C. RBORUNDUM COMPANY

Site No. 932102

RECORD OF DECISION

Carborundum Company

Site No. 9-32-102

Record of Decision

Prepared by:

New York State
Department of Environmental Conservation

August 1991

DECLARATION STATEMENT - RECORD OF DECISION

Site Name and Location:

Carborundum Company
Town of Wheatfield, Niagara County, New York
Site Registry No. 932102
Classification Code: 2

Statement of Purpose:

This Record of Decision (ROD) sets forth the selected remedial action plan for the Carborundum Company Site. This remedial action plan was developed in accordance with the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) of 1980, as amended by the Superfund Amendments and Reauthorization Act (SARA) of 1986, and the New York State Environmental Conservation Law (ECL). The selected remedial plan complies to the maximum extent practicable with Applicable or Relevant and Appropriate Requirements (ARARs) of Federal and State environmental statutes and would be protective of human health and the environment.

State of Basis:

This decision is based upon the Administrative Record for the Carborundum Company Site and upon public input to the Proposed Remedial Action Plan (PRAP). A copy of the Administrative Record is available at the New York State Department of Environmental Conservation, 600 Delaware Avenue, Buffalo, New York and copies of the Feasibility Study Report and PRAP are available at the Niagara County Community College, 3111 Saunders Settlement Road, Sanborn, New York. A bibliography of those documents included as part of the Administrative Record is contained in the ROD. A Responsiveness Summary that documents the public's expressed concerns has been included.

Description of the Selected Remedy:

Soil will be remediated to achieve a clean-up goal of 3 parts per million trichloroethylene using in-situ vapor extraction. Results from a pilot study are expected shortly which initially indicates the technology will achieve the clean-up goals. Other soil treatment techniques (i.e. thermal/desorption) may be used if the study, or the actual implementation of vapor extraction, does not achieve the remedial goals.

Groundwater will be extracted and initially discharged to the local municipal wastewater treatment facility. After six months of groundwater remediation, the data on contaminant concentrations and optimum pump rates will be evaluated and the feasibility of installing permanent on-site treatment and subsequent discharge to Cayuga Creek will be explored. Long-term monitoring of groundwater and surface water is required.

Soil gas surveys will be required twice per year at the adjacent military housing facility to ensure protection of human health.

Declaration:

The selected remedial action will meet State Standards, Criteria and Guidelines (SCGs) and Federal ARARs by: 1). removing the volatile organic contaminants from the soil on-site (source control) and 2). extracting groundwater to prevent further migration of contaminants and to enhance groundwater quality in an effort to meet NYS groundwater quality standards. The remedy will satisfy, to the maximum extent practicable, the statutory preference for remedies that employ treatment that reduces toxicity, mobility or volume as a principle element.

The proximity of the Department of Navy's Housing Facility has resulted in a number of Navy concerns regarding potential health risks to its residents. Primarily, the Navy is demanding a role in the review of Remedial Design Work Plans. The responsiveness summary contains the Department's responses to the Navy's concerns. In general, the Responsible Party has agreed to keep the Navy informed of all planned work that could affect the housing facility, such as soil gas surveys, air emissions, etc. The Navy's concerns as well as the community's concerns will be addressed in the Remedial Design, and the remedial action plan will be implemented as proposed.

The selected remedial action has been used successfully at other hazardous waste sites, however, it is recognized that groundwater may never achieve NYS groundwater standards. To ensure the remedy provides adequate protection of human health and the environment, a review of the effectiveness of the remedy will be conducted at a minimum of every five years.

