UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION 2
290 BROADWAY
NEW YORK, NY 10007-1866

Public Meeting
MacKenzie Chemical Works Superfund Site #152017
Central Islip, New York

AGENDA

Monday, March 3, 2003
7:00 P.M. - 9:00 P.M.

I. Welcome
Cecilia Echols
Community Involvement Coordinator
Community Affairs Branch

II. Overview of Superfund
Joel Singerman
Chief, Western New York Section
Superfund Remedial Branch

III. Results of the Remedial Investigation/
Feasibility Study/Remedial Alternatives
Mark Granger
Project Manager
Superfund Remedial Branch

IV. Proposed Plan of Cleanup
Mark Granger

V. Questions & Answers
Cecilia Echols

VI. Closing

MacKenzie Chemical Works Site

Town of Islip, New York

EPA

Region 2

January 2003

PURPOSE OF PROPOSED PLAN

This Proposed Plan describes the remedial alternatives considered for the contaminated soil and groundwater at the MacKenzie Chemical Works Superfund site, and identifies the preferred remedy with the rationale for this preference. The Proposed Plan was developed by the U.S. Environmental Protection Agency (EPA) in consultation with the New York State Department of Environmental Conservation (NYSDEC). EPA is issuing this Proposed Plan as part of its public participation responsibilities under Section 117(a) of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) of 1980, as amended, and Sections 300.430(f) and 300.435(c) of the National Oil and Hazardous Substances Pollution Contingency Plan (NCP). The alternatives summarized here are described in the August 2000 Remedial Investigation/Feasibility Study (RI/FS)[1] Report and the January 2003 RI/FS Report Addendum. EPA and the NYSDEC encourage the public to review these documents to gain a more comprehensive understanding of the site and Superfund activities that have been conducted at the site.

This Proposed Plan is being provided as a supplement to the RI/FS report and the RI/FS report addendum to inform the public of EPA's and NYSDEC's preferred remedy and to solicit public comments pertaining to all of the remedial alternatives evaluated, including the preferred soil and groundwater alternatives. EPA's preferred soil remedy consists of thermally-enhanced in-situ soil vapor extraction (ISVE)[2] for soils contaminated with volatile organic compounds (VOCs) and some limited excavation and off-site disposal for soils contaminated with semi-volatile organic compounds (SVOCs). EPA's preferred groundwater remedy involves treatment using in-situ air sparging with ozone injection[3].

Should the findings of design-phase studies indicate that thermally-enhanced ISVE would not be sufficiently effective in addressing the soils contaminated with volatile organics, then these soils would also be excavated and treated/disposed off-site. Similarly, should design-phase studies conclude that in-situ air sparging with ozone injection would not adequately address the contaminated groundwater, or if its implementation proves logistically impracticable, then the groundwater would be treated with a permeable reactive barrier[4].

The remedy described in this Proposed Plan is the preferred remedy for the site. Changes to the preferred remedy, or a change from the preferred remedy to another remedy, may be made if public comments or additional data indicate that such a change will result in a more appropriate remedial action. The final decision regarding the selected remedy will be made after EPA has taken into consideration all public comments. EPA is soliciting public comment on all of the alternatives considered in the Proposed Plan and in the detailed analysis sections of the RI/FS report and RI/FS report addendum because EPA and NYSDEC may select a remedy other than the preferred remedy.

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1 An RI/FS determines the nature and extent of the contamination at and emanating from a site and identifies and evaluates remedial alternatives.

2 Thermally-enhanced ISVE involves drawing heated air through a series of wells to volatilize the solvents in the soils. The extracted vapors are then treated.

3 In-situ air sparging with ozone injection involves injecting a mixture of air and ozone under pressure into the groundwater via wells to strip and treat the contaminants .

4 A permeable reactive barrier is a subsurface structure which allows groundwater to naturally flow through a permeable media which is capable of removing contaminants from the groundwater.

MARK YOUR CALENDAR

January 23, 2003 - February 21, 2003: Public comment period on the Proposed Plan.

February 18, 2003 at 7:00 p.m.: Public meeting at the Central Islip Public Library, 33 Hawthorne Avenue, Central Islip, New York 11722, (631) 234-9333.

COMMUNITY ROLE IN SELECTION PROCESS

EPA and NYSDEC rely on public input to ensure that the concerns of the community are considered in selecting an effective remedy for each Superfund site. To this end, the RI/FS report, RI/FS report addendum, and this Proposed Plan have been made available to the public for a public comment period which begins on January 23, 2003 and concludes on February 21, 2003.

A public meeting will be held during the public comment period at the Central Islip Public Library on February 18, 2003 at 7:00 p.m. to present the conclusions of the RI/FS, to elaborate further on the reasons for recommending the preferred remedy, and to receive public comments.

Comments received at the public meeting, as well as written comments, will be documented in the Responsiveness Summary Section of the Record of Decision (ROD), the document which formalizes the selection of the remedy.

Copies of the Proposed Plan and supporting documentation are available at the following information repositories:

Central Islip Public Library
33 Hawthorne Avenue
Central Islip, New York 11722
(631) 234-9333

Contact: Ms. Anne Pavlak, Director

Hours: Monday - Friday, 10:00-9:00
Saturday, 10:00-5:00
Sunday, 1:00-5:00

USEPA-Region II
Superfund Records Center
290 Broadway, 18th Floor
New York, New York 10007-1866
(212) 637-4308

Hours: Monday-Friday, 9:00-5:00

Written comments on this Proposed Plan should be addressed to:

Mark Granger, Project Manager
Central New York Remediation Section
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SCOPE AND ROLE OF ACTION

The primary objectives of this action are to remediate the source of contamination at the site, to reduce and minimize the downward migration of contaminants to the aquifer, and to minimize any potential future health and environmental impacts.

SITE BACKGROUND

Site Description

The site includes a parcel of property located at One Cordello Avenue, Central Islip, Suffolk County, New York in a residential/light commercial area. (See Figure 1 for a site location map.) The property, which contains three one-story block buildings (a former manufacturing building and two warehouses) and a two-story (structurally-unsound) block building (a former laboratory) encompasses approximately 1.4 acres and is currently occupied by a paving and excavation firm. The property is bounded to the north by the Long Island Rail Road and commercial properties, to the east by a residential property and an abandoned parking lot, to the south by Railroad Avenue and residential properties, and to the west by Cordello Avenue and vacant land. (See Figure 2 for a property layout map.)

The local topography surrounding the site consists of relatively flat terrain with a very slight southerly downward slope (*i.e.*, a difference in elevation of approximately seventy feet over several miles). The Long Island Rail Road tracks immediately to the north produce a berm approximately two feet above the general ground surface of the property. The eastern half of the property is currently used for storage of construction materials, such as sand and fill. As these materials are stored on the property on a temporary basis, surface features of this nature change regularly. Subsurface features include two former concrete-lined waste lagoons backfilled with clean soils, at least one cesspool, and at least nine storm-water drywells.

The property, which has been used for industrial/commercial purposes since 1948, is presently zoned industrial; according to the Town of Islip Department of Planning and Development, it is not anticipated that the land use will change in the future.

Site Geology/Hydrogeology

The depth to groundwater is approximately fifty feet below ground surface (bgs). The only known private well near or downgradient of the property is located on a residential property that is hydrologically sidegradient. Sampling of this well has shown that it is not impacted by-related contaminants. The nearest municipal drinking water supply well is located approximately 3,500 feet southeast of the property (well beyond the contaminant plume) and is screened at a depth of 710 feet bgs.

There are three primary water-bearing aquifers underlying Suffolk County, comprising a federally-designated sole source of drinking water for Long Island. Therefore, groundwater in the vicinity of the site is a potential source of drinking water. Surficial geology is comprised of one to two feet of topsoil/fill underlain by the sand and gravel of the upper geologic unit. Typically, fill materials are encountered to a maximum depth of two feet bgs. Local groundwater flow at the site moves south to southeast. No surface water bodies exist at or near the site. There are no streams or stream-cut channels at or near the property. The nearest surface water bodies are Champlin Creek, which is located over a mile south of the property and the Connetquot River, which is located approximately two miles east of the property.

Property History

The property was used from approximately 1948 to 1987 for the manufacture of various chemical products by MacKenzie Chemical Works, Inc. (MCW), including fuel additives and metal acetylacetonates. Over the years of operation, the Suffolk County Department of Health Services (SCDHS) and the Suffolk County Fire Department documented poor housekeeping and operational procedures. According to SCDHS, MCW stored 1,2,3-trichloropropane (1,2,3-TCP) in three 10,000-gallon tanks on the property. Other potential historical waste sources include other storage tanks[5], leaking drums, two waste lagoons, a cesspool, and storm-water drywells. Spills, explosions, and fires have occurred at the facility, including a methyl ethyl ketone (MEK) spill in 1977, a nitrous oxide release in 1978, and an MEK fire in 1979. SCDHS fined MCW for the nitrous oxide release and ordered it to perform a general property cleanup, including the excavation and drumming of stained surface soils. This effort was completed in 1979.

An assessment was conducted in 1983 by EPA, which recommended that action be taken at the property. Subsequently, MCW arranged for the disposal of thirty-three drums of stained surface soils (from the 1979 cleanup effort) and twenty-two drums of liquid wastes. MCW operations at the property ceased in 1987. In 1993, SCDHS installed nine downgradient temporary well points in order to assess the horizontal and vertical extent of groundwater contamination. The results of the SCDHS effort indicated the presence of elevated levels of 1,2,3-TCP, tetrachloroethylene (PCE), and trichloroethylene (TCE) in downgradient groundwater. In 1993, NYSDEC completed an investigation of the property. The results of the NYSDEC effort indicated the presence of elevated levels of 1,2,3-TCP, PCE, and TCE in on-property soils and on-property groundwater. Metals and SVOCs were detected in on-property soils. In January 1998, NYSDEC commenced an RI/FS to determine the nature and extent of contamination at and emanating from the property and to identify and evaluate remedial alternatives. During this investigation, NYSDEC emptied the two concrete-lined and intact waste lagoons of all soil and sludge materials and backfilled them with clean soils. The excavated material was disposed of at an appropriate waste-receiving facility. In June 1999, based on the preliminary findings of the RI, NYSDEC requested that EPA take a response action at the property. In response to NYSDEC's request, EPA collected groundwater samples from off-property monitoring wells, two municipal supply wells, and one private well in April 2000. Based upon the results of this investigation, EPA concluded that immediate actions were not required, but that remedial actions should be considered to address potential long-term threats. NYSDEC completed the RI/FS in August 2000.

The site was proposed for inclusion on the National Priorities List (NPL) in June 2001; it was listed on the NPL in September 2001.

Because a number of subsequent occupants have completely reworked the surface of the property several times since MCW's operations ceased, EPA undertook sampling in July 2002 in order to assess current conditions related to on-property surface soil. Based in part upon these sample results, an RI/FS report addendum was completed by EPA in January 2003.

A search for potential responsible parties (PRPs) is ongoing.

RESULTS OF THE REMEDIAL INVESTIGATION

The results of the RI are summarized below.

Groundwater

Groundwater samples were collected from four on-property monitoring wells, eleven temporary vertical profile wells, four temporary wells, eight downgradient monitoring wells, and two upgradient background monitoring wells. The samples were analyzed for VOCs, SVOCs, pesticides/PCBs, and metals.

The primary VOC of concern in the groundwater beneath and downgradient of the property is 1,2,3-TCP. 1,2,3-TCP was detected in two on-property monitoring wells at concentrations of 40 micrograms per liter (μg/l) and 250 μg/l. Downgradient groundwater detections for 1,2,3-TCP included a concentration as high as 34,000 μg/l in a shallow (sixty feet bgs) temporary well point located approximately one-hundred feet downgradient of the property and 9,300 μg/l in an intermediate (eighty feet bgs) temporary well point located five-hundred feet downgradient. Much lower concentrations of 1,2,3-TCP (220 μg/l) were found in a deep (140 feet bgs) monitoring well located approximately fifteen hundred feet downgradient from the source area. No contamination was detected in the most recent sample collected from this well. (Figure 3 delineates the 1,2,3-TCP plume.)

PCE was detected in three on-property monitoring wells at concentrations ranging from 13 to 54 μg/l. PCE was detected at 5,600 μg/l in a shallow (sixty feet bgs) downgradient temporary well point; PCE was not detected in deeper samples at this location or in any of the sampling points located downgradient. Additionally, low concentrations of TCE were detected in some groundwater samples.

