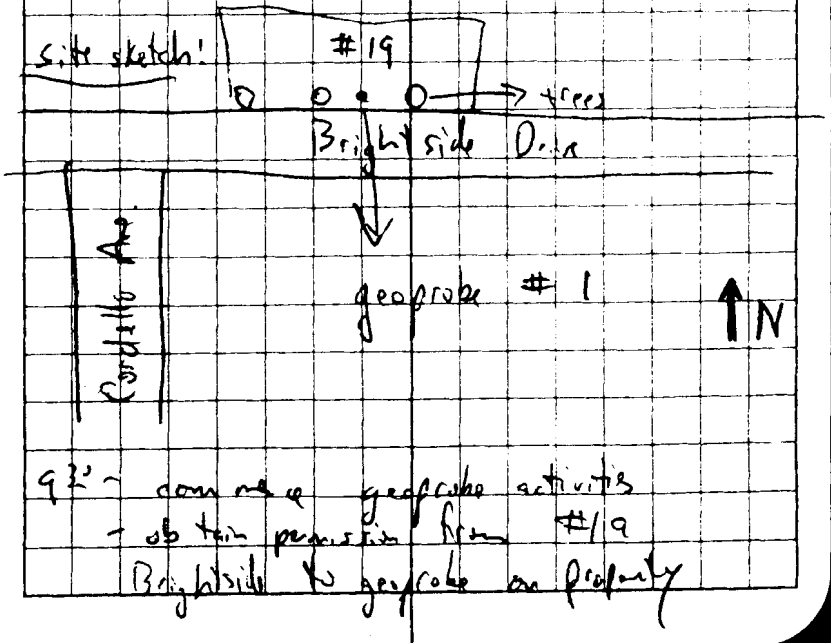
9:25 - MPE conducts field screening w/ OVA/Mini FID - shows no reading

equipment on site: HazW: Truck #78
Mini FID

DEC: 1 truck

LMS: 1 Ford F350 Diesel power probe box truck
1 support truck

site sketch:



9:30 - commence geoprobe activities
- obtain permission from #19 Brightside to geoprobe on property

4 Location Daily Sample log Date 11/9/95 - Mon.

Project / Client DECS9801

Mackensie Chemical (MPC)

location/depth	Sample name	time	matrix	mobile lab	analytical lab
VP-1					TCL/TAL
Brightside-120	VP #1-120'	12:15	Ag	X	
Brightside-100	VP #1-100'	2:00	Ag	X	
Brightside-80'	VP 1-80'	3:20	Ag	X	
Brightside-60	VP-1-60'	5:00	Ag	X	

☆ VP 1-120' sample is probably 112'
≈ 8' of steel rod broke off of probe so all samples are probably short 8'.

VP - Vertical Profile → Water Sample via geoprobe

Location _____ Date 11/9/95 5

Project / Client DECS9801

Mackensie Chemical (MPC)

Each offsite geoprobe boring, ground water samples to be collected @ 120', 100', 80', & 60' bgs.

9:45 - MPC & B&L Filbin meet Eric Schmidt & William Slapoff at 1 Cardinal Drive

10:00 - MWF on site to discuss matters w/ Eric Schmidt & Bill Slapoff also bring glassware for mobile lab

11:00 - probed down to 100'

12:00 - MWG offsite

12:15 - collect VP-1-120' sample

12:50 - Drums on site
- 10 55 gallon drums from A/B cell / move inside gate

2:40 - MWF back on site

3:30 - MWF off site

☆ Please note on page 4 about VP-1 sample and 8' rod missing

Location _____ Date 11/9/98

Project / Client DECS 9801

Mackensie Chemical

4⁰⁰ - probing down to 60'
on VP-1-60 since
we lost 8' of rod and
question sample depths

5⁰⁰ - complete probing to 60'
collect 4th and final
sample from VP-1

5²⁵ - offsite

Michelle Engelmann

Location _____ Date 11/10/98

Project / Client DECS 9801

MACKENSIE CHEMICAL

on site: 7⁴⁵
MPE (H2m)
LMS + check : Bret
DEC - Bob Fillmore

Job #: DECS 9801

location: Mackensie Chemical
offsite geoprobe @ Brightside Drive

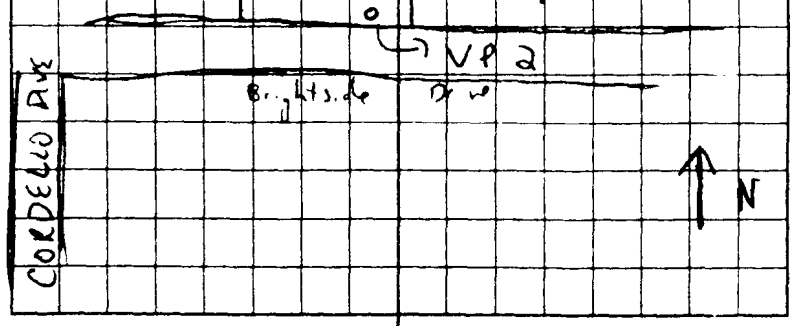
date: Tuesday, November 10, 1998

field conditions: cloudy, cool, 50°

objective: continue w/ vertical
profile wells (geoprobe)
on Brightside and
collect water samples @ 120', 100', 80', 60'

7⁴⁵ - MPE conducts tailgate meeting
8⁰⁰ - commence geoprobing activities

site sketch:



8 Location DUCK SAMPLE LOC Date 11/10/92-Tue

Project / Client DSCS 9211

MARKEWISE CHEMICAL (MFS)

Section / depth	sample name	time	matrix	matrix lab	analytical lab TCL/TAL
VP-2					
Brightside-120	VP 2-120	1045	Aq	X	
Brightside-100	VP-2-100	11 20	Aq	X	
Brightside-80	VP-2-80	12 00	Aq	X	** X/BTinsDup
Brightside-60	VP-2-60	1 30	Aq	X	
VP-3 (MM)					
~~Brightside-120~~	~~VP-3-120~~		Aq (MM)		
~~Brightside-100~~	~~VP-3-100~~		Aq (MM)		
~~Brightside-80~~	~~VP-3-80~~		Aq (MM)		
~~Brightside-60~~	~~VP-3-60~~		Aq (MM)		

** - Analytical lab sample for VP-2-80 Blind Duplicate collected here

VP = Vertical Profile, water sample via geoprobe

Location _____ Date 11/10/92 9

Project / Client DSCS 9211

MARKEWISE CHEMICAL (MFS)

10[15] - complete VP-2 geoprobing down to 120'

12[15] - still collecting sample from VP-2

2[00] - complete last sample @ VP-2

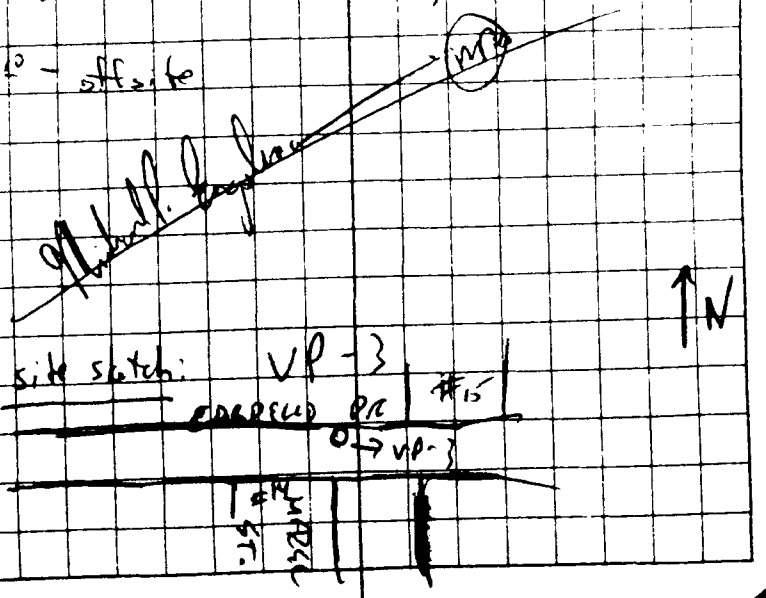
2[05] - break for lunch

2[30] - start VP-3 on Brightside Rd.

5[00] - complete geoprobing to 120' on VP-3

- we will collect samples tomorrow

5[10] - offsite



10 Location DAILY SAMPLES LOG Date 11/11/98 -WED

Project / Client DSCS980

Mackenzie Chemical (MW)

location/depth	sample name	time	matrix	mobile lab	analytical lab
VP-3					
~~Bright side -120'~~	VP-3-120'	915	Aq.	X	
~~Bright side -100'~~	VP-3 100'		Aq.	(MW)	
~~Bright side -80'~~	VP-3 80'		Aq.	(MW)	
~~Bright side -60'~~	VP-3 60'		Aq.	(MW)	
Field Blank		10[30]	Aq.		X
send out analytical samples				11/11/98 via Fed Ex	4[00]
1 Field Blank					
1 Blind Duplicate					
1 sample VP-2-80'					
1 Trip Blank					
VP - Vertical Profile Well via geoprobe					

Location _____ Date 11/11/98 11

Project / Client DSCS980

Mackenzie Chemical (MW)

- 8[00] - MPE on site
check & set level on tank
Bob Filkins (NYSDEC) on site

job #: DSCS980

location: Mackenzie Chemical
1 Cordello Drive
Ft. Lee geoprobe - VP-3 Bright side

date: Wednesday, November 11, 1998

field conditions: drizzle, windy, cloudy, 50°

objective: continue w/ geoprobe profile wells on Bright side (VP-3), collect samples @ 120, 100, 80, 60 bgs

8[00] - MPE conduct tailgate meeting

- mobile lab +
TCL + Trichloropropane

10[30] - probe down to 120'

10[32] - Mobile lab on site

12 Location _____ Date 11/12/98

Project / Client DECS 9801

Mackenzie Chemical (MPG)

11³⁰ - drive cap breaks on LMS geoprobe - cannot continue because LMS must work part.

11⁴⁵ - LMS off site

MPE → mobile lab replenish supply / grout set up

Severn Trent Mobile Lab:

Tim & Josh Kneillman

- to collect 3 vials instead of 2 on every 10th sample for BTEX
- technicians + TEL gets temp / locks + switches locks on gate

2³⁰ MPE gets temp / locks + switches locks on gate

3³⁰ Back to office

Staff (MPG)

Location _____ Date 11/12/98 13

Project / Client DECS 9801

Mackenzie Chemical (MPG)

on site: 7⁴⁵ - MPG

mobile lab (Tim & Josh) on site

job # DECS 9801

site: Mackenzie Chemical (Cabell Pt.)

date: Thursday, Nov 12, 1998

field conditions: sunny breezy 30°

objective: continue geoprobe @ VP-3 collect samples @ 100, 80, 60

8³⁰ - MPG on site

9⁰⁰ - LMS on site - commence geoprobe activities

9³⁰ - Bob (PSE) on site

11⁰⁰ - complete plugging down to 100 on VP-3

1⁰⁰ - complete last VP-3 sample

Location Daily Sample Log Date 11/12/98 - Thurs

Project / Client DEC 9801

Mackenzie Chemical

location / depth	sample name	time	matrix	mobile lab	analytical lab
VP-3					
Brightside -100'	VP-3-100'	11[30]	Aq	X *	
Brightside -80'	VP-3-80'	12[00]	Aq	X	
Brightside -60'	VP-3-60'	1[00]	Aq	X	X
Field Blank #1		9[30]	Aq	X	
Blind Duplicate taken on VP-3-60'	VP-3X-00		Aq	X	
Brightside -120'	VP-4-120'	4[30]	Aq	X	X 11/13/98

Analytical lab ms/msd collected on VP-4-120'

* - mobile lab extra vial collected on 10[th] extra trip/QC
- mobile lab B.B. #1, F.B. #1

Take extra vial for mobile lab 3 total of 2 on 10[th] (every 10[th]) sample

VP = Vertical Profile Well

Location _____ Date 11/12/98

Project / Client DEC 9801

Mackenzie Chemical

Joseph Peck (NYSDEC-Albany) 457-7924

Susan Trent (mobile lab) - (413) 572-4000
(Pat's Law)

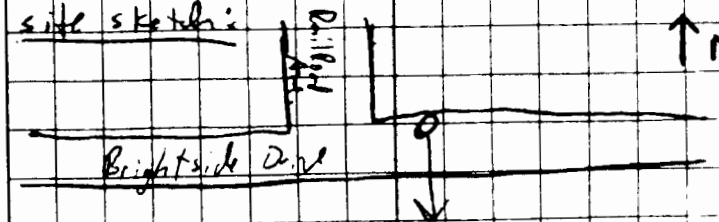
American Analytics - (315) 673-7496 (P)
(Judy or Ricky) (315) 673-7189 (F)

VEC, Inc. - (919) 968-3203 (P)
(Edna) - (919) 968-5313 (F)

Accredited Labs - (732) 541-2025
(Bob Coffey) X 106
(Willie Vicksteadt) X 109

1[30] - commence geophysics work @ VP-4

site sketch:



2[00] - done to 70'
3[30] - MNG on site
4[00] - complete profiling to 120'
5[00] - collect last sample 120'
5[30] - offsite

16 Location Daily Sample Log Date 11/13/98

Project / Client DEQ 9801

Mackenzie Chemical (MPC)

location/depth	sample name	time	matrix	mtl.b lab	anal'z
VP-4					
Brightside -100'	VP-4-100	@ 3[0]	Aq	X	
Brightside -80'	VP-4-80'	q 15	Aq	X	
~~Brightside -60'~~	~~VP-4-60~~		~~Aq~~		(MPC)
Field Blank #2	F B # 2	q 3[0]	Aq	X	
VP-5					
1st Johns St 100'	VP-5-100'	1[00]	Aq	X	
St. Johns St 80'	VP-5-80'	1[15]	Aq	X	
St. Johns St 60'	VP-5-60'	2[00]	Aq	X	

VP= Vertical Profile Well

Location _____ Date 11/13/98 17

Project / Client DEQ 9801

Mackenzie Chemical (MPC)

on site 7[30] - MPC + Ch.H

7[40] - Bob (PEC)

- Brent (KHM)

job # DEQ 9801

site Mackenzie Chemical Corp

1 Candella Place

date Friday, Nov. 13, 1998

field conditions cloudy, cool, 45°

objectives continue grab @ VP 4

collect @ 100' 80' & 60'

- start collecting sample for VP 100'

@ 8[20]

9[30] - Bob (DEQ) spoke w/ Ian Rank (KHM)

they decide to stop taking VOC

samples due to equipment and

plume delineation questions

1[00] - we did not collect VP-60 4 sample

- we will come back to it

as per Bob (DEQ)

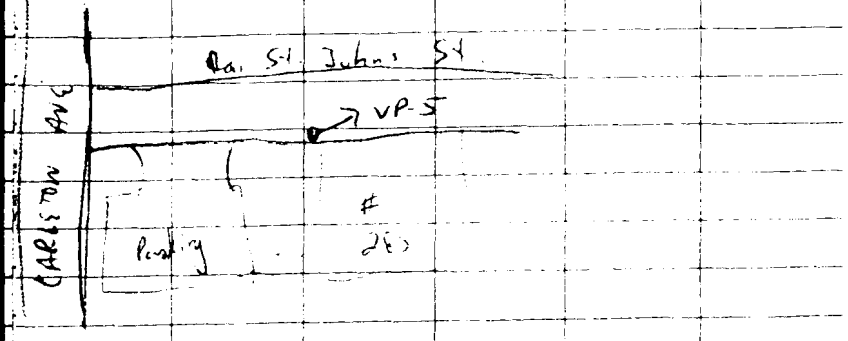
18 Location _____ Date 11/16/98

Project / Client D&S9801

Mackenzie Chemical (MPA)

11:00 Mobile to St. John St
to VP-5

site sketch



1:00 - complete probing to 15'
on VP-5

1:20 - MNE on site

2:00 off site

Location Mack Date 11/16/98 19

Project / Client D&S9801

Mackenzie Chemical (MPA)

on site: 6:35 - MPE
Bob (P&C) @ 7:20
MNE (H&M) @ 7:35

job #: D&S9801

site: Mackenzie Chemical Corp
1 Cordelia Dr.
Central Islip N.Y.

date Monday Nov. 16 1998

(JF) on site 8:45
(M) on site

field conditions: sunny, cold, SO

objective CJF -> continue vertical profile wells via geoprobe
MPE -> start surface soil samples / drainage structures

* see CJF for field notes on vertical profile wells

Wed 11/4/98 - 10[45] mobil lab on site
11/10/98 - Mon - 9[50] mobil lab
11/10/98 LMS - 2 geoprobes
only 1 on site @ 8[00]
2nd on site @ 12[20]

11/16/98 11[40] - backhoe on site
11/16/98 ~~11[40]~~ 12[45] - Joe Peck on site

8[50] - MPE offsite

9[00] MPE offsite
9[20] Mobil lab on site
(Tim + Jack)

- MPE goes to Advantage Fuel
to set up Hamza drill
(Sampling in building
- other lab generator & augers

11[00] - MPE back on site

11[40] - Ryan Brian of American Augers
on site w/ Backhoe

12[00] - Commence soil mixing activities

12[30] - Joe Nixon } LMS
John Thornberg }
on site w/ no geoprobe
just equipment

12[45] - Joe Peck on site

1[00] - MPE on site

* as per Joe (DEC) collect
soil w/ sample @ OS-5
called OS-5 since
water bubbled up as we were
excavating soil

22 Location Daily Sample Log Date 11/6/98

Project / Client DESS9801

Mackenzie Chemical (MPC)

Location / Depth	Sample name	Time / Matrix	Moisture	Analysis Lab	QA/QC
DS-5	DS-5 surface	2PM / Aq	X		

42° - MNG off site
- Tim off site

- Ryan clears area for SS-17 & 18
- locate DS-3

Location Date 11/16/98 23

Project / Client DESS9801

Mackenzie Chemical (MPC)

Surface Soils

Location	PID (p.p.m) Reading	Sample time
SS-15	0.0	2 10
SS-17	0.0	2 45
SS-18	0.0	3 30
SS-20	0.0	3 15
SS-21	0.0	3 30
SS-19	0.0	3 45
SS-14	0.0	4 00
SS-4	0.0	16 30
SS-3	0.0	16 40
SS-6	0.0	16 45

12 - on site
4:30 - spoke to Furniture people about gaining access to DS-6

5:30 - off site

(MPC)

24 Location _____ Date 4/12/[illegible]

Project / Client DESC 9201 Monday

Markems - Chemical (MPW)

		FID Level
on site: 7[30] - MPW		
CJF		0.0 →
Bob Fillers (DSC)		0.0 →
John, John, Brad, Chuck Human (LMS)		0.0 →
Ryan (American Augers)		0.0 →
		0.0 →
- Chris will continue geoprobe for vertical profile wells		0.0 →
		0.0 →
9[00] - Joe Peck (DSC) on site		0.0 →
- Ryan excavating DS-6 area		
- Chuck MPW collect surface soil samples		
11[00] - American Augers backhoe breaks		
11[15] - Gary J. Mills on site		
- mobil lab has to be calibrated instruments		
11[20] - MPW / Ryan mobilize to Advantage tool Rental to Return Bosch Hammer →		

Location Daily Sample Log Date 4/17/[illegible] 25

Project / Client DESC 9201

Markems - Chemical (MPW)

location/depth	sample name	time/date	matrix	mobil lab	analytical
SS-2 0-4	SS-2	9[20]	Soil	X	
SS-1 0-4	SS-1	7[30]	soil	X	
SS-17 0-4	SS-17	10[00]	soil	X	
SS-18 0-4	SS-18	10[15]	soil	X	
SS-10 0-4	SS-10	11[00]	soil	X	
DS-6-10-12	DS-6-10' Bottom	11[45]	Soil		X
DS-6 24-28	DS-6-25'	13[45]	Soil	X	
DS-6 38-42	DS-6-40'	16[20]	Soil	X	

and try to obtain backh

1200 - @ Advantage Ryan rents a 753 Bobcat

[illegible] - back on site

Location [illegible] Date 11/17/98

Project / Client DSC 9801

Paulsboro Chemical

1:30 - continue drainage structure DS @ DS-6 in front of building

- Ryan still locating DS-2

Bob Coffey (PEI) calls MPE to visit about LIPE sample → call Ken Rydzewski (718) 558-3536

3:00 - Ryan finds 2nd drainage structure DS-2

5:00 - MPE/CJF off site

Location [illegible] Date 11/18/98 Wednesday

27

Project / Client DSC 9801

Paulsboro Chemical

7:30 - MPE on site

Job #: DSC 9801

Location: Paulsboro Chemical Corp
1 Cordella Rd
Clarksboro, NJ

date Wednesday, Nov. 18, 1998

field conditions: cloudy, cold, 45°

objective: MPE → continue w/ drainage structures
CJF → continue w/ vertical profiling wells

CJF (Hydro)
Bob (RC)
Josh (Mobil Lab)
Chuck, John², Bret (Ames)
Ryan (American Engr)

On site by 7:45

Location Daily Sample Log Date 11/18/98

Project / Client DECS 9802

McKenzie Chemical

(initials, circled)

Sample name & depth	time/matrix	mobil lab	analytical lab	QC/QC	FID ppm (ppm)
DS-2-25'	10^45/soil	X			0.0
DS-2-40'	12^00/soil	X			0.0
DS-2-Bottom 10'	12^20/soil		X		0.0
DS-3-25'	2^00/soil	X			0.0
DS-12-PIPE	15^45/soil	X			12.9 ↑
DS-3-40'	16^15/soil	X			0.0
DS-3-Bottom 10'	16^30/soil		X		0.0

Able moved 5 1/2 drums 11/18/98

ESI removed 6 drums 11/18/98

Location Date 11/18/98

Project / Client DECS 9801

McKenzie Chemical

(initials, circled)

8^00 - Josh informs MPE that mobil lab should have results by 12^00 ±

MNG - on site

8^10 - Joe Peck on site

- Ryan digs up lagoons ES 8 & 11
- find oil / product in lagoon

- As per DEC → pump oil liquids store solids in poly.

12^00 - Complete DS-2
- complete DS-2

12^50 - AB oil Environmental on site

1^50 - Bob Stewart on site

2^00 - A&B oil off site

3^00 - Able Environmental back on site [illegible] Vactored

ESI
[illegible] - Permission by NYSDEC to provide backhoe @ $800.00/day + pump out [illegible] drums

5^30 offsite

(initials, circled)

30 Location _____ Date 11/19/98

Project / Client DE98801 Thursday

Mackenzie Chemical (MPE)

on site - 7:30 MPE, CJF, MNE, Jack, Jake², Bob, Bob, Chuck,

8:00 - Environmental Services on site ⊂ Robert, Frank, mini track

job #: DE98801
site: Mackenzie Chemical Corp
Candelle Ave. CT
date: Thursday, November 19, 1998
field conditions: cloudy, cold, 40°

9:00 - Jim Peck (DEC) on site

- CJF will continue ⊂ Vertical Profile Wells offsite

- MNE locating dry wells & moving tanks ⊂ Environmental Services

- MPE - collecting soil samples ⊂ Drainage Structures

9:05 - Ryan (N.A) locate DS-13 Near DS-5

Location Daily Sample Log Date 11/19/98 31

Project / Client DE98801 Thursday

Mackenzie Chemical (MPE)

sample ID / depth	time / matrix	metals	analytical	OVA/OK	FID (ppm)
SS-15-4'-8'	7:45 / soil	X			0.0
DS-13-25'	10:45 / soil	X			0.0
DS- Field Blank #1	11:00 / Aq.	X			
DS-13-40'	12:00 / soil	X		BD	0.0
DS-13X	"	X		BD	0.0
DS-13-Extra	12:05 / soil		X	B.D.	0.0
DS-XX			X		
SS-5-0-4'	14:45 / soil	X			very strong odor
SS-5-4-8'	14:50 / soil	X			strong odor
SS-5-20-24'	15:00 / soil	X			strong odor
SS-4-4-8'	16:00 / soil	X			strong odor

DS-13X is a Blind Dup. of DS-13-40' (mbl)

DS-XX is a Blnky. of DS-Extra analytical .0'

32 Location _____ Date 11/19/12

Project / Client DECSWMU

Mackenzie Chemical (MFG)

9[10]- commence Drainage Structure sampling @ SS-15, as per MNF. collect soil 4-8', 20-24

9[45]- GJM on site

- Chuck (Lms) informs MFG that 20-24' sample cannot be obtained for SS-15 due to refusal.

10[45]- GJM off site

11[50]- Bob Stewart (NYSDEC) on site

12[15]- As per MNF → continue SS-5 to 40' to obtain sample

- Joe Peck at site at some point?