3-21-91
Date

Edward O. Sullivan
Deputy Commissioner

ATTACHMENT 1

THE CARBORUNDUM SITE (ID #932102)

COST ESTIMATES FOR THE SELECTED REMEDIAL ALTERNATIVE

Operable Unit	Selected Alternative	Total Estimated Cost (Present Worth)	Estimated Capital Costs	O&M Costs as Present Worth	Estimated Annual O&M Costs
Soil Remediation (Source Control)	In-situ Vapor Extraction	$6,630,000	$3,970,000	$2,670,000	$1,820,000
Groundwater	Pump & Treat (on-site carbon treatment) and long-term monitoring.	$2,970,000	$1,300,800	$1,670,000	$110,000
TOTAL		$9,600,000	$5,270,800	$4,340,000	$1,930,000

CARBORUNDUM COMPANY

Site No. 932102

Remedial Action Plan

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I. SITE LOCATION AND DESCRIPTION

The Carborundum facility is located in a rural area in the Town of Wheatfield, Niagara County, New York [please refer to Figure 1]. The facility property is approximately 40 acres in size and lies to the north of the New York Central railroad easement. The majority of land immediately adjacent to the facility is used for agricultural purposes. Department of Defense (DoD) military housing borders the facility along its western side [please refer to Figure 2]. Numerous other private residences are within a 0.75-mile radius of the facility. In addition, the Niagara Falls Air Force Base is located about 0.5 mile south of the facility.

Surface topography in the facility area generally slopes southward at a rate of about 5 feet per mile toward the Niagara River. Surface water from the active areas of the facility discharges into the plant's sewer system which discharges to the Niagara County Sewer District 1 Sewage Treatment Plant (NCSD). Cayuga Creek is located about 0.25 mile east of the facility and flows southward for about 4.5 miles until it discharges into the Niagara River in the City of Niagara Falls. Prior to this investigation, the SPDES (State Pollutant Discharge Elimination System) outfall, which is presently inactive, carried surface runoff and non-contact cooling waters from the facility into Cayuga Creek.

Site geology consists of 7 to 20 feet of unconsolidated glacial lake sediments and till which is underlaid by the Lockport Dolomite. Shallow horizontal and vertical fractures in the weathered uppermost section of the Lockport Dolomite comprise the primary aquifer beneath the facility. This weathered zone ranges in thickness from about 10 to 20 feet and appears to be the predominant route for migration within and off the site.

Soil

II. SITE HISTORY AND PREVIOUS INVESTIGATIONS

Operations at the Carborundum facility commenced in 1963. Trichloroethene (TCE), the principal chlorinated organic found in the groundwater, was used from 1963 to 1983 as a degreasing solvent in the manufacture of carbon and graphite cloth. Other chlorinated organics used during this period included 1,1,1-trichloroethane (TCA) and carbon tetrachloride. TCA was used on a trial basis as a degreasing solvent in the cloth manufacturing process and as a source of chlorine in the purification of graphite. Carbon tetrachloride was used also as a source of chlorine in the purification process and is no longer in use. TCA is still used as a purifying agent. Methylene chloride (MC) is currently used (beginning in June 1988) as a solvent in the filter manufacturing process.

Concern that chlorinated organics in the overburden and groundwater might pose a problem at the Carborundum facility was first raised in 1983 when TCE was found in the facility's SPDES outfall from samples collected during a NYSDEC inspection and in groundwater samples collected from production well P-2. In coordination with NYSDEC's Division of Water, an initial phase of investigation was

conducted, involving soil borings, well installation, groundwater sampling, a soil gas survey, private well and sump sampling, and seismic and resistivity geophysical surveys, were implemented since TCE was first found in the SPDES outfall. Groundwater samples were first collected in August 1984 during the first field investigation. Since March 1985, groundwater samples have been collected on a quarterly basis. The chlorinated organics that have been found include TCE, TCA, MC, trans-1,2-dichloroethene (trans-1,2-DCE), cis-1,2-dichloroethene (cis-1-2-DCE), 1,1-dichloroethane (1,1-DCA), vinyl chloride (VC), carbon tetrachloride, chloroform, 1,1-dichloroethene (1,1-DCE), and tetrachloroethene (PCE).

There are two areas of very high levels of chlorinated organics on the Carborundum plant: along the southwest corner of the manufacturing building, and in the grassy area northeast of the manufacturing building. Other source areas include the courtyard within the manufacturing building and the area south and southeast of the manufacturing building. Past chemical handling practices at the Carborundum facility, which were commonplace in industry during that period, suggest these areas are likely source locations of chlorinated organics which have been documented by soil gas and soil sampling studies. Figure 9 schematically outlines all the suspected source areas identified on the Carborundum plant to date [please refer to Exhibit A for additional information describing source areas].