For SVOCs, bis-(2-ethylhexyl)phthalate and 2-nitroanaline were detected at 35 μg/l and 14 μg/l, respectively, in on-property monitoring wells. Bis-(2-ethylhexyl)phthalate was detected at 40 μg/l in a downgradient monitoring well.

For metals, manganese was detected in three on-property monitoring wells at concentrations ranging from 388 μg/l to 5,110 μg/l. Arsenic, cadmium, and lead were detected at 30 μg/l, 19 μg/l, and 74 μg/l, respectively.

Based upon the sampling results, it has been determined that an approximately 1,500-foot long, 300-foot wide, and 140-foot deep groundwater VOC plume extends in a southeasterly direction from the western portion of the property. Concentrations of 1,2,3-TCP tend to be significantly lower downgradient from South Road

5 All tanks associated with MCW operations were decommisioned. Most were scrapped in the 1990s.

(approximately eight-hundred feet from the property). Further, although 1,2,3-TCP is resistant to biological and chemical degradation, it appears that the groundwater contaminant plume is no longer expanding.

Subsurface Soil

Subsurface soil sampling locations were selected on the basis of soil-gas sampling results and by screening the sampling results of numerous shallow soil borings using a mobile laboratory. In addition, all nine on-property storm-water drywells were sampled. (Figure 4 shows subsurface soil sampling locations and sampling results for 1,2,3-TCP.)

Significant concentrations of 1,2,3-TCP were detected in the unsaturated (above the water table) subsurface soils at five of the eighteen on-property soil-boring locations; the maximum concentration detected was 680 milligrams per kilogram (mg/kg). The 1,2,3-TCP-contaminated soils are located predominantly immediately east of the laboratory building, to a maximum depth of approximately forty feet. 1,2,3-TCP was also detected southeast of the laboratory building and east of the warehouse buildings. PCE was detected at 2.3 mg/kg toward the north of the warehouse buildings. Several other VOCs, including TCE, were detected in subsurface soils, generally at low concentrations.

Soil borings were collected from the nine on-property storm-water drywells. 1,2,3-TCP was detected in a number of the drywells that were located east of the laboratory building, with the highest concentration being 87 mg/kg. The SVOCs benzo(b)fluoranthene (28 mg/kg), benzo(a)pyrene (23 mg/kg), benzo(a)anthracene (17 mg/kg), and benzo(k)fluoranthene (11 mg/kg) were detected in a drywell located east of the warehouse buildings.

Mercury at 1 mg/kg was detected in a subsurface soil sample collected southeast of the warehouse buildings. Zinc at 224 mg/kg was detected in a soil sample collected from east of the warehouse buildings.

A sample from the bottom of a manhole located at the entrance to 1 Cordello Drive had arsenic at 2,180 mg/kg and zinc at 67 mg/kg.

Surface Soil

Twenty on-property surface soil samples were collected from ten locations. Because a number of subsequent occupants have completely reworked the surface of the property several times since MCW's operations ceased, surface soil sampling locations were randomly selected to assess current property conditions. SVOCs were detected in all sample locations. The detected compounds and their maximum concentrations included benzo(a)pyrene (8 mg/kg), dibenzo(a,h)anthracene (1.5 mg/kg), and benzo(a)anthracene (10 mg/kg). It is likely that the nature of several businesses that have occupied the property since MCW ceased operations have contributed to SVOC contamination of surface soils.

Aqueous Samples

An aqueous sample collected from an excavated subsurface drain pipe had a 1,2,3-TCP concentration of 11,000,000 µg/l.

Soil Gas

Soil gas samples were analyzed for VOCs in order to evaluate the potential for subsurface gas migration. Samples were collected from four on-property locations southeast of the laboratory building and at twelve downgradient locations immediately to the south of this area (*i.e.*, in the direction of groundwater flow and toward the residential area). Samples were collected from five feet, ten feet, and fifteen feet bgs at each of the locations. In general, the concentrations of VOCs in soil gas tended to increase with depth.

The VOCs 1,2,3-TCP, PCE, and TCE were found at elevated concentrations throughout the soil column in each of the four on-property locations. Most notably, the maximum concentration of 1,2,3-TCP was 2,200 micrograms per cubic meter (µg/m^3). PCE was detected up to a concentration of 600 µg/m^3 and TCE was detected up to a concentration of 300 µg/m^3. The high soil gas concentrations were generally associated with soil source areas.

1,2,3-TCP was not found in any of the twelve off-property locations. PCE levels were approximately half of those found on-property, with a maximum detection of 330 µg/m^3; TCE was found at levels ten times lower than those on-property, with a maximum detection of 19 µg/m^3.

SUMMARY OF SITE RISKS

Based upon the results of the RI, a baseline risk assessment was conducted to estimate the risks associated with current and future property conditions. A baseline risk assessment is an analysis of the potential adverse human health effects caused by hazardous-substance exposure in the absence of any actions to control or mitigate these under current and future land uses.

The human-health estimates summarized below are based on current reasonable maximum exposure scenarios and were developed by taking into account various conservative estimates about the frequency and duration of an individual's exposure to the contaminants of concern (COCs), as well as the toxicity of these contaminants.

While a screening of ecological considerations lead to the conclusion that property conditions do not necessitate a quantitative ecological risk assessment, a qualitative discussion is included below.

WHAT IS RISK AND HOW IS IT CALCULATED?

A Superfund baseline human health risk assessment is an analysis of the potential adverse health effects caused by hazardous substance releases from a site in the absence of any actions to control or mitigate these under current- and future-land uses. A four-step process is utilized for assessing site-related human health risks for reasonable maximum exposure scenarios.

Hazard Identification: In this step, the COCs at the site in various media (*i.e.*, soil, groundwater, surface water, and air) are identified based on such factors as toxicity, frequency of occurrence, and fate and transport of the contaminants in the environment, concentrations of the contaminants in specific media, mobility, persistence, and bioaccumulation.

Exposure Assessment: In this step, the different exposure pathways through which people might be exposed to the contaminants identified in the previous step are evaluated. Examples of exposure pathways include incidental ingestion of and dermal contact with contaminated soil. Factors relating to the exposure assessment include, but are not limited to, the concentrations that people might be exposed to and the potential frequency and duration of exposure. Using these factors, a "reasonable maximum exposure" scenario, which portrays the highest level of human exposure that could reasonably be expected to occur, is calculated.

Toxicity Assessment: In this step, the types of adverse health effects associated with chemical exposures, and the relationship between magnitude of exposure and severity of adverse effects are determined. Potential health effects are chemical-specific and may include the risk of developing cancer over a lifetime or other non-cancer health effects, such as changes in the normal functions of organs within the body (*e.g.*, changes in the effectiveness of the immune system). Some chemicals are capable of causing both cancer and non-cancer health effects.

Risk Characterization: This step summarizes and combines outputs of the exposure and toxicity assessments to provide a quantitative assessment of site risks. Exposures are evaluated based on the potential risk of developing cancer and the potential for non-cancer health hazards. The likelihood of an individual developing cancer is expressed as a probability. For example, a 10^{-4} cancer risk means a "one-in-ten-thousand excess cancer risk"; or one additional cancer may be seen in a population of 10,000 people as a result of exposure to site contaminants under the conditions explained in the Exposure Assessment. Current Superfund guidelines for acceptable exposures are an individual lifetime excess cancer risk in the range of 10^{-4} to 10^{-6} (corresponding to a one-in-ten-thousand to a one-in-a-million excess cancer risk) with 10^{-6} being the point of departure. For non-cancer health effects, a "hazard index" (HI) is calculated. An HI represents the sum of the individual exposure levels compared to their corresponding reference doses. The key concept for a non-cancer HI is that a "threshold level" (measured as an HI of less than 1) exists below which non-cancer health effects are not expected to occur.

Human Health Risk Assessment

As was noted above, the current land use of the property is industrial/commercial, and it is anticipated that the land use will not change in the future.

The baseline risk assessment began with selecting COCs in the various media that would be representative of property risks. Since the area is served by municipal water, it is not likely that the groundwater underlying the property will be used for potable purposes in the foreseeable future; however, since regional groundwater is designated as a drinking water source, hypothetical exposure to groundwater was evaluated. The other media that were evaluated included surface and subsurface soil. The primary COCs in groundwater are 1,2,3-TCP and other VOCs and metals, in surface soil are SVOCs and metals, and in subsurface soil are 1,2,3-TCP and SVOCs.

The baseline risk assessment evaluated the health effects which could result from exposure to contaminated property media through ingestion, dermal contact, or inhalation. The assessment evaluated hazards and risks to on-property trespassers and future on-property workers exposed to surface soils; future on-property construction and utility workers exposed to subsurface soils; and hypothetical on-property workers and hypothetical off-property adult and child residents exposed to potable groundwater. In addition, a qualitative risk evaluation was performed to assess potential risks for current off-property residents and future on-property workers exposed to soil gas.

The results of the baseline risk assessment indicate that the contaminated subsurface soils at the property and groundwater at the site pose an unacceptable risk to human health due, primarily, to the presence of VOCs, SVOCs, and metals. The estimated excess cancer risks related to the ingestion of and dermal contact with subsurface soils at the property for future on-property construction and utility workers exceed the acceptable risk range at 9.4×10^{-3}. For potable groundwater ingestion and inhalation by hypothetical on-property workers and hypothetical off-property adult and child residents, the risks were 2.8×10^{-2}, 3.8×10^{-2}, and 2.2×10^{-2}, respectively, which exceed the acceptable risk range for each receptor population. Risks are driven by 1,2,3-TCP. To determine potential downgradient risks, a separate calculation was performed using data from the downgradient monitoring wells to estimate the risks to hypothetical off-property residents from ingestion and inhalation of groundwater contaminated with 1,2,3-TCP. The resulting risk estimate was 4.1×10^{-4}, which is above the acceptable risk range. The estimated excess cancer risks for future on-property workers and trespassers exposed to surface soil were within the acceptable risk range.

The total estimated HI value for individual chemicals and combinations of chemicals for ingestion of and dermal contact with subsurface soils at the property for future on-property construction and utility workers was 4, which is above the acceptable level of 1, driven by 1,2,3-TCP. Total estimated HI values for future on-property workers and trespassers exposed to surface soil did not exceed 1. For potable groundwater ingestion and inhalation by hypothetical on-property workers and hypothetical off-property adult and child residents, the HIs were 37, 52, and 120, respectively, which are all above the acceptable level of 1. These HIs are primarily driven by 1,2,3-TCP and iron.

In assessing potential inhalation risk for the soil-gas medium, the sampling results for soil gas were compared against the target values in EPA's Subsurface Vapor Intrusion Guidance (SVIG). For site-related VOCs, the SVIG values used correspond with the 10^{-4} cancer risk threshold value for vapor concentrations in shallow soil. The comparison suggests there may be an unacceptable risk to a future on-property worker performing tasks in a basement, driven almost exclusively by 1,2,3-TCP. The maximum on-property soil-gas concentration for 1,2,3-TCP was 2,200 $\mu g/m^3$. The SVIG value for 1,2,3-TCP is 49 $\mu g/m^3$.

Based on the SVIG values, there is no apparent qualitative risk to a current off-property resident. 1,2,3-TCP was not found in any of the thirty-six soil-gas samples collected from twelve off-property locations. With a high concentration of 330 $\mu g/m^3$, the 810 $\mu g/m^3$ SVIG value for PCE was not exceeded. All PCE levels were approximately half of those found on the property. TCE was found at levels ten times lower than those on-property, with all reported values being below the SVIG value for TCE of 22 $\mu g/m^3$.

Ecological Risk Assessment

Information from the NYSDEC Bureau of Wildlife indicates that there are no endangered or threatened plant or animal species at or in the vicinity of the site. Therefore, EPA evaluated potential exposure pathways for non-endangered and non-threatened animal and plant species. Since the property includes an industrial/commercial facility, there is minimal habitat available for ecological receptors on the property. Due to the suburban/commercial setting, the potential for exposure to receptors and ecological risk is minimal in the area surrounding the property as well.

Because the main medium of concern is groundwater, and the depth to the surface of the groundwater is approximately fifty feet bgs, direct contact with groundwater by ecological receptors is unlikely. Because there are no wetlands or surface water bodies on or in the immediate vicinity of the site, there is no potential for contaminated groundwater to discharge into surface water. Therefore, groundwater is not considered to be an exposure pathway for ecological receptors.