Tomorrow 11/20 → continue SS-4 20-24'

Location _____ Date 11/15/12 33

Project / Client DECSWMU

Mackenzie Chemical (MFG)

4[00]- Man from Environmental Services off site

4[15]- Bob Stewart off site

→ 4[20]- collect SS-4 4-8' sample - will re-start tomorrow 20-24' - Chris had to leave

5[15] off site

34 Location Daily Sample Log Date 11/20/98 Friday

Project / Client DECS 9801

Mackensie Chemical (Mfg)

Sample name depth	time / matrix	metals lab	analytical lab	QA/QC	FID (ppm)
DS- Field Blk #2	8[35] / Aq	X		F.B. #2	
DS- Fidy Blank	1000 / Aq		X	F.B. DS.	
DS-15-25'	9[35] / Soil	X			0.0
DS-15-40'	1100 / Soil	X			0.0
DS-15-Bottom 10'	12[00] / Soil		X		0.0
DS-12-25'	15 / Soil	X			0.0
DS-12-40'	20 / Soil	X			0.0
DS-12-Bottom 10'	2[20] / Soil		X		0.0

Location _____ Date 11/20/98 35

Project / Client DECS 9801

Mackensie Chemical (Mfg)

7[25] - Mtg on site
4 men Lms
CJF, MNG,
Bob Stewart, NYSDEC
Josh - (Lab Analyst)

Hs pertaining to:
DS-15, DS-12 → 10'-14', 20'-24', 40'-44'
DS-14, → contrast

8[00] common geophysics activities @ DS-15

CJF @ DS-5, SS-4

Job #: DECS 9801
Date: Friday, Nov. 20, 1998
Field conditions: cloudy, cool, 50°

Site: on site @ Mackensie Chemical Corp.
1 Cordell Dr.
Clifton, NY

10[15] - Lms gas probe
to sat hydraulics

11⁰⁰ - Gary Milk on site

11³⁰ - GJM off site
11⁴⁵ - MNG off site
12²⁰ - CJF off site

→ LMS [illegible]

→ [illegible]

4²⁰ - [illegible]

7²³ - [illegible]

Job # D&J98
Date Monday, Nov 23 98
Weather cold sunny, 45°

8⁰⁰ - [illegible]

8¹⁵ - MNG off site

→ [illegible]

→ [illegible]

11⁰⁰ - [illegible]

38 Location Daily Sample Log Date 11/21/92

Project / Client Occidental

Mackenzie Chemical (MFW)

Sample name Depth	Time/matrix	mobile lab	analytical lab	QA/QC	F.I.D. scan
DS-Field Blank #3	8:30/Aq.	X		Field Blk #3	
SS-4-2'	9:50/soil	X			21.0 ppm
SS-4-4'	10:05/soil	X			2.5 ppm
DS-14-4-8'	11:35/soil		X		110 ppm
DS-14-8-12'	11:40/soil	X			250 ppm
SS-9-0-4'	11:50/soil	X			1.0 ppm
DS-14-2'	12:15/soil	X			8.0 ppm
DS-14-4'	2:30/soil	X			20.0 ppm
SS-11-0-4'	2:45/soil	X			1.0 ppm
SS-6-2'	3:30/soil	X			1.0 ppm
SS-6-4'	4:00/soil	X			ppm

Location Date 11/21/92 39

Project / Client Occidental

Mackenzie Chemical (MFW)

11:25 - mobile lab + called sample DS-14 4-8 → analytical lab 8-12

12:10 - break for lunch

12:35 - re-commence sampling

2:30 - called DS-14-4' sample

3:00 - Bob Stewart offsite

3:30 - MNG on site

4:00 - MNG offsite

4:15 - MFW offsite

Michael P. Gray (MFW)

40 Location Daily Sample Log Date 11-[illegible]

Project / Client DE(S9[illegible]

Mackenzie Chemical

sample	depth	time/date	mobile lab analysis	OVA/GC	soil
SS-3-21'	0945/Soil	X		350 ppm	
SS-3-41'	930/Soil	X		450 ppm	
SS-13-21'	1030/Soil	X		ppm	
SS-13-41'	1040/Soil	X		1.0 ppm	

Location _____ Date 11/24/98 41

Project / Client DE(S9801 Task 1

Mackenzie Chemical

7:30 - on site

Mike, Mark (H2m)

Bob (D&C)

Josh (mobile lab)

John 2 (crew)

8:00 - commence geophysical survey @ SS-3 collect at 21', 41'

Job # DE(S9801

weather sunny, cool 55°

Date Tuesday, November 24, 1998

9:00 - calibrate OVA (FID)

9:30 - Mark & Mike SP

10:00 - mobilize to SS-13

11:00 - Bob & Steve off site

12:00 - off site Mike

Location _____ Date 12/[illegible]

Project / Client Dresser Tuesday

Mackenzie Chemical

7[50] - on site mtg

Pub Systems NIOSH on site

?[00] - Ryan & Todd & American Augers on site

- mobilize equipment

- equipment on site - Foreman Bill 3/4 Rob Ed 5 offsite truck trucks

job - Dresser

Date Tuesday December 2 [illegible]

Subcontractors Daily cost 45

8[00] - mtg Bob/Ryan Tom & Ed get permits on hydrant

10[00] - York Canada Daily Report Environmental on site

- mobilize to site

Location _____ Date 12/3/98

Project / Client Dresser Wed

Mackenzie Chemical

→ go to Fire Hall Islip Highway Dept. Old Carleton SCWA BK Engineering → RI2 test.

As per mtg Tom will concentrate on obtaining well permit

2[00] mtg goes to 4 Mayfair for Hydrofracture info

Told Bob Ryan to go to bay view bank Plaza to take pt. Tom Parker to steam pit

will meet Thursday @ 7[00]

5[00] - left site

6:55 – Mtg (Main)
onsite: Bob (Mission)
Ryan Todd (Arcadis Buffalo)

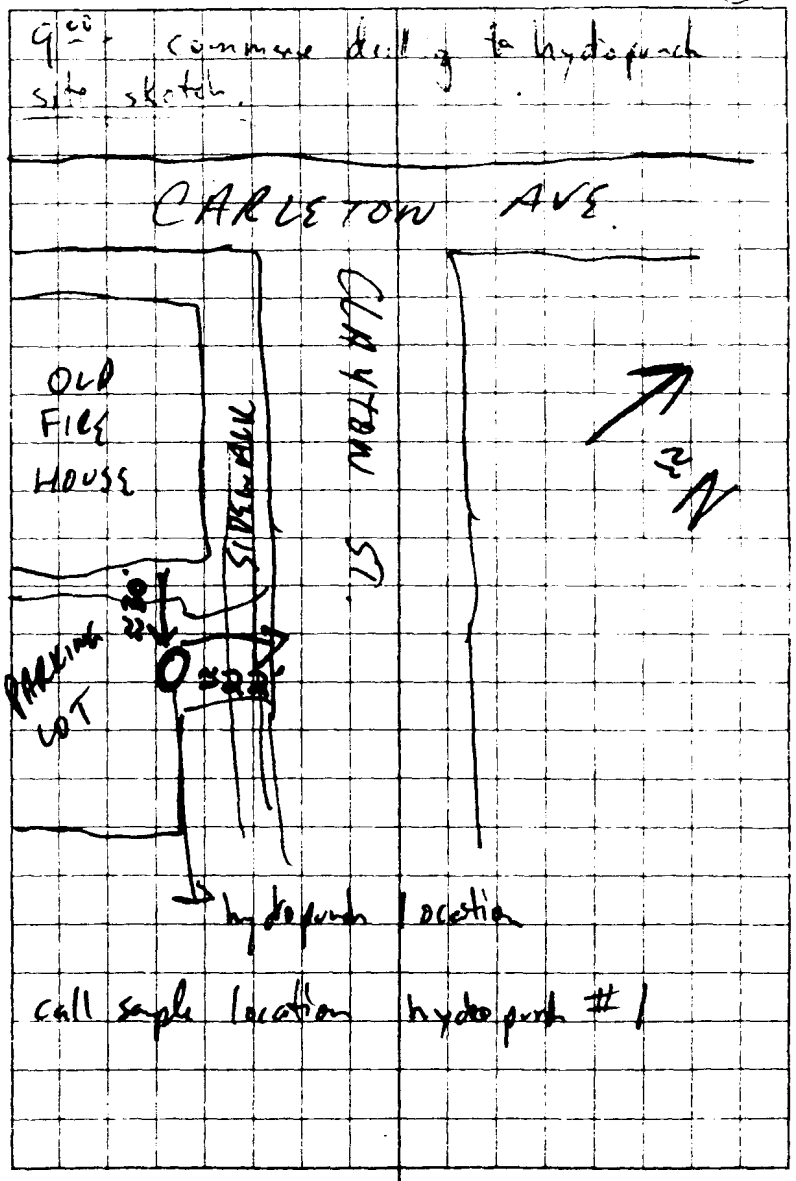
Site: Decision
Date: Wednesday, December 7, 2018
Weather: cloudy, cold 40°
Objective: as per Bob & Ryan Bob Cooley (NYSDEC)
conduct hydropunch sampling @
Carleton St. obtain samples
beginning @ 12', every 20'
to 180'
→ analysis @ H&K Labs, Inc.
$100/sample TCL VOCs + 1,4-Dioxane
4 day turnaround time

7:30 – meet on site
with Clifford Fire Chief
8:30 – proceed to Carleton / Colvin
Old Fire House

8:45 – meet at site

9:00 – commence drilling to hydropunch

Site sketch.



 Location ______ Date 12/[illegible]

Project / Client Dec[illegible]

[illegible] Chemical

9:45 - MPE goes to get Hydropunch [illegible] [illegible]

→ [illegible] to obtain hydrant permit

10:30 - MPE [illegible]

10:40 - [illegible] 120

2:00 - [illegible] 140

DAILY SAMPLE LOG

Sample name	depth	time	matrix	[illegible]
Hydropunch #1-120' - 120'	10:30	Aq.	✓
Hydropunch #1-140' - 140'	2:40	Aq.	✓
Hydropunch #1-160' - 160'	3:45	Aq.	✓

3:30 - [illegible] on site

5:30 - complete installation [illegible]

6:00 - MPE off site

[signature] (initials)

Location ______ Date 12/10/99

Project / Client DEC5980 Thursday

Malarse Chemical (initials)

Ryan (American Auger) - 1 (315) 430-3212

Bob Filkins (NYSDEC) - 1 (518) 461-5536

- Bob Cozzy - (518) 457-7924

6:45 - MPE on site

7:05 - Bob (DEC) on site

Ryan, Todd (American Auger)

objective:

→ complete installation of Hydropunch #1 well installation

→ Monitoring well called

OS#1

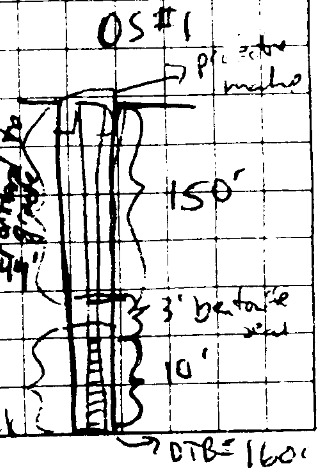
date: Thursday December 10, 1999

field conditions: cloudy, cold 35°

10:30 Bob offsite

1:30 Ryan/Todd offsite

2:00 MPE off site



[signature] (initials)

48 Location _____ Date 12/11/93 Friday

Project / Client DEC59801

Mackensie Chemical (MPG)

on site: 2[ND]

job#: DEC59801

date: Friday, December 11 1993

objective: perform radiation test @ Cordell Dr. Mackensie Chemical Corp.

MPG performs Radiation screen
- by walking entire perimeter of
- property
- inside buildings
- neighboring properties

→ Rad Meter indicates no reading besides background mR/hr.

instrument: Radiation Alert™ Monitor 4

no readings on site

4[TH] MPG off site (MPG)

49 Location _____ Date 12/14/93 Monday

Project / Client DEC59801

Mackensie Chemical (MPG)

on site: 11[DE] MPG

Ryan Todd on site 11[HS]

job#: DEC59801

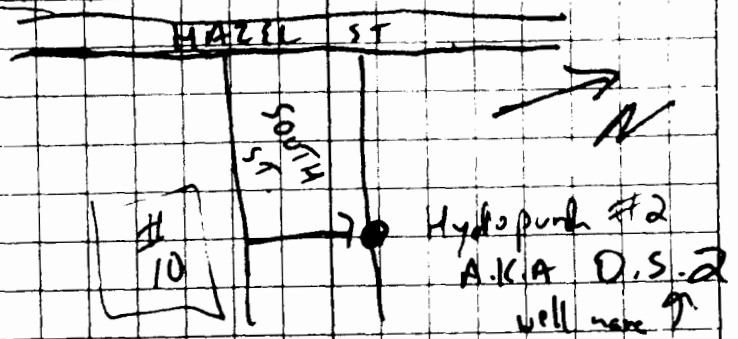
date: Monday, December 14, 1993

weather: cold sunny, 39°

objective: continue hydropunch and install monitoring well

location: South St.

site sketch:



2[ND] - MW G on site
3[RD] - MW G off site

50 Location Daily Sample Log Date 12/9/98

Project / Client P&S 9801

Mackenzie Chemical

Daily Sample Log

Sample name	depth	time	matrix	HCl preserved → TCL VOC's
Hydropunch #2-80'	- 80'	3:10	Aq	✓
Hydropunch #2-100	- 100'	4:20	Aq	✓
Hydropunch #2-100	- 120'	5:20	Aq	✓

end @ 120'

5:30 - off site

Location Date 12/15/98

51

Project / Client P&S 9801

Mackenzie Chemical

6:50 - on site

7:00 - Ryan & Todd on site

job #: P&S 9801

Date: Tuesday December 15, 1998

weather: cold, sunny, 28°

objective - continue @ Hydropunch #2
- install monitoring well

7:45 - commence drilling activities

well construction diagram → same as DS#1 & DS#2 on p. 47

8:15 - MNG on site

8:30 - collect Hydropunch #2-140'

9:15 - MNG off site

9:30 - collect Hydropunch #2-160'

52 Location Daily Sample Log Date 12/15/98

Project / Client DECS9801

Mackenzie Chemical

Daily Sample Log

sample name	depth	time	matrix	H2M Labs Inc	TCL VOA's 1,2,-Trichloroethane
Hydropunch #2-140'	-140'	8[55]	Aq.	✓	
Hydropunch #2-160'	-160'	9[30]	Aq.	✓	

1[00] - Bob Filkins on site (DEC)

5[00] Complete well installation

Location _____ Date 12/16/98 53

Project / Client DECS9801 Wednesday

Mackenzie Chemical

7[00] - MPE on site
Ryan & Todd on site

date: Wednesday December 16, 1998
weather: cold cloudy, 35°
job # DECS9801
objective ~~continue~~ hydropunch @ VP-2
hydropunch #3 and install well
OS #7

-8[30] - MW/A on site
-10[00] - MW/A off site
1[00] - Bob Filkins on site (DEC)

site sketch: same as VP-2
on pg #7

11[00] - collect hydropunch #3 - 140'

12[00] - collect hydropunch #3 - 160'

54 Location Daily Sample Log Date 12/16/88

Project / Client Dess9801

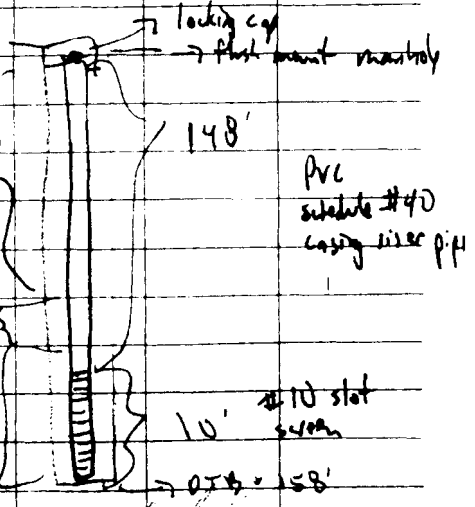
Mackenzie Chemical

Daily Sample Log

Sample name	depth	time	matrix	Hazmat labels
Hydropunch #3-140	140'	11:00	Aq.	✓
Hydropunch #3 160	160'	12:-	Aq	✓

2:01 - spl 0.S. #3 well @ 158' O.S.

well construction diagram:



5:00 - mpi off site

Location Date 12/17/88 55

Project / Client Dess9801 Thursday

Mackenzie Chemical

6:55 mpi - site

Ryan - field work

date: Thursday December 17, 1988

field conditions: cloudy, cold, 45°

job #: Dess9801

objective: Continue drilling offsite with monitoring well installation

→ 7:40 - Ryan informs mpi that himand Todd will be leaving for Syracuse in the afternoon

for 12/17/88 they will set flush mount wells, decon all equipment, fill & mound soil cutting drums

10:00 - offsite

Mackenzie Engineering

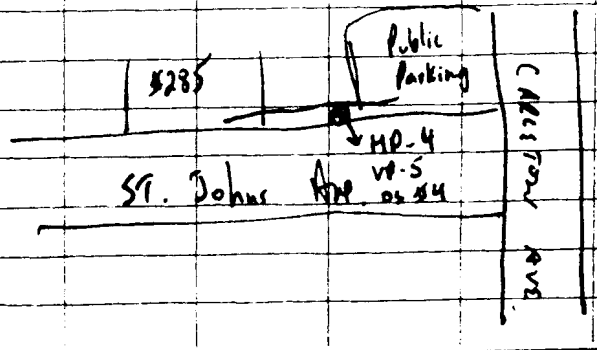
11[00] - MPE on site
11[30] - Ryan & Jeremy (American Aqua) on site

date Monday December 21, 1998
job # DSCS9801
field conditions: cloudy, cool, 45°

objectives today: hydropunch activities and well installations
- HP-4 - collect samples @ 120, 140 & 160

12[00] - mobilize to hydropunch #4 @ St. Johns Ave.

site sketch - some locations are approx



2[45] - done HP-4

DAILY SAMPLE LOG

Sample name	depth	time	matrix	H&M LABS	TCL 1,2,3 VOCs Triethylene
HP-4-120'	120'	4[00]	Aq.	✓	✓
HP-4-140'	140'	4[30]	Aq.	✓	✓

→ well to be called OS #4

* HP - hydropunch

4[00] - collect HP-4-120' sample
4[30] - collect HP-4-140' sample

4[45] - MPE off site

Location _____ Date 12/22/98

Project / Client DES980: Tuesday

Mackenzie Chemical (MPE)

L[55] - on site MPE

Ryan & Jeremy

date: Tuesday December 22, 1998

field conditions: cloudy, cold, 45°

job #: DES980

objective: continue E hydropunch Hydropunch #4 and set well OS #4

DAILY SAMPLE LOG

Sample name	depth	time	matrix	Hom Labs Tubes 1,2,3 milliliters
HP-4-160'	160'	8[15]	Aq	✓

HP = hydropunch

9[00] - begin to set well

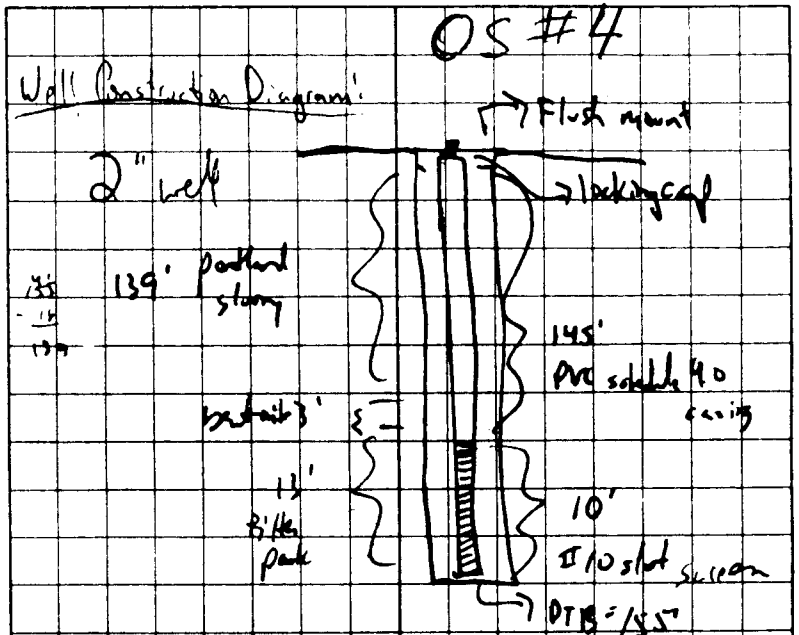
Location _____ Date 12/22/98

Project / Client DES980:

Mackenzie Chemical (MPE)

OS #4

Well Construction Diagram:



2[00] - Bob filling (NYSDEC) on site

3[30] - mobilize to South St.

- will install shallow 60' well @ OS #2

* site sketch some ⇒ OS #2/HP #2

⇒ OS #2 S

⇒ some location ⇒ OS #2 D

⇒ Aqua to 60'

5[30] - MPE off site

(MPE)

7:00 MPE on site
Ryan + Jeremy on site

8:00 - commence activities @ OS #25
→ set well hole cover in
concrete

9:00 - Bob Filkins on site

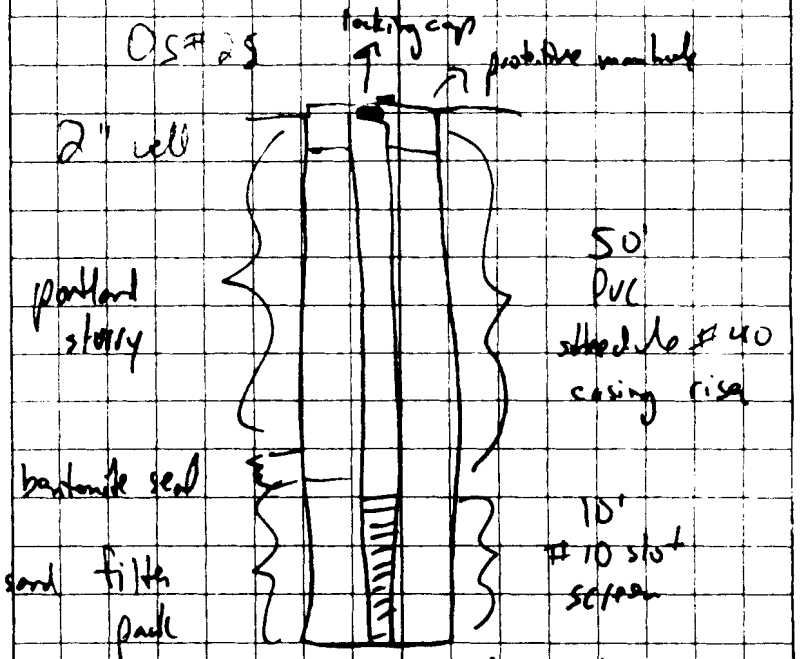
10:00 - began setting well

weather cloudy cold, 25°
Date Wednesday December 23, 1998

12:00 - Bob (NYSDEC) offsite

12:45 - began setting flushmount
@ OW #2 and OS #4

Well Construction Diagram:



3:00 - MPE offsite

on site 11:30 - MPK
Ryan & Jeremy (Amoco) Augis
on site

date Monday January 4 1998
job #: DECS980
field conditions: cold, 35°
observations: [illegible]
11:45

→ Ryan informs MPK that the
Bobcat 873 was stolen since
we last met on site
- Ryan called police
- filed site report

1:30 - commence well installation
6" VP 1 foot slots
120' well set @ 2'

3:30 - [illegible]

4:15 - MPK on site
4:45 - MPK off site
6:00 - Amoco Kyle finish sampling
well OS #3I

site photo - view of OS #3I

Well Diagram

OS #3I

2' PVC well

→ protective cap / J plug

104' Portland

110' PVC casing riser #40 slotted

bentonite 3'

fifth pack 13'

10' #.10 slot PVC screen

→ DTB = 120'

64 Location _____ Date 1/5/99

Project / Client DES9801 Tuesday

Mackenzie Chemical

7:00 - MPE on site
Ryan + Penny

job #: DES9801
Date: Tuesday January 5, 1999
field conditions: sunny, cold 18°
objective: continue well installation

8:00 - steam clean augers

8:30 - MPE goes to Kaiser Sunnidin to obtain permission to drill upgradient
→ will leave gate open

9:00 - calculate drums for well daily
9:00 - start drilling on South St. → OS#2T ≈130'
10:00 - MPE calls Accredited Lab → Bob Coffey to request soil + air glassware

10:15 - MPE tries calling Bob Filkin 3 Xs, no success
1:30 - complete setting well OS#2I

Location _____ Date 1/5/99 65

Project / Client DES9801 Tuesday

Mackenzie Chemical

site sketch: same as OS#2D
OS#2S

Well Construction Diagram: 2" well

OS#2I

grade

114' portland slurry

120' Schedule 40 PVC casing Riser

3' bentonite

filter pack

13'

10' #.10 slot screen

→ DTB = 130'

3:00 - MW 6 onsite
3:30 - MW- off site
5:00 - MPE off site

MPE

66 Location _____ Date 1/[illegible]

Project / Client OU5980 Industrial

Markets Chemical Corp

date: Wednesday, January 6, 1993

Job # OU5980

Field conditions: cold, low 17°

Objective: continue well installations - updated

7:00 - MPE on site
Ryan & Jeremy

→ load equipment

8:00 move to site, locate site of abandoned well

8:30 - move off site

8:45 - start drilling @ OS#5D - updated

11:30 - Complete drilling to 150'