Six monitoring wells (B-3M through B-8M) were drilled and installed at the facility during the first phase of work in 1984 [please refer to Figure 2]. Each well was installed into approximately the top 5 feet of the weathered section of the Lockport Dolomite. The highest TCE concentration encountered during the first phase of work was 98,000 parts per billion (ppb) from groundwater in well B-8M. Other confirmed high concentrations encountered included total 1,2-DCE (110,000 ppb) and VC (1,300 ppb) from well B-3M; total-1,2-DCE (14,000 ppb) from well B-8. During this same period, groundwater data from the other wells yielded comparatively low concentrations of chlorinated organics.

The second phase of work began in March 1986 and continued through 1987. The tasks that yielded significant information during the second phase of work were a soil gas survey, the installation of six additional monitoring wells, a seismic refraction survey, residential well sampling, nearby quarry seep sampling, and the completion of a 24-hour pumping test.

The soil gas survey demonstrated four areas of high concentrations (ranging from 10 to 3,500 micrograms per liter [ug/L]) of TCE in shallow soil gas in areas around the manufacturing building. In addition, data from groundwater monitoring resulted in a second phase of monitoring well installation which included six additional shallow bedrock monitoring wells (B-9M through B-14M) installed on the site during November and December 1986.

A 24-hour pumping test, which utilized production well No. 2 (P-2) as the pumping well, was also completed in December 1986. The

pumping test indicated that groundwater over much of the site could be captured and treated by pumping production well No. 2 (P-2) [please refer to Figure 7]. However, it was also noted that an additional pumping well would be necessary to capture the groundwater plume at the western edge of the site, at and around well B-3M. Groundwater concentrations of VC, total-1,2-DCE, and TCE measured in the parts per million (ppm) range in well B-3M.

Groundwater from 22 private residential wells was sampled by the Niagara County Department of Health in 1985 and 1988. One well, which was 5,000 feet upgradient of the facility, contained a low level of TCE (4.6 ppb). Since the well was so far upgradient, its contamination is not considered to be attributable to the facility. Two other wells yielded low concentrations of chloroform (2.0 to 11 ppb) and one well showed MC (5.1 ppb). None of these chlorinated organics were derived from the Carborundum facility. This conclusion is supported by the fact that two of the locations are upgradient and none of the wells contained the expected chemicals of the downgradient chlorinated organics plume, 1,2-DCE and VC. No other well sampled contained chlorinated organics.

The third phase of work, which was completed in 1988 and 1989, was designed to further define the extent of chlorinated organics in the groundwater and to investigate potential aspects of the site that would affect remedial design. Tasks performed in the third phase of the study included the installation of 10 shallow bedrock monitoring wells and three deep bedrock monitoring wells; the performance of residential well and sump sampling within a 0.75-mile radius of the site; the installation and testing of a secondary recovery well at the western boundary of the site adjacent to B-3M; sediment and surface water sampling in the inactive SPDES outfall in Cayuga Creek; the sampling for the potential presence of Dense Non-Aqueous Phase Liquids (DNAPL) in the two monitoring wells (B-8M and B-17M) with the highest levels of chlorinated organics; an investigation of the sewer trench on Cory Road and the conceptual development of an Interim Remedial Measure (IRM) for septic tank closure on the plant site.

IRM

In February 1989, the company entered into an Order on Consent to combine all the studies and conduct further work under the auspices of Article 27 of the New York State Environmental Conservation Law (ECL), i.e. State Superfund. The Phase II Remedial Investigation (RI), completed in the last quarter of 1989 and the first half of 1990 constituted the fourth phase of field investigation, and included the installation of four additional shallow bedrock monitoring wells to the southwest and east of the facility; the performance of a soil gas survey at the DoD housing facility to the west of facility boundary; the completion of shallow subsurface soil sampling in the SPDES outfall; the completion of an IRM for septic tank closure; and the preparation of a vacuum extraction treatability study in a source area.