Soil samples did contain VOCs, some of which (*e.g.*, 1,2,3-TCP) are present in concentrations greater than conservative screening criteria considered protective of soil invertebrate species. Therefore, there is a potential for an unacceptable risk to burrowing animals that may come into contact with these contaminated surface soils (zero to two-foot depth).

Summary of Human Health and Ecological Risks

The results of the risk assessment indicate that ingestion of and dermal contact with on-property subsurface soils by future on-property construction and utility workers, ingestion and inhalation of groundwater by hypothetical on-property workers and hypothetical off-property adult and child residents, and inhalation of on-property soil gas by future on-property workers pose unacceptable excess cancer risks.

The total estimated HI values for future on-property construction and utility workers exposed to subsurface soil and ingestion and inhalation of groundwater by hypothetical on-property workers and hypothetical off-property adult and child residents pose a chronic adverse non-cancer health effect to such receptors.

Contamination in the surface soil poses a potential unacceptable risk to burrowing animals that may come into contact with these soils.

Based upon the results of the RI and the risk assessment, EPA has determined that actual or threatened releases of hazardous substances from the property, if not addressed by the preferred remedy or one of the other active measures considered, may present a current or potential threat to human health and the environment.

REMEDIAL ACTION OBJECTIVES

Remedial action objectives are specific goals to protect human health and the environment. These objectives are based on available information and standards, such as applicable or relevant and appropriate requirements (ARARs), to-be-considered guidance, and site-specific risk-based levels.

The following remedial action objectives were established for the site:

- Restore groundwater to levels which meet state and federal standards within a reasonable time frame;
- Mitigate the potential for chemicals to migrate from soils and drainage structures on the property into groundwater;
- Mitigate the migration of the affected groundwater; and
- Reduce or eliminate any direct contact, ingestion, or inhalation threat associated with contaminated soil on the property.

Soil cleanup levels will be those established pursuant to the New York State Technical and Administrative Guidance Memorandum No. 94-HWR-4046 (TAGM). These levels are the more stringent cleanup level between a human-health protection value and a value based on protection of groundwater as specified in the TAGM. All of these levels fall within EPA's acceptable risk range.

Groundwater cleanup goals will be the more stringent of the state or federal promulgated standards.

SUMMARY OF REMEDIAL ALTERNATIVES

CERCLA §121(b)(1), 42 U.S.C. §9621(b)(1), mandates that remedial actions must be protective of human health and the environment, cost-effective, comply with ARARS, and utilize permanent solutions and alternative treatment technologies and resource recovery alternatives to the maximum extent practicable. Section 121(b)(1) also establishes a preference for remedial actions which employ, as a principal element, treatment to permanently and significantly reduce the volume, toxicity, or mobility of the hazardous substances, pollutants and contaminants at a site. CERCLA §121(d), 42 U.S.C. §9621(d), further specifies that a remedial action must attain a level or standard of control of the hazardous substances, pollutants, and contaminants, which at least attains ARARs under federal and state laws, unless a waiver can be justified pursuant to CERCLA §121(d)(4), 42 U.S.C. §9621(d)(4).

Detailed descriptions of the remedial alternatives for addressing the contamination associated with the site can be found in the RI/FS report and the RI/FS report addendum. These documents present five soil remediation alternatives and five groundwater remediation alternatives. To facilitate the presentation and evaluation of these alternatives, the RI/FS report and RI/FS report addendum's ten alternatives were reorganized in formulating the remedial alternatives discussed below.

The construction time for each alternative reflects only the time required to construct or implement the remedy and does not include the time required to design the remedy, negotiate the performance of the remedy with any PRPs, or procure contracts for design and construction. The present-worth costs associated with the soil remedies are calculated using a discount rate of seven percent and a five-year time interval. The present-worth costs associated with the groundwater remedies are calculated using a discount rate of seven percent and a fifteen-year time interval.

The remedial alternatives are:

Soil Alternatives

Alternative S-1: No Action

Capital Cost:	$0
Annual Operation and Maintenance Cost:	$0
Present-Worth Cost:	$0
Construction Time:	0 months

The Superfund program requires that the "no-action" alternative be considered as a baseline for comparison with the other alternatives. The no-action remedial alternative for soil does not include any physical remedial measures that address the problem of soil contamination at the property.

Because this alternative would result in contaminants remaining on-property above levels that allow for unrestricted use and unlimited exposure, CERCLA requires that the site be reviewed at least once every five years. If justified by the review, remedial actions may be implemented to remove, treat, or contain the wastes.

Alternative S-2: Excavation of Contaminated Soils and Off-Site Treatment/Disposal

Capital Cost:	$1,542,000
Annual Operation and Maintenance Cost:	$0
Present-Worth Cost:	$1,542,000
Construction Time:	6 months

This remedial alternative includes the excavation of all source-area soils which exceed the TAGM cleanup levels, along with any contaminated drywell structures, cesspools, and associated piping.

To obtain access to all of the contaminated soils, this alternative also includes the demolition of the laboratory building. The building debris, after decontamination, if necessary, would be disposed of off-site.

The estimated volume of contaminated soil to be excavated is 5,000 cubic yards (contamination is as deep as forty-one feet). The actual extent of the excavation and the volume of the excavated material would be based on post-excavation confirmatory sampling. Shoring of the excavation and extraction and treatment of any water that enters the trench would be necessary.

The excavated areas would be backfilled with clean fill and revegetated. All excavated material would be characterized and transported for treatment/disposal at an off-site Resource Conservation and Recovery Act (RCRA)-compliant facility.

Alternative S-3: Excavation of Contaminated Soils, On-Property Treatment via Low Temperature Thermal Desorption, and Redeposition

Capital Cost:	$2,502,000
Annual Operation and Maintenance Cost:	$0
Present-Worth Cost:	$2,502,000
Construction Time:	1 year

This alternative is the same as Alternative S-2, except that instead of off-site treatment/disposal, the excavated soils would be fed to a mobile Low-Temperature Thermal Desorption (LTTD) unit brought to the property, where hot air injected at a temperature above the boiling points of the organic contaminants of concern would allow them to be volatilized into gases and escape from the soil. The organic vapors extracted from the soil would then be either condensed, transferred to another medium (such as granular activated carbon), or thermally treated in an afterburner operated to ensure complete destruction of the VOCs. The off-gases would be filtered through a carbon vessel. Once the treated soil achieved the TAGM levels , it would be tested in accordance with the Toxicity Characteristic Leaching Procedure (TCLP) to determine whether it constitutes a RCRA hazardous waste for metals and, provided that it passes the test, it would be used as backfill material for the excavated area. Soil above TCLP metals levels would be either re-treated or disposed of at an approved off-site facility, as appropriate.

To obtain access to all of the contaminated soils, this alternative also includes the demolition of the laboratory building. The building debris, after decontamination, if necessary, would be disposed of off-site.

The excavated drywell structures, cesspools, and associated piping would be disposed of off-site at a RCRA-compliant facility.

Alternative S-4: Treatment of VOC-Contaminated Soils Using Thermally-Enhanced ISVE; Excavation of SVOC-Contaminated Soils with Off-Site Treatment/Disposal

Capital Cost:	$789,000
Annual Operation and Maintenance Cost:	$ 98,000
Present-Worth Cost:	$1,191,000
Construction Time:	3 months

Under this alternative, the VOC-contaminated soils (approximately 5,000 cubic yards) would be remediated by thermally-enhanced ISVE[6]. Under this treatment process, either steam or heated air would be forced through a series of wells to volatilize the solvents contaminating the soils in the unsaturated zone (above the water table). The extracted vapors would be treated by granular activated carbon and/or other appropriate technologies before being vented to the atmosphere. The exact configuration and number of vacuum extraction wells and heat-injection points would be determined based on the results of a pilot-scale treatability study.

While the actual period of operation of the ISVE system would be based upon soil sampling results which demonstrate that the affected soils have been treated to soil TAGM levels, it is estimated that the system would operate for a period of five years.

Since thermally-enhanced ISVE would not be effective at remediating the SVOC-contaminated soils located, primarily, east of the warehouse buildings, these soils (approximately 100 cubic yards in total) would be excavated and disposed of off-site. In addition, contaminated drywell structures, cesspools, and associated piping would be excavated and removed.

To obtain access to all of the contaminated soils, this alternative also includes the demolition of the laboratory building. The building debris, after decontamination, if necessary, would be disposed of off-site.

The excavated areas would be backfilled with clean fill and revegetated. All excavated materials would be characterized and transported for treatment/disposal at an off-site RCRA-compliant facility.

This alternative also includes engineering controls, such as fencing and signs, to protect the integrity of the soil treatment system and to limit access until the soil remediation effort has been completed.

Groundwater Remedial Alternatives

Alternative GW-1: No Action

Capital Cost:	$0
Annual Monitoring Cost:	$0
Present-Worth Cost:	$0
Construction Time:	0 months

The Superfund program requires that the "no-action" alternative be considered as a baseline for comparison with the other alternatives. The no-action remedial alternative would not include any physical remedial measures to address the groundwater contamination at the site.

Because this alternative would result in contaminants remaining on-site above levels that allow for unrestricted use and unlimited exposure, CERCLA requires that the site be reviewed at least once every five years. If justified by the review, remedial actions may be implemented to remove or treat the wastes.

6 Factors that contribute to the effectiveness of a conventional ISVE system are the chemical and physical properties of the contaminants and the soil characteristics. Based on the results of the RI, the property's soils should be conducive to vapor extraction. The chemical and physical properties of 1,2,3-TCP suggest that thermal enhancement would be necessary for ISVE to be effective in the contaminant's removal (*i.e.*, heating would make 1,2,3-TCP more volatile).

Alternative GW-2: Groundwater In-Situ Air Sparging with Ozone Injection

Capital Cost:	$ 445,000
Annual Operation, Maintenance and Monitoring Cost:	$90,000
Present-Worth Cost:	$1,265,000
Construction Time:	4 months

Under this alternative, a mixture of ozone and air would be injected under pressure into the aquifer through injection-well points installed into the plume along the southern boundary of the property or at the source areas (immediately east of the laboratory building, southeast of the laboratory building, and east of the warehouse buildings) and within the downgradient plume (see Figure 3). It is anticipated that six injection-well points with a pallet-mounted injection system would be required to treat the source area contamination and eight injection-well points with a street curb-mounted injection system would be required in downgradient areas to address the existing plume. The injection-well points would be installed to depths of up to 140 feet bgs. Because the area downgradient from the source areas is highly-developed and densely-populated, the injection-well points and the associated piping installed downgradient of the source areas would be placed beneath roadways or in road right-of-ways so as to avoid having to install them on residential properties.

Under this process, bubbles are formed from the injected ozone and air, which strip and oxidize[7] the VOCs from the groundwater, a reaction that breaks down VOCs (including 1,2,3-TCP) into carbon dioxide and chlorides. Ozone is required to enhance air sparging both because of the depth to which 1,2,3-TCP is present and due to its solubility in groundwater.

Bench- and pilot-scale treatability studies would be performed to optimize the effectiveness of the injection system and to determine optimum installation locations for the injection-well points.

As part of a long-term groundwater monitoring program, groundwater samples would be collected and analyzed regularly in order to verify that the concentrations and the extent of groundwater contaminants are declining. The exact frequency and parameters of sampling and location of any additional monitoring wells would be determined during the design phase. Soil-vapor monitoring in the treatment areas would also be conducted, as necessary.

It has been estimated that it would take fifteen years to remediate the contaminated groundwater through air sparging and ozone injection.

This alternative also includes institutional controls restricting the installation and use of groundwater wells at and downgradient of the property until groundwater quality has been restored. Institutional controls would be in the form of existing use and development restrictions limiting the use of groundwater as a potable or process water without treatment, as determined by SCDHS. Engineering controls, such as fencing and signs, would be used to protect the integrity of all above-surface installations.

Because this alternative would result in contaminants remaining on-site above levels that allow for unrestricted use and unlimited exposure, CERCLA requires that the site be reviewed at least once every five years.