1:45 - Bob Fikes (NYSDEC) on site

3:00 - complete setting - OS#5D

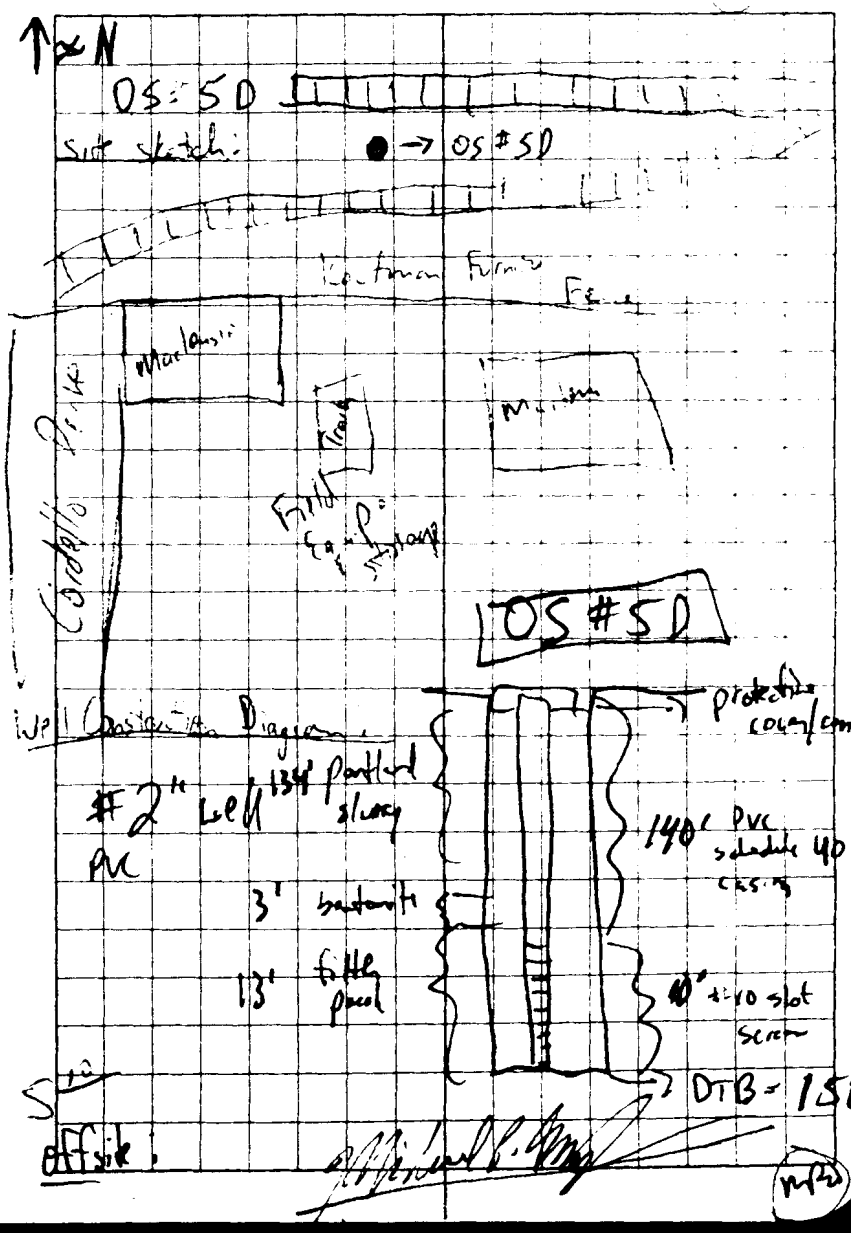
4:00 - start drilling OS#5S
shallow well next to OS#5D

5:00 - complete drilling OS#5S

Location _____ Date 1/[illegible] 67

Project / Client OU5980 Industrial

Markets Chemical Corp



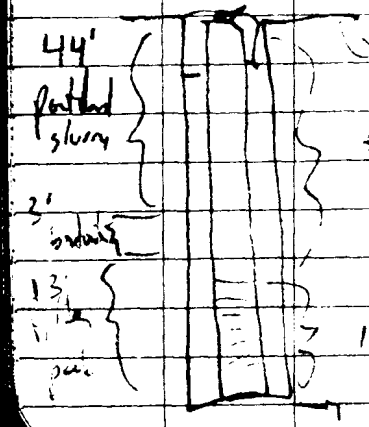
7:00 - mob on site
Ryan & Jeremy

job # DEIS
date Thursday January 8/98
field conditions cold, clear, calm
objective contour drilling, set well @ OS #55

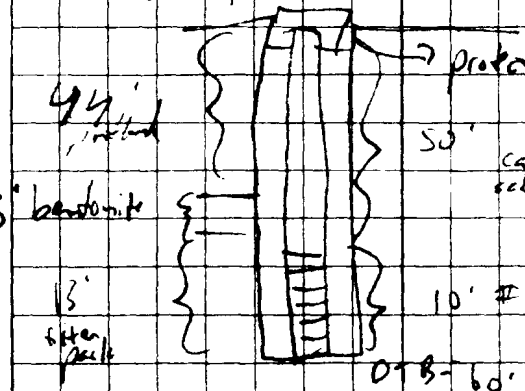
8:00 setting well OS #55

site sketch → same as OS #50

well Diagram OS #55
2" well



10:00 - complete setting well OS #55
11:00 - start last well → OS #35
→ OS #35 → site sketch, same as OS #55
12:00 - complete drilling
2:00 - complete setting well
well diagram OS #35 2" well



3:00 - start drainage structure sampling through 2 cement vaults
→ no success, cement is too thick
→ As per MNG, go right next to each drainage vault

70 Location _____ Date 1/7/99

Project / Client DECS 9801

Mackenzie Chemical (MPW)

3:15 collect 1st sample @ 8' bgs

4:20 - complete 2nd Waste Lagoon sampling

5:00 - offsite

(MPW)

71 Location _____ Date 1/7/99

Project / Client SAMLE LOG

Mackenzie Chemical (MPW)

Sample Location	depth	MATRIX	TIME	DATE
Waste Lagoon #1	8'	S	3:15	1/7/99
Waste Lagoon #1	25'	S	3:25	1/7/99
Waste Lagoon #1	40'	S	3:20	1/7/99
Waste Lagoon #2	8'		4:15	1/7/99
Waste Lagoon #2	25'		4:25	1/7/99
Waste Lagoon #2	40'		4:30	1/7/99

★ S = Soil

→ WASTE LAGOON #1 is on Bill Sleppoff's property the northernmost lagoon, eastmost

→ Waste Lagoon #2 is on Ede's property by his east side door

Location ______ Date [illegible]

Project / Client [illegible]

Mackenz[illegible] [illegible]

Job [illegible]

Date Friday January [illegible] 199[illegible]

Onsite 7:00 AM

Ryan & [illegible]

Field conditions [illegible] snow, 20°

Objective [illegible] well [illegible] flush [illegible]

[illegible]

10:[illegible] [illegible] flush mounts [illegible]

[illegible] Ryan & [illegible]

[illegible]

[illegible]

[illegible]

[illegible]

3:00 - off site → [illegible]

[illegible]

Location ______ Date 1/[illegible]

Project / Client [illegible]

[illegible]

Job [illegible]

Date Monday, January 1[illegible]

Onsite 11:[illegible] AM

1:[illegible] - Ryan & Rocky ([illegible])

Field conditions: cold, [illegible], 2[illegible]°

Objective: develop all new monitoring wells and old wells

- 11:[illegible] MPE location [illegible] wells

→ got Eric [illegible] with [illegible]

[illegible]

- [illegible] location [illegible] MW-2

1:[illegible] Ryan & Rocky [illegible]

→ start [illegible] set up equipment

2:[illegible] start [illegible] development

3:[illegible] MW-[illegible] on site

3:[illegible] [illegible] off site

5:[illegible] [illegible] Ryan & Rocky [illegible]

Location _____ Date 1/4/99

Project / Client D2159201

Well Development Log

MW	Pre-	OTB	Static DTW after comp.	Feet of H2O	3 x feet of H2O
			1/11/99		
OS #3S	46.98	60'	13.02	2.13	6.56 -2"
OS #3I	47.12	120'	72.8	11.67	35.61 -2
OS #3D	46.96'	158'	111.04	18.61	54.22 -4
			1/12/99		
OS#2S	40.38	60'	19.02	3.10	9.30 -3"
OS#2I	41.14	130'	88.64	14.48	43.44 -2
OS#2D	42.0'	160'	118.0	19.23	57.70 -2"
OS#4D	42.9'	155'	112.14	18.27	54.86 -2"
OS #1D	42.21	160'	117.79	19.19	57.59 -2"
OS#5D	48.96	150'	101.04	16.46	49.40 -2"
OS #5S	49.02	60.0'	10.98	1.78	5.36 -2"
MCMW-1	51.88	66.0	14.12	9.22	27.66 -4"
MCMW-3	48.3	65.0	16.7	10.90	32.71 -4"
MCMW-5*	49.92	65.0	15.08	9.84	29.54 -4"
MCMW-4	49.96	65.0	15.04	9.82	29.46 -4"

*MCMW-2 → cannot locate well

*MCMW-5 - plastic pipe stick-up collar is broken off

Location _____ Date 1/12/99

Project / Client D2159201 Tuesday

D2159201

Job #: D2159201

Date: Tuesday, January 12, 1999

field conditions: cloudy, cold, 35°

objective: continue well development

on site: 7:00 - RMES

Ryan, Ricky (American Auger)

7:30 - start well development

11:00 - cannot locate MCMW-2, obstruction not found.

1:30 - complete well development

1:45 - complete loading all equipment

Ryan, Ricky - American Auger

2:00 off site: MPE, Ryan + Ricky (American Auger)

12 hrs. total well development

Michael P. Eagle

MPE

76 Location Drum Court Date 1/[illegible]/99

Project / Client DECS9801

Mackenzie Chemical (mfe)

19 — pick up [illegible]

15 — to [illegible]

14 — remove [illegible]

13 — [illegible] take [illegible]

66 - [illegible]

11 - empty

12 - [illegible]

1,14,2235,41,52 (12)

20

11:30 - off site

Totals: As of 1/12/99	
Brookside = 12	
American Recyc = 1 Drum Water 10 Dev. Water 5 + 63 Empty drums	
Brookside Total: 12 + 75 + 05	AA Total = 91

Location _____ Date 1/21/99 Thursday 77

Project / Client DECS9801

Mackenzie Chemical (mfe)

Job #: DECS9801

Date: Thursday, January 21, 1999

Field conditions: cloudy, cool, 40°

Field scientists: Michael P. Engelmann (mpe)
Eric J. Gross (EJG)

objective: sampling of all 10 new monitoring wells and 5 on site existing monitoring wells

on site: 8:30

→ commence well sampling

* cannot locate mw-1 mcmw-2 on site see well sampling sheet

Well I.D.		DTB	DTW	Time Sampled	
mcmw-1	—	66	54.76	9:30	
mcmw-3	—	65	48.14	10:00	
mcmw-4	—	65	50.93	10:45	
mcmw-5	—	65	49.83	11:15	
OS #9D	=	155	39.27	13:00	MS/MSD
OS # 10	=	[illegible]	42.12	13:30	
OS # 6S	=	60	46.90	14:00	
OS # 8D	=	150	46.89	14:30	
mw-8x	=				Blind Duplicate
OS # 2S	=	60	46.18	15:00	
OS # 2D	=	150	46.31	15:30	
OS # 3D	=	140	46.20	15:45	
OS # 3S	=	60	46.86	14:45	
OS # 3 S	=	120	46.86	15:15	
OS # 3 D	=	158	46.96	15:00	

60' - offsite mpe/EJG

mw-8x is a Blind Duplicate of mcmw-1

1 Field Blank collected

78 Location _____ Date 3/3/99

Project / Client DECS9-1

Mackensie Chemical (MPE)

job #: DECS9801

date: Wednesday, February 3, 1999

Field conditions: Sunny, pleasant ≈55°

field scientists: Michael P. Engelmann (MPE)

objective: collect soil vapor samples

- 4 locations
- 3 depths each (5', 10', 15' bgs)

on site: MPE - 9:00

LMS (Bart & John) 9:30

equipment: APS Power Probe

communication: 1C's @ AS #1

AS = Air Sample

Sample names:

AS #1-5'	AS #2-5'	AS #3-5'	AS #4-5'
AS #1-10'	AS #2-10'	AS #3-10'	AS #4-10'
AS #1-15'	AS #2-15'	AS #3-15'	AS #4-15'

} 12 samples total

each air sample tube is labeled & red, blue, or yellow top

red - 15' or deep

blue - 10' or intermediate

yellow - 5' or shallow

Complete - post installation @ 4:00

4:00 - MPE/LMS off site

Location _____ Date 2/4/99 79

Project / Client DECS 9801 Thursday

Mackensie Chemical (MPE)

job #: DECS 9801

date: Thursday, February 4, 1999

Field Conditions: rainy, cool ≈ 45°

field scientists: Scott E. Hamrick (SEH)

Michael P. Engelmann (MPE)

objective: collect 12 air samples from AS #1, 2, 3, 4 (5, 10, 15' bgs) that LMS installed on 2/4/99

on site: MPE/SEH - 10:45

equipment: Bios - DC-1 air calibrator

Gast - 9V pump

Tenax - charcoal tubes

11:15 - set up equipment

Sample name	time purged	flow rate	= total flow vol.
1) AS#1-5'	20 min	x 193.57 ml/min	= 3870.3 = 3.87 liters
2) AS#1-10'	20 min	x 162.42 ml/min	= 3249.4 = 3.25 liters
3) AS#1-15'	21 min	x 193.81 ml/min	= 4069.2 = 4.07 liters
4) AS#2-5'	26 min	x 195.60 ml/min	= 5085.6 = 5.086 liters
5) AS#2-10'	23 min	x 193.77 ml/min	= 4455.7 = 4.456 liters
6) AS#2-15'	21 min	x 195.30 ml/min	= 4101.3 = 4.101 liters
7) AS#3-5'	22 min	x 191.90 ml/min	= 4222.8 = 4.223 liters
8) AS#3-10'	23 min	x 188.90 ml/min	= 4344.7 = 4.345 liters
9) AS#3-15'	23 min	x 194.10 ml/min	= 4464.3 = 4.464 liters
10) AS#4-5'	22 min	x 193.50 ml/min	= 4257.0 = 4.257 liters
11) AS#4-10'	22 min	x 189.95 ml/min	= 4178.9 = 4.179 liters
12) AS#4-15'	22 min	x 191.85 ml/min	= 4220.7 = 4.221 liters

2 pm - off site MPE/SEH

80 Location 1 of 2 Date 2/18/99

Project / Client DECS9801 Thursday

Mackenzie Chemical

job #: DECS9801

date: Friday, February 18, 1999

Field Conditions: Rainy, Cold ≈ 38°F

Field Scientist: Michael P. Engelmann (MPE)

objective: meet w/ Y.E.C. surveyors and take synoptic water levels

7:00 - MPE on site

9:30 - MPE Y.E.C. surveyor Giami, Jon Lamonica

10:00 - Fritz (3 total) show them the wells

Well ID	DTW	DTB
MCMW-1	51.51'	66'
MCMW-2	cannot locate, steel magnatometer	
MCMW-3	47.87'	65'
MCMW-4	50.55'	65'
MCMW-5	49.55'	65'
OS #1D	41.69'	160'
OS #2S	39.77'	60'
OS #2I	39.95'	130'
OS #2D	48.45'	160'
OS #3S	46.54'	60'
OS #3I	46.56'	120'
OS #3D	47.08'	158'
OS #4D	38.80'	155'
OS #5S	48.64'	60'
OS #5D	48.59'	150'

Location 2 of 3 Date 2/18/99 Thurs 81

Project / Client DECS9801

Mackenzie Chemical

→ 2:30 - complete synoptic water levels.

Surveyors inform MPE that they will need to come back to site for survey.

3:00 - MPE off site

MPE 2/18/99

82 Location _____ Date 5/3/94

Project / Client DECS 9801 Monday

Mackensie Chemical MW

job #: DECS9801T2

Site: Mackensie Chemical - Brightside Drive
#19 & #17

date: Monday, May 3 1994

objective: Install Phase II Soil Gas Point
@ 5, 10, 15' bgs + 12 different points

Field Conditions: Cloudy, Cool 50

Field Scientist: Michael P. Engelmann (MPE)

on site: MPE @ 9[30]
LMS @ 10[00] (Beth & Edith)

equipment: Ams Power Probe

→ Connect @ 10[15] #17 Brightside

10[30] - MNG on site

11[20] - MNG off site
- Edith off site to pick up other drilling probe

sample name: @ 5, 10 & 15' bgs

location → see map

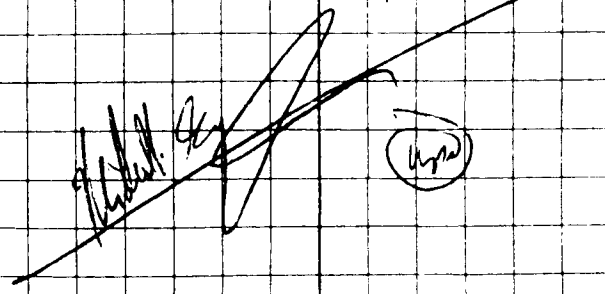
AS#5	AS#10	AS#15	36 sample points total
AS#6	AS#11	AS#16	
AS#7	AS#12		
AS#8	AS#13		
AS#9	AS#14		

Location _____ Date 5/3/94 83

Project / Client DECS 9801 Monday

Mackensie Chemical MW2

1[00] - MNG on site
1[20] - MNG off site ★ { blue - 10' bgs, red - 5' bgs, yellow - 15' bgs
1[50] - Joe Peck (NYSDEC) on site
2[30] - MNG on site
3[20] - MPE/MNG on-site
- Joe Peck, Beth stay on site



MW2

84 Location _____ Date 5/4/94

Project / Client DECISIONTEC Tuesday

Mackenzie Chemical (MPE)

Job #: 9DEC9401

site: Mackenzie Chemical Blightside Drive - Air, C Islip

date: Tuesday May 4, 1994

objective: Commence air sampling at Phase II

Field Conditions: Rain, cool, 50°

Field Scientists: Michael P. Engelmann (MPE)
Scott E. Thomas (SET)

Equipment: Generator, 2 mon, Air calibrator, Pumps, truck

on site: 6:15 A.M.

→ 7:00 Commence air sampling

Red - 5'
blue - 10'
yellow - 15'

4:30 - LMS offsite
5:00 - Environmental

* Environmental Services to remove all soil, liq. & today
* LMS to finish installing air points

7:30 - Brett & Edith on site & Pontiac + Concord Tube
8:00 MNG - Hazen
Joe Peck (NYSDEC) on site
8:30 - Environmental Services Inc on-site
9:00 - Start moving soils/liquids to Eastern Mackenzie Facility
9:30 - Chuck (LMS) on site

1 of 2

Location _____ Date 5/4/94 85

Project / Client DECISIONTEC Tuesday

Mackenzie Chemical (MPE) 4.6342 AL

Lab i.D.	Field I.D.	Time Pump	Vol/min	Total Vol
041	AS #8 - 5'	186.77/25	186.77	4669.42
Ham 010	AS # 8 - 10'	25 min	196.32	4908.07
044	AS # 14 - 5'	25 min	195.13	4878.25
Ham 015	AS # 14 - 10'	25 min	195.7	4892.50
045	AS # 13 - 5'	25 min	189.47	4736.75
040	AS # 13 - 10'	25 min	189.2	4730.41
038	AS #9 - 5'	25 min	185.43	4635.83
042	AS #9 - 10'	25 min	190.57	4764.28
033	AS #9 - 15'	25 min	194.35	4858.75
039	AS # - 15 - 5'	25 min	185.18	4629.48
043	AS # 15 - 10'	25 min	201.41	5035.25
024	AS # 15 - 15'	25 min	196.99	4924.64
Ham 002	AS #10 - 5'	25 min	197.96	4949.00
037	AS # 10 - 10'	25 min	187.08	4677.03
Ham 014	AS # 10 - 15'	25 min	195.41	4885.31
025	AS # 16 - 5'	25 min	201.18	5029.50
026	AS # 16 + 10'	25 min	193.02	4825.55
Ham 019	AS # 16 + 15'	25 min	188.72	4718.05
036	AS # 3 - 15'	25 min	192.36	4809.10
Ham 009	AS # 14 - 15'	25 min	189.04	4726.00
Ham 020	AS # 8 + 15	25 min	194.76	4869.00
Ham 021	AS # 7 - 15'	25 min	194.27	4856.87
	(20)			

6:00 - MPE/SET off-site

2 of 2

job #: DECS980173
site: MacKenzie Chemical, Brightside Ave, Central Islip N.Y.
date: Wednesday, May 5, 1999
objective: complete air sampling at 5, 10, & 15' bgs points
field conditions: light rain, ~55°
field activities: Michael P. Friedman (MPF)
Scott E. Hammond (SEH)

on site: 6:30

7:00 - commence air sampling

red - 5'
blue - 10'
yellow - 15'

8:00 - Environmental Services, Inc on-site to remove drums
9:00 - EST off-site
→ inform MPF that they will be back to pick up rest of drums
9:35 - Joe Peck (NYSDEC) on-site
11:05 - GJM & RJB (H2M) on-site

1 of 2

LAB I.D.	FIELD I.D.	Time	mL Vol/min	x25 min =	mL Total Vol.
H2M004	AS #7-5'	25	190.62	x25 =	4765.57
H2M005	AS #7-10'	25	198.80	x25 =	4970.19
054	AS #6-5'	25	193.11	x25 =	4827.88
028	AS #6-10'	25	198.68	x25 =	4967.00
032	AS #6-15'	25	199.48	x25 =	4987.00
H2M014	AS #5-5'	25	195.91	x25 =	4897.75
031	AS #5-10'	25	195.47	x25 =	4886.75
029	AS #5-15'	25	199.33	x25 =	4983.25
035	AS #12-5'	25	192.80	x25 =	4820.00
046	AS #12-10'	25	195.73	x25 =	4893.40
047	AS #12-15'	25	189.12	x25 =	4728.05
033	AS #11-5'	25	193.72	x25 =	4843.03
048	AS #11-10'	25	191.86	x25 =	4796.50
049	AS #11-25'	25	193.27	x25 =	4831.75
	(14)				

total samples collected for 5/4/99 & 5/5/99 Phase II = 36

12:00 - GJM/RJB
Joe Peck off-site

3:00 - MPF/SEH off-site

2 of 2

job #: DEC9201
site: Mackenzie Chemical, C. Islip New York
date: Thursday, May 6, 1993
Field Conditions: Cloudy, 60°
Field Scientists: Michael P. Engelmann (MPE)
Eric J Gross (EJG)
objective: collect synoptic water levels from all wells
10 a - on-site

Well ID	DTW	DTB
mcmw-1	50.99	65'
mcmw-2	→ cannot locate well	
mcmw-3	47.36	65'
mcmw-4	50.01	65'
mcmw-5	———	60' buried
OS#1D	41.23	160'
OS#2S	39.38	60'
OS#2I	39.47	130'
OS#2D	48.20	160'
OS#3S	46.02	60'
OS#3I	46.10	120'
OS#3D	46.46	158'
OS#4D	38.37	155'
OS#5S	48.14	60'
OS#5D	48.03	150'

12p - MPE/EJG offsite

MPE

APPENDIX E

Groundwater Monitoring Well Sampling Analytical Results
November 1999

RECRA
ENVIRONMENTAL
INC.

Chemical and Environmental Measurement Information

29 December 1999

Mr. Jack Ryan
NYSDEC
Room 392
50 Wolf Road
Albany, NY 12233-3502

Ref: Contract C003783
Sample Data Package: RFW Batch 9911L757
NYSDEC ID: RA099-1117-0S1DMC to 0SFBMC

Dear Mr. Ryan:

Enclosed please find the data report for 6 water samples received 18 November 1999. These were analyzed for CLP VOAs. The EDD has been emailed to you and a disk is enclsed to the sampler.

We had received an extension for this report.

Please do not hesitate to contact me at (610) 280-3000 with any questions you may have.

Very truly yours,

Recra LabNet Philadelphia

Judith L. Stone
Senior Project Manager

Enclosure

cc: Joe Peck (NYSDEC)

208 Welsh Pool Road •Lionville, PA 19341-1333 •(610) 280-3000 • Fax (610) 280-3041

Recra LabNet - Lionville Laboratory
Volatiles By GC/MS, Special List
Report Date: 12/28/99 14:39

RFW Batch Number: 9911L757 Client: NYSDEC Work Order: 01667600001 Page: 1a

	Cust ID:	RA099-1117-0 S1DMC		RA099-1117-0 S2DMC		RA099-1117-0 S3DMC		RA099-1117-0 S3DMC		RA099-1117-0 S4DMC		RA099-1117-0 S5DMC	
Sample	RFW#:	001		002		003		003		004		005	
Information	Matrix:	WATER		WATER		WATER		WATER		WATER		WATER	
	D.F.:	1.00		1.00		1.00		1.00		1.00		1.00	
	Units:	UG/L		UG/L		UG/L		UG/L		UG/L		UG/L	
								REPREP					
	Toluene-d8	98	%	98	%	94	%	93	%	101	%	96	%
Surrogate	Bromofluorobenzene	90	%	88	%	85 *	%	83 *	%	86	%	88	%
Recovery	1,2-Dichloroethane-d4	93	%	94	%	90	%	89	%	94	%	96	%
Chloromethane		10	U	10	U	10	U	10	U	10	U	10	U
Bromomethane		10	U	10	U	10	U	10	U	10	U	10	U
Vinyl Chloride		10	U	10	U	10	U	10	U	10	U	10	U
Chloroethane		10	U	10	U	10	U	10	U	10	U	10	U
Methylene Chloride		6	JB	6	JB	5	JB	29	B	6	JB	31	B
Acetone		10	U	10	U	10	U	10	U	10	U	10	U
Carbon Disulfide		10	U	10	U	10	U	10	U	10	U	10	U
1,1-Dichloroethene		10	U	10	U	10	U	10	U	10	U	10	U
1,1-Dichloroethane		10	U	10	U	1	J	1	J	1	J	10	U
1,2-Dichloroethene (total)		10	U	10	U	10	U	10	U	10	U	10	U
Chloroform		1	J	10	U	10	U	10	U	10	U	10	U
1,2-Dichloroethane		10	U	10	U	10	U	10	U	10	U	10	U
2-Butanone		10	U	10	U	10	U	10	U	10	U	10	U
1,1,1-Trichloroethane		10	U	10	U	10	U	10	U	1	J	10	U
Carbon Tetrachloride		10	U	10	U	10	U	10	U	10	U	10	U
Bromodichloromethane		10	U	10	U	10	U	10	U	10	U	10	U
1,2-Dichloropropane		10	U	10	U	10	U	10	U	10	U	10	U
cis-1,3-Dichloropropene		10	U	10	U	10	U	10	U	10	U	10	U
Trichloroethene		10	U	10	U	10	U	10	U	10	U	10	U
Dibromochloromethane		10	U	10	U	10	U	10	U	10	U	10	U
1,1,2-Trichloroethane		10	U	10	U	10	U	10	U	10	U	10	U
Benzene		10	U	10	U	10	U	10	U	10	U	10	U
Trans-1,3-Dichloropropene		10	U	10	U	10	U	10	U	10	U	10	U
Bromoform		10	U	10	U	10	U	10	U	10	U	10	U
4-Methyl-2-pentanone		10	U	10	U	10	U	10	U	10	U	10	U
2-Hexanone		10	U	10	U	10	U	10	U	10	U	10	U
Tetrachloroethene		10	U	10	U	10	U	10	U	10	U	10	U
1,1,2,2-Tetrachloroethane		10	U	10	U	10	U	10	U	10	U	10	U
Toluene		10	U	10	U	10	U	10	U	10	U	10	U

* = Outside of EPA CLP QC limits.