III. CURRENT STATUS

1. The RI and the Risk Assessment (RA) Report - June 1990 - Ecology & Environment (E&E)

Remedial Investigation

Presently TCE and its primary degradation products 1,2-dichloroethene (1,2 DCE) and vinyl chloride (VC) are the most common chlorinated organics contained in the aquifer in the area of the facility. These chemicals are restricted primarily to the shallow portion (upper 20 feet) of the Lockport Dolomite bedrock aquifer. In most areas of the facility, TCE and its degradation products are not found in deeper portions of the aquifer; only one deeper well contains levels of these compounds that warrant concern. This well has recently been tested using down-hole geophysical techniques to determine if there is a mechanical problem with the well such as a grout channel. If found to be defective, the well will be properly abandoned and replaced. If the well is found to be useable then it will be included in the monitoring program to determine the effectiveness of the remedial program.

With the exception of the source areas, low levels of chlorinated organics in overburden soils are introduced to the bedrock aquifer from fluctuations of groundwater which periodically saturate the soil on a seasonal basis [please refer to Figure 3]. Off site to the southwest, groundwater is restricted to the bedrock throughout the year. While the overburden on site is periodically saturated, its hydraulic conductivity is so low that it does not transmit significant amounts of groundwater laterally and is classified as an aquitard.

Groundwater in the bedrock moves away from the facility to the south, southeast, and southwest. Plume movement also occurs in the shallow bedrock aquifer in all of these directions; however, the primary migration of the plume is to the southwest. Migration of the plume is most likely controlled by the high hydraulic gradient to the southwest. Chlorinated organics, principally 1,2-DCE and VC, have been found in the monitoring wells to the southwest at levels which exceed drinking water standards. Sampling data from domestic wells further downgradient beyond the current monitoring wells network, as well as rapid declines in concentration in that direction, suggest that the plume falls to non-detectable levels prior to reaching any downgradient receptors [please refer to Figures 4, 5 and 6].

Pumping tests performed in on-site recovery wells, P-2 and P-3, indicate that a sufficient capture area can be attained by pumping these two wells to prevent further plume migration. Preliminary interpretation of degradation patterns off-site suggests that an on-site treatment program which utilizes pumping and treatment of the groundwater and remediation of overburden source areas will be effective at reducing chlorinated organic levels to drinking water standards in the off-site plume [please refer to Figures 7 and 8].

Durin; the RI a number of citizen participation activities were undertaken including 1). a door-to-door visitation in November 1988 to determine if nearby residents were utilizing groundwater for drinking or other p rposes, 2). Establishment of a "800" line by the Company to answer que tions that the citizens may have, 3). public meeting in May 1989 to di cuss the RI and 4). public meeting in August 1990 to discuss th RI results associated with the DoD housing facility.

Risk ssessment

Four otential exposure routes were considered in assessing the risks pose by chlorinated organics of the Carborundum site. These were:

- Inhal tion by facility workers of vapors emanating from the groun ;
- Inhal tion by residents of the adjacent DoD housing area of vapor emanating from the ground;
- Inhal tion of vapors and ingestion of contaminated surface soils by fa ility workers in the area of the State Pollution Discharge Elimi ation System ditch; and
- Inhal tion and ingestion of chlorinated organics from groundwater as a esult of using the groundwater for domestic supply purpo es.

The f rst three scenarios could actually occur under existing conditions while the fourth scenario is only hypothetical since groundwate is not presently used for domestic supply purposes in the area where chlorinated organics have been found in the groundwater [please re er to Tables 1, 2 and 3].

E&E's estimated risks associated with the first three exposure scenarios anged from 1×10^{-11} (one in 100 billion) to 1×10^{-10} (one in 10 bill on) [NOTE: In general, regulatory agencies in the United States hav not established a uniform cancer risk level for distinguis ing between risks which are deemed acceptable and those which may e of concern. The EPA has generally considered risks in the range f one in ten thousand (1×10^{-4}) to one in ten million (1×10^{-7}) to b acceptable, and has recently adopted a risk level of one in a millio n (1×10^{-6}) as a "point of departure" for selecting the risk level that will be considered acceptable (EPA 1990)].