Alternative GW-3: Groundwater Extraction and Treatment

Capital Cost:	$1,149,000
Annual Operation, Maintenance and Monitoring Cost:	$155,000
Present-Worth Cost:	$2,561,000
Construction Time:	6 months

Under this alternative, a network of wells installed into the plume along the southern boundary of the property or within the source areas (immediately east of the laboratory building, southeast of the laboratory building, and east of the warehouse buildings) and within the downgradient plume would extract contaminated groundwater. The extracted groundwater would be piped to an on-property facility where it would be treated by air stripping and/or other appropriate technologies, and would be reinjected to the aquifer. It is anticipated that three wells would be required to extract contaminated groundwater from the source areas and three wells would be required in downgradient areas. Because the area downgradient from the source areas is highly-developed and densely-populated, the extraction wells and the associated piping installed downgradient of the source areas would be placed beneath roadways or in road right-of-ways so as to avoid having to install them on residential properties.

Air stripping involves pumping untreated groundwater to the top of a "packed" column, which contains a specified amount of inert packing material. The column receives ambient air under pressure in an upward direction from the bottom of the column as the water flows downward, transferring VOCs to the air phase. The air-stripping process would be followed by a groundwater polishing system using granular activated carbon and/or other appropriate technologies. To comply with New York State air guidelines, granular activated carbon treatment of the air strippers' air exhaust streams may be necessary.

As part of a long-term groundwater monitoring program, groundwater samples would be collected and analyzed regularly in order to verify that the concentrations and the

7 An oxidizing agent uses oxygen to degrade VOCs.

extent of groundwater contaminants are declining. The exact frequency and parameters of sampling and the location of any additional monitoring wells would be determined during the design phase.

It has been estimated that it would take approximately fifteen years of groundwater extraction and treatment to remediate the entire groundwater plume.

This alternative also includes institutional controls restricting the installation and use of groundwater wells at and downgradient of the property until groundwater quality has been restored. Institutional controls would be in the form of existing use and development restrictions limiting the use of groundwater as a potable or process water without treatment, as determined by SCDHS. Engineering controls, such as fencing and signs, would be used to protect the integrity of all above-surface installations.

Because this alternative would result in contaminants remaining on-site above levels that allow for unrestricted use and unlimited exposure, CERCLA requires that the site be reviewed at least once every five years.

Alternative GW-4: In-Situ Permeable Reactive Barrier

Capital Cost:	$ 2,400,000
Annual Operation, Maintenance and Monitoring Cost:	$18,000
Present-Worth Cost:	$2,564,000
Construction Time:	6 months

Under this alternative, subsurface permeable reactive barriers would be installed across the width and depth of the groundwater plume along the southern boundary of the property (immediately east of the laboratory building, southeast of the laboratory building, and east of the warehouse buildings) and within the downgradient plume to catalytically break down VOCs into carbon dioxide and chlorides as the groundwater passes through the barrier.

Installation of a permeable reactive barrier involves the fracturing of the subsurface using standard drilling technologies and immediately filling the fracture with a soluble slurry containing catalytic iron, a substance proven to break down VOCs (including 1,2,3-TCP). The controlled fracturing and filling are accomplished in up to thirty-foot wide reactive panels, requiring the installation of a number of panels into the water table with a drill rig to approximately 140 feet bgs. The thickness of the reactive panel can also be controlled and is determined as a function of contaminant concentration and groundwater velocity. With a panel porosity higher than the surrounding formation, VOCs are degraded to harmless compounds as they pass through the barrier.

As part of a long-term groundwater monitoring program, groundwater samples would be collected and analyzed regularly in order to verify that the concentrations and the extent of groundwater contaminants are declining. The exact frequency and parameters of sampling and the location of any additional monitoring wells would be determined during the design phase.

It has been estimated that it would take approximately fifteen years to remediate the groundwater plume using permeable reactive barriers.

This alternative also includes institutional controls restricting the installation and use of groundwater wells at and downgradient of the property until groundwater quality has been restored. Institutional controls would be in the form of existing use and development restrictions limiting the use of groundwater as a potable or process water without treatment, as determined by SCDHS. Engineering controls, such as fencing and signs, would be used to protect the integrity of all above-surface installations.

Because this alternative would result in contaminants remaining on-site above levels that allow for unrestricted use and unlimited exposure until MCLs are achieved, CERCLA requires that the site be reviewed at least once every five years.

COMPARATIVE ANALYSIS OF ALTERNATIVES

During the detailed evaluation of remedial alternatives, each alternative is assessed against nine evaluation criteria, namely, overall protection of human health and the environment, compliance with applicable or relevant and appropriate requirements, long-term effectiveness and permanence, reduction of toxicity, mobility, or volume through treatment, short-term effectiveness, implementability, cost, and state and community acceptance.

The evaluation criteria are described below.

- Overall protection of human health and the environment addresses whether or not a remedy provides adequate protection and describes how risks posed through each exposure pathway (based on a reasonable maximum exposure scenario) are eliminated, reduced, or controlled through treatment, engineering controls, or institutional controls.
- Compliance with ARARs addresses whether or not a remedy would meet all of the applicable or relevant and appropriate requirements of other federal and state environmental statutes and requirements or provide grounds for invoking a waiver.
- Long-term effectiveness and permanence refers to the ability of a remedy to maintain reliable protection of human health and the environment over time, once cleanup goals have been met. It also addresses the magnitude and effectiveness of the measures that may be required to manage the risk

posed by treatment residuals and/or untreated wastes.

- Reduction of toxicity, mobility, or volume through treatment is the anticipated performance of the treatment technologies, with respect to these parameters, a remedy may employ.

- Short-term effectiveness addresses the period of time needed to achieve protection and any adverse impacts on human health and the environment that may be posed during the construction and implementation period until cleanup goals are achieved.

- Implementability is the technical and administrative feasibility of a remedy, including the availability of materials and services needed to implement a particular option.

- Cost includes estimated capital and operation and maintenance costs, and net present-worth costs.

- State acceptance indicates if, based on its review of the RI/FS and Proposed Plan, the state concurs with the preferred remedy at the present time.

- Community acceptance will be assessed in the ROD and refers to the public's general response to the alternatives described in the Proposed Plan and the RI/FS reports.

A comparative analysis of these alternatives based upon the evaluation criteria noted above follows.

Overall Protection of Human Health and the Environment

Alternative S-1 (no action) would not be protective of human health and the environment, since it would not actively address the contaminated soils, which present unacceptable risks of exposure and are a source of groundwater contamination. Alternative S-2 (excavation of contaminated soils and off-site treatment/disposal), Alternative S-3 (excavation of contaminated soils and on-property treatment via LTTD), and Alternative S-4 (thermally-enhanced ISVE) would be protective of human health and the environment, since each alternative relies upon a remedial strategy and/or treatment technology capable of eliminating human exposure and removing the source of groundwater contamination in the unsaturated zone. Under these alternatives, the contaminants would either be treated on-property or treated/disposed of off-site.

Alternative GW-1 (no action) would be the least protective groundwater alternative in that it would result in no affirmative steps to restore groundwater quality to drinking water standards. Therefore, under this alternative, the restoration of the groundwater would take a significantly longer time (estimated to be at least thirty years) in comparison to the other alternatives. All three of the active groundwater alternatives are estimated to restore groundwater quality significantly faster (approximately fifteen years) and, therefore, would be protective of human health and the environment.

Compliance with ARARs

There are currently no federal or state promulgated standards for contaminant levels in soils, only New York State soil cleanup levels as specified in the soil TAGM (which are used as "To-Be-Considered" criteria).

Since the contaminated soils would not be addressed under Alternative S-1 (no action), this alternative would not comply with the soil cleanup levels , Alternative S-2 (excavation of contaminated soils and off-site treatment/disposal), Alternative S-3 (excavation of contaminated soils and on-property treatment via LTTD), and Alternative S-4 (thermally-enhanced ISVE), would attain the soil cleanup levels specified in the TAGM.

Under Alternative S-4, spent granular activated carbon from the ISVE units would need to be managed in compliance with RCRA treatment/disposal requirements.

Alternative S-2 and Alternative S-4, and, to a lesser extent, Alternative S-3 (for the SVOC-contaminated soils and any contaminated drywell structures, cesspools, and piping), would be subject to New York State and federal regulations related to the transportation and off-site treatment/disposal of wastes. Alternatives S-2 and S-3 would involve the excavation of contaminated soils and would, therefore, require compliance with fugitive dust and VOC emission regulations. In the case of Alternative S-3, compliance with air emission standards would be required at the LTTD unit, as well. Any emissions from the ISVE system for Alternative S-4 would require similar compliance. Specifically, treatment of off-gases would have to meet the substantive requirements of New York State Regulations for Prevention and Control of Air Contamination and Air Pollution (6 NYCRR Part 200 *et.seq.*) and comply with the substantive requirements of other state and federal air emission standards.

EPA and NYSDOH have promulgated health-based protective Maximum Contaminant Levels (MCLs)(40 CFR Part 141), which are enforceable standards for various drinking water contaminants (chemical-specific ARARs). Although the groundwater at the site is not presently being utilized as a potable water source, achieving MCLs in the groundwater is an applicable standard, because the groundwater at the site is a potential source of drinking water. The aquifer is classified as Class GA (6 NYCRR 701.18), meaning that it is designated as a potable water supply.

Alternative GW-1 (no action) does not provide for any direct remediation of the groundwater and would, therefore, involve no actions to achieve chemical-specific ARARs. All three of the active groundwater alternatives would be effective in reducing groundwater contaminant concentrations below MCLs.

Any emissions from the air stripper under Alternative GW-3 would be required to comply with the substantive requirements of state and federal air emission standards.

Long-Term Effectiveness and Permanence

Alternative S-1 (no action) would involve no active remedial measures and, therefore, would not be effective in eliminating the potential exposure to contaminants in soil and would allow the migration of contaminants in soil and groundwater. Alternative S-2 (excavation of contaminated soils and off-site treatment/disposal), Alternative S-3 (excavation of contaminated soils and on-property treatment via LTTD), and Alternative S-4 (thermally-enhanced ISVE) would all be effective in the long term and would provide permanent remediation by either removing the wastes from the property or treating them on-site.

Alternatives S-3 and S-4 would generate treatment residuals which would have to be appropriately handled; Alternative S-2 would not generate such residuals.

Alternative GW-1 (no action) would be far less effective in the long term in restoring groundwater quality, since it would take at least twice as long to restore groundwater than Alternative GW-2 (in-situ air sparging with ozone injection), Alternative GW-3 (groundwater extraction and treatment), and Alternative GW-4 (permeable reactive barrier). All of the active groundwater alternatives would effectively restore groundwater quality within approximately fifteen years.

Alternative GW-3 may generate treatment residuals which would have to be appropriately handled; Alternatives GW-1, GW-2, and GW-4 would not generate such residuals.

Reduction in Toxicity, Mobility, or Volume Through Treatment

Alternative S-1 (no action) would provide no reduction in toxicity, mobility or volume. Under Alternative S-3 (excavation of contaminated soils and on-property treatment via LTTD) and Alternative S-4 (thermally-enhanced ISVE), the toxicity, mobility, and volume of contaminants would be reduced or eliminated through on-property treatment. Under Alternative S-2 (excavation of contaminated soils and off-site treatment/disposal), the toxicity, mobility, and volume of the contaminants would be eliminated by removing the contaminated soil from the property for treatment/disposal.

Alternative GW-1 (no action) would not effectively reduce the toxicity, mobility, or volume of contaminants in the groundwater, as this alternative involves no active remedial measures. Alternative GW-2 (in-situ air sparging with ozone injection), Alternative GW-3 (groundwater extraction and treatment), and Alternative GW-4 (permeable reactive barrier) would reduce the toxicity, mobility, or volume of contaminants in the groundwater through treatment at (or adjacent to) the source and in downgradient areas, thereby satisfying CERCLA's preference for treatment. Alternatives GW-2 and GW-3 possess the added flexibility of being constructed within the source areas, thus, potentially reducing the toxicity, mobility, or volume of contaminants in the source areas in a shorter time period.

Short-Term Effectiveness

Alternative S-1 (no action) does not include any physical construction measures in any areas of contamination and, therefore, would not present any potential adverse impacts to on-property workers or the community as a result of its implementation. Alternatives S-2 (excavation of contaminated soils and off-site treatment/disposal) and S-3 (excavation of contaminated soils and on-property treatment via LTTD) could present some limited adverse impact to on-property workers through dermal contact and inhalation related to post-excavation sampling activities. Similarly, Alternative S-4 (thermally-enhanced ISVE) could result in some adverse impacts to on-property workers through dermal contact and inhalation related to the installation of ISVE wells through contaminated soils. Noise from the treatment units associated with Alternatives S-3 and S-4 could present some limited adverse impacts to on-property workers and nearby residents. In addition, interim and post-remediation soil sampling activities would pose some risk. The risks to on-property workers and nearby residents under all of the alternatives could, however, be mitigated by following appropriate health and safety protocols, by exercising sound engineering practices, and by utilizing proper protective equipment.