RFW Batch Number: 9911L757 Client: NYSDEC Work Order: 01667600001 Page: 1b

	Cust ID:	RA099-1117-0 S1DMC	RA099-1117-0 S2DMC	RA099-1117-0 S3DMC	RA099-1117-0 S3DMC REPREP	RA099-1117-0 S4DMC	RA099-1117-0 S5DMC
	RFW#:	001	002	003	003 REPREP	004	005
Chlorobenzene		10 U	10 U	10 U	10 U	10 U	10 U
Ethylbenzene		10 U	10 U	10 U	10 U	10 U	10 U
Styrene		10 U	10 U	10 U	10 U	10 U	10 U
Xylene (total)		10 U	10 U	10 U	10 U	10 U	10 U
1,2,3-Trichloropropane		10 U	10 U	10 U	10 U	10 U	10 U

*= Outside of EPA CLP QC limits.

Recra LabNet - Lionville Laboratory
Volatiles By GC/MS, Special List
Report Date: 12/28/99 14:39

RFW Batch Number: 9911L757 Client: NYSDEC Work Order: 01667600001 Page: 2a

Sample Information	Cust ID:	RA099-1117-0 S5DMC	RA099-1117-0 S5DMC	RA099-1117-F BMC	TRIP BLANK	NYSDEC-FRIDG E BLANK	NYSDEC-FRIDG E BLANK
	RFW#:	005 MS	005 MSD	006	007	008	008
	Matrix:	WATER	WATER	WATER	WATER	WATER	WATER
	D.F.:	1.00	1.00	1.00	1.00	1.00	1.00
	Units:	UG/L	UG/L	UG/L	UG/L	UG/L	UG/L
							RBPREP
Surrogate Recovery	Toluene-d8	102 %	93 %	96 %	98 %	101 %	98 %
	Bromofluorobenzene	90 %	83 * %	88 %	89 %	83 * %	84 * %
	1,2-Dichloroethane-d4	93 %	90 %	89 %	97 %	82 %	88 %
Chloromethane		10 U	10 U	10 U	10 U	10 U	10 U
Bromomethane		10 U	10 U	10 U	10 U	10 U	10 U
Vinyl Chloride		10 U	10 U	10 U	10 U	10 U	10 U
Chloroethane		10 U	10 U	10 U	10 U	10 U	10 U
Methylene Chloride		35 B	23 B	32 B	28 B	7 JB	7 JB
Acetone		10 U	10 U	10 U	10 U	10 U	10 U
Carbon Disulfide		10 U	10 U	10 U	10 U	10 U	10 U
1,1-Dichloroethene		98 %	93 %	10 U	10 U	10 U	10 U
1,1-Dichloroethane		10 U	10 U	1 J	10 U	10 U	10 U
1,2-Dichloroethene (total)		10 U	10 U	10 U	10 U	10 U	10 U
Chloroform		10 U	10 U	10 U	10 U	10 U	10 U
1,2-Dichloroethane		10 U	10 U	10 U	10 U	10 U	10 U
2-Butanone		10 U	10 U	10 U	10 U	10 U	10 U
1,1,1-Trichloroethane		10 U	10 U	10 U	10 U	10 U	10 U
Carbon Tetrachloride		10 U	10 U	10 U	10 U	10 U	10 U
Bromodichloromethane		10 U	10 U	10 U	10 U	10 U	10 U
1,2-Dichloropropane		10 U	10 U	10 U	10 U	10 U	10 U
cis-1,3-Dichloropropene		10 U	10 U	10 U	10 U	10 U	10 U
Trichloroethene		94 %	95 %	10 U	10 U	10 U	10 U
Dibromochloromethane		10 U	10 U	10 U	10 U	10 U	10 U
1,1,2-Trichloroethane		10 U	10 U	10 U	10 U	10 U	10 U
Benzene		104 %	106 %	10 U	10 U	10 U	10 U
Trans-1,3-Dichloropropene		10 U	10 U	10 U	10 U	10 U	10 U
Bromoform		10 U	10 U	10 U	10 U	10 U	10 U
4-Methyl-2-pentanone		10 U	10 U	10 U	10 U	10 U	10 U
2-Hexanone		10 U	10 U	10 U	10 U	10 U	10 U
Tetrachloroethene		10 U	10 U	10 U	10 U	10 U	10 U
1,1,2,2-Tetrachloroethane		10 U	10 U	10 U	10 U	10 U	10 U
Toluene		96 %	98 %	10 U	10 U	10 U	10 U

*= Outside of EPA CLP QC limits.

RFW Batch Number: 9911L757 Client: NYSDEC Work Order: 01667G00001 Page: 2b

Cust ID:	RA099-1117-0 S5DMC	RA099-1117-0 S5DMC	RA099-1117-F BMC	TRIP BLANK	NYSDEC-FRIDGE BLANK	NYSDEC-FRIDGE BLANK
RFW#:	005 MS	005 MSD	006	007	008	008 REPREP
Chlorobenzene	93 %	97 %	10 U	10 U	10 U	10 U
Ethylbenzene	10 U	10 U	10 U	10 U	10 U	10 U
Styrene	10 U	10 U	10 U	10 U	10 U	10 U
Xylene (total)	10 U	10 U	10 U	10 U	10 U	10 U
1,2,3-Trichloropropane	10 U	10 U	10 U	10 U	10 U	10 U

*= Outside of EPA CLP QC limits.

Recra LabNet - Lionville Laboratory
Volatiles By GC/MS, Special List

RFW Batch Number: 9911L757 Client: NYSDEC Work Order: 01667600001 Page: 3a

Report Date: 12/28/99 14:39

	Cust ID:	VBLKAS		VBLKCP		VBLKCP BS		VBLKDQ	
Sample Information	RFW#:	99LVH595-MB1		99LVH597-MB1		99LVH597-MB1		99LVH600-MB1	
	Matrix:	WATER		WATER		WATER		WATER	
	D.F.:	1.00		1.00		1.00		1.00	
	Units:	UG/L		UG/L		UG/L		UG/L	
Surrogate Recovery	Toluene-d8	109	%	106	%	95	%	102	%
	Bromofluorobenzene	95	%	98	%	87	%	89	%
	1,2-Dichloroethane-d4	97	%	102	%	92	%	91	%
Chloromethane		10	U	10	U	10	U	10	U
Bromomethane		10	U	10	U	10	U	10	U
Vinyl Chloride		10	U	10	U	10	U	10	U
Chloroethane		10	U	10	U	10	U	10	U
Methylene Chloride		7	J	9	J	32	B	5	J
Acetone		5	J	5	J	10	U	2	J
Carbon Disulfide		10	U	10	U	10	U	10	U
1,1-Dichloroethene		10	U	10	U	94	%	10	U
1,1-Dichloroethane		10	U	10	U	10	U	10	U
1,2-Dichloroethene (total)		10	U	10	U	10	U	10	U
Chloroform		10	U	10	U	10	U	10	U
1,2-Dichloroethane		10	U	10	U	10	U	10	U
2-Butanone		10	U	10	U	10	U	10	U
1,1,1-Trichloroethane		10	U	10	U	10	U	10	U
Carbon Tetrachloride		10	U	10	U	10	U	10	U
Bromodichloromethane		10	U	10	U	10	U	10	U
1,2-Dichloropropane		10	U	10	U	10	U	10	U
cis-1,3-Dichloropropene		10	U	10	U	10	U	10	U
Trichloroethene		10	U	10	U	94	%	10	U
Dibromochloromethane		10	U	10	U	10	U	10	U
1,1,2-Trichloroethane		10	U	10	U	10	U	10	U
Benzene		10	U	10	U	104	%	10	U
Trans-1,3-Dichloropropene		10	U	10	U	10	U	10	U
Bromoform		10	U	10	U	10	U	10	U
4-Methyl-2-pentanone		10	U	10	U	10	U	10	U
2-Hexanone		10	U	10	U	10	U	10	U
Tetrachloroethene		10	U	10	U	10	U	10	U
1,1,2,2-Tetrachloroethane		10	U	10	U	10	U	10	U
Toluene		10	U	10	U	96	%	10	U

*= Outside of EPA CLP QC limits.

Cust ID:	VBLKAS	VBLKCP	VBLKCP BS	VBLKDQ
RFW#:	99LVH595-MB1	99LVH597-MB1	99LVH597-MB1	99LVH600-MB1
Chlorobenzene	10 U	10 U	95 %	10 U
Ethylbenzene	10 U	10 U	10 U	10 U
Styrene	10 U	10 U	10 U	10 U
Xylene (total)	10 U	10 U	10 U	10 U
1,2,3-Trichloropropane	10 U	10 U	10 U	10 U

*= Outside of BPA CLP QC limits.

2A

WATER VOLATILE SURROGATE RECOVERY

Lab Name: Recra.LabNet Contract: 1667-00-01

Lab Code: Recra Case No.: _____ SAS No.: _____ SDG No.: _____

	EPA SAMPLE NO.	S1 (TOL) #	S2 (BFB) #	S3 (DCE) #	OTHER	TOT OUT
01	RA099-1117-0S1DMC	98	90	93		0
02	RA099-1117-0S2DMC	98	88	94		0
03	RA099-1117-0S3DMC	94	85 *	90		1
04	RA099-1117-0S3DMCRE	93	83 *	89		1
05	RA099-1117-0S4DMC	101	86	94		0
06	RA099-1117-0S5DMC	96	88	96		0
07	RA099-1117-0S5DMCMS	102	90	93		0
08	RA099-1117-0S5DMCMSD	93	83 *	90		1
09	RA099-1117-FBMC	96	88	89		0
10	TRIP BLANK	98	89	97		0
11	NYSDEC-FRIDGE BLANK	101	83 *	82		1
12	NYSDEC-FRIDGE BLANKRE	98	84 *	88		1
13	VBLKAS	109	95	97		0
14	VBLKCP	106	98	102		0
15	VBLKCP BS	95	87	92		0
16	VBLKDQ	102	89	91		0

	QC LIMITS
S1 (TOL) = Toluene-d8	(88-110)
S2 (BFB) = Bromofluorobenzene	(86-115)
S3 (DCE) = 1,2-Dichloroethane-d4	(76-114)

Column to be used to flag recovery values

* Values outside of contract required QC limits

D Surrogates diluted out

APPENDIX F

USEPA Groundwater Monitoring Well Investigation

April 2000

Roy F. Weston, Inc.
Federal Programs Division
Suite 201
1090 King Georges Post Road
Edison, New Jersey 08837-3703
732-225-6116 •Fax 732-225-7037

SUPERFUND TECHNICAL ASSESSMENT AND RESPONSE TEAM
EPA CONTRACT 68-W5-0019

April 21, 2000

Mr. James Haklar
U.S. Environmental Protection Agency
Removal Action Branch
2890 Woodbridge Avenue
Edison, NJ 08837

TDD NO: **02-00-02-0014**
DCN NO: **START-02-F-04295**
SUBJECT: **SAMPLING TRIP REPORT**
MACKENZIE CHEMICAL SITE, CENTRAL ISLIP, SUFFOLK COUNTY, NEW YORK

Dear Mr. Haklar:

Enclosed please find one copy of the Sampling Trip Report for the sampling of 11 monitoring wells, 1 private well, and 2 municipal wells which occurred between April 10 and 14, 2000 at the Mackenzie Chemical Site, Central Islip, Suffolk County, New York. If you have any questions or comments, please contact me at (732) 225-6116.

Sincerely,

ROY F. WESTON, INC.

Daniel G. Crouse, P.E.
Site Project Manager

cc: TDD File
enclosure

tr6560n1.wpd

SAMPLING TRIP REPORT

SITE NAME: Mackenzie Chemical Site
DCN No: START-02-F-04295
TDD NO: 02-00-02-0014

SAMPLING DATES: April 10 through 14, 2000

1. **Site Location:** Mackenzie Chemical Site
Central Islip, Suffolk County, New York

2. **Sample Locations:** Refer to the Site Map in Appendix A and Table 1 for the locations of the samples collected.

3. **Sample Descriptions:**

- The identification code for the monitoring well samples collected during this sampling event were identified by the existing well designations (except for OS-2S which was designated as OS-2A and OS-2D which was designated as OS-2B). The private well was designated as the street address with one digit (i.e., 5RRA for 5 Railroad Avenue). The two municipal wells were designated as abbreviations of the well field locations (i.e., CAWF for Carleton Avenue Well Field and DPWF#1 for Dolores Place Well Field pump # 1).

- The following number of samples were collected for the listed parameters:

Parameter	Number of samples collected
VOAs	13 samples + 1 duplicate + 3 trip blanks + 3 rinsate blanks = 20 samples
TAL Metals	13 samples + 1 duplicate + 3 rinsate blanks = 17 samples
pH	13 samples + 1 duplicate + 3 rinsate blanks = 17 samples

- Three trip blanks were collected. The trip blank collected on Monday April 10, 2000 was designated as trip blank # 1; the trip blank for April 12, 2000 was designated as GARD2; and the trip blank for April 14, 2000 was designated as GARD3. The trip blanks were collected from previously unopened 1-Liter bottles of ultrapure DI water (the Certificates of Compliance are in Appendix B).

- One duplicate sample was collected for the entire sampling event. It was designated as MW-10 which was a duplicate for location MW-5S for all analytical parameters [volatile organic compounds, (VOCs); base, neutral, and extractable compounds (BNAs); pesticides; polychlorinated biphenyls (PCBs); and target analyte list (TAL) metals].

- Three rinsate blank samples of the pump components were collected. The one collected on Tuesday, April 11, 2000, was designated as rinsate blank; the one collected on Wednesday, April 12, 2000, was designated as TR#2; and the one collected on Thursday April 13, 2000, was designated as TR#3.

4. Laboratory Receiving Samples:

Sample Type	Name and Address of Laboratory	Analysis	Dates
Groundwater	Mitkem Corporation 175 Metro Center Boulevard Warwick, RI 02886	VOAs	April 11, 13, and 14, 2000
Groundwater	Ceimic Corporation 10 Dean Knauss Drive Narragansett, RI 02882	BNAs, PCBs, & pesticides	April 11, 12, 13, and 14, 2000
Groundwater	Liberty Analytical 501 Madison Avenue Cary, NC 27513	TAL Metals	April 11, 13, and 14, 2000

5. Sample Dispatch Data:

All TAL metals samples were preserved with nitric acid (HNO_3) to a pH of less than 2.0 standard units. All VOAs samples were preserved with hydrochloric acid (HCl) to a pH of less than 2.0 standard units. All samples were shipped in coolers with vermiculite and ice. The following describes the daily shipment of samples (the copies of the Federal Express Airbills are in Appendix C):

Tuesday, April 11, 2000

	VOCs Samples	Organic Samples	TAL Metals Samples
Laboratory	Mitkem Corp	Ceimic Corp	Liberty Analytical
	First Cooler	First Cooler	First Cooler
Number of samples	9	1	6
Number of duplicates	1	1	1
Number of trip blanks	1	NA	NA
Number of rinsate blanks	1	1	1
Number of MS/MSDs	1	1	1
Fedex Airbill Number	819304703230	891304703241	819304703220

	VOCs Samples	Organic Samples	TAL Metals Samples
Laboratory	MitkemCorp	Ceimic Corp	Liberty Analytical
	Second Cooler	Second Cooler	Second Cooler
Number of samples	NA	3	NA
Number of duplicates	NA	0	NA
Number of trip blanks	NA	NA	NA
Number of rinsate blanks	NA	NA	NA
Number of MS/MSDs	NA	0	NA
Multiple Power Ship Number	NA	816851420717	NA

	VOCs Samples	Organic Samples	TAL Metals Samples
Laboratory	MitkemCorp	Ceimic Corp	Liberty Analytical
	Third Cooler	Third Cooler	Third Cooler
Number of samples	NA	3	NA
Number of duplicates	NA	0	NA
Number of trip blanks	NA	NA	NA
Number of rinsate blanks	NA	NA	NA
Number of MS/MSDs	NA	0	NA
Multiple Power Ship Number	NA	816851420728	NA

Wednesday, April 12, 2000

	VOCs Samples	Organic Samples	TAL Metals Samples
Laboratory	MitkemCorp	Ceimic Corp	Liberty Analytical
	First Cooler	First Cooler	First Cooler
Number of samples	NA	3	NA
Number of duplicates	NA	0	NA
Number of trip blanks	NA	NA	NA
Number of rinsate blanks	NA	0	NA
Number of MS/MSDs	NA	0	NA
Fedex Airbill Number	NA	820050710248	NA

Thursday, April 13, 2000

	VOCs Samples	Organic Samples	TAL Metals Samples
Laboratory	MitkemCorp	Ceimic Corp	Liberty Analytical
	First Cooler	First Cooler	First Cooler
Number of samples	8	3	7
Number of duplicates	0	0	0
Number of trip blanks	1	NA	NA
Number of rinsate blanks	2	0	2
Number of MS/MSDs	0	0	0
Fedex Airbill Number	820055971946	820050710259	820050710260

Friday, April 14, 2000

	VOCs Samples	Organic Samples	TAL Metals Samples
Laboratory	MitkemCorp	Ceimic Corp	Liberty Analytical
	First Cooler	First Cooler	First Cooler
Number of samples	3	3	2
Number of duplicates	0	0	0
Number of trip blanks	1	NA	NA
Number of rinsate blanks	0	1	0
Number of MS/MSDs	0	0	0
Fedex Airbill Number	820050710281	820050710270	820050710292

	VOCs Samples	Organic Samples	TAL Metals Samples
Laboratory	MitkemCorp	Ceimic Corp	Liberty Analytical
	Second Cooler	Second Cooler	Second Cooler
Number of samples	NA	1	NA
Number of duplicates	NA	0	NA
Number of trip blanks	NA	NA	NA
Number of rinsate blanks	NA	NA	NA
Number of MS/MSDs	NA	0	NA
Multiple Power Ship Number	NA	816851420360	NA

6. Changes from the QAPP

The QAPP Sampling Plan for this sampling event included the sampling of approximately 20 monitoring wells, 20 private wells, and 2 municipal wells. Only 1 private well was recorded after a door to door search of the residences was completed within the 2-block area to the southeast of the site. Also, no additional monitoring wells other than the 10 installed by the NYSDEC in 1998 and 1999 and the one on Cordello Avenue were located. Therefore, the total number of samples was only 17 instead of the 42 estimated.

7. Corrections Required to the Chain of Custody Records

The following is a list of corrections that should be made to the Chain of Custody Records:

Chain of Custody Number	Corrected Entry
383325	The preservative in Box D for all samples should be 5 instead of 6.
383324	The preservative in Box D for the sample should be 5 instead of 6.
383326	The preservative in Box D for all samples should be 5 instead of 6.
383319	The preservative in Box D for all samples should be 5 instead of 6.
382551	The Regional Specific Tracking Number or Tag Numbers in Box F should have been listed as Not Required for all samples.

These corrections have been made on the original Inorganic Traffic Reports and Organic Traffic Reports.

8. On-Site Personnel:

Name	Representing	Duties on Site
James Haklar	Region II TM	On-Scene Coordinator
Dan Crouse	Region II START	Site Project Manager and Sample Management
Jim Kearns	Region II START	Sample Collection
Ward Campbell	Region II START	Sample Collection
Shawna Rigby	Region II START	Sample Collection

9. Weather Conditions:

The weather on Monday and Tuesday was windy, cold, and rainy with temperatures in the low 40s degrees Fahrenheit (F). On Wednesday, Thursday, and Friday it was windy warm, and clear with temperatures ranging from 50 and 60 degrees F.

10. Additional Comments:

- Monitoring Well OS-2D (designated as OS-2B) was not sampled because the 2-inch poly-vinyl chloride (PVC) casing was damaged approximately 2-feet below ground surface. The damage would not allow the 2-inch sampling pump to be lowered into the well. The water within the well was bailed with a disposable bailer, but the recharge was so slow, that the water did not clear up adequately for a sample to be collected.

- The information available on the monitoring wells did not provide the well depths of the three wells located at location OS-2. Therefore, a water level indicator was used to measure the depth of these wells so the sampling team would know the proper length of sampling tubing to add to each well. The EPA low-flow sampling method requires the pump to be inserted into the well first, and then the water level is monitored as the water is pumped from the well. Therefore, by inserting the water level to the bottom of the well, was against the standard operating procedure.

- The well in OS-2D (designated as OS-2B) was collapsed at approximately 60 feet below ground surface, which is above the well screened interval. This is probably why the well did not recharge very well when it was bailed.

- Appendix D contains the Monitoring Well Sampling Information Data Sheets for all monitoring wells sampled.

- Appendix E contains copies of the CLP Chain of Custody Records for both Inorganic Traffic Records and Organic Traffic Records.

- Appendix F contains the Certificates of Analysis for the sample containers (the 40-mL VOA vials, the 32-ounce amber glass bottles, and the 1-Liter polyethylene bottles) used during this sampling event.

- Appendix G contains copies of the field notes.

11. **Report prepared by:** Daniel G. Crouse, P.E. Date: April 21, 2000

Report reviewed by: Carl Kelley Date: April 21, 2000

TABLE 1
Description of all Samples Collected
Mackenzie Chemical Site
Central Islip, Suffolk County, New York
April 21, 2000

Sample ID	Organic CLP Number (BNAs, PCBs, and pesticides	Inorganic CLP Number (TAL Metals)	VOCs & TCP	Comments
OS-1D	B01F0	MB026T	Yes	Deep well located in the Fire Department parking lot downgradient of the site.
OS-2I	B01F8	MB027H	Yes	Intermediate depth well on South Street downgradient of the site.
OS-2A (OS-2S)	B01F7	MB0286	Yes	Shallow well on South Street downgradient of the site.
OS-2B (OS-2D)	Not Applicable	Not Applicable	No	Deep well on South Street downgradient of the site. Casing has been damaged approximately 2 feet below the surface, so the sampling pump could not be installed in the casing. Therefore, no sample was collected. The casing collapsed at approximately 60 feet below ground surface, and the recharge rate was very slow.
OS-3S	B01FK	MB027K	Yes	Shallow well on Brightside Avenue just downgradient of the site.
OS-3I	B01F9	MB027J	Yes	Intermediate depth well on Brightside Avenue just downgradient of the site.
OS-3D	B01F6	MB0285	Yes	Deep well on Brightside Avenue just downgradient of the site.
OS-4D	B01CX	MB026Q	Yes	Deep well located on St. Johns Street near Carleton Avenue downgradient of the site.