E&E's estimated risk associated with potential exposure to non-carcin genic chemicals is expressed as the ratio of the estimated exposure t the smallest exposure that might possibly cause adverse effects. The ratio is called a hazard index. A hazard index greater than one i dicates that adverse effects may be possible while a value less than o ne means that adverse effects would not be likely to occur. The hazard indices for the first three exposure scenarios ranged from 1×10^{-6} (o ne in a million) to 1×10^{-9} (one in a billion).

Therefore, the RA indicates potential exposures to chlorinated organics via airborne pathways under existing conditions do not pose any significant risks to human health. However, the NYSDOH considers additional soil gas sampling at the DoD housing area necessary before final conclusions can be made regarding risk to public health from soil gas vapors [please refer to Section III.3 on page 6].

Groundwater in the immediate vicinity of the Carborundum facility where chlorinated organics have been found would pose a health risk if it were to be used for domestic supply purposes such as drinking, showering or bathing over extended periods. However, groundwater in the affected area is not presently used for domestic supply purposes, as there are no homes with residential wells or basements in the affected area. Consequently, the estimated risks associated with groundwater usage are not applicable to any residents around the site.

2. Feasibility Study Report - Ecology & Environment - October 1990

A. General Response Actions for the Groundwater Medium

General response actions for the groundwater medium are limited to no action, extraction, on-site aboveground treatment, and off-site treatment and/or disposal. The effectiveness of extraction in capturing the on-site groundwater plume had been demonstrated through the pumping tests described in Section 4.3.1 of the RI. Aboveground treatment would remove or destroy the chlorinated organics and could be implemented either on-site or off-site. Off-site treatment would take place at the NCSD which currently services the Carborundum facility. Containment responses are not considered feasible for the groundwater medium. A substantial amount of the groundwater plume is located in the bedrock aquifer. The water-bearing zones of the aquifer consist of weathered zones and fractures, thereby making it impractical to install containment barriers. In addition, the unknown extent and trend of such fractures prohibits selecting containment barrier locations. This situation also makes in-situ groundwater response actions impractical for the groundwater medium. As in-situ methods would include the addition of treatment agents to the groundwater, the complex fracture system would make the design of such a system difficult, if not impossible. Furthermore, the on-site soils, which contain the overburden component of the plume on a seasonal basis, are of relatively low permeability, thus making injection of treatment agents into this groundwater difficult and impractical.

B. General Response Actions for the Soil Medium

The general response actions for the soil medium include excavation, aboveground treatment, off-site disposal, and in-situ treatment. Containment responses are not considered feasible for two reasons: first, no direct-contact or vapor-phase threats are posed by the soils and, thus, containment capping would not be needed to mitigate such a threat. Second, although the migration route of

concern is from the soil to the groundwater, containment would only minimally reduce the rate of this migration. Groundwater levels on site, where soils are contaminated, fluctuate seasonally from the bedrock level to near the surface. Thus, although containment would reduce the degree of infiltration from surface water and precipitation, periodic saturation of soils containing chlorinated organics would still occur from the seasonal fluctuations and flow of the groundwater.

3. Discussion between NYSDEC and Carborundum - August through January 1991.

As a result of the soil gas work done at the DoD housing area, the NYS Department of Health (NYSDOH) considered the soil gas vapors a public health concern and required monitoring [please refer to Exhibit B - NYSDOH letter dated 8/6/90]. The Company responded on 10/2/90 that the RA estimated carcinogenic health risks from soil gas to residents of the DoD to be 10,000 times less than the benchmark risk level of 1×10^{-6} (i.e. 1×10^{-10}).