Alternative S-2 would require the off-site transport of contaminated waste material, which may pose the potential for traffic accidents, which could result in releases of hazardous substances. Alternatives S-3 and S-4 would also require the off-site transport of contaminated wastes, but at a volume substantially less than the other active alternatives.

Under Alternatives S-2 and S-3, substantial disturbance of the land during excavation activities could affect the surface water hydrology of the property. There is a potential for increased stormwater runoff and erosion during excavation and construction activities that would have to be properly managed to prevent or minimize any adverse impacts. For these alternatives, appropriate measures would have to be taken during excavation activities to prevent transport of fugitive dust and exposure of workers and downgradient receptors to VOCs.

Since no actions would be performed under Alternative S-1, there would be no implementation time. It is estimated that it would take six months to excavate and transport the contaminated soils to an EPA-approved treatment/disposal facility under Alternative S-2 and one year to excavate and treat the contaminated soils using LTTD under Alternative S-3. It is estimated that Alternative S-4 would require three months to install the ISVE system and five years to achieve soil cleanup levels.

All of the groundwater alternatives could present some limited adverse short-term impacts to on-property workers through dermal contact and inhalation related to groundwater sampling activities. Alternative GW-2 (in-situ air sparging with ozone injection), Alternative GW-3 (groundwater extraction and treatment), and Alternative GW-4 (permeable reactive barrier) could present adverse impacts to on-property workers, since these alternatives would involve the installation of either injection wells, extraction wells, or reactive panels through potentially contaminated soils and groundwater. Alternative GW-2 could pose more adverse impacts than Alternatives GW-3 and GW-4, since it would require the installation of significantly more well points than Alternatives GW-3 and GW-4. On the other hand, both Alternatives GW-2 and GW-3 require the installation of piping and other components in the street right-of-way, thus, potentially increasing the potential for adverse impacts. Noise from the treatment units associated with Alternatives GW-2 and GW-3 could present some limited adverse impacts to on-property workers and nearby residents. The risks to on-property workers and nearby residents under all of the alternatives could, however, be minimized by following appropriate health and safety protocols, by exercising sound engineering practices, and by utilizing proper protective equipment.

Since no activities would be performed under Alternative GW-1, no time would be required to implement this alternative. It is estimated that the groundwater remediation systems under Alternative GW-2, Alternative GW-3, and Alternative GW-4 would be constructed in four, six, and six months, respectively.

It is estimated that Alternative GW-1 would require at least thirty years to remediate the source areas and the contaminant plume. Alternatives GW-2, GW-3, and GW-4, with similar configurations with respect to the source areas and the plume, but with varying technologies, would require approximately fifteen years to remediate the contaminated groundwater. The actual time for the groundwater to be remediated under all of the alternatives may vary and may need to be refined based on the results of groundwater monitoring and, as appropriate, groundwater modeling.

Implementability

Alternative S-1 (no action) would be the easiest to implement, as there are no activities to undertake. Potentially difficult factors related to the excavation of soils down to fifty feet bgs adjacent to on-property buildings and on a property that is so small may need to be resolved for Alternative S-2 (excavation of contaminated soils and off-site treatment) and Alternative S-3 (excavation of contaminated soils and on-property treatment via LTTD). Additional measures, such as building demolition (in addition to the laboratory building), may be required to make space. In addition, finding sufficient space for the placement of an LTTD unit on-property could be problematic. Alternative S-4 (thermally-enhanced ISVE) would be much easier to implement than Alternative S-2 and Alternative S-3 since large-scale soil excavation and handling would not be required. All three active soil alternatives would require the demolition of the laboratory building in order to facilitate the goal of attaining cleanup levels. Staging the building debris for off-site disposal may be difficult for all of these alternatives because of the small size of the property. Under Alternatives S-2 and S-3, the excavation of soils down to fifty feet bgs adjacent to on-property buildings and on a property that is so small may necessitate additional building demolition, further complicating the building debris staging requirements. Also, because of space limitations, staging the excavated soil for off-site treatment/disposal and on-property treatment, under Alternatives S-2 and S-3, respectively, may prove difficult.

All three soil action alternatives would employ technologies known to be reliable and that can be readily implemented. In addition, equipment, services, and materials needed for these alternatives are readily available, and the actions under these alternatives would be administratively feasible. Sufficient facilities are available for the treatment/disposal of the excavated soils under Alternative S-2. Thermally-enhanced ISVE (Alternative S-4) is an effective technology for removing VOCs, although pilot-scale treatability studies would need to be performed to ensure that it can successfully treat 1,2,3-TCP.

Under Alternative S-2 and Alternative S-3, monitoring the effectiveness of the excavation could be easily accomplished through post-excavation soil sampling and analysis. Monitoring the effectiveness of the LTTD system under Alternative S-3 could be easily accomplished through post-treatment soil sampling and analysis, although, based on EPA's experience at other Superfund sites, there may be implementation issues related to public acceptance with respect to locating an LTTD unit in a densely-populated area. Monitoring the effectiveness of the ISVE system under Alternative S-4 would be easily accomplished through soil and soil-vapor sampling and analysis.

Alternative GW-1 (no action) would be the easiest to implement, since it would not entail the performance of any activities. While the air sparging/ozone injection system related to Alternative GW-2 and the groundwater extraction and treatment system related to Alternative GW-3 would be relatively easy to implement, the implementation of Alternative GW-4 (permeable reactive barrier) would be the easiest to implement as there are no piping or facilities to construct or maintain. While there is sufficient space on the property for most of the constructed components of each of the active groundwater alternatives, Alternative GW-4 would be substantially easier to implement than either Alternatives GW-2 or GW-3 in the highly-developed and densely-populated downgradient plume area; both Alternatives GW-2 and GW-3 would require the installation of piping and other components in the street right-of-way potentially complicated by the presence of gas and water lines, utility poles, and large trees. Alternative GW-3 would be the most difficult to implement due to the size and quantity of the water piping that would be required to be installed along the street right-of-way back to the on-property treatment system and due to the limited options related to the discharge of a relatively high volume of treated groundwater. Both Alternative GW-2 and Alternative GW-3 would use conventional well and piping installation techniques and equipment. Alternative GW-4 would use conventional installation techniques, but would require the use of sophisticated control technology in the placement of the reactive panels.

Air sparging, as a general rule, is only effective to a depth of fifty feet below the water table. At the site, the saturated thickness of the plume is over seventy feet. A recently developed air sparging technology appears to be viable. This system injects an air/ozone mixture into the aquifer up to 150 feet below the water surface using an injection-well point system. Because 1,2,3-TCP is not a typical contaminant, there has been no experience using this technology for this particular contaminant. However, given the chemical nature of 1,2,3-TCP, it appears likely that it would be amenable to treatment with this technology. Consequently, bench- and pilot-scale treatability studies would be required to verify its effectiveness.

The groundwater extraction and treatment system that would be used under Alternative GW-3 has been implemented successfully at numerous sites to extract, treat, and hydraulically control contaminated groundwater. Though relatively new compared to Alternative GW-3, the groundwater treatment system that would be used under Alternative GW-4 has also been implemented successfully at numerous sites in treating contaminated groundwater.

The air stripping and granular activated carbon technologies that might be used for Alternative GW-3 are proven and reliable in achieving the specified performance goals and are readily available, as is the catalytic iron technology associated with Alternative GW-4.

Cost

The present-worth costs associated with the soil remedies are calculated using a discount rate of seven percent and a five-year time interval. The present-worth costs associated with the groundwater remedies are calculated using a discount rate of seven percent and a fifteen-year time interval.

The estimated capital, operation, maintenance, and monitoring (OM&M), and present-worth costs for each of the alternatives are presented below.

Alternative	Capital	OM&M	Present-Worth
S-1	$0	$0	$0
S-2	$1,542,000	$0	$1,542,000
S-3	$2,502,000	$0	$2,502,000
S-4	$789,000	$98,000	$1,191,000
GW-1	$0	$0	$0
GW-2	$445,000	$90,000	$1,265,000
GW-3	$1,149,000	$155,000	$2,561,000
GW-4	$2,400,000	$18,000	$2,564,000

As can be seen by the cost estimates, Alternative S-1 (no action) is the least costly soil alternative at $0. Alternative S-3 (excavation of contaminated soils and on-property treatment via LTTD) is the most costly soil alternative at $2,502,000. The least costly groundwater remedy is Alternative GW-1 (no action) at $0. Alternative GW-3 and GW-4 are the most costly groundwater alternatives, each estimated at an approximate cost of $2,560,000.

State Acceptance

NYSDEC concurs with the preferred alternative.

Community Acceptance

Community acceptance of the preferred alternative will be assessed in the ROD following review of the public comments received on the Proposed Plan.

PROPOSED REMEDY

Based upon an evaluation of the various alternatives, EPA and NYSDEC recommend Alternative S-4 (thermally-enhanced ISVE) and Alternative GW-2 (in-situ air sparging with ozone injection) as the preferred remedy for soil and groundwater, respectively (see Figures 5 and 6 for conceptual illustrations of the preferred remedial alternatives). The total capital cost for Alternatives S-4 and GW-2 together is $1,234,000 and the total present worth cost is $2,456,000. Specifically, this would involve the following:

- Treatment of the unsaturated soils using thermally-enhanced ISVE in on-property source areas which exceed NYSDEC's soil TAGM levels for VOCs. Post-treatment confirmatory samples would be collected to ensure that the entire source areas have been effectively treated to the cleanup levels. Off-gases from the ISVE system may need to be treated to meet air-discharge requirements. Soil-vapor monitoring in the treatment areas and in adjacent residential areas would also be conducted, as necessary. Should this monitoring indicate a problem with respect to residences, appropriate actions will be taken.

- Excavation and off-site disposal of approximately 100 cubic yards of SVOC-contaminated soils which exceed NYSDEC's soil TAGM levels for SVOCs. In addition, any contaminated drywell structures, cesspools, and associated piping would also be excavated. Confirmatory sampling would be conducted to ensure that all soils above the cleanup goals have been removed. The excavation would be backfilled with certified clean fill.

- Demolition of the laboratory building. The building debris, after decontamination, if necessary, would be disposed of off-site.

- Treatment of the contaminated groundwater using air sparging with ozone injection. The exact configuration and number of injection wells would be determined during the remedial design. The system would be operated until MCLs are attained in the groundwater.

- Long-term groundwater monitoring in order to verify that the concentrations and the extent of groundwater contaminants are declining, that the remedies remain effective, and that public water supplies are protected. The exact frequency and parameters of sampling and the location of any additional monitoring wells would be determined during the design phase.

- Institutional controls restricting the installation and use of groundwater wells at and downgradient of the property until groundwater quality has been restored. Institutional controls would be in the form of existing use and development restrictions limiting the use of groundwater as a potable or process water without necessary water treatment as determined by SCDHS. Engineering controls, such as fencing and signs, would also be considered in order to protect the integrity of the remedies and to limit facility access until cleanup goals have been attained.

The effectiveness of thermally-enhanced ISVE (and, if appropriate, the configuration and number of ISVE wells) would be determined based upon the results of pilot-scale treatability studies conducted during the design phase. Should the findings of these treatability studies indicate that thermally-enhanced ISVE would not be sufficiently effective in addressing the contaminated soils at the property, then the soils would be excavated and treated/disposed off-site (Alternative S-2).

The effectiveness of air sparging with ozone injection (and, if appropriate, the configuration and number of injection wells) would be determined based upon the results of bench- and pilot-scale treatability studies conducted during the design phase. Should the findings of the treatability studies indicate that this technology is not sufficiently effective in addressing the contaminated groundwater at the site, or if its implementation proves logistically impracticable (it would require the installation of piping and other components in the street right-of-way, potentially complicated by the presence of gas and water lines, utility poles, and large trees), then the groundwater would be treated with a permeable reactive barrier (Alternative GW-4).

Because the preferred remedy would result in contaminants remaining on-site above levels that allow for unrestricted use and unlimited exposure, CERCLA requires that the site be reviewed at least once every five years. If justified by the review, additional remedial actions may be implemented.