TABLE 1 (Continued)
Description of all Samples Collected
Mackenzie Chemical Site
Central Islip, Suffolk County, New York
April 21, 2000

Sample ID	Organic CLP Number (BNAs, PCBs, and pesticides	Inorganic CLP Number (TAL Metals)	VOCs & TCP	Comments
MW-5S	B01CN	MB026J	Yes	Shallow off-site upgradient well located in the Kauffman Furniture lot. MS/MSD sample collected.
MW-5D	B01CT	MB027Y	Yes	Deep off-site upgradient well located in the Kauffman Furniture lot.
MW-10	B01CW	MB027Z	Yes	Duplicate of MW-5D.
MCMW-1	B01FP	MB027P	Yes	Site Monitoring Well Number 1
CAWF	B01CP	MB026K	Yes	Carleton Avenue Well Field. Downgradient municipal well. The depth is 791 feet. The sample was collected from a tap on the discharge pipeline after purging for 20 minutes.
DPWF#1	B01CQ	MB026N	Yes	Dolores Place Well Field pump # 1. Upgradient municipal well equal distance from the site as the downgradient municipal well at Carleton Avenue. Pump # 2 is turbid most of the year, and it is only used during the summer months after it has been purged to clear up the turbidity. The sample was collected from a tap on the discharge pipeline after purging for 20 minutes.
5RRA	B01F4	MB026P	Yes	Sample collected from 5 Railroad Street. Water was purged for 20 minutes from the kitchen tap. Five gallons was purged from the spigot before the water softener unit.
Trip Blank #1	Not Applicable	Not Applicable	Yes	Trip blank for 4-11-00
GARD2	Not Applicable	Not Applicable	Yes	Trip blank for 4-13-00
GARD3	Not Applicable	Not Applicable	Yes	Trip blank for 4-14-00

TABLE 1 (Continued)
Description of all Samples Collected
Mackenzie Chemical Site
Central Islip, Suffolk County, New York
April 21, 2000

Sample ID	Organic CLP Number (BNAs, PCBs, and pesticides	Inorganic CLP Number (TAL Metals)	VOCs & TCP	Comments
Rinsate Blank	B01CY	MB0284	Yes	Rinsate blank for 4-11-00
TR#2	B01F5	MB0280	Yes	Rinsate blank for 4-12-00
TR#3	B01FN	MB027N	Yes	Rinsate blank for 4-13-00

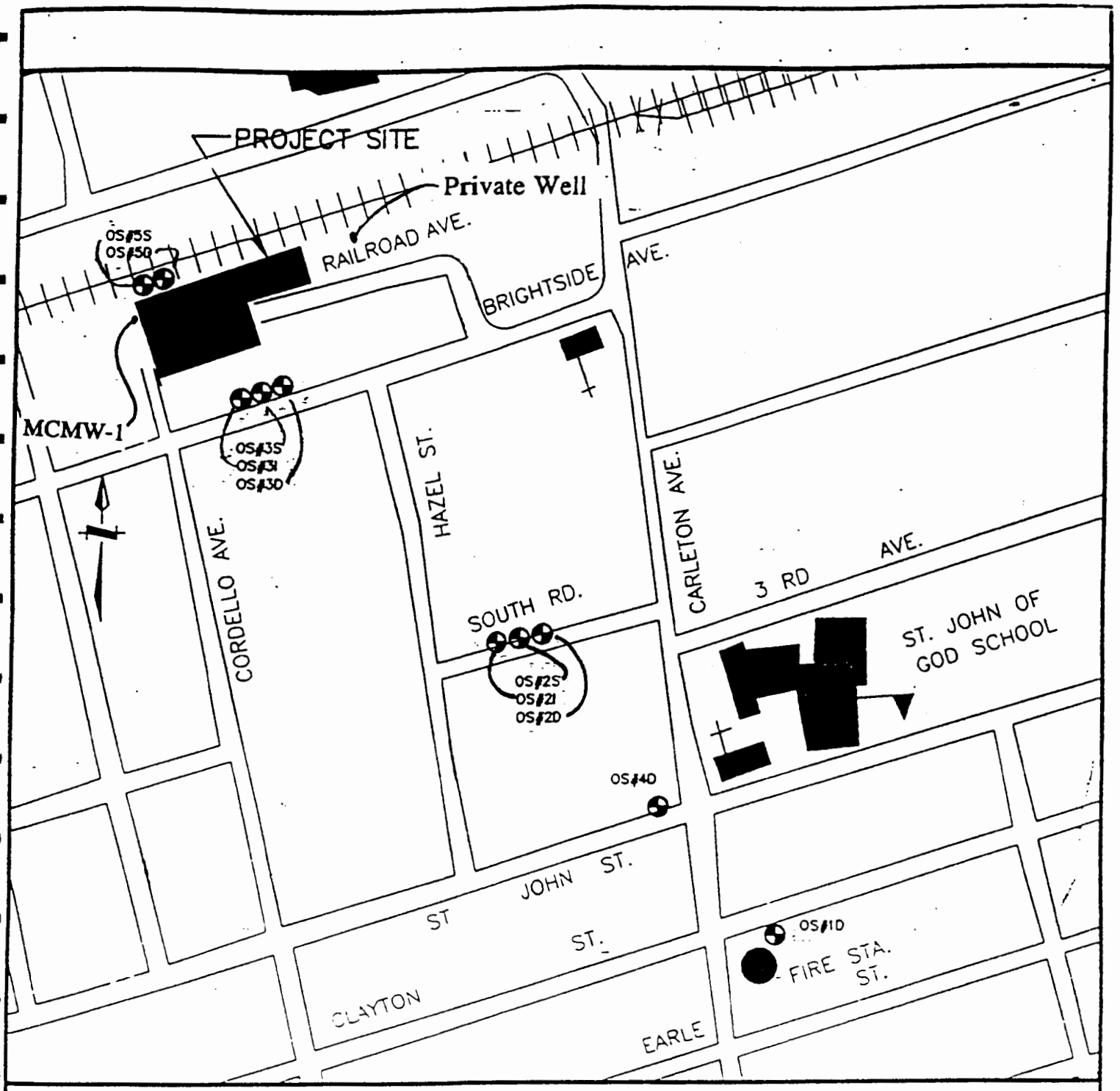


FIGURE 1

OFF-SITE MONITORING SITE LOCATION MAP MACKENZIE CHEMICAL NYSDEC SITE NO. 1-52-017

SCALE: 1" = 300'

LEGEND:

MONITORING WELL

VOLATILES

Roy F. Weston, Inc.
Federal Programs Division
Suite 201
1090 King Georges Post Road
Edison, New Jersey 08837-3703
732-225-6116 • Fax 732-225-7037

SUPERFUND TECHNICAL ASSESSMENT AND RESPONSE TEAM
EPA CONTRACT 68-W5-0019

START-02-F-04352

TRANSMITTAL MEMO

To: James Haklar, OSC
Response and Prevention Branch, U.S. EPA Region II

From: David Rosenberg, Data Reviewer
START Region II

Subject: **MacKenzie Chemical Site**
Central Islip, Suffolk County, NY

Data Validation Assessment

Date: May 22, 2000

The purpose of this memo is to transmit the following information:

Data validation results for the following parameters:

TCL- VOA	20 samples
Matrices and Number of Samples	
Groundwater	20 samples
Sampling date:	April 10-14, 2000

The final data assessment narrative and original analytical data package are attached.

cc: START PM Dan Crouse
START FILE TDD #: 02-00-02-0014
TDD #: 02-00-04-0002
PCS #: 6683

U.S. ENVIRONMENTAL PROTECTION AGENCY

MEMORANDUM

DATE: May 22, 2000
TO: James Haklar, OSC
USEPA Region II

FROM: David Rosenberg
START Data Review Team

SUBJECT: QA/QC Compliance Review Summary

As requested quality control and performance measures for the data packages noted have been examined and compared to EPA standards for compliance. Measures for the following general areas were evaluated as applicable:

Data Completeness	Blanks
Spectra Matching Quality	DFTPP and BFB Tuning
Surrogate Spikes	Chromatography
Matrix Spikes/Duplicates	Holding Times
Calibration	Compound ID (HSL, TIC)

Any statistical measures used to support the following conclusions are attached so that the review may be reviewed by others.

Summary of Results

	I VOA	II BNA	III PEST/PCB	IV HERB
Acceptable as Submitted	____	____	____	____
Acceptable with Comments	X	____	____	____
Unacceptable, Action Pending	____	____	____	____
Unacceptable	____	____	____	____

Data Reviewed by: [signature] Date: May 22, 2000
Approved By: [signature] Date: 4/7/01

Area Code/Phone No.: (732) 225-6116

DATA ASSESSMENT

Functional Guidelines for Evaluating Organic Analysis

RFP # 6683 SDG # _____

LAB: Mitkem Corp. SITE: MacKenzie Chemical

The current Functional Guidelines for evaluating organic data have been applied.

All data are valid and acceptable except those analytes which have been qualified with a "J" (estimated), "N" (presumptive evidence for the presence of the material), "U" (non-detects), "R" (unusable), or "JN" (presumptive evidence for the presence of the material at an estimated value). All action is detailed on the attached sheets.

Two facts should be noted by all data users. First, the "R" flag means that the associated value is unusable. In other words, due to significant QC problems, the analysis is invalid and provides no information as to whether the compound is present or not. "R" values should not appear on data tables because they cannot be relied upon, even as a last resort. The second fact to keep in mind is that no compound concentration, even if it has passed all QC tests, is guaranteed to be accurate. Strict QC serves to increase confidence in data but any value potentially contains error.

Analytical data qualified as "JN" or "R" may not be used to demonstrate compliance with Toxicity Characteristic or Land Ban Regulations.

Reviewer's Signature: _____ Date: 5/22/2000

Verified By: _____ Date: ___/___/2000

DATA ASSESSMENT

On 10 April 2000, START personnel collected seven (7) ground water samples, including a trip blank and a duplicate at the MacKenzie Chemical Site in Central Islip, LI, NY. On 11 April 2000, START personnel collected three (3) ground water samples, including a rinsate blank. On 12 April 2000, START personnel collected four (4) ground water samples, including a trip blank and a rinsate blank. On 13 April 2000, START personnel collected four (4) ground water samples, including a trip blank. On 14 April 2000, START personnel collected two (2) ground water samples, including a trip blank. All samples were shipped by Federal Express to Mitkem Corp. and submitted for VOA analysis by EPA Method 524.2.

Client identification (ID) and laboratory ID numbers:

Client ID No.	Laboratory ID No.	Sample Date	
5RRA	70554005	04/10/00	
CAWF	70554003	04/10/00	
DPWF1	70554004	04/10/00	
GARD2	70568002	04/12/00	-Trip blank
GARD3	70573002	04/14/00	-Trip blank
MCMW1	70573003	04/14/00	
MW10	70554006	04/10/00	- duplicate of MW-5S
MW5S	70554001	04/10/00	
OS2A	70568004	04/12/00	
OS2I	70568005	04/12/00	
OS3D	70573001	04/13/00	
OS3I	70568006	04/13/00	
OS3S	70568008	04/13/00	
OS4D	70554008	04/11/00	
OS5D	70554007	04/10/00	
OSID	70568001	04/11/00	
RINSEATE	70554009	04/11/00	- rinsate blank
TB1	70554002	04/10/00	-Trip blank
TR#2	70568003	04/12/00	- rinsate blank
TR#3	70568007	04/13/00	- rinsate blank

DATA ASSESSMENT

Due to analyst error, 1,2,3-Trichloropropane was misidentified in the original chromatogram as a TIC. Upon further review, the laboratory provided correction which showed that this compound was present and over the upper calibration limit, therefore it was qualified "J". Since this correction was made long after the holding time, a dilution analysis was not performed.

1A

VOLATILE ORGANICS ANALYSIS DATA SHEET

EPA SAMPLE NO.

MCMW1

Lab Name: MITKEM CORPORATION Contract:

Lab Code: MITKEM Case No.: SAS No.: SDG No.: 70554

Matrix: (soil/water) WATER Lab Sample ID: 70573003

Sample wt/vol: 25.00 (g/mL) ML Lab File ID: V5C0568

Level: (low/med) LOW Date Received: 04/15/00

% Moisture: not dec. _____ Date Analyzed: 04/20/00

GC Column: DB-624 ID: 0.25 (mm) Dilution Factor: 1.0

Soil Extract Volume:_____(uL) Soil Aliquot Volume: _____(uL)

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/Kg) UG/L	Q
75-71-8	Dichlorodifluoromethane	0.5	U
74-87-3	Chloromethane	0.5	U
75-01-4	Vinyl Chloride	0.5	U
74-83-9	Bromomethane	0.5	U
75-00-3	Chloroethane	0.5	U
75-69-4	Trichlorofluoromethane	0.5	U
75-35-4	1,1-Dichloroethene	0.5	U
75-09-2	Methylene Chloride	0.5	U
156-60-5	trans-1,2-Dichloroethene	0.5	U
1634-04-4	Methyl tert-butyl ether	0.7	
75-34-3	1,1-Dichloroethane	0.5	U
156-59-2	cis-1,2-Dichloroethene	0.5	U
590-20-7	2,2-Dichloropropane	0.5	U
107-06-2	1,2-Dichloroethane	0.5	U
74-97-5	Bromochloromethane	0.5	U
67-66-3	Chloroform	0.5	U
56-23-5	Carbon Tetrachloride	0.5	U
71-55-6	1,1,1-Trichloroethane	0.5	U
563-58-6	1,1-Dichloropropene	0.5	U
79-01-6	Trichloroethene	0.5	U
78-87-5	1,2-Dichloropropane	0.5	U
71-43-2	Benzene	0.5	U
74-95-3	Dibromomethane	0.5	U
75-27-4	Bromodichloromethane	0.5	U
10061-01-5	cis-1,3-Dichloropropene	0.5	U
108-88-3	Toluene	0.5	U
10061-02-6	trans-1,3-Dichloropropene	0.5	U
79-00-5	1,1,2-Trichloroethane	0.5	U
127-18-4	Tetrachloroethene	0.5	U
142-28-9	1,3-Dichloropropane	0.5	U
124-48-1	Dibromochloromethane	0.5	U
106-93-4	1,2-Dibromoethane	0.5	U
108-90-7	Chlorobenzene	0.5	U
630-20-6	1,1,1,2-Tetrachloroethane	0.5	U

VOLATILE ORGANICS ANALYSIS DATA SHEET

EPA SAMPLE NO.

MCMW1

Lab Name: MITKEM CORPORATION Contract:

Lab Code: MITKEM Case No.: SAS No.: SDG No.: 70554

Matrix: (soil/water) WATER Lab Sample ID: 70573003

Sample wt/vol: 25.00 (g/mL) ML Lab File ID: V5C0568

Level: (low/med) LOW Date Received: 04/15/00

% Moisture: not dec. _____ Date Analyzed: 04/20/00

GC Column: DB-624 ID: 0.25 (mm) Dilution Factor: 1.0

Soil Extract Volume:_____(uL) Soil Aliquot Volume: _____(uL)

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/Kg) UG/L	Q
100-41-4	Ethylbenzene	0.5	U
136777-61-2	m,p-Xylene	0.5	U
95-47-6	o-Xylene	0.5	U
100-42-5	Styrene	0.5	U
75-25-2	Bromoform	0.5	U
98-82-8	Isopropylbenzene	0.5	U
79-34-5	1,1,2,2-Tetrachloroethane	0.5	U
108-86-1	Bromobenzene	0.5	U
96-18-4	1,2,3-Trichloropropane	0.5	U
103-65-1	n-Propylbenzene	0.5	U
95-49-8	2-Chlorotoluene	0.5	U
108-67-8	1,3,5-Trimethylbenzene	0.5	U
106-43-4	4-Chlorotoluene	0.5	U
98-06-6	tert-Butylbenzene	0.5	U
95-63-6	1,2,4-Trimethylbenzene	0.5	U
135-98-8	sec-Butylbenzene	0.5	U
541-73-1	1,3-Dichlorobenzene	0.5	U
99-87-6	4-Isopropyltoluene	0.5	U
106-46-7	1,4-Dichlorobenzene	0.5	U
104-51-8	n-Butylbenzene	0.5	U
95-50-1	1,2-Dichlorobenzene	0.5	U
96-12-8	1,2-Dibromo-3-chloropropane	0.5	U
120-82-1	1,2,4-Trichlorobenzene	0.5	U
87-68-3	Hexachlorobutadiene	0.5	U
91-20-3	Naphthalene	0.5	U
87-61-6	1,2,3-Trichlorobenzene	0.5	U

1E

VOLATILE ORGANICS ANALYSIS DATA SHEET
TENTATIVELY IDENTIFIED COMPOUNDS

EPA SAMPLE NO.

MCMW1

Lab Name: MITKEM CORPORATION Contract:

Lab Code: MITKEM Case No.: SAS No.: SDG No.: 70554

Matrix: (soil/water) WATER Lab Sample ID: 70573003

Sample wt/vol: 25.00 (g/mL) ML Lab File ID: V5C0568

Level: (low/med) LOW Date Received: 04/15/00

% Moisture: not dec. _____ Date Analyzed: 04/20/00

GC Column: DB-624 ID: 0.25 (mm) Dilution Factor: 1.0

Soil Extract Volume: _____(uL) Soil Aliquot Volume: _____(uL)

Number TICs found: 1

CONCENTRATION UNITS:
(ug/L or ug/Kg) ug/L

	CAS NUMBER	COMPOUND NAME	RT	EST. CONC.	Q
1.	110-54-3	HEXANE	5.20	0.5	NJ
2.					
3.					
4.					
5.					
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22.					
23.					
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27.					
28.					
29.					
30.					

1A

VOLATILE ORGANICS ANALYSIS DATA SHEET

EPA SAMPLE NO.

OS5D

Lab Name: MITKEM CORPORATION Contract:

Lab Code: MITKEM Case No.: SAS No.: SDG No.: 70554

Matrix: (soil/water) WATER Lab Sample ID: 70554007

Sample wt/vol: 25.00 (g/mL) ML Lab File ID: V5C0565

Level: (low/med) LOW Date Received: 04/12/00

% Moisture: not dec. _____ Date Analyzed: 04/20/00

GC Column: DB-624 ID: 0.25 (mm) Dilution Factor: 1.0

Soil Extract Volume:_____(uL) Soil Aliquot Volume: _____(uL)

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/Kg) UG/L	Q
75-71-8	Dichlorodifluoromethane	0.5	U
74-87-3	Chloromethane	0.5	U
75-01-4	Vinyl Chloride	0.5	U
74-83-9	Bromomethane	0.5	U
75-00-3	Chloroethane	0.5	U
75-69-4	Trichlorofluoromethane	0.5	U
75-35-4	1,1-Dichloroethene	0.5	U
75-09-2	Methylene Chloride	0.5	U
156-60-5	trans-1,2-Dichloroethene	0.5	U
1634-04-4	Methyl tert-butyl ether	0.5	U
75-34-3	1,1-Dichloroethane	0.5	U
156-59-2	cis-1,2-Dichloroethene	0.5	U
590-20-7	2,2-Dichloropropane	0.5	U
107-06-2	1,2-Dichloroethane	0.5	U
74-97-5	Bromochloromethane	0.5	U
67-66-3	Chloroform	0.5	U
56-23-5	Carbon Tetrachloride	0.5	U
71-55-6	1,1,1-Trichloroethane	0.5	U
563-58-6	1,1-Dichloropropene	0.5	U
79-01-6	Trichloroethene	0.5	U
78-87-5	1,2-Dichloropropane	0.5	U
71-43-2	Benzene	0.5	U
74-95-3	Dibromomethane	0.5	U
75-27-4	Bromodichloromethane	0.5	U
10061-01-5	cis-1,3-Dichloropropene	0.5	U
108-88-3	Toluene	0.5	U
10061-02-6	trans-1,3-Dichloropropene	0.5	U
79-00-5	1,1,2-Trichloroethane	0.5	U
127-18-4	Tetrachloroethene	0.5	U
142-28-9	1,3-Dichloropropane	0.5	U
124-48-1	Dibromochloromethane	0.5	U
106-93-4	1,2-Dibromoethane	0.5	U
108-90-7	Chlorobenzene	0.5	U
630-20-6	1,1,1,2-Tetrachloroethane	0.5	U

VOLATILE ORGANICS ANALYSIS DATA SHEET

EPA SAMPLE NO.

OS5D

Lab Name: MITKEM CORPORATION Contract:

Lab Code: MITKEM Case No.: SAS No.: SDG No.: 70554

Matrix: (soil/water) WATER Lab Sample ID: 70554007

Sample wt/vol: 25.00 (g/mL) ML Lab File ID: V5C0565

Level: (low/med) LOW Date Received: 04/12/00

% Moisture: not dec. _____ Date Analyzed: 04/20/00

GC Column: DB-624 ID: 0.25 (mm) Dilution Factor: 1.0

Soil Extract Volume: _____(uL) Soil Aliquot Volume: _____(uL)

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/Kg) UG/L	Q
100-41-4	Ethylbenzene	0.5	U
136777-61-2	m,p-Xylene	0.5	U
95-47-6	o-Xylene	0.5	U
100-42-5	Styrene	0.5	U
75-25-2	Bromoform	0.5	U
98-82-8	Isopropylbenzene	0.5	U
79-34-5	1,1,2,2-Tetrachloroethane	0.5	U
108-86-1	Bromobenzene	0.5	U
96-18-4	1,2,3-Trichloropropane	0.5	U
103-65-1	n-Propylbenzene	0.5	U
95-49-8	2-Chlorotoluene	0.5	U
108-67-8	1,3,5-Trimethylbenzene	0.5	U
106-43-4	4-Chlorotoluene	0.5	U
98-06-6	tert-Butylbenzene	0.5	U
95-63-6	1,2,4-Trimethylbenzene	0.5	U
135-98-8	sec-Butylbenzene	0.5	U
541-73-1	1,3-Dichlorobenzene	0.5	U
99-87-6	4-Isopropyltoluene	0.5	U
106-46-7	1,4-Dichlorobenzene	0.5	U
104-51-8	n-Butylbenzene	0.5	U
95-50-1	1,2-Dichlorobenzene	0.5	U
96-12-8	1,2-Dibromo-3-chloropropane	0.5	U
120-82-1	1,2,4-Trichlorobenzene	0.5	U
87-68-3	Hexachlorobutadiene	0.5	U
91-20-3	Naphthalene	0.5	U
87-61-6	1,2,3-Trichlorobenzene	0.5	U

1E

VOLATILE ORGANICS ANALYSIS DATA SHEET
TENTATIVELY IDENTIFIED COMPOUNDS

EPA SAMPLE NO.

OS5D

Lab Name: MITKEM CORPORATION Contract:

Lab Code: MITKEM Case No.: SAS No.: SDG No.: 70554

Matrix: (soil/water) WATER Lab Sample ID: 70554007

Sample wt/vol: 25.00 (g/mL) ML Lab File ID: V5C0565

Level: (low/med) LOW Date Received: 04/12/00

% Moisture: not dec. _____ Date Analyzed: 04/20/00

GC Column: DB-624 ID: 0.25 (mm) Dilution Factor: 1.0

Soil Extract Volume:_____(uL) Soil Aliquot Volume: _____(uL)

Number TICs found: 0 CONCENTRATION UNITS: (ug/L or ug/Kg) ug/L

	CAS NUMBER	COMPOUND NAME	RT	EST. CONC.	Q
1.					
2.					
3.					
4.					
5.					
6.					
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30.					

VOLATILE ORGANICS ANALYSIS DATA SHEET

EPA SAMPLE NO.

OS4D

Lab Name: MITKEM CORPORATION Contract:

Lab Code: MITKEM Case No.: SAS No.: SDG No.: 70554

Matrix: (soil/water) WATER Lab Sample ID: 70554008

Sample wt/vol: 25.00 (g/mL) ML Lab File ID: V5C0557

Level: (low/med) LOW Date Received: 04/12/00

% Moisture: not dec. _____ Date Analyzed: 04/20/00

GC Column: DB-624 ID: 0.25 (mm) Dilution Factor: 1.0

Soil Extract Volume: _____(uL) Soil Aliquot Volume: _____(uL)

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/Kg) UG/L	Q
75-71-8	Dichlorodifluoromethane	0.5	U
74-87-3	Chloromethane	0.5	U
75-01-4	Vinyl Chloride	0.5	U
74-83-9	Bromomethane	0.5	U
75-00-3	Chloroethane	0.5	U
75-69-4	Trichlorofluoromethane	0.5	U
75-35-4	1,1-Dichloroethene	0.5	U
75-09-2	Methylene Chloride	0.5	U
156-60-5	trans-1,2-Dichloroethene	0.5	U
1634-04-4	Methyl tert-butyl ether	0.5	U
75-34-3	1,1-Dichloroethane	1	
156-59-2	cis-1,2-Dichloroethene	0.5	U
590-20-7	2,2-Dichloropropane	0.5	U
107-06-2	1,2-Dichloroethane	0.5	U
74-97-5	Bromochloromethane	0.5	U
67-66-3	Chloroform	0.5	U
56-23-5	Carbon Tetrachloride	0.5	U
71-55-6	1,1,1-Trichloroethane	1	
563-58-6	1,1-Dichloropropene	0.5	U
79-01-6	Trichloroethene	0.5	U
78-87-5	1,2-Dichloropropane	0.5	U
71-43-2	Benzene	0.5	U
74-95-3	Dibromomethane	0.5	U
75-27-4	Bromodichloromethane	0.5	U
10061-01-5	cis-1,3-Dichloropropene	0.5	U
108-88-3	Toluene	0.5	U
10061-02-6	trans-1,3-Dichloropropene	0.5	U
79-00-5	1,1,2-Trichloroethane	0.5	U
127-18-4	Tetrachloroethene	0.5	U
142-28-9	1,3-Dichloropropane	0.5	U
124-48-1	Dibromochloromethane	0.5	U
106-93-4	1,2-Dibromoethane	0.5	U
108-90-7	Chlorobenzene	0.5	U
630-20-6	1,1,1,2-Tetrachloroethane	0.5	U

VOLATILE ORGANICS ANALYSIS DATA SHEET

EPA SAMPLE NO.

OS4D

Lab Name: MITKEM CORPORATION Contract:

Lab Code: MITKEM Case No.: SAS No.: SDG No.: 70554

Matrix: (soil/water) WATER Lab Sample ID: 70554008

Sample wt/vol: 25.00 (g/mL) ML Lab File ID: V5C0557

Level: (low/med) LOW Date Received: 04/12/00

% Moisture: not dec. _____ Date Analyzed: 04/20/00

GC Column: DB-624 ID: 0.25 (mm) Dilution Factor: 1.0

Soil Extract Volume:_____(uL) Soil Aliquot Volume: _____(uL)

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/Kg) UG/L	Q
100-41-4	Ethylbenzene	0.5	U
136777-61-2	m,p-Xylene	0.5	U
95-47-6	o-Xylene	0.5	U
100-42-5	Styrene	0.5	U
75-25-2	Bromoform	0.5	U
98-82-8	Isopropylbenzene	0.5	U
79-34-5	1,1,2,2-Tetrachloroethane	0.5	U
108-86-1	Bromobenzene	0.5	U
96-18-4	1,2,3-Trichloropropane	0.5	U
103-65-1	n-Propylbenzene	0.5	U
95-49-8	2-Chlorotoluene	0.5	U
108-67-8	1,3,5-Trimethylbenzene	0.5	U
106-43-4	4-Chlorotoluene	0.5	U
98-06-6	tert-Butylbenzene	0.5	U
95-63-6	1,2,4-Trimethylbenzene	0.5	U
135-98-8	sec-Butylbenzene	0.5	U
541-73-1	1,3-Dichlorobenzene	0.5	U
99-87-6	4-Isopropyltoluene	0.5	U
106-46-7	1,4-Dichlorobenzene	0.5	U
104-51-8	n-Butylbenzene	0.5	U
95-50-1	1,2-Dichlorobenzene	0.5	U
96-12-8	1,2-Dibromo-3-chloropropane	0.5	U
120-82-1	1,2,4-Trichlorobenzene	0.5	U
87-68-3	Hexachlorobutadiene	0.5	U
91-20-3	Naphthalene	0.5	U
87-61-6	1,2,3-Trichlorobenzene	0.5	U

1E

VOLATILE ORGANICS ANALYSIS DATA SHEET
TENTATIVELY IDENTIFIED COMPOUNDS

EPA SAMPLE NO.