The issue of soil gas vapors being a public health concern was addressed in three separate meetings starting with a meeting on 8/22/90 with the Navy personnel in charge of maintaining the military housing facility. The Navy had been receiving health complaints from residents in the housing area for a period of time and was concerned that the problem may be from the Carborundum facility. At the 8/22/90 meeting, the results of the RI and RA were presented by E&E with the conclusion there was no reason to believe the symptoms presented by the residents were caused by soil vapors. Other areas of concern were active air discharges from the facility (an active manufacturing facility) and faulty heating units in the housing units. Approximately 45 persons attended a public meeting on 8/29/90 sponsored by the Navy. NYSDEC, NYSDOH, Company officials and the Navy presented the results of the RI, as well as independent studies by the Navy. Results of the meeting included commitments by Carborundum to evaluate and eliminate nuisance odors (which was accomplished later in the year) and by the Navy to evaluate the furnaces and ventilation systems of the homes.

A second meeting was convened on 12/7/90 to discuss the soil gas and air concerns at the site. The NYSDEC Division of Air inspected the site on three separate occasions during the Fall 1990 and found the company in compliance with applicable regulations. Regarding the soil gas issue, NYSDOH requested a monitoring program be set up to evaluate the site conditions during various seasons, on the presumption that seasonal changes may impact the amount of soil gas that could escape to the ambient air. At the Company's request, it was necessary to meet with NYSDOH experts regarding risk assessment (RA) since the Company maintained that the RA indicated minimal risks from the contamination at the site.

The third meeting took place on 1/26/91, during which the RA procedures and methods were discussed. NYSDOH and the Company agreed that assumptions used in the RA can affect the risk. Therefore, it was agreed it was prudent to monitor the soil gas in the areas where

the contaminated plume of groundwater passes under the housing area [Please refer to Exhibit C & D - letters from E&E dated 2/6/91 and 3/26/91 respectively].

IV. ENFORCEMENT STATUS

The NYSDEC has entered into a Consent agreement with the Carborundum Company under Article 27 of the Environmental Conservation Law (ECL) entitled "Inactive Hazardous Waste Disposal Sites". The consent agreement was signed by the Commissioner of NYSDEC on February 9, 1989. The purpose of this agreement was to provide for the implementation of an RI/FS at the site and the selection of a final remedial alternative.

A second Consent agreement, drafted in accordance with Article 27 of the ECL sets forth the goals as being the development and implementation of the selected remedial alternative, and operation, maintenance and monitoring of the selected remedial alternative. The draft consent agreement was presented to the company on 2/19/91 and is currently under review.

V. GOALS FOR THE REMEDIAL ACTION

Remedial action objectives have been developed in the RI to be protective of human health and the environment for all exposure pathways and to comply with applicable standards, criteria, and guidelines (SCGs). As summarized in Section 7 of the RI and noted earlier on page 5, no current threats to human health or the environment are posed by the chlorinated organics at the Carborundum facility. Thus, the requirement for remediation is driven by SCGs. SCGs apply specifically to the groundwater medium.

The remedial action objective (RAO) for groundwater at the site is to control, minimize or eliminate the migration of contaminants from the site. Generally, it is NYSDEC's policy to attain SCGs to ensure protection at all points of potential exposure. For groundwater, NYSDEC remediation goals are to attain New York State groundwater standards throughout the contaminated plume.

Recent data from other groundwater remediation programs has documented the difficulty of achieving restrictive groundwater standards at and near source areas. Consequently, E&E has proposed that on-site groundwater remediation goals should be less restrictive than off-site. These conclusions are based on theoretical calculations outlined in Exhibit E.

After review of this information it is unlikely that groundwater within the facility boundaries (as defined by wells B3, B4, B5, B6, B9, B13 and B27) can attain NYS groundwater standards, however federal maximum contaminant levels (MCLs) are expected to be attainable [please refer to Table 4]. These are the concentrations set by the federal government, below which the water would be safe to drink. If it is determined that some portion of the groundwater within the area of attainment cannot be returned to its beneficial use (drinking

water source), then institutional controls will be put into place above groundwater contaminated above health-based levels and appropriate containment measures will be continued. As noted on page 15 (Section C), based upon the uncertainty involved in predicting the ultimate effectiveness of groundwater pump and treat systems, NYSDEC will routinely review the remedial actions to determine if the stricter NYS groundwater standards can be acheived.