Basis for the Remedy Preference

While Alternative S-2 (excavation of contaminated soils and off-site treatment/disposal), Alternative S-3 (excavation of contaminated soils and on-property treatment via LTTD), and Alternative S-4 (thermally-enhanced ISVE) would all effectively achieve the soil cleanup levels, Alternative S-2 and Alternative S-3 would be more expensive than Alternative S-4. Potentially difficult factors related to the excavation of soils down to fifty feet bgs adjacent to on-property buildings and on a property that is so small may need to be resolved for Alternative S-2 and Alternative S-3. Additional measures, such as building demolition (in addition to the laboratory building), may be required. Also, because of space limitations, staging the excavated soil for off-site treatment/disposal and on-property treatment, under Alternatives S-2 and S-3, respectively, as well as staging any additional building demolition debris, may prove difficult. While Alternative S-4 would require the performance of pilot-scale treatability studies and would take significantly longer to achieve the soil cleanup levels than the other action alternatives (five years for thermally-enhanced ISVE, as compared to six months to excavate and transport the contaminated soils to an EPA-approved treatment/disposal facility and one year to excavate and treat the contaminated soils using LTTD), considering that the groundwater component of the preferred remedy would address the contaminated groundwater in an estimated fifteen years, the increase in the time needed to clean up the soil would not be a significant concern. Therefore, EPA believes that Alternative S-4 would effectuate the soil cleanup while providing the best balance of tradeoffs with respect to the evaluating criteria.

Alternative S-2 is the preferable contingency alternative because, while Alternative S-3 (LTTD) is as effective as Alternative S-2, it would take more time to implement, require on-property space for the placement of an LTTD unit (which may be problematic), and is estimated to be more than twice as costly, as is noted above.

All three of the active groundwater alternatives are estimated to take approximately fifteen years to restore groundwater quality. Because there are no piping or facilities to construct or maintain, Alternative GW-4 (permeable reactive barrier) would be easier to implement than the two other action alternatives (especially in the highly-developed and densely-populated downgradient plume area, where implementation would be complicated by the presence of gas and water lines, utility poles, and large trees); however, Alternative GW-4 is approximately twice the cost of Alternative GW-2 (in-situ air sparging with ozone injection). Alternative GW-3 (groundwater extraction and treatment) would require the installation of considerably more piping and other components in the street right-of-way than Alternative GW-2, In addition, there are limited options related to the discharge of a relatively high volume of treated groundwater. Therefore, EPA has identified Alternative GW-2 as its preferred groundwater alternative since it would effectuate the groundwater cleanup while providing the best balance of tradeoffs among the alternatives with respect to the evaluating criteria.

With regard to the groundwater contingency alternative (Alternative GW-4), while Alternative GW-4 is as effective as Alternative GW-3 and would take about the same time to implement, it is considerably easier to implement, as is noted above.

The preferred remedy is believed to provide the greatest protection of human health and the environment, provide the greatest long-term effectiveness, be able to achieve the ARARs more quickly, or as quickly, as the other alternatives, and is cost effective. Therefore, the preferred remedy will provide the best balance of tradeoffs among alternatives with respect to the evaluating criteria. EPA and NYSDEC believe that the preferred remedy will treat principal threats, be protective of human health and the environment, comply with ARARs, be cost-effective, and utilize permanent solutions and alternative treatment technologies or resource recovery technologies to the maximum extent practicable. The preferred remedy also will meet the statutory preference for the use of treatment as a principal element.

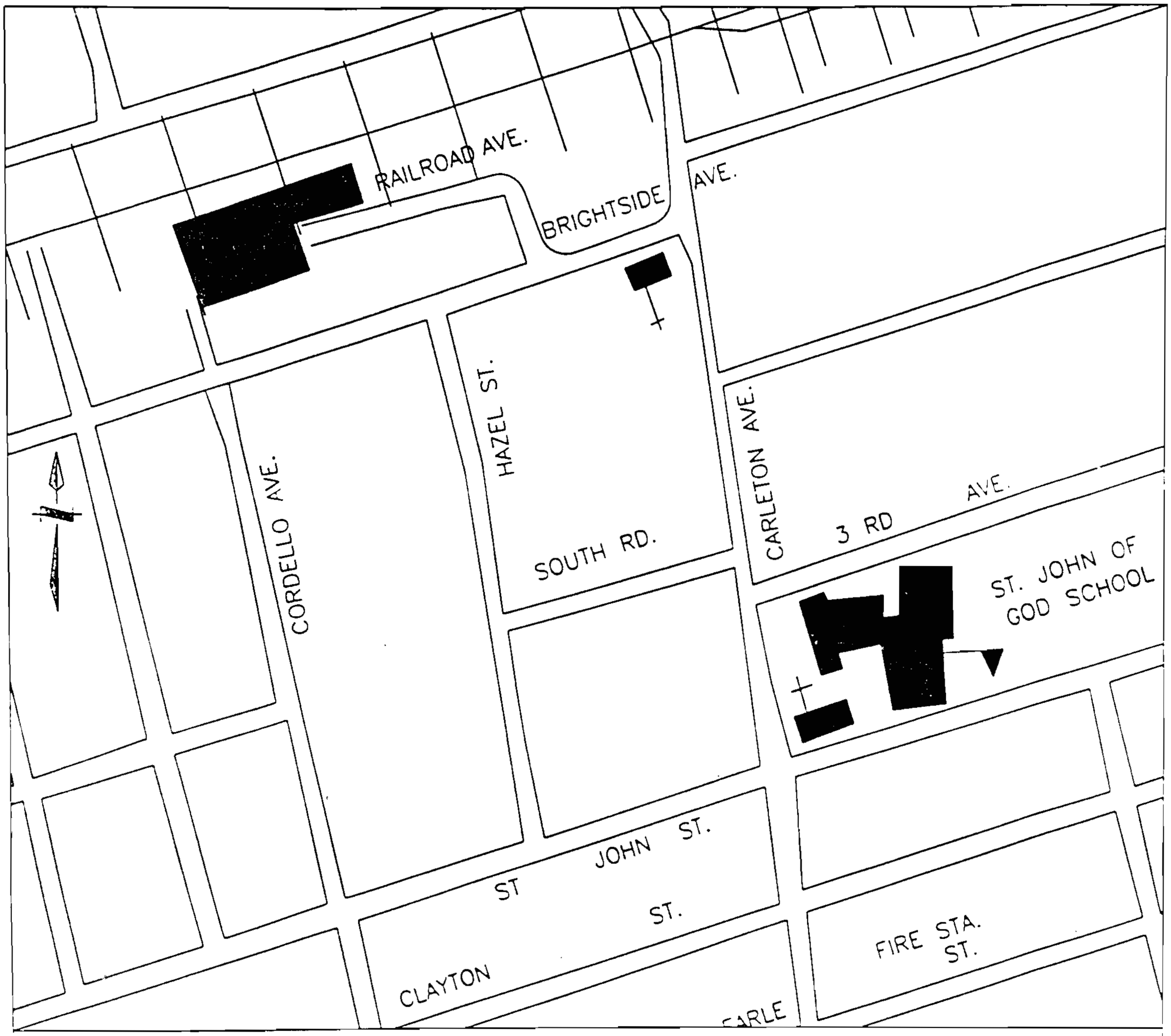

FIGURE 1

MACKENZIE CHEMICAL

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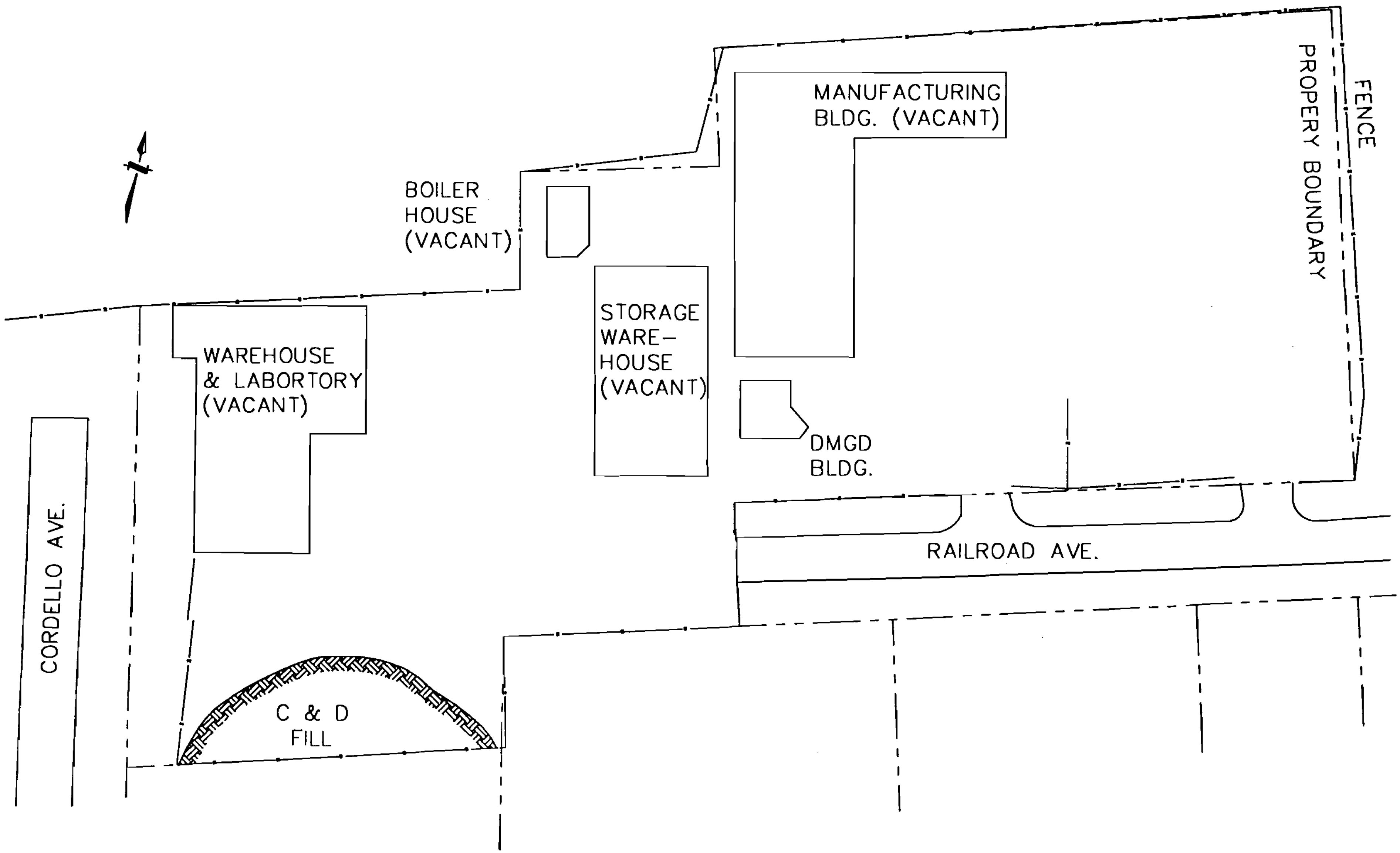
Figure 2: Site Layout
MacKenzie Chemical Works Site