OS4D

Lab Name: MITKEM CORPORATION Contract:

Lab Code: MITKEM Case No.: SAS No.: SDG No.: 70554

Matrix: (soil/water) WATER Lab Sample ID: 70554008

Sample wt/vol: 25.00 (g/mL) ML Lab File ID: V5C0557

Level: (low/med) LOW Date Received: 04/12/00

% Moisture: not dec. _____ Date Analyzed: 04/20/00

GC Column: DB-624 ID: 0.25 (mm) Dilution Factor: 1.0

Soil Extract Volume:_____(uL) Soil Aliquot Volume: _____(uL)

Number TICs found: 0

CONCENTRATION UNITS:
(ug/L or ug/Kg) ug/L

	CAS NUMBER	COMPOUND NAME	RT	EST. CONC.	Q
1.					
2.					
3.					
4.					
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VOLATILE ORGANICS ANALYSIS DATA SHEET

EPA SAMPLE NO.

OS3S

Lab Name: MITKEM CORPORATION Contract:

Lab Code: MITKEM Case No.: SAS No.: SDG No.: 70554

Matrix: (soil/water) WATER Lab Sample ID: 70568008

Sample wt/vol: 25.00 (g/mL) ML Lab File ID: V5C0645

Level: (low/med) LOW Date Received: 04/14/00

% Moisture: not dec. _____ Date Analyzed: 04/24/00

GC Column: DB-624 ID: 0.25 (mm) Dilution Factor: 1.0

Soil Extract Volume: _____(uL) Soil Aliquot Volume: _____(uL)

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/Kg) UG/L	Q
75-71-8	Dichlorodifluoromethane	0.5	U
74-87-3	Chloromethane	0.5	U
75-01-4	Vinyl Chloride	0.5	U
74-83-9	Bromomethane	0.5	U
75-00-3	Chloroethane	0.5	U
75-69-4	Trichlorofluoromethane	0.5	U
75-35-4	1,1-Dichloroethene	0.5	U
75-09-2	Methylene Chloride	0.5	U
156-60-5	trans-1,2-Dichloroethene	0.5	U
1634-04-4	Methyl tert-butyl ether	0.5	U
75-34-3	1,1-Dichloroethane	0.5	U
156-59-2	cis-1,2-Dichloroethene	0.5	U
590-20-7	2,2-Dichloropropane	0.5	U
107-06-2	1,2-Dichloroethane	0.5	U
74-97-5	Bromochloromethane	0.5	U
67-66-3	Chloroform	0.5	U
56-23-5	Carbon Tetrachloride	0.5	U
71-55-6	1,1,1-Trichloroethane	0.5	U
563-58-6	1,1-Dichloropropene	0.5	U
79-01-6	Trichloroethene	3	
78-87-5	1,2-Dichloropropane	1	
71-43-2	Benzene	0.5	U
74-95-3	Dibromomethane	0.5	U
75-27-4	Bromodichloromethane	0.5	U
10061-01-5	cis-1,3-Dichloropropene	0.5	U
108-88-3	Toluene	0.5	U
10061-02-6	trans-1,3-Dichloropropene	0.5	U
79-00-5	1,1,2-Trichloroethane	0.5	U
127-18-4	Tetrachloroethene	2	
142-28-9	1,3-Dichloropropane	0.5	U
124-48-1	Dibromochloromethane	0.5	U
106-93-4	1,2-Dibromoethane	0.5	U
108-90-7	Chlorobenzene	0.5	U
630-20-6	1,1,1,2-Tetrachloroethane	0.5	U

00117 RE

VOLATILE ORGANICS ANALYSIS DATA SHEET

EPA SAMPLE NO.

OS3S

Lab Name: MITKEM CORPORATION Contract:

Lab Code: MITKEM Case No.: SAS No.: SDG No.: 70554

Matrix: (soil/water) WATER Lab Sample ID: 70568008

Sample wt/vol: 25.00 (g/mL) ML Lab File ID: V5C0645

Level: (low/med) LOW Date Received: 04/14/00

% Moisture: not dec. _____ Date Analyzed: 04/24/00

GC Column: DB-624 ID: 0.25 (mm) Dilution Factor: 1.0

Soil Extract Volume: _____(uL) Soil Aliquot Volume: _____(uL)

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/Kg) UG/L	Q
100-41-4	Ethylbenzene	0.5	U
136777-61-2	m,p-Xylene	0.5	U
95-47-6	o-Xylene	0.5	U
100-42-5	Styrene	0.5	U
75-25-2	Bromoform	0.5	U
98-82-8	Isopropylbenzene	0.5	U
79-34-5	1,1,2,2-Tetrachloroethane	0.5	U
108-86-1	Bromobenzene	0.5	U
96-18-4	1,2,3-Trichloropropane	1400	E
103-65-1	n-Propylbenzene	0.5	U
95-49-8	2-Chlorotoluene	0.5	U
108-67-8	1,3,5-Trimethylbenzene	0.5	U
106-43-4	4-Chlorotoluene	0.5	U
98-06-6	tert-Butylbenzene	0.5	U
95-63-6	1,2,4-Trimethylbenzene	0.5	U
135-98-8	sec-Butylbenzene	0.5	U
541-73-1	1,3-Dichlorobenzene	3	
99-87-6	4-Isopropyltoluene	0.5	U
106-46-7	1,4-Dichlorobenzene	4	
104-51-8	n-Butylbenzene	0.5	U
95-50-1	1,2-Dichlorobenzene	4	
96-12-8	1,2-Dibromo-3-chloropropane	0.5	U
120-82-1	1,2,4-Trichlorobenzene	0.5	U
87-68-3	Hexachlorobutadiene	0.5	U
91-20-3	Naphthalene	0.5	U
87-61-6	1,2,3-Trichlorobenzene	0.5	U

1E

VOLATILE ORGANICS ANALYSIS DATA SHEET
TENTATIVELY IDENTIFIED COMPOUNDS

EPA SAMPLE NO.

OS3S

Lab Name: MITKEM CORPORATION Contract:

Lab Code: MITKEM Case No.: SAS No.: SDG No.: 70554

Matrix: (soil/water) WATER Lab Sample ID: 70568008

Sample wt/vol: 25.00 (g/mL) ML Lab File ID: V5C0645

Level: (low/med) LOW Date Received: 04/14/00

% Moisture: not dec. _____ Date Analyzed: 04/24/00

GC Column: DB-624 ID: 0.25 (mm) Dilution Factor: 1.0

Soil Extract Volume: _____(uL) Soil Aliquot Volume: _____(uL)

Number TICs found: 8

CONCENTRATION UNITS:
(ug/L or ug/Kg) ug/L

	CAS NUMBER	COMPOUND NAME	RT	EST. CONC.	Q
1.	110-54-3	HEXANE	5.21	0.5	NJ
2.	78-88-6	1-PROPENE, 2,3-DICHLORO-	7.79	2	NJ
3.		UNKNOWN	12.24	1	J
4.		UNKNOWN	12.69	4	J
5.		UNKNOWN	12.76	2	J
6.		UNKNOWN	12.88	2	J
7.	2441-97-6	CYCLOHEXENE, 3-CHLORO-	13.00	3	NJ
8.		UNKNOWN	18.76	0.5	J
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VOLATILE ORGANICS ANALYSIS DATA SHEET

EPA SAMPLE NO.: OS3I

Lab Name: MITKEM CORPORATION Contract:

Lab Code: MITKEM Case No.: SAS No.: SDG No.: 70554

Matrix: (soil/water) WATER Lab Sample ID: 70568006

Sample wt/vol: 25.00 (g/mL) ML Lab File ID: V5C0644

Level: (low/med) LOW Date Received: 04/14/00

% Moisture: not dec. _____ Date Analyzed: 04/24/00

GC Column: DB-624 ID: 0.25 (mm) Dilution Factor: 1.0

Soil Extract Volume: _____(uL) Soil Aliquot Volume: _____(uL)

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/Kg) UG/L	Q
75-71-8	Dichlorodifluoromethane	0.5	U
74-87-3	Chloromethane	0.5	U
75-01-4	Vinyl Chloride	0.5	U
74-83-9	Bromomethane	0.5	U
75-00-3	Chloroethane	0.5	U
75-69-4	Trichlorofluoromethane	0.5	U
75-35-4	1,1-Dichloroethene	0.5	U
75-09-2	Methylene Chloride	0.5	U
156-60-5	trans-1,2-Dichloroethene	0.5	U
1634-04-4	Methyl tert-butyl ether	0.5	U
75-34-3	1,1-Dichloroethane	0.5	U
156-59-2	cis-1,2-Dichloroethene	0.5	U
590-20-7	2,2-Dichloropropane	0.5	U
107-06-2	1,2-Dichloroethane	0.5	U
74-97-5	Bromochloromethane	0.5	U
67-66-3	Chloroform	0.5	U
56-23-5	Carbon Tetrachloride	0.5	U
71-55-6	1,1,1-Trichloroethane	0.5	U
563-58-6	1,1-Dichloropropene	0.5	U
79-01-6	Trichloroethene	0.5	U
78-87-5	1,2-Dichloropropane	0.5	U
71-43-2	Benzene	0.5	U
74-95-3	Dibromomethane	0.5	U
75-27-4	Bromodichloromethane	0.5	U
10061-01-5	cis-1,3-Dichloropropene	0.5	U
108-88-3	Toluene	0.5	U
10061-02-6	trans-1,3-Dichloropropene	0.5	U
79-00-5	1,1,2-Trichloroethane	0.5	U
127-18-4	Tetrachloroethene	0.5	U
142-28-9	1,3-Dichloropropane	0.5	U
124-48-1	Dibromochloromethane	0.5	U
106-93-4	1,2-Dibromoethane	0.5	U
108-90-7	Chlorobenzene	0.5	U
630-20-6	1,1,1,2-Tetrachloroethane	0.5	U

VOLATILE ORGANICS ANALYSIS DATA SHEET

EPA SAMPLE NO.

OS3I

Lab Name: MITKEM CORPORATION Contract:

Lab Code: MITKEM Case No.: SAS No.: SDG No.: 70554

Matrix: (soil/water) WATER Lab Sample ID: 70568006

Sample wt/vol: 25.00 (g/mL) ML Lab File ID: V5C0644

Level: (low/med) LOW Date Received: 04/14/00

% Moisture: not dec. _____ Date Analyzed: 04/24/00

GC Column: DB-624 ID: 0.25 (mm) Dilution Factor: 1.0

Soil Extract Volume: _____(uL) Soil Aliquot Volume: _____(uL)

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/Kg) UG/L	Q
100-41-4	Ethylbenzene	0.5	U
136777-61-2	m,p-Xylene	0.5	U
95-47-6	o-Xylene	0.5	U
100-42-5	Styrene	0.5	U
75-25-2	Bromoform	0.5	U
98-82-8	Isopropylbenzene	0.5	U
79-34-5	1,1,2,2-Tetrachloroethane	0.5	U
108-86-1	Bromobenzene	0.5	U
96-18-4	1,2,3-Trichloropropane	0.5	U
103-65-1	n-Propylbenzene	0.5	U
95-49-8	2-Chlorotoluene	0.5	U
108-67-8	1,3,5-Trimethylbenzene	0.5	U
106-43-4	4-Chlorotoluene	0.5	U
98-06-6	tert-Butylbenzene	0.5	U
95-63-6	1,2,4-Trimethylbenzene	0.5	U
135-98-8	sec-Butylbenzene	0.5	U
541-73-1	1,3-Dichlorobenzene	0.5	U
99-87-6	4-Isopropyltoluene	0.5	U
106-46-7	1,4-Dichlorobenzene	0.5	U
104-51-8	n-Butylbenzene	0.5	U
95-50-1	1,2-Dichlorobenzene	0.5	U
96-12-8	1,2-Dibromo-3-chloropropane	0.5	U
120-82-1	1,2,4-Trichlorobenzene	0.5	U
87-68-3	Hexachlorobutadiene	0.5	U
91-20-3	Naphthalene	0.5	U
87-61-6	1,2,3-Trichlorobenzene	0.5	U

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VOLATILE ORGANICS ANALYSIS DATA SHEET
TENTATIVELY IDENTIFIED COMPOUNDS

EPA SAMPLE NO.

OS3I

Lab Name: MITKEM CORPORATION Contract:

Lab Code: MITKEM Case No.: SAS No.: SDG No.: 70554

Matrix: (soil/water) WATER Lab Sample ID: 70568006

Sample wt/vol: 25.00 (g/mL) ML Lab File ID: V5C0644

Level: (low/med) LOW Date Received: 04/14/00

% Moisture: not dec. _____ Date Analyzed: 04/24/00

GC Column: DB-624 ID: 0.25 (mm) Dilution Factor: 1.0

Soil Extract Volume:_____(uL) Soil Aliquot Volume: _____(uL)

Number TICs found: 2

CONCENTRATION UNITS:
(ug/L or ug/Kg) ug/L

	CAS NUMBER	COMPOUND NAME	RT	EST. CONC.	Q
1.	110-54-3	HEXANE	5.21	4	NJ
2.	96-37-7	CYCLOPENTANE, METHYL-	5.67	0.8	NJ
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VOLATILE ORGANICS ANALYSIS DATA SHEET

EPA SAMPLE NO.

OS3D

Lab Name: MITKEM CORPORATION Contract:

Lab Code: MITKEM Case No.: SAS No.: SDG No.: 70554

Matrix: (soil/water) WATER Lab Sample ID: 70573001

Sample wt/vol: 25.00 (g/mL) ML Lab File ID: V5C0566

Level: (low/med) LOW Date Received: 04/15/00

% Moisture: not dec. _____ Date Analyzed: 04/20/00

GC Column: DB-624 ID: 0.25 (mm) Dilution Factor: 1.0

Soil Extract Volume: _____(uL) Soil Aliquot Volume: _____(uL)

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/Kg) UG/L	Q
75-71-8	Dichlorodifluoromethane	0.5	U
74-87-3	Chloromethane	0.5	U
75-01-4	Vinyl Chloride	0.5	U
74-83-9	Bromomethane	0.5	U
75-00-3	Chloroethane	0.5	U
75-69-4	Trichlorofluoromethane	0.5	U
75-35-4	1,1-Dichloroethene	0.5	U
75-09-2	Methylene Chloride	0.5	U
156-60-5	trans-1,2-Dichloroethene	0.5	U
1634-04-4	Methyl tert-butyl ether	0.5	U
75-34-3	1,1-Dichloroethane	1	
156-59-2	cis-1,2-Dichloroethene	0.5	U
590-20-7	2,2-Dichloropropane	0.5	U
107-06-2	1,2-Dichloroethane	0.5	U
74-97-5	Bromochloromethane	0.5	U
67-66-3	Chloroform	0.5	U
56-23-5	Carbon Tetrachloride	0.5	U
71-55-6	1,1,1-Trichloroethane	0.8	
563-58-6	1,1-Dichloropropene	0.5	U
79-01-6	Trichloroethene	0.5	U
78-87-5	1,2-Dichloropropane	0.5	U
71-43-2	Benzene	0.5	U
74-95-3	Dibromomethane	0.5	U
75-27-4	Bromodichloromethane	0.5	U
10061-01-5	cis-1,3-Dichloropropene	0.5	U
108-88-3	Toluene	0.5	U
10061-02-6	trans-1,3-Dichloropropene	0.5	U
79-00-5	1,1,2-Trichloroethane	0.5	U
127-18-4	Tetrachloroethene	0.5	U
142-28-9	1,3-Dichloropropane	0.5	U
124-48-1	Dibromochloromethane	0.5	U
106-93-4	1,2-Dibromoethane	0.5	U
108-90-7	Chlorobenzene	0.5	U
630-20-6	1,1,1,2-Tetrachloroethane	0.5	U

VOLATILE ORGANICS ANALYSIS DATA SHEET

EPA SAMPLE NO.

OS3D

Lab Name: MITKEM CORPORATION Contract:

Lab Code: MITKEM Case No.: SAS No.: SDG No.: 70554

Matrix: (soil/water) WATER Lab Sample ID: 70573001

Sample wt/vol: 25.00 (g/mL) ML Lab File ID: V5C0566

Level: (low/med) LOW Date Received: 04/15/00

% Moisture: not dec. _____ Date Analyzed: 04/20/00

GC Column: DB-624 ID: 0.25 (mm) Dilution Factor: 1.0

Soil Extract Volume:_____(uL) Soil Aliquot Volume: _____(uL)

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/Kg) UG/L	Q
100-41-4	Ethylbenzene	0.5	U
136777-61-2	m,p-Xylene	0.5	U
95-47-6	o-Xylene	0.5	U
100-42-5	Styrene	0.5	U
75-25-2	Bromoform	0.5	U
98-82-8	Isopropylbenzene	0.5	U
79-34-5	1,1,2,2-Tetrachloroethane	0.5	U
108-86-1	Bromobenzene	0.5	U
96-18-4	1,2,3-Trichloropropane	0.5	U
103-65-1	n-Propylbenzene	0.5	U
95-49-8	2-Chlorotoluene	0.5	U
108-67-8	1,3,5-Trimethylbenzene	0.5	U
106-43-4	4-Chlorotoluene	0.5	U
98-06-6	tert-Butylbenzene	0.5	U
95-63-6	1,2,4-Trimethylbenzene	0.5	U
135-98-8	sec-Butylbenzene	0.5	U
541-73-1	1,3-Dichlorobenzene	0.5	U
99-87-6	4-Isopropyltoluene	0.5	U
106-46-7	1,4-Dichlorobenzene	0.5	U
104-51-8	n-Butylbenzene	0.5	U
95-50-1	1,2-Dichlorobenzene	0.5	U
96-12-8	1,2-Dibromo-3-chloropropane	0.5	U
120-82-1	1,2,4-Trichlorobenzene	0.5	U
87-68-3	Hexachlorobutadiene	0.5	U
91-20-3	Naphthalene	0.5	U
87-61-6	1,2,3-Trichlorobenzene	0.5	U

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VOLATILE ORGANICS ANALYSIS DATA SHEET
TENTATIVELY IDENTIFIED COMPOUNDS

EPA SAMPLE NO.

OS3D

Lab Name: MITKEM CORPORATION Contract:

Lab Code: MITKEM Case No.: SAS No.: SDG No.: 70554

Matrix: (soil/water) WATER Lab Sample ID: 70573001

Sample wt/vol: 25.00 (g/mL) ML Lab File ID: V5C0566

Level: (low/med) LOW Date Received: 04/15/00

% Moisture: not dec. _____ Date Analyzed: 04/20/00

GC Column: DB-624 ID: 0.25 (mm) Dilution Factor: 1.0

Soil Extract Volume: _____(uL) Soil Aliquot Volume: _____(uL)

Number TICs found: 0

CONCENTRATION UNITS:
(ug/L or ug/Kg) ug/L

	CAS NUMBER	COMPOUND NAME	RT	EST. CONC.	Q
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VOLATILE ORGANICS ANALYSIS DATA SHEET

EPA SAMPLE NO.

OS2I

Lab Name: MITKEM CORPORATION Contract:

Lab Code: MITKEM Case No.: SAS No.: SDG No.: 70554

Matrix: (soil/water) WATER Lab Sample ID: 70568005

Sample wt/vol: 25.00 (g/mL) ML Lab File ID: V5C0643

Level: (low/med) LOW Date Received: 04/14/00

% Moisture: not dec. _____ Date Analyzed: 04/24/00

GC Column: DB-624 ID: 0.25 (mm) Dilution Factor: 1.0

Soil Extract Volume: _____(uL) Soil Aliquot Volume: _____(uL)

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/Kg) UG/L	Q
75-71-8	Dichlorodifluoromethane	0.5	U
74-87-3	Chloromethane	0.5	U
75-01-4	Vinyl Chloride	0.5	U
74-83-9	Bromomethane	0.5	U
75-00-3	Chloroethane	0.5	U
75-69-4	Trichlorofluoromethane	0.5	U
75-35-4	1,1-Dichloroethene	0.5	U
75-09-2	Methylene Chloride	0.5	U
156-60-5	trans-1,2-Dichloroethene	0.5	U
1634-04-4	Methyl tert-butyl ether	0.5	U
75-34-3	1,1-Dichloroethane	0.5	U
156-59-2	cis-1,2-Dichloroethene	0.5	U
590-20-7	2,2-Dichloropropane	0.5	U
107-06-2	1,2-Dichloroethane	0.5	U
74-97-5	Bromochloromethane	0.5	U
67-66-3	Chloroform	0.8	U
56-23-5	Carbon Tetrachloride	0.5	U
71-55-6	1,1,1-Trichloroethane	0.5	U
563-58-6	1,1-Dichloropropene	0.5	U
79-01-6	Trichloroethene	0.5	U
78-87-5	1,2-Dichloropropane	0.5	U
71-43-2	Benzene	0.5	U
74-95-3	Dibromomethane	0.5	U
75-27-4	Bromodichloromethane	0.5	U
10061-01-5	cis-1,3-Dichloropropene	0.5	U
108-88-3	Toluene	0.5	U
10061-02-6	trans-1,3-Dichloropropene	0.5	U
79-00-5	1,1,2-Trichloroethane	0.5	U
127-18-4	Tetrachloroethene	0.5	U
142-28-9	1,3-Dichloropropane	0.5	U
124-48-1	Dibromochloromethane	0.5	U
106-93-4	1,2-Dibromoethane	0.5	U
108-90-7	Chlorobenzene	0.5	U
630-20-6	1,1,1,2-Tetrachloroethane	0.5	U

VOLATILE ORGANICS ANALYSIS DATA SHEET

EPA SAMPLE NO.

OS2I

Lab Name: MITKEM CORPORATION Contract:

Lab Code: MITKEM Case No.: SAS No.: SDG No.: 70554

Matrix: (soil/water) WATER Lab Sample ID: 705o8005

Sample wt/vol: 25.00 (g/mL) ML Lab File ID: V5C0643

Level: (low/med) LOW Date Received: 04/14/00

% Moisture: not dec. _____ Date Analyzed: 04/24/00

GC Column: DB-624 ID: 0.25 (mm) Dilution Factor: 1.0

Soil Extract Volume:_____(uL) Soil Aliquot Volume: _____(uL)

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/Kg) UG/L	Q
100-41-4	Ethylbenzene	0.5	U
136777-61-2	m,p-Xylene	0.5	U
95-47-6	o-Xylene	0.5	U
100-42-5	Styrene	0.5	U
75-25-2	Bromoform	0.5	U
98-82-8	Isopropylbenzene	0.5	U
79-34-5	1,1,2,2-Tetrachloroethane	0.5	U
108-86-1	Bromobenzene	0.5	U
96-18-4	1,2,3-Trichloropropane	0.5	U
103-65-1	n-Propylbenzene	0.5	U
95-49-8	2-Chlorotoluene	0.5	U
108-67-8	1,3,5-Trimethylbenzene	0.5	U
106-43-4	4-Chlorotoluene	0.5	U
98-06-6	tert-Butylbenzene	0.5	U
95-63-6	1,2,4-Trimethylbenzene	0.5	U
135-98-8	sec-Butylbenzene	0.5	U
541-73-1	1,3-Dichlorobenzene	0.5	U
99-87-6	4-Isopropyltoluene	0.5	U
106-46-7	1,4-Dichlorobenzene	0.5	U
104-51-8	n-Butylbenzene	0.5	U
95-50-1	1,2-Dichlorobenzene	0.5	U
96-12-8	1,2-Dibromo-3-chloropropane	0.5	U
120-82-1	1,2,4-Trichlorobenzene	0.5	U
87-68-3	Hexachlorobutadiene	0.5	U
91-20-3	Naphthalene	0.5	U
87-61-6	1,2,3-Trichlorobenzene	0.5	U

1E

VOLATILE ORGANICS ANALYSIS DATA SHEET
TENTATIVELY IDENTIFIED COMPOUNDS

EPA SAMPLE NO.

OS2I

Lab Name: MITKEM CORPORATION Contract:

Lab Code: MITKEM Case No.: SAS No.: SDG No.: 70554

Matrix: (soil/water) WATER Lab Sample ID: 70568005

Sample wt/vol: 25.00 (g/mL) ML Lab File ID: V5C0643

Level: (low/med) LOW Date Received: 04/14/00

% Moisture: not dec. _____ Date Analyzed: 04/24/00

GC Column: DB-624 ID: 0.25 (mm) Dilution Factor: 1.0

Soil Extract Volume: _____(uL) Soil Aliquot Volume: _____(uL)

Number TICs found: 2

CONCENTRATION UNITS:
(ug/L or ug/Kg) ug/L

	CAS NUMBER	COMPOUND NAME	RT	EST. CONC.	Q
1.	110-54-3	HEXANE	5.21	6	NJ
2.	96-37-7	CYCLOPENTANE, METHYL-	5.87	1	NJ
3.					
4.					
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VOLATILE ORGANICS ANALYSIS DATA SHEET

EPA SAMPLE NO.