Beyond the facility boundaries, (off-site wells begin with the first ring of wells which are B-21M, B-22M, B-23M, B-24M, B-25M, B-26M and B-31M), the groundwater RAOs will be the standards presented in NYCRR (New York Code of Rules and Regulations) Part 703. These latter standards are even more strict than the federal MCLs [please refer to Table 4].

For soil, the Feasibility Study (FS) originally proposed remediation to the extent that the soils would no longer present a threat to the groundwater at concentrations above MCLs. While this, in general, remains the RAO, a more specific soil clean up goal was requested by NYSDEC. Carborundum and E&E developed a clean-up goal based primarily on site specific data in response to the request by NYSDEC. The rationale for the following numbers can be found as Exhibit E and F (Letter dated 3/7/91, E&E to NYSDEC, and NYSDEC Memo dated 3/20/91). A statistical sampling approach will be used which considers an average soil concentration of 3 ppm TCE, 1 ppm cis-1,2-DCE, and 0.5 ppm VC to be the overall goal for soils remediation. Areas of the plant site expected to require soil remediation is shown in Figure 4.

VI. SUMMARY OF THE EVALUATION OF THE REMEDIAL ALTERNATIVES

Regulations established by the State and federal governments which deal with the remediation of inactive hazardous waste sites require that the selected remedial alternative be protective of human health and the environment, cost effective and comply with statutory requirements. A comprehensive list of remedial technologies established by the USEPA was utilized to determine potentially feasible remedial alternatives.

A preliminary screening of remedial alternatives identified six (6) alternatives for contaminated groundwater and six (6) alternatives for contaminated soils.

Remedial Alternatives for Groundwater:

- No Action Alternative
- Groundwater Extraction and Treatment by Air Stripping
- Groundwater Extraction and Treatment by Carbon Adsorption
- Groundwater Extraction and Treatment by UV/Ozone Oxidation
- Groundwater Extraction, Treatment and Reinjection to Groundwater
- Groundwater Extraction, Treatment and Off-site Treatment at NCSD

lemedial Alternatives for Soil:

- No Action Alternative
- Excavation and Treatment by Volatilization (Low Temperature Thermal Desorption, Vibratory Screen Method)
- Excavation and Treatment by Incineration
- In-Situ Vapor Extraction
- Soil Flushing
- Excavation and Off-site Disposal

A. Groun water Remediation:

No Ac ion Alternative - This alternative would not use any active remedial t chnology for the site groundwater. Under this alternative, a groundwa er monitoring program (sampling and analysis) would be implemente to determine the concentration and migration of chlorinate organics over time.

Groun water Extraction and Treatment by Air Stripping - Air stripping, using packed towers, is widely accepted as an effective method for removing volatile organics from groundwater. Contaminated water is p mped to the top of an air stripping tower, where it is distribute over a bed of packing materials. The packing provides a large wett d surface area for contact between the water and air. Air is introdu ed below the packing material and is blown up through the tower coun ercurrent to the water. As the water comes in contact with the air, e uilibrium is attained between the aqueous and gas phases. Dissolved rganics will transfer to the gas phase from the liquid phase. Th organic laden air is then passed through a granulated activated arbon filter unit to adsorb contaminants before being discharged to the atmosphere.

Groun water Extraction and Treatment by Carbon Adsorption - This alternativ is a simple and effective means of removing most dissolved organic co pounds from water. As contaminated groundwater comes in contact wi h the surface of activated carbon, an equilibrium is establishe between the surface of the carbon and the aqueous phase resulting n the preferential transfer of organic compounds to the carbon sur ace. Consequently, an activated carbon unit will remove all the ad orbable organic compounds from an aqueous influent as long as the carl on unit has not been saturated with any of those compounds.

Groun water Extraction and Treatment by UV/Ozone Oxidation - Chemical t eatment for the chlorinated organics present in the groundwate at the site is limited to oxidation treatment. Oxidation technology is used to chemically oxidize organic compounds present in water. Co plex organic molecules are broken down into a series of less compl x molecules; the end product being water, carbon dioxide and hydrog n chloride. For many years, chemical oxidants (e.g. ozone) have been sed widely used for industrial treatment without ultraviole (UV) enhancement. UV light, when combined with ozone and/or hyd ogen peroxide, produces a highly oxidative environment significan ly more destructive than that created by ozone alone.