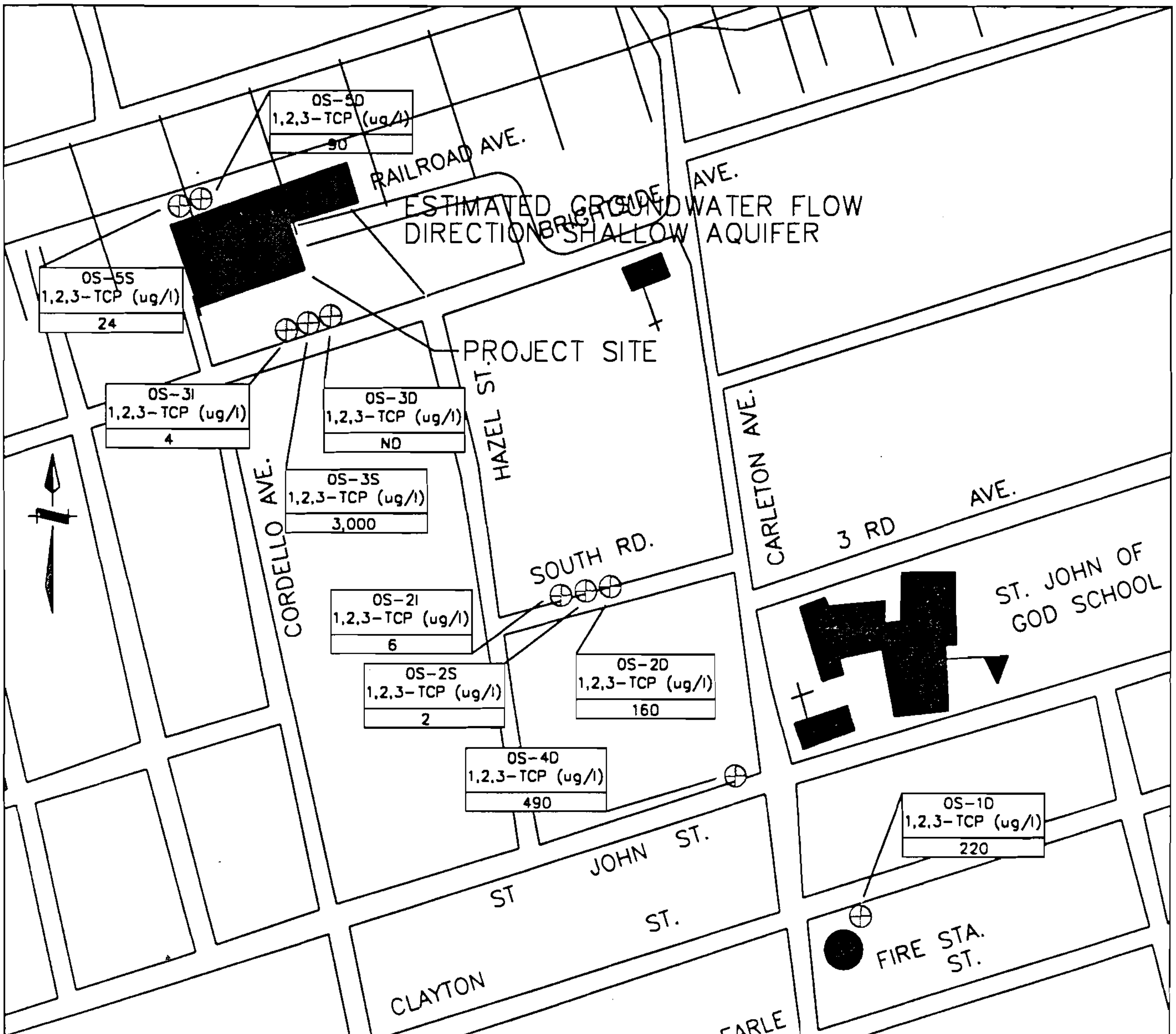


FIGURE 3
OFF-SITE MONITORING WELLS
AUGUST 1999
CONCENTRATIONS OF
1,2,3-TRICHLOROPROPANE
MACKENZIE CHEMICAL

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

SCALE: 1"=300'

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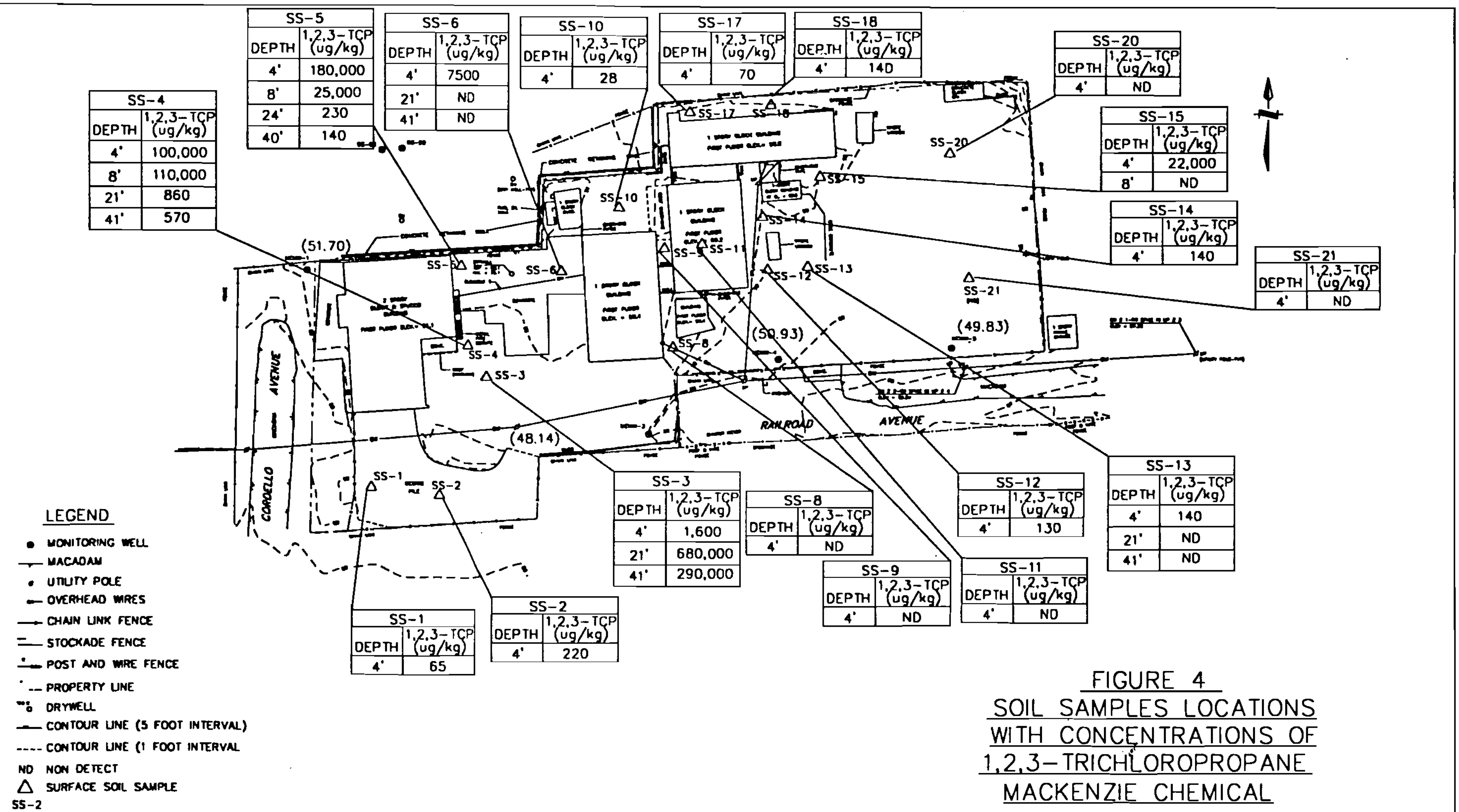

SS-1

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

SS-2

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

SS-3

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

SS-4

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

SS-5

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

SS-6

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

SS-8

DEPTH	1,2,3-TCP (ug/kg)
4'	ND

SS-9

DEPTH	1,2,3-TCP (ug/kg)
4'	ND

SS-10

DEPTH	1,2,3-TCP (ug/kg)
4'	28

SS-11

DEPTH	1,2,3-TCP (ug/kg)
4'	ND

SS-12

DEPTH	1,2,3-TCP (ug/kg)
4'	130

SS-13

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

SS-14

DEPTH	1,2,3-TCP (ug/kg)
4'	140

SS-15

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

SS-17

DEPTH	1,2,3-TCP (ug/kg)
4'	70

SS-18

DEPTH	1,2,3-TCP (ug/kg)
4'	140

SS-20

DEPTH	1,2,3-TCP (ug/kg)
4'	ND

SS-21

DEPTH	1,2,3-TCP (ug/kg)
4'	ND

FIGURE 4
SOIL SAMPLES LOCATIONS WITH CONCENTRATIONS OF 1,2,3-TRICHLOROPROPANE
MACKENZIE CHEMICAL

SCALE: 1" = 50'

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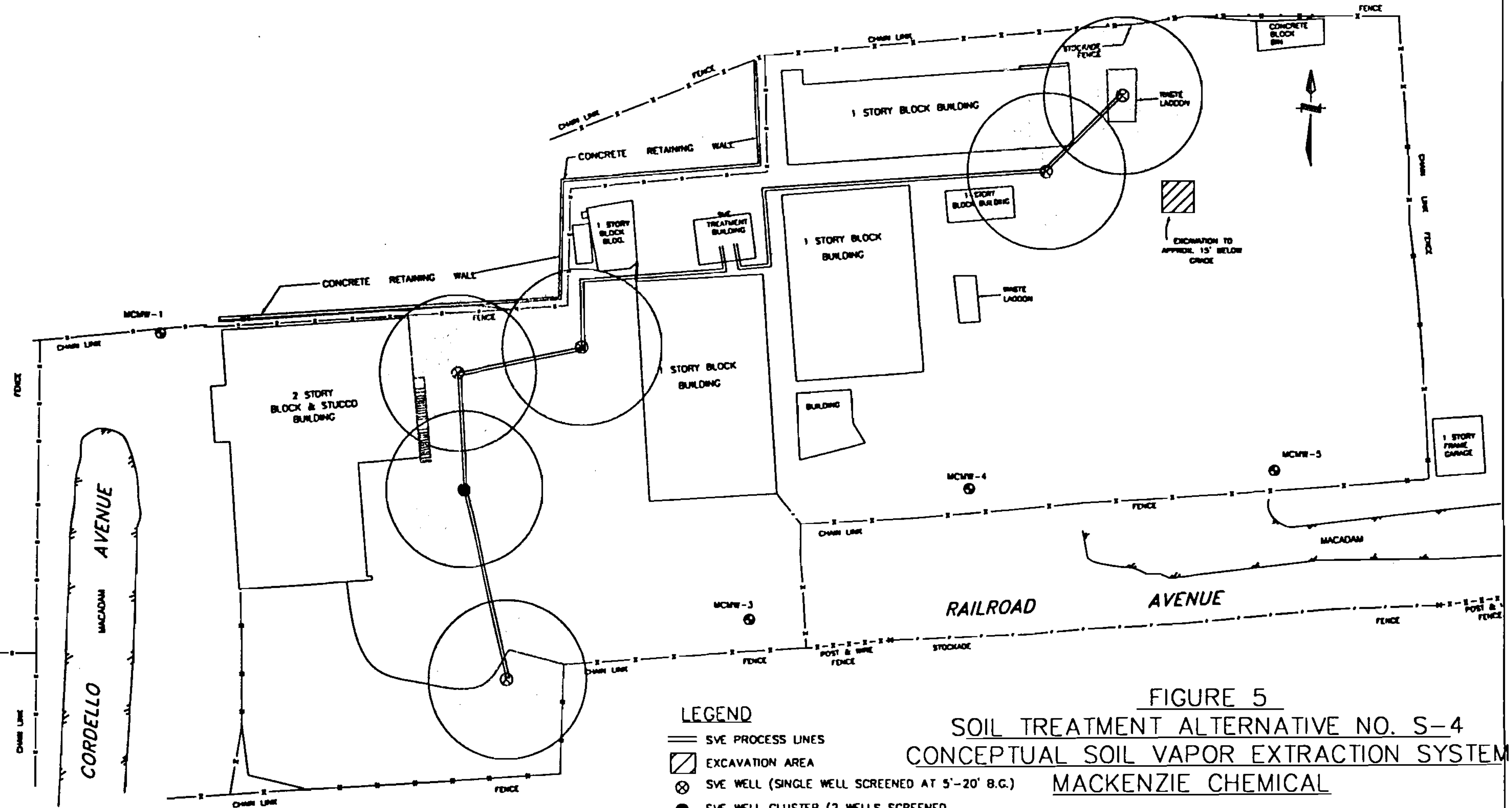

FIGURE 5

SOIL TREATMENT ALTERNATIVE NO. S-4
CONCEPTUAL SOIL VAPOR EXTRACTION SYSTEM
MACKENZIE CHEMICAL

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

H2M GROUP — ENGINEERS (MELVILLE, N.Y.) ARCHITECTS PLANNERS (SHELTON, CT.) SCIENTISTS SURVEYORS (TOTOWA, N.J.)