OS2A

Lab Name: MITKEM CORPORATION Contract:

Lab Code: MITKEM Case No.: SAS No.: SDG No.: 70554

Matrix: (soil/water) WATER Lab Sample ID: 70568004

Sample wt/vol: 25.00 (g/mL) ML Lab File ID: V5C0642

Level: (low/med) LOW Date Received: 04/14/00

% Moisture: not dec. _____ Date Analyzed: 04/24/00

GC Column: DB-624 ID: 0.25 (mm) Dilution Factor: 1.0

Soil Extract Volume: _____(uL) Soil Aliquot Volume: _____(uL)

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/Kg) UG/L	Q
75-71-8	Dichlorodifluoromethane	0.5	U
74-87-3	Chloromethane	0.5	U
75-01-4	Vinyl Chloride	0.5	U
74-83-9	Bromomethane	0.5	U
75-00-3	Chloroethane	0.5	U
75-69-4	Trichlorofluoromethane	0.5	U
75-35-4	1,1-Dichloroethene	0.5	U
75-09-2	Methylene Chloride	0.5	U
156-60-5	trans-1,2-Dichloroethene	0.5	U
1634-04-4	Methyl tert-butyl ether	0.5	U
75-34-3	1,1-Dichloroethane	0.5	U
156-59-2	cis-1,2-Dichloroethene	0.5	U
590-20-7	2,2-Dichloropropane	0.5	U
107-06-2	1,2-Dichloroethane	0.5	U
74-97-5	Bromochloromethane	0.5	U
67-66-3	Chloroform	1	U
56-23-5	Carbon Tetrachloride	0.5	U
71-55-6	1,1,1-Trichloroethane	0.5	U
563-58-6	1,1-Dichloropropene	0.5	U
79-01-6	Trichloroethene	0.5	U
78-87-5	1,2-Dichloropropane	0.5	U
71-43-2	Benzene	0.5	U
74-95-3	Dibromomethane	0.5	U
75-27-4	Bromodichloromethane	0.5	U
10061-01-5	cis-1,3-Dichloropropene	0.5	U
108-88-3	Toluene	0.5	U
10061-02-6	trans-1,3-Dichloropropene	0.5	U
79-00-5	1,1,2-Trichloroethane	0.5	U
127-18-4	Tetrachloroethene	0.5	U
142-28-9	1,3-Dichloropropane	0.5	U
124-48-1	Dibromochloromethane	0.5	U
106-93-4	1,2-Dibromoethane	0.5	U
108-90-7	Chlorobenzene	0.5	U
630-20-6	1,1,1,2-Tetrachloroethane	0.5	U

VOLATILE ORGANICS ANALYSIS DATA SHEET

EPA SAMPLE NO.

OS2A

Lab Name: MITKEM CORPORATION Contract:

Lab Code: MITKEM Case No.: SAS No.: SDG No.: 70554

Matrix: (soil/water) WATER Lab Sample ID: 70568004

Sample wt/vol: 25.00 (g/mL) ML Lab File ID: V5C0642

Level: (low/med) LOW Date Received: 04/14/00

% Moisture: not dec. _____ Date Analyzed: 04/24/00

GC Column: DB-624 ID: 0.25 (mm) Dilution Factor: 1.0

Soil Extract Volume:_____(uL) Soil Aliquot Volume: _____(uL)

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/Kg) UG/L	Q
100-41-4	Ethylbenzene	0.5	U
136777-61-2	m,p-Xylene	0.5	U
95-47-6	o-Xylene	0.5	U
100-42-5	Styrene	0.5	U
75-25-2	Bromoform	0.5	U
98-82-8	Isopropylbenzene	0.5	U
79-34-5	1,1,2,2-Tetrachloroethane	0.5	U
108-86-1	Bromobenzene	0.5	U
96-18-4	1,2,3-Trichloropropane	0.5	U
103-65-1	n-Propylbenzene	0.5	U
95-49-8	2-Chlorotoluene	0.5	U
108-67-8	1,3,5-Trimethylbenzene	0.5	U
106-43-4	4-Chlorotoluene	0.5	U
98-06-6	tert-Butylbenzene	0.5	U
95-63-6	1,2,4-Trimethylbenzene	0.5	U
135-98-8	sec-Butylbenzene	0.5	U
541-73-1	1,3-Dichlorobenzene	0.5	U
99-87-6	4-Isopropyltoluene	0.5	U
106-46-7	1,4-Dichlorobenzene	0.5	U
104-51-8	n-Butylbenzene	0.5	U
95-50-1	1,2-Dichlorobenzene	0.5	U
96-12-8	1,2-Dibromo-3-chloropropane	0.5	U
120-82-1	1,2,4-Trichlorobenzene	0.5	U
87-68-3	Hexachlorobutadiene	0.5	U
91-20-3	Naphthalene	0.5	U
87-61-6	1,2,3-Trichlorobenzene	0.5	U

1E

VOLATILE ORGANICS ANALYSIS DATA SHEET
TENTATIVELY IDENTIFIED COMPOUNDS

EPA SAMPLE NO.

OS2A

Lab Name: MITKEM CORPORATION Contract:

Lab Code: MITKEM Case No.: SAS No.: SDG No.: 70554

Matrix: (soil/water) WATER Lab Sample ID: 70568004

Sample wt/vol: 25.00 (g/mL) ML Lab File ID: V5C0642

Level: (low/med) LOW Date Received: 04/14/00

% Moisture: not dec. _____ Date Analyzed: 04/24/00

GC Column: DB-624 ID: 0.25 (mm) Dilution Factor: 1.0

Soil Extract Volume: _____(uL) Soil Aliquot Volume: _____(uL)

Number TICs found: 1

CONCENTRATION UNITS:
(ug/L or ug/Kg) ug/L

	CAS NUMBER	COMPOUND NAME	RT	EST. CONC.	Q
1.	110-54-3	HEXANE	5.21	0.5	NJ
2.					
3.					
4.					
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1A

VOLATILE ORGANICS ANALYSIS DATA SHEET

EPA SAMPLE NO.

MW5S

Lab Name: MITKEM CORPORATION Contract:

Lab Code: MITKEM Case No.: SAS No.: SDG No.: 70554

Matrix: (soil/water) WATER Lab Sample ID: 70554001

Sample wt/vol: 25.00 (g/mL) ML Lab File ID: V5C0559

Level: (low/med) LOW Date Received: 04/12/00

% Moisture: not dec. _____ Date Analyzed: 04/20/00

GC Column: DB-624 ID: 0.25 (mm) Dilution Factor: 1.0

Soil Extract Volume:_____(uL) Soil Aliquot Volume: _____(uL)

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/Kg) UG/L	Q
75-71-8	Dichlorodifluoromethane	0.5	U
74-87-3	Chloromethane	0.5	U
75-01 4	Vinyl Chloride	0.5	U
74-83-9	Bromomethane	0.5	U
75-00-3	Chloroethane	0.5	U
75-69-4	Trichlorofluoromethane	0.5	U
75-35-4	1,1-Dichloroethene	0.5	U
75-09-2	Methylene Chloride	0.5	U
156-60-5	trans-1,2-Dichloroethene	0.5	U
1634-04-4	Methyl tert-butyl ether	0.5	U
75-34-3	1,1-Dichloroethane	0.5	U
156-59-2	cis-1,2-Dichloroethene	0.5	U
590-20-7	2,2-Dichloropropane	0.5	U
107-06-2	1,2-Dichloroethane	0.5	U
74-97-5	Bromochloromethane	0.5	U
67-66-3	Chloroform	0.9	u
56-23-5	Carbon Tetrachloride	0.5	U
71-55-6	1,1,1-Trichloroethane	0.5	U
563-58-6	1,1-Dichloropropene	0.5	U
79-01-6	Trichloroethene	0.5	U
78-87-5	1,2-Dichloropropane	0.5	U
71-43-2	Benzene	0.5	U
74-95-3	Dibromomethane	0.5	U
75-27-4	Bromodichloromethane	0.5	U
10061-01-5	cis-1,3-Dichloropropene	0.5	U
108-88-3	Toluene	0.5	U
10061-02-6	trans-1,3-Dichloropropene	0.5	U
79-00-5	1,1,2-Trichloroethane	0.5	U
127-18-4	Tetrachloroethene	0.5	U
142-28-9	1,3-Dichloropropane	0.5	U
124-48-1	Dibromochloromethane	0.5	U
106-93-4	1,2-Dibromoethane	0.5	U
108-90-7	Chlorobenzene	0.5	U
630-20-6	1,1,1,2-Tetrachloroethane	0.5	U

VOLATILE ORGANICS ANALYSIS DATA SHEET

EPA SAMPLE NO.

MW5S

Lab Name: MITKEM CORPORATION Contract:

Lab Code: MITKEM Case No.: SAS No.: SDG No.: 70554

Matrix: (soil/water) WATER Lab Sample ID: 70554001

Sample wt/vol: 25.00 (g/mL) ML Lab File ID: V5C0559

Level: (low/med) LOW Date Received: 04/12/00

% Moisture: not dec. _____ Date Analyzed: 04/20/00

GC Column: DB-624 ID: 0.25 (mm) Dilution Factor: 1.0

Soil Extract Volume:_____(uL) Soil Aliquot Volume: _____(uL)

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/Kg) UG/L	Q
100-41-4	Ethylbenzene	0.5	U
136777-61-2	m,p-Xylene	0.5	U
95-47-6	o-Xylene	0.5	U
100-42-5	Styrene	0.5	U
75-25-2	Bromoform	0.5	U
98-82-8	Isopropylbenzene	0.5	U
79-34-5	1,1,2,2-Tetrachloroethane	0.5	U
108-86-1	Bromobenzene	0.5	U
96-18-4	1,2,3-Trichloropropane	0.5	U
103-65-1	n-Propylbenzene	0.5	U
95-49-8	2-Chlorotoluene	0.5	U
108-67-8	1,3,5-Trimethylbenzene	0.5	U
106-43-4	4-Chlorotoluene	0.5	U
98-06-6	tert-Butylbenzene	0.5	U
95-63-6	1,2,4-Trimethylbenzene	0.5	U
135-98-8	sec-Butylbenzene	0.5	U
541-73-1	1,3-Dichlorobenzene	0.5	U
99-87-6	4-Isopropyltoluene	0.5	U
106-46-7	1,4-Dichlorobenzene	0.5	U
104-51-8	n-Butylbenzene	0.5	U
95-50-1	1,2-Dichlorobenzene	0.5	U
96-12-8	1,2-Dibromo-3-chloropropane	0.5	U
120-82-1	1,2,4-Trichlorobenzene	0.5	U
87-68-3	Hexachlorobutadiene	0.5	U
91-20-3	Naphthalene	0.5	U
87-61-6	1,2,3-Trichlorobenzene	0.5	U

1E

VOLATILE ORGANICS ANALYSIS DATA SHEET
TENTATIVELY IDENTIFIED COMPOUNDS

EPA SAMPLE NO.

MW5S

Lab Name: MITKEM CORPORATION Contract:

Lab Code: MITKEM Case No.: SAS No.: SDG No.: 70554

Matrix: (soil/water) WATER Lab Sample ID: 70554001

Sample wt/vol: 25.00 (g/mL) ML Lab File ID: V5C0559

Level: (low/med) LOW Date Received: 04/12/00

% Moisture: not dec. _____ Date Analyzed: 04/20/00

GC Column: DB-624 ID: 0.25 (mm) Dilution Factor: 1.0

Soil Extract Volume: _____(uL) Soil Aliquot Volume: _____(uL)

Number TICs found: 0

CONCENTRATION UNITS:
(ug/L or ug/Kg) ug/L

	CAS NUMBER	COMPOUND NAME	RT	EST. CONC.	Q
1.					
2.					
3.					
4.					
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Analytical Results (Qualified Data)

Case #: 27964
SDG : MB026J
Site : MACKENZIE CHEMICAL
Lab. : LIBRTY
Reviewer :
Date :

Number of Soil Samples : 0
Number of Water Samples : 17

Sample Number :	MB026J		MB026JD-Do Not Use		MB026JS-Do Not Use		MB026K		MB026N	
Sampling Location :	MW-5S		MW-5S		MW-5S		CAWF		DPW#1	
Matrix :	Water		Water		Water		Water		Water	
Units :	ug/L		ug/L		ug/L		ug/L		ug/L	
Date Sampled :	04/10/2000		04/10/2000		04/10/2000		04/10/2000		04/10/2000	
Time Sampled :	14:45		14:45		14:45		16:25		17:05	
%Solids :	0.0		0.0		0.0		0.0		0.0	
Dilution Factor :	1.0		1.0		1.0		1.0		1.0	
ANALYTE	Result	Flag	Result	Flag	Result	Flag	Result	Flag	Result	Flag
ALUMINUM	37.0	U	37.0	U	1960		37.0	U	37.0	U
ANTIMONY	21	U	21	U	30		23	U	27	U
ARSENIC	2.3	U	2.3	U	42.0		2.3	U	2.3	U
BARIUM	702	B	710	B	2140		0.26	U	0.45	B
BERYLLIUM	0.20	U	0.20	U	50.8		0.20	U	0.20	U
CADMIUM	0.25	B	1.1	B	5.9		0.20	U	0.20	U
CALCIUM	15200		15900				975	B	1070	B
CHROMIUM	2.1	B	2.0	B	206		0.30	U	0.30	U
COBALT	0.71	B	0.50	U	515		0.85	B	0.84	B
COPPER	2.0	B	1.9	B	259		5.3	B	3.5	B
IRON	29.5	B	39.6	B	1060		614		14.3	U
LEAD	1.3	U	1.3	U	19.0		2.5	B	1.5	B
MAGNESIUM	2100	B	2240	B			906	B	836	B
MANGANESE	288		300		812		5.4	B	2.3	B
MERCURY	0.10	U	0.10	U	1.1		0.10	U	0.10	U
NICKEL	3.4	B	3.9	B	512		1.5	B	1.7	B
POTASSIUM	2280	B					334	B	305	B
SELENIUM	2.2	U	2.2	U	10.0		2.2	U	2.2	U
SILVER	0.60	U	0.60	U	42.9		0.60	U	0.60	U
SODIUM	43900		45800				3860	B	3830	B
THALLIUM	3.2	U	3.2	U	51.1		3.2	U	3.2	U
VANADIUM	0.97	B	0.56	B	51		0.30	U	0.30	U
ZINC	79.9		83.6		600		6.5	B	25.8	
CYANIDE	N/A		N/A		N/A		N/A		N/A	

Case #: 27964 SDG : MB026J

Site : MACKENZIE CHEMICAL

Lab. : LIBRTY

Reviewer :

Date :

Sample Number :	MB026P		MB026Q		MB026T		MB027H		MB027J	
Sampling Location :	5RRA		OS-4D		OS-1D		OS-2I		OS-3I	
Matrix :	Water		Water		Water		Water		Water	
Units :	ug/L		ug/L		ug/L		ug/L		ug/L	
Date Sampled :	04/10/2000		04/11/2000		04/11/2000		04/12/2000		04/13/2000	
Time Sampled :	18:25		12:10		18:30		14:45		13:40	
%Solids :	0.0		0.0		0.0		0.0		0.0	
Dilution Factor :	1.0		1.0		1.0		1.0		1.0	
ANALYTE	Result	Flag	Result	Flag	Result	Flag	Result	Flag	Result	Flag
ALUMINUM	37.0	U	89.7	B	37.4	B	544		37.0	U
ANTIMONY	2.1	U	2.1	U	2.0	U	2.1	U	2.1	U
ARSENIC	2.3	U	2.3	U	2.3	U	2.3	U	2.3	U
BARIUM	55.4	B	242	B	33.0	B	612	B	40	B
BERYLLIUM	0.20	U	0.20	U	0.20	U	0.20	U	0.20	U
CADMIUM	0.31	B	0.20	U	0.20	U	0.50	B	0.20	U
CALCIUM	17100		16900		15800		12200		15400	
CHROMIUM	0.70	B	2.42		1.62		0.91	B	2.2	B
COBALT	0.50	U	1.0	B	0.63	B	1.9	B	0.60	B
COPPER	5.32		2.2	B	1.9	B	2.3	B	1.5	B
IRON	94.6	B	528		411		34.9	B	14.3	U
LEAD	5.6		13	U	7.5	U	2	U	13	U
MAGNESIUM	5680		7330		6010		6840		8580	
MANGANESE	9.0	B	151		30.2		754		9.2	B
MERCURY	0.10	U	0.10	U	0.10	U	0.10	U	0.10	U
NICKEL	0.98	B	17.5	B	8.5	B	4.5	B	6.7	B
POTASSIUM	2220	B	1290	B	1460	B	1040	B	1710	B
SELENIUM	3.7	B	2.2	U	2.2	U	2.2	U	2.2	U
SILVER	0.60	U	0.60	U	0.60	U	0.60	U	0.60	U
SODIUM	19600		21800		22200		33400		22600	
THALLIUM	3.2	U	3.2	U	3.2	U	3.2	U	3.2	U
VANADIUM	0.40	U	1.2	B	0.40	U	0.40	U	0.40	U
ZINC	16.7	B	209		109		231		0.80	U
CYANIDE	N/A		N/A		N/A		N/A		N/A	

Case #: 27964 SDG : MB026J
Site : MACKENZIE CHEMICAL
Lab. : LIBRTY
Reviewer :
Date :

Sample Number :	MB027K		MB027N		MB027P		MB027Y		MB027Z	
Sampling Location :	OS-3S		TRIP3		MCMW-1		OS05D		MW-10	
Matrix :	Water		Water		Water		Water		Water	
Units :	ug/L		ug/L		ug/L		ug/L		ug/L	
Date Sampled :	04/13/2000		04/13/2000		04/14/2000		04/10/2000		04/10/2000	
Time Sampled :	17:30		17:15		12:00		18:45		18:45	
%Solids :	0.0		0.0		0.0		0.0		0.0	
Dilution Factor :	1.0		1.0		1.0		1.0		1.0	
ANALYTE	Result	Flag	Result	Flag	Result	Flag	Result	Flag	Result	Flag
ALUMINUM	318		37.0	U	37.0	U	37.0	U	37.0	U
ANTIMONY	2.1	U	2.1	U	2.1	U	2.1	U	2.1	U
ARSENIC	2.3	U	2.3	U	2.3	U	2.3	U	2.3	U
BARIUM	39.8	B	0.21	B	30.5	B	4.11	B	20.2	B
BERYLLIUM	0.20	U	0.20	U	0.20	U	0.20	U	0.20	U
CADMIUM	1.7	B	0.20	U	0.23	B	0.20	U	0.20	U
CALCIUM	25900		10.9	U	13600		16400		15600	
CHROMIUM	6.5	B	0.40	U	2.1	B	0.7	B	1.3	B
COBALT	36.8	B	0.50	U	0.50	U	0.50	U	0.50	U
COPPER	11.7	B	1.5	B	2.5	B	2.1	B	2.5	B
IRON	89.4	B	14.3	U	52.7	B	78.1	B	88.2	B
LEAD	1.3	U	1.3	U	1.3	U	1.3	U	1.3	U
MAGNESIUM	2090	B	6.3	U	2650	B	7280		6890	
MANGANESE	2220		0.76	B	181	B	7.6	B	6.5	B
MERCURY	0.10	U	0.10	U	0.10	U	0.10	U	0.10	U
NICKEL	15.8	B	0.70	U	2.8	B	7.2	B	6.6	B
POTASSIUM	4700	B	26.5	U	5060	J	1120	B	1070	B
SELENIUM	2.2	U	2.2	U	3.1	B	12.2	U	2.2	U
SILVER	0.60	U	0.60	U	0.60	U	0.60	U	0.60	U
SODIUM	17000		500	U	14400		23700		22800	
THALLIUM	3.2	U	3.2	U	3.2	U	3.2	U	3.2	U
VANADIUM	0.40	U	0.40	U	0.40	U	0.40	U	0.40	U
ZINC	60.8		0.80	U	4.0	B	167		160	
CYANIDE	N/A		N/A		N/A		N/A		N/A	

Case #: 27964 SDG : MB026J

Site : MACKENZIE CHEMICAL

Lab. : LIBRTY

Reviewer :

Date :

Sample Number :	MB0280		MB0284		MB0285		MB0286		IDL	
Sampling Location :	TR#2		RINSATEBLANK		OS-3D		OS-2A			
Matrix :	Water		Water		Water		Water		Water	
Units :	ug/L		ug/L		ug/L		ug/L		ug/L	
Date Sampled :	04/12/2000		04/10/2000		04/13/2000		04/12/2000			
Time Sampled :	18:35				18:30		15:15			
%Solids :	0.0		0.0		0.0		0.0			
Dilution Factor :	1.0		1.0		1.0		1.0			
ANALYTE	Result	Flag	Result	Flag	Result	Flag	Result	Flag	Result	Flag
ALUMINUM	37.0	U	37.0	U	397		37.0	U	37.0	
ANTIMONY	2.1	U	2.1	U	2.1	U	2.1	U	2.1	
ARSENIC	2.3	U	2.3	U	2.3	U	2.3	U	2.3	
BARIUM	0.27	B	0.24	B	71.8	B	52.0	B	0.10	
BERYLLIUM	0.20	U	0.20	U	0.29	B	0.20	U	0.20	
CADMIUM	0.20	U	0.20	U	0.50	B	0.46	B	0.20	
CALCIUM	13.5	B	10.9	U	14200		14600		10.9	
CHROMIUM	0.40	U	0.40	U	30.1		2.3	B	0.40	
COBALT	0.50	U	0.50	U	6.0	B	0.50	U	0.50	
COPPER	0.60	U	1.2	B	3.4	B	2.0	B	0.60	
IRON	14.3	U	14.3	U	574		15.7	B	14.3	
LEAD	1.3	U	1.3	U	1.3	U	1.3	U	1.3	
MAGNESIUM	6.3	U	6.3	U	6420		2720	B	6.3	
MANGANESE	0.33	B	0.23	B	535		292		0.20	
MERCURY	0.10	U	0.10	U	0.10	U	0.10	U	0.10	
NICKEL	0.70	U	0.70	U	30.4	B	5.0	B	0.70	
POTASSIUM	33.5	B	26.5	U	1360	B	2850	B	26.5	
SELENIUM	2.2	U	2.2	U	2.2	U	2.2	U	2.2	
SILVER	0.65	B	0.60	U	0.60	U	0.60	U	0.60	
SODIUM	300	U	300	U	24500		14200		300	
THALLIUM	3.2	U	3.2	U	3.2	U	3.2	U	3.2	
VANADIUM	0.40	U	0.40	U	0.71	B	0.40	U	0.40	
ZINC	0.80	U	0.80	U	25.7		207		0.80	
CYANIDE	N/A		N/A		N/A		N/A		N/A	

APPENDIX G

Off-Site Manhole Sampling Analytical Results

APPENDIX G
Manhole Soil Sample
Metals Analytical Results
Mackenzie Chemical

Metals - mg/kg	Manhole Sample	CONCENTRATIONS OF CONCERN[1]	
		RSCO[A]	EUS BG[B]
Aluminum	2,390	SB[2]	33,000
Antimony	<8.0	SB	NA[3]
Arsenic	2,180	7.5 or SB	3 - 12
Barium	<26.7	300 or SB	15 - 600
Beryllium	<0.67	0.16 or SB	0 - 1.75
Cadmium	<0.67	10	0.1 - 1
Calcium	1,360	SB	130 - 35,000
Chromium	6.8	50	1.5 - 40
Cobalt	6.9	30 or SB	2.5 - 60
Copper	23.7	25 or SB	1 - 50
Iron	5,050	2,000 or SB	2,000 - 550,00
Lead	21.0	*	200 - 500
Magnesium	851	SB	100 - 5,000
Manganese	41.5	SB	50 - 5,000
Mercury	<0.10	0.1	0.001 - 0.2
Nickel	7.4	13 or SB	0.5 - 25
Potassium	147	SB	8,500 - 43,000
Selenium	<0.67	2 or SB	0.1 - 3.9
Silver	<1.3	SB	NA
Sodium	51.5	SB	6,000 - 8,000
Thallium	<1.3	SB	NA
Vanadium	29.4	150 or SB	1 - 300
Zinc	66.7	20 or SB	9 - 50

NOTES:

[1] Concentrations of Concern - Values based on NYSDEC TAGM - Recommended Soil Cleanup Objectives, HWR-94-4046, Revised 4/95 and other indicated documents.

[A] RSCO - Recommended Soil Cleanup Objective

[B] EUS BG - Eastern USA Background

[2] SB - Site Background.

[3] NA - Indicates Recommended Soil Cleanup Objective was not available.

* Background levels for lead vary widely. Average background levels in metropolitan or suburban areas near highways are much higher and typically range from 200-500 ppm. The USEPA's Interim Lead Hazard Guidance (July 14, 1994) establishes a resedential screeening level of 400ppm.