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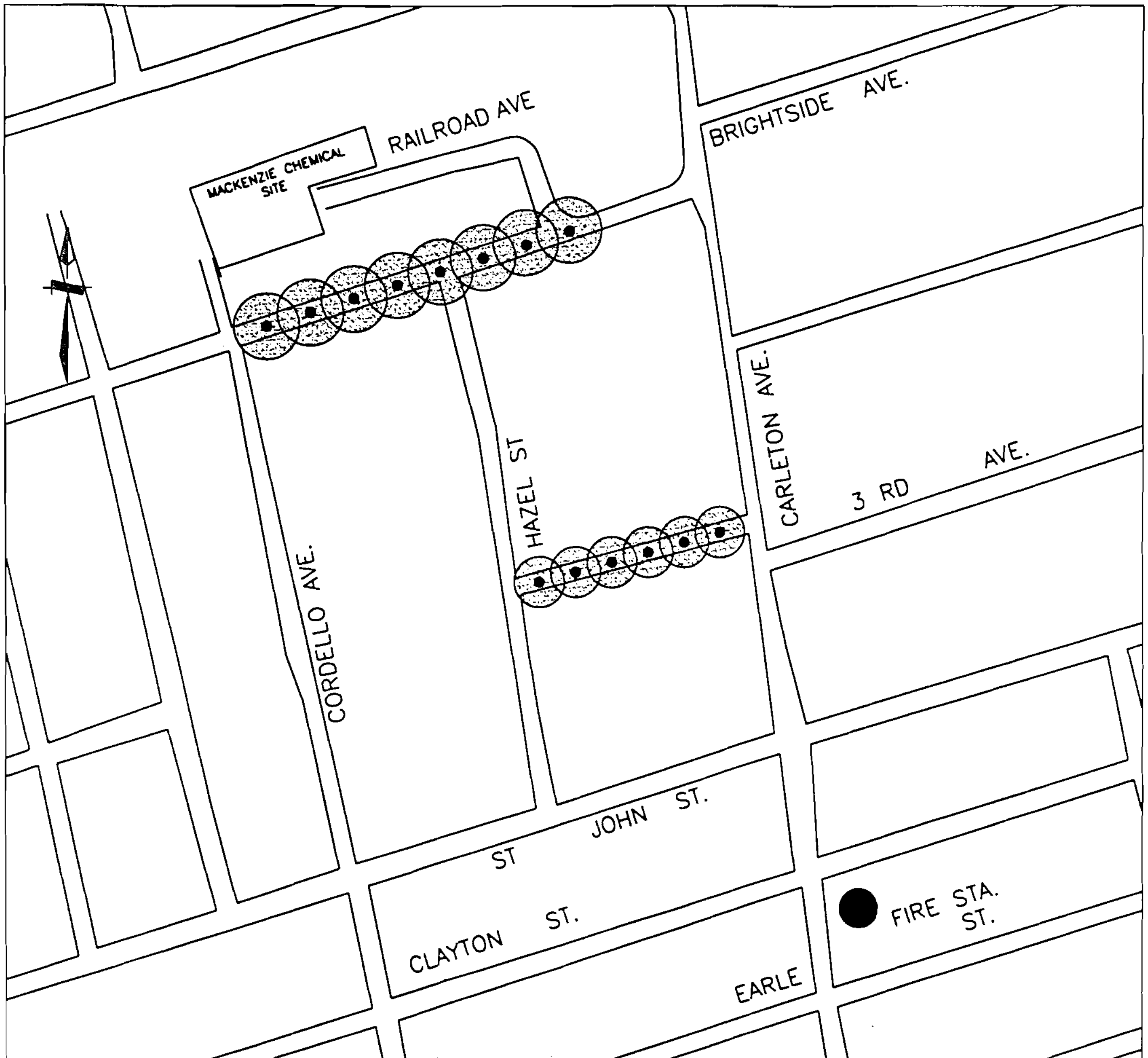

FIGURE 6

CONCEPTUAL GROUNDWATER ALTERNATIVE NO. GW-2
AIR SPARGE/ OZONE INJECTION SYSTEM
MACKENZIE CHEMICAL

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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MacKenzie Chemical Works Superfund Site

Proposed Plan
Public Meeting
March 3, 2003

Agenda

Introduction	Cecilia Echols, USEPA
Superfund Remedial Process	Joel Singerman, USEPA
Background	Mark Granger, USEPA
Remedial Investigation	Mark Granger
Remedial Alternatives	Mark Granger
Proposed Remedy	Mark Granger
Q & A	

Comprehensive Environmental Response, Compensation and Liability Act

- Toxic waste disposal disasters prompted passage by Congress in 1980
- Provides federal funds for cleanup of hazardous waste sites and to respond to emergencies involving hazardous substances

Comprehensive Environmental Response, Compensation and Liability Act

- Empowers EPA to compel responsible parties to pay for or conduct necessary response actions

Superfund Remedial Process

- Site Discovery and Ranking
- Site Placed on National Priorities List
- Remedial Investigation/Feasibility Study
- Proposed Remedy
- Record of Decision
- Remedial Design
- Remedial Action
- Site Deletion

·igure 1

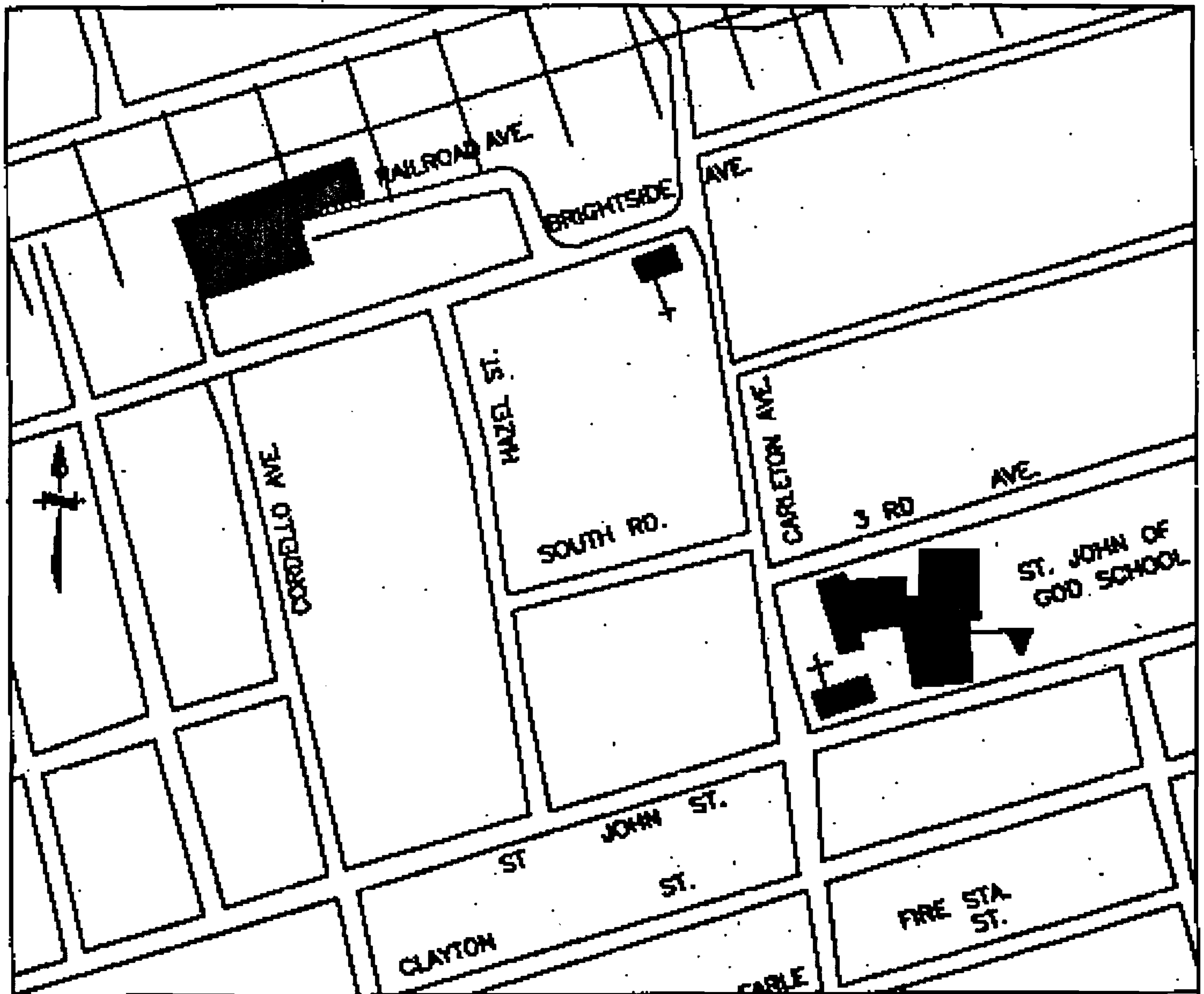

FIGURE 1

Background

- MacKenzie Chemical Works located in Central Islip, Suffolk County
- Plant operated continuously from the 1950s to mid-1980s
- MacKenzie operations included manufacture of various chemical products

Background (con't)

- Spills and poor-housekeeping practices documented in late 1970s and early 1980s
- Property sold in late 1980s
- Several small businesses have occupied property since that time

Background (con't)

- New York State and Suffolk County studies of site in 1993 found significant levels of contaminants in soil and groundwater
- New York State completed comprehensive study in August 2000
- Added to Superfund National Priorities List in September 2001

Summary of Remedial Investigation

- New York State and EPA studies conducted between 1998 to 2002 included:
  - Sampling of groundwater
  - Sampling of subsurface soil and drainage structures
  - Sampling of surface soil and soil vapor

Results of Remedial Investigation

- Groundwater flow generally to southeast
- Contaminants detected above state and federal standards in groundwater beneath and downgradient of site; most notably 1,2,3-TCP
- Public drinking-water supply wells located far downgradient of site

Results of the Remedial Investigation (con't)

- Many subsurface soil samples found to contain contaminants above state guidance values
- Off-site soil gas and site-related surface soils not significantly impacted
- Significant source of VOC contamination to groundwater from subsurface soils and drainage structures in lab and warehouse areas; primarily 1,2,3-TCP

Results of the Remedial Investigation (con't)

- Low to moderate levels of contaminants in subsurface soils throughout site
- While relatively high immediately downgradient, VOC levels in groundwater tend to be significantly lower beyond South Road

Risk Assessment Summary

- Sampling results from RI compiled and analyzed
- Risk analysis determines if site poses threat to human health and environment
- Risks were unacceptable under hypothetical scenarios for subsurface soils and groundwater, primarily due to 1,2,3-TCP

Soil Remediation Alternatives:

- Alternative S-1: No Action
- Alternative S-2: Excavation and Off-Site Treatment/Disposal
- Alternative S-3: Soil Excavation, Treatment via LTTD, and Redeposition
- Alternative S-4: Treatment of VOC-Contaminated Soils Using Thermally-Enhanced ISVE, Excavation of SVOC-Contaminated Soils with Off-Site Treatment/Disposal

Costs for Soil Remedies

Alt.	Total Cost
S-1	$0
S-2	$1.5 million
S-3	$2.5 million
S-4	$1.2 million

Groundwater Remediation Alternatives:

- Alternative GW-1: No Action
- Alternative GW-2: Groundwater In-Situ Air Sparging with Ozone Injection
- Alternative GW-3: Groundwater Extraction and Treatment
- Alternative GW-4: In-Situ Permeable Reactive Barrier

Costs for Groundwater Remedies

Alt.	Total Cost
GW-1	$0
GW-2	$1.3 million
GW-3	$2.6 million
GW-4	$2.6 million

EPA's Evaluation Criteria

- Overall Protection of Human Health and the Environment
- Compliance with Environmental Regulations
- Long-term Effectiveness and Permanence
- Reduction of Toxicity, Mobility, or Volume Through Treatment

EPA's Evaluation Criteria (con't)

- Short-term Effectiveness
- Implementability
- Cost
- State Acceptance
- Community Acceptance

EPA's Proposed Remedy for Site

- Alternative S-4: Treatment of VOC-Contaminated Soils Using Thermally-Enhanced ISVE, Excavation of SVOC-Contaminated Soils with Off-Site Treatment/Disposal
- Alternative GW-2: Groundwater In-Situ Air Sparging with Ozone Injection

EPA's Proposed Remedy for Site

- Alternative S-4: Treatment of VOC-Contaminated Soils Using Thermally-Enhanced ISVE, Excavation of SVOC-Contaminated Soils with Off-Site Treatment/Disposal
- Alternative GW-2: Groundwater In-Situ Air Sparging with Ozone Injection

Rationale

- Provides best balance of EPA's criteria
- Protects human health and the environment
- Reduces toxicity, mobility, and volume through treatment
- Readily implementable
- Cost effective