H2M LABS INC.
575 Broad Hollow Road, Me[lv]ille, N.Y. 11747
(516)694-3040 FAX:(516)4[illegible]36 NYSDOH ID# 10478

LAB NO: 9926804

MACKENSIE CHEMICAL
1 CORDELLO AVE.
CENTRAL ISLIP, NY 11722

TYPE..... SOIL
ROUTINE
METHOD.... GRAB

DATE COLLECTED. 09/09/99
TIME COLLECTED. 1330 HRS.
DATE RECEIVED.. 09/09/99
COLLECTED BY... MPE03
PROJECT NO..... DECS9801

POINT NO:
LOCATION: MANHOLE SOIL

REMARKS:

PARAMETER (S)	RESULTS	UNITS
SILVER	<1.3	mg/kg
ALUMINUM	2390	mg/kg
ARSENIC	2180	mg/kg
BARIUM	<26.7	mg/kg
BERYLLIUM	<0.67	mg/kg
CALCIUM	1360	mg/kg
CADMIUM	<0.67	mg/kg
COBALT	6.9	mg/kg
CHROMIUM	6.8	mg/kg
COPPER	23.7	mg/kg
IRON	5050	mg/kg
MERCURY	<0.10	mg/kg
POTASSIUM	147	mg/kg
MAGNESIUM	851	mg/kg
MANGANESE	41.5	mg/kg
SODIUM	51.5	mg/kg
NICKEL	7.4	mg/kg
LEAD	21.0	mg/kg
ANTIMONY	<8.0	mg/kg
SELENIUM	<0.67	mg/kg
THALLIUM	<1.3	mg/kg
TOTAL SOLIDS	74.8	%
VANADIUM	29.4	mg/kg
ZINC	66.7	mg/kg

COPIES TO: MPE/MNG

DATE ISSUED 09/27/9[illegible]

J M Slavin LABORATORY DIRECTOR

ORIGINAL

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LAB NO: 9926804

MACKENSIE CHEMICAL
1 CORDELLO AVE.
CENTRAL ISLIP, NY 11722

TYPE..... SOIL
ROUTINE
METHOD.... GRAB

DATE COLLECTED. 09/09/99
TIME COLLECTED. 1330 HRS.
DATE RECEIVED.. 09/09/99
COLLECTED BY... MPE03
PROJECT NO..... DECS9801

POINT NO:
LOCATION: MANHOLE SOIL

REMARKS:

VOLATILE ORGANIC (METHOD 8021) - (ug/kg)

PARAMETER (S)	RESULT	PARAMETER (S)	RESULT
DICHLORODIFLUOROMETHANE	<1	4-CHLOROTOLUENE	<1
CHLOROMETHANE	<1	M-DICHLOROBENZENE	<1
VINYL CHLORIDE	<1	P-DICHLOROBENZENE	<1
BROMOMETHANE	<1	O-DICHLOROBENZENE	<1
CHLOROETHANE	<1	1,2,4-TRICHLOROBENZENE	<1
FLUOROTRICHLOROMETHANE	<1	HEXACHLOROBUTADIENE	<1
1,1-DICHLOROETHENE	<1	1,2,3-TRICHLOROBENZENE	<1
METHYLENE CHLORIDE	<1	BENZENE	<1
TRANS-1,2-DICHLOROETHENE	<1	TOLUENE	<1
1,1-DICHLOROETHANE	<1	ETHYLBENZENE	<1
CIS-1,2-DICHLOROETHENE	<1	1,3-XYLENE	<1
2,2-DICHLOROPROPANE	<1	1,4-XYLENE	<1
BROMOCHLOROMETHANE	<1	1,2-XYLENE	<1
CHLOROFORM	<1	STYRENE	<1
1,1,1-TRICHLOROETHANE	<1	ISOPROPYLBENZENE (CUMENE)	<1
CARBON TETRACHLORIDE	<1	N-PROPYLBENZENE	<1
1,1-DICHLOROPROPENE	<1	1,3,5-TRIMETHYLBENZENE	<1
1,2-DICHLOROETHANE	<1	TERT-BUTYLBENZENE	<1
TRICHLOROETHENE	<1	1,2,4-TRIMETHYLBENZENE	<1
1,2-DICHLOROPROPANE	<1	SEC-BUTYLBENZENE	<1
DIBROMOMETHANE	<1	P-ISOPROPYLTOLUENE	<1
BROMODICHLOROMETHANE	<1	N-BUTYLBENZENE	<1
1,1,2-TRICHLOROETHANE	<1	NAPHTHALENE	<1
TETRACHLOROETHENE	<1	1,2-DIBROMO-3-CHL.PROPANE	<1
1,3-DICHLOROPROPANE	<1	1,2-DIBROMOETHANE	<1
CHLORODIBROMOMETHANE	<1		
CHLOROBENZENE	<1		
1,1,1,2-TETRACHLOROETHANE	<1		
BROMOFORM	<1		
BROMOBENZENE	<1		
1,1,2,2-TETRACHLOROETHANE	<1		
1,2,3-TRICHLOROPROPANE	<1		
2-CHLOROTOLUENE	<1		

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DATE ISSUED 09/27/99

DATE RUN..... 09/10/99
DATE REPORTED.. 09/24/99

LABORATORY DIRECTOR

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LAB NO: 9926804

MACKENSIE CHEMICAL
1 CORDELLO AVE.
CENTRAL ISLIP, NY 11722

TYPE..... SOIL
ROUTINE
METHOD.... GRAB

DATE COLLECTED. 09/09/99
TIME COLLECTED. 1330 HRS.
DATE RECEIVED.. 09/09/99
COLLECTED BY... MPE03
PROJECT NO..... DECS9801

POINT NO:
LOCATION: MANHOLE SOIL

REMARKS:

TCL SEMI-VOLATILE ORGANICS - (ug/kg)

PARAMETER (S)	RESULT	PARAMETER (S)	RESULT
1,3-DICHLOROBENZENE	<200	BIS(2ETHYLHEXYL)PHTHALATE	<200
1,4-DICHLOROBENZENE	<200	CHRYSENE	<200
HEXACHLOROETHANE	<200	BENZO(A)ANTHRACENE	<200
BIS(2-CHLOROETHYL)ETHER	<200	3,3-DICHLOROBENZIDINE	<200
1,2-DICHLOROBENZENE	<200	DI-N-OCTYL PHTHALATE	<200
2,2-OXYBIS(1-CHL.PROPANE)	<200	BENZO(B)FLUORANTHENE	<200
N-NITROSO-DI-N-PROPYLAMIN	<200	BENZO(K)FLUORANTHENE	<200
NITROBENZENE	<200	BENZO(A)PYRENE	<200
HEXACHLOROBUTADIENE	<200	INDENO(1,2,3-C,D)PYRENE	<200
1,2,4-TRICHLOROBENZENE	<200	DIBENZO(A,H)ANTHRACENE	<200
ISOPHORONE	<200	BENZO (G,H,I)PERYLENE	<200
NAPHTHALENE	<200	2-CHLOROPHENOL	<200
BIS(2-CHL.ETHOXY)METHANE	<200	2-NITROPHENOL	<200
CARBAZOLE	<200	PHENOL	<200
HEXACHLOROCYCLOPENTADIENE	<200	2,4-DIMETHYLPHENOL	<200
2-CHLORONAPHTHALENE	<200	2,4-DICHLOROPHENOL	<200
ACENAPHTHYLENE	<200	2,4,6-TRICHLOROPHENOL	<200
ACENAPHTHENE	<200	4-CHLORO-3-METHYLPHENOL	<200
DIMETHYLPHTHALATE	<200	2,4-DINITROPHENOL	<500
2,6-DINITROTOLUENE	<200	2-METH.-4,6-DINITROPHENOL	<500
FLUORENE	<200	PENTACHLOROPHENOL	<500
4-CHL.PHENYL PHENYLETHER	<200	4-NITROPHENOL	<500
2,4-DINITROTOLUENE	<200	2-METHYLPHENOL	<200
DIETHYL PHTHALATE	<200	2,4,5-TRICHLOROPHENOL	<500
N-NITROSODIPHENYLAMINE	<200	4-METHYLPHENOL	<200
HEXACHLOROBENZENE	<200	4-CHLOROANILINE	<200
4-BROMOPHENYLPHENYLETHER	<200	2-METHYLNAPHTHALENE	<200
PHENANTHRENE	<200	2-NITROANILINE	<500
ANTHRACENE	<200	3-NITROANILINE	<500
DI-N-BUTYL PHTHALATE	<200	DIBENZOFURAN	<200
FLUORANTHENE	<200	4-NITROANILINE	<500
PYRENE	<200		
BUTYL BENZYL PHTHALATE	<200		

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DATE ISSUED 09/27/99

DATE EXTRACTED. 09/10/99
DATE RUN..... 09/20/99
DATE REPORTED.. 09/21/99

J M Slavin LABORATORY DIRECTOR

ORIGINAL

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(516)694-3040 FAX:(516)420-L NYSDOH ID# 10478

LAB NO: 9926803

MACKENSIE CHEMICAL
1 CORDELLO AVE.
CENTRAL ISLIP, NY 11722

TYPE..... GROUND WATER
ROUTINE

DATE COLLECTED. 09/09/99
TIME COLLECTED. 1300 HRS.
DATE RECEIVED.. 09/09/99
COLLECTED BY... MPE03
PROJECT NO..... DECS9801

POINT NO:
LOCATION: MANHOLE LIQUID

REMARKS:

VOLATILE ORGANIC (METHOD 8021) - (ug/l)

PARAMETER (S)	RESULT	PARAMETER (S)	RESULT
DICHLORODIFLUOROMETHANE	<1	4-CHLOROTOLUENE	<1
CHLOROMETHANE	<1	M-DICHLOROBENZENE	<1
VINYL CHLORIDE	<1	P-DICHLOROBENZENE	<1
BROMOMETHANE	<1	O-DICHLOROBENZENE	<1
CHLOROETHANE	<1	1,2,4-TRICHLOROBENZENE	<1
FLUOROTRICHLOROMETHANE	<1	HEXACHLOROBUTADIENE	<1
1,1-DICHLOROETHENE	<1	1,2,3-TRICHLOROBENZENE	<1
METHYLENE CHLORIDE	<1	BENZENE	<1
TRANS-1,2-DICHLOROETHENE	<1	TOLUENE	<1
1,1-DICHLOROETHANE	<1	ETHYLBENZENE	<1
CIS-1,2-DICHLOROETHENE	<1	1,3-XYLENE	<1
2,2-DICHLOROPROPANE	<1	1,4-XYLENE	<1
BROMOCHLOROMETHANE	<1	1,2-XYLENE	<1
CHLOROFORM	<1	STYRENE	<1
1,1,1-TRICHLOROETHANE	<1	ISOPROPYLBENZENE (CUMENE)	<1
CARBON TETRACHLORIDE	<1	N-PROPYLBENZENE	<1
1,1-DICHLOROPROPENE	<1	1,3,5-TRIMETHYLBENZENE	<1
1,2-DICHLOROETHANE	<1	TERT-BUTYLBENZENE	<1
TRICHLOROETHENE	<1	1,2,4-TRIMETHYLBENZENE	<1
1,2-DICHLOROPROPANE	<1	SEC-BUTYLBENZENE	<1
DIBROMOMETHANE	<1	P-ISOPROPYLTOLUENE	<1
BROMODICHLOROMETHANE	<1	N-BUTYLBENZENE	<1
1,1,2-TRICHLOROETHANE	<1	NAPHTHALENE	<1
TETRACHLOROETHENE	<1	1,2-DIBROMO-3-CHL.PROPANE	<1
1,3-DICHLOROPROPANE	<1	1,2-DIBROMOETHANE	<1
CHLORODIBROMOMETHANE	<1		
CHLOROBENZENE	<1		
1,1,1,2-TETRACHLOROETHANE	<1		
BROMOFORM	<1		
BROMOBENZENE	<1		
1,1,2,2-TETRACHLOROETHANE	<1		
1,2,3-TRICHLOROPROPANE	<1		
2-CHLOROTOLUENE	<1		

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DATE ISSUED 09/14/9

DATE RUN..... 09/14/99
DATE REPORTED.. 09/14/99

ORIGINAL

LABORATORY DIRECTOR

APPENDIX H

Drummed Waste Lagoon Sludge
Waste Characterization Analytical Results
And Disposal Manifests

H2M LABS, INC.
575 Broad Hollow Road, Melville, N.Y. 11747
(516)694-3040 FAX.(516)420-8436 NYS ID# 10478

LAB NO: 9912050

MACKENSIE CHEMICAL
1 CORDELLO AVE.
CENTRAL ISLIP, NY 11722

TYPE..... SLUDGE
ROUTINE
METHOD.... GRAB

DATE COLLECTED. 04/30/99
TIME COLLECTED. 1500 HRS.
DATE RECEIVED.. 04/30/99
COLLECTED BY... MNG03
PROJECT NO..... DECS9801

POINT NO:
LOCATION: DRUM

REMARKS: MACKENZIE CHEMICAL

PARAMETER (S)	RESULTS	UNITS
% MOISTURE	56.6	%
SILVER	<2.3	mg/kg
ARSENIC	<2.3	mg/kg
BARIUM	48.4	mg/kg
CADMIUM	<1.2	mg/kg
CHROMIUM	25.3	mg/kg
COPPER	30.0	mg/kg
FLASH POINT	>60	°C
MERCURY	1.2	mg/kg
NICKEL	<9.2	mg/kg
LEAD	104	mg/kg
PETROLEUM HYDROCARBON(IR)	573	mg/kg
PH (CORROS.)	6.0	units
SELENIUM	<1.2	mg/kg
TOTAL ORGANIC HALIDES/TOX	38	mg/kg
TOTAL SOLIDS	43.4	%
ZINC	157	mg/kg

COPIES TO: MNG

DATE ISSUED 05/25/99

LABORATORY DIRECTOR

ORIGINAL

H2M LABS, INC.
575 Broad Hollow Road, Melville, N.Y. 11747
(516)694-3040 FAX:(516)420-8436 NYSLOH ID# 10478

LAB NO: 9912050

MACKENSIE CHEMICAL
1 CORDELLO AVE.
CENTRAL ISLIP, NY 11722

TYPE..... SLUDGE
ROUTINE
METHOD.... GRAB

DATE COLLECTED. 04/30/99
TIME COLLECTED. 1500 HRS.
DATE RECEIVED.. 04/30/99
COLLECTED BY... MNG03
PROJECT NO..... DECS9801

POINT NO:
LOCATION: DRUM

REMARKS: MACKENZIE CHEMICAL

TCL SEMI-VOLATILE ORGANICS - (ug/kg)

PARAMETER (S)	RESULT	PARAMETER (S)	RESULT
1,3-DICHLOROBENZENE	<1500	BIS(2ETHYLHEXYL)PHTHALATE	<1500
1,4-DICHLOROBENZENE	<1500	CHRYSENE	6500
HEXACHLOROETHANE	<1500	BENZO(A)ANTHRACENE	6200
BIS(2-CHLOROETHYL)ETHER	<1500	3,3-DICHLOROBENZIDINE	<1500
1,2-DICHLOROBENZENE	<1500	DI-N-OCTYL PHTHALATE	<1500
2,2-OXYBIS(1-CHL.PROPANE)	<1500	BENZO(B)FLUORANTHENE	9100
N-NITROSO-DI-N-PROPYLAMIN	<1500	BENZO(K)FLUORANTHENE	3400
NITROBENZENE	<1500	BENZO(A)PYRENE	6300
HEXACHLOROBUTADIENE	<1500	INDENO(1,2,3-C,D)PYRENE	2500
1,2,4-TRICHLOROBENZENE	<1500	DIBENZO(A,H)ANTHRACENE	<1500
ISOPHORONE	<1500	BENZO (G,H,I)PERYLENE	2100
NAPHTHALENE	3000	2-CHLOROPHENOL	<1500
BIS(2-CHL.ETHOXY)METHANE	<1500	2-NITROPHENOL	<1500
CARBAZOLE	<1500	PHENOL	<1500
HEXACHLOROCYCLOPENTADIENE	<1500	2,4-DIMETHYLPHENOL	<1500
2-CHLORONAPHTHALENE	<1500	2,4-DICHLOROPHENOL	<1500
ACENAPHTHYLENE	<1500	2,4,6-TRICHLOROPHENOL	<1500
ACENAPHTHENE	2800	4-CHLORO-3-METHYLPHENOL	<1500
DIMETHYLPHTHALATE	<1500	2,4-DINITROPHENOL	<3800
2,6-DINITROTOLUENE	<1500	2-METH.-4,6-DINITROPHENOL	<3800
FLUORENE	6500	PENTACHLOROPHENOL	<3800
4-CHL.PHENYL PHENYLETHER	<1500	4-NITROPHENOL	<3800
2,4-DINITROTOLUENE	<1500	2-METHYLPHENOL	<1500
DIETHYL PHTHALATE	<1500	2,4,5-TRICHLOROPHENOL	<3800
N-NITROSODIPHENYLAMINE	<1500	4-METHYLPHENOL	<1500
HEXACHLOROBENZENE	<1500	4-CHLOROANILINE	<1500
4-BROMOPHENYLPHENYLETHER	<1500	2-METHYLNAPHTHALENE	7000
PHENANTHRENE	15000	2-NITROANILINE	<3800
ANTHRACENE	4800	3-NITROANILINE	<3800
DI-N-BUTYL PHTHALATE	<1500	DIBENZOFURAN	2000
FLUORANTHENE	15000	4-NITROANILINE	<3800
PYRENE	8500		
BUTYL BENZYL PHTHALATE	<1500		

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DATE ISSUED 05/25/99

DATE EXTRACTED. 05/03/99
DATE RUN..... 05/07/99
DATE REPORTED.. 05/25/99

J M Slavin
LABORATORY DIRECTOR

ORIGINAL

H2M LABS, INC.
575 Broad Hollow Road, Melville, N.Y. 11747
(516)[illegible]-3040 FAX:(516)420-84[illegible] NYSDOH ID# 10478

LAB NO: 9912050

MACKENSIE CHEMICAL
1 CORDELLO AVE.
CENTRAL ISLIP, NY 11722

TYPE..... SLUDGE
ROUTINE
METHOD.... GRAB

DATE COLLECTED. 04/30/99
TIME COLLECTED. 1500 HRS.
DATE RECEIVED.. 04/30/99
COLLECTED BY... MNG03
PROJECT NO..... DECS9801

POINT NO:
LOCATION: DRUM

REMARKS: MACKENZIE CHEMICAL

PCB'S - (ug/kg)

PARAMETER (S)	RESULT	PARAMETER (S)	RESULT
AROCLOR 1016	<33		
AROCLOR 1221	<66		
AROCLOR 1232	<33		
AROCLOR 1242	<33		
AROCLOR 1248	<33		
AROCLOR 1254	<33		
AROCLOR 1260	<33		

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DATE ISSUED 05/25/99

DATE EXTRACTED. 05/03/99
DATE RUN..... 05/12/99
DATE REPORTED.. 05/13/99

J M Slavin
LABORATORY DIRECTOR

ORIGINAL

THERMAL LABS, INC.
575 Broad Hollow Road, Melville, N.Y. 11747
(516)694 3040 FAX:(516)420 8[illegible] NYSDOH ID# 10478

LAB NO: 9912050

MACKENSIE CHEMICAL
1 CORDELLO AVE.
CENTRAL ISLIP, NY 11722

TYPE..... SLUDGE
ROUTINE
METHOD.... GRAB

DATE COLLECTED. 04/30/99
TIME COLLECTED. 1500 HRS.
DATE RECEIVED.. 04/30/99
COLLECTED BY... MNG03
PROJECT NO..... DECS9801

POINT NO:
LOCATION: DRUM

REMARKS: MACKENZIE CHEMICAL

TCL PURGEABLE ORGANICS - (ug/kg)

PARAMETER (S)	RESULT	PARAMETER (S)	RESULT
CHLOROMETHANE	<23		
BROMOMETHANE	<23		
VINYL CHLORIDE	<23		
CHLOROETHANE	<23		
METHYLENE CHLORIDE	<23		
1,1-DICHLOROETHENE	<23		
1,1-DICHLOROETHANE	<23		
TOTAL-1,2-DICHLOROETHENE	<23		
CHLOROFORM	<23		
1,2-DICHLOROETHANE	<23		
1,1,1-TRICHLOROETHANE	<23		
CARBON TETRACHLORIDE	<23		
BROMODICHLOROMETHANE	<23		
1,2-DICHLOROPROPANE	<23		
TRANS-1,3-DICHLOROPROPENE	<23		
TRICHLOROETHENE	<23		
DIBROMOCHLOROMETHANE	<23		
1,1,2-TRICHLOROETHANE	<23		
CIS-1,3-DICHLOROPROPENE	<23		
BENZENE	<23		
BROMOFORM	<23		
1,1,2,2-TETRACHLOROETHANE	<23		
TETRACHLOROETHENE	<23		
TOLUENE	67		
CHLOROBENZENE	<23		
ETHYLBENZENE	208		
XYLENES (TOTAL)	590		
ACETONE	<23		
2-BUTANONE (MEK)	<23		
4-METHYL-2PENTANONE(MIBK)	<23		
CARBON DISULFIDE	<23		
2-HEXANONE	<23		
STYRENE	<23		

COPIES TO: MNG

DATE ISSUED 05/25/99

DATE RUN..... 05/03/99
DATE REPORTED.. 05/11/99

ORIGINAL

J M Slavin
LABORATORY DIRECTOR

H2M LABS, INC.

Environmental and Industrial Analytical Laboratory

575 Broad Hollow Road, Melville, NY 11747-5076
(516) 694-3040 • FAX: 516-420-8436

NYSDOH ID# 10478

MACKENSIE CHEMICAL
ONE CORDELLLO AVE.
CENTRAL ISLIP NY 11722

LAB NO.: 9912050

TYPE: SLUDGE

METHOD: GRAB

LOCATION: DRUM

DATE COLLECTED: 4/30/99
DATE RECEIVED: 4/30/99
COLLECTED BY: MNG03
PROJECT NO. DEC9801

REACTIVITY

REACTIVE TO WATER:	NO
RELEASES CYANIDE:	NO <100 mg/kg
RELEASES SULFIDE:	NO <100 mg/kg

DATE ISSUED 5/25/99

LABORATORY DIRECTOR

NON-HAZARDOUS WASTE MANIFEST

1. Generator's US EPA ID No.

Manifest Document No. 10465

2. Page 1 of 1

GENERATOR

3. Generator's Name and Mailing Address

Mackenzie Chemical
1 Cordello Ave, Centreal Islip NY

4. Generator's Phone ( )

5. Transporter 1 Company Name: Environmental Services Inc

6. US EPA ID Number

A. Transporter's Phone: (516) 395-9888

7. Transporter 2 Company Name

8. US EPA ID Number

B. Transporter's Phone

9. Designated Facility Name and Site Address
Clean Water of New York
3249 Richmond Terrace
Staten Island NY

10. US EPA ID Number

C. Facility's Phone: (718) 981-4600

11. Waste Shipping Name and Description	12. Containers No.	12. Containers Type	13. Total Quantity	14. Unit Wt/Vol
a. N012 Oil Sludge	012	DM	660	G
b.				
c.				
d.				

D. Additional Descriptions for Materials Listed Above

See Analytical

E. Handling Codes for Wastes Listed Above

15. Special Handling Instructions and Additional Information

For Emergencies Call: Chemtrec 1 (800) 424-9300

TRANSPORTER

16. **GENERATOR'S CERTIFICATION:** I certify the materials described above on this manifest are not subject to federal regulations for reporting proper disposal of Hazardous Waste.

Printed/Typed Name	Signature	Month	Day	Year
Joseph Parisi Agent for Hann		06	14	99

17. Transporter 1 Acknowledgement of Receipt of Materials

Printed/Typed Name	Signature	Month	Day	Year
Joseph Parisi		06	14	99

18. Transporter 2 Acknowledgement of Receipt of Materials

Printed/Typed Name	Signature	Month	Day	Year

FACILITY

19. Discrepancy Indication Space

Meets EPA Regs For Non-Haz Waste

20. Facility Owner or Operator: Certification of receipt of waste materials covered by this manifest except as noted in Item 19.

Printed/Typed Name	Signature	Month	Day	Year
		06	15	99

ORIGINAL – RETURN TO GENERATOR

APPENDIX I

ARARs

TABLE A-1

Chemical-Specific ARARs for Groundwater Cleanup Criteria [1]

Compound	Class GA Groundwater Quality Standards [2]	NYS Drinking Water (MCLs) Standards [3]	Minimum ARAR-Based Groundwater Cleanup Criteria
Methylene Chloride	5	5	5
Chloroform	7	50	7
1,1,1-Trichloroethane	5	5	5
Trichloroethene	5	5	5
1,2-Dichloropropane	1	5	1
Tetrachloroethylene	5	5	5
1,2,3-Trichloropropane	0.04	5	0.04
Toluene	5	5	5
Ethylbenzene	5	5	5
M&P-Xylene	5	5	5
O-Xylene	5	5	5

(1) Micrograms per liter

(2) 6 NYCRR 703.5

(3) 10 NYCRR 5-1.52.

NR Not Regulated.

TABLE A-2

Chemical-Specific ARARs for Groundwater Discharge Criteria [1]

Compound	Class GA Groundwater Quality Standards [1]	NYS Drinking Water MCLs) Standards [2]	Groundwater Effluent Standards Class GA [3]	Minimum ARAR-Based Groundwater Cleanup Criteria
Methylene Chloride	5	5	5	5
Chloroform	7	50	7	7
1,1,1-Trichloroethane	5	5	NR	5
Trichloroethene	5	5	5	5
1,2-Dichloropropane	1	5	1	1
Tetrachloroethylene	5	5	NR	5
1,2,3-Trichloropropane	0.04	5	0.04	0.04
Toluene	5	5	NR	5
Ethylbenzene	5	5	NR	5
M&P-Xylene	5	5	NR	5
O-Xylene	5	5	NR	5

(1) Micrograms per liter

(2) 6 NYCRR 703.6.

(3) 6 NYCRR 702.16.

(4) No standard is available for Total 1,2-Dichloroethane. The standard of 5 ug/l is for cis-1,2-Dichloroethane, and trans-1,2-Dichloroethane.

NR Not Regulated.

P Principle Organic Compound; each cannot exceed 5 ug/l.

U Unspecified Organic Compound; each cannot exceed 50 ug/l.

NDx Not detected at or above x.

TABLE A-3

New York State Draft Guidelines for Air Emissions [1]

Compound	Short-Term Guideline Concentration	Annual Guideline Concentration
Methylene Chloride	22,000	770
Chloroform	150	0.043
1,1,1-Trichloroethane	NR	NR
Trichloroethene	54,000	0.45
1,2-Dichloropropane	NR	0.038
Tetrachloroethylene	1,000	1
1,2,3-Trichloropropane	NR	140
Toluene	37,000	400
Ethylbenzene	54,000	1,000
M&P-Xylene	4,300	700
O-Xylene	4,300	700

[1] grams per cubic meter.

NYSDEC Air Guide-1, April 4, 1994.

NR Not Regulated.

Table A-4
Chemical-Specific SCGs for Soil

Compound	NYSDEC[1] RSCOs (ug/kg)
VOCs	
Methylene Chloride	100
Chloroform	300
1,1,1-Trichloroethane	800
Trichloroethene	700
1,2-Dichloropropane	NA
Tetrachloroethylene	1,400
1,2,3-Trichloropropane	400
Toluene	1,500
Ethylbenzene	5,500
Xylene (Total)	1,200
SVOCs	
Benzo(a)anthracene	224 or MDL
Chrysene	400
Benzo(b)fluoranthene	224 or MDL
Benzo(k)fluoranthene	224 or MDL
Benzo(a)pyrene	61 or MDL
Indeno(1,2,3-cd)pyrene	3,200
Dibenzo(a,h)anthracene	14 or MDL

(1) NYSDEC Recommended Soil Cleanup Objectives and Cleanup Levels Division of Hazardous Waste Remediation - Technical and Adminstrative Guidance Memorandum (NYSDEC TAGM No. 92-4046, revised 4/95).