Groundwater Extraction, Treatment and Reinjection to Groundwater - Treated groundwater may be reinjected into the aquifer from which it was withdrawn. This approach can be used to help direct the flow of contaminated groundwater toward the extraction wells or recovery trenches.

Extraction and off-site Treatment at NCSD - Niagara County Sewer District No. 1 (NCSD) presently services the Carborundum facility. Carborundum has contacted NCSD regarding the discharge of extracted groundwater containing 200 to 1000 ppb of total chlorinated organics. NCSD is currently reviewing the proposal and is expected to accept the discharge.

B. Soil Remediation:

No Action Alternative - This alternative would not use any active remedial technology for the site soils.

Excavation and Treatment by Volatilization - This alternative is a process that uses air, heat and/or mechanical agitation to physically transfer contaminants into the air phase. Recently, various volatilization techniques have been tested and used as innovative technologies to remediate soils containing volatile organic compounds. The two volatilization techniques that appear to be the most applicable for this site are volatilization utilizing a mobile low-temperature thermal desorption unit and the vibratory screen method. Each of these two methods is described below.

Low-Temperature Thermal Desorption: Low-temperature thermal desorption is a physical separation process used to transfer volatile compounds from a solid matrix into a gas stream, typically using air, heat, and mechanical agitation. The volatile compounds transferred into the gas stream are then subjected to further treatment (e.g., carbon adsorption or high-temperature incineration). This is a relatively new technology, and many applications are under development. Removal efficiencies exceeding 99.9% for non-polar halogenated aromatic compounds like TCE have been demonstrated by low-temperature thermal desorption units during bench, pilot, and full-scale studies (CDM 1989).

Vibratory Screen Method: The vibratory screen method is a volatilization technique that disturbs the structure of the soil facilitating the release of volatile compounds. This volatilization technique employs a vibratory screen mechanism, or mechanical sieve. A mechanical sieve is a conventional piece of portable construction equipment typically used for size fraction grading in the construction and quarry industries. Using this volatilization technique, contaminated soils are excavated and dumped into the loading hopper of the mechanical sieve. The mechanical sieve processes the soil through a series of blades and grates to break it down. The soil is then transported on a conveyor belt to a series of vibratory screens that further disaggregate and separate the soil into three size fractions.

The soil is then stockpiled until samples collected from the treated soil verify that cleanup goals have been met. Some soil may require more than one pass through the mechanical sieve to achieve cleanup goals.

Excavation and Treatment by Incineration - Thermal treatment is a method that employs high-temperature oxidation under controlled conditions to degrade substances into products that generally include carbon dioxide, water vapor, sulfur dioxide, nitrogen oxides, hydrogen chloride, and ash. Several types of incinerators are technically feasible and have been used to treat hazardous soil, including multiple-hearth, fluidized-bed, and rotary-kiln incinerators. Rotary kiln incineration is most commonly used for soil, probably because of its relative simplicity and more readily available equipment. Feed systems can be altered to accommodate large-diameter particles, and residence times can be increased to ensure that all contaminants have been treated. Depending on the capacity of the unit, rotary kilns also process large volumes of wastes.

Thermal destruction is a proven technology that can effectively and rapidly treat all organic compounds. This procedure consistently achieves the best overall results for these contaminants, usually accomplishing well over 99% removal.

Excavation and Treatment by Soil Flushing - In-situ soil flushing is a process applied to unexcavated soils using a groundwater extraction/reinjection system. An aqueous solution is injected into the area of contamination, and the contaminant elutriate is pumped to the surface for removal, recirculation, or on-site treatment. During elutriation, contaminants are mobilized into solution because of solubility, formation of an emulsion, or chemical reaction with the flushing solution. An in-situ soil-flushing system includes extraction wells installed in the area of soil contamination, injection wells installed upgradient of the contaminated soil area, and a waste water treatment system.

Vapor Extraction - In-situ vapor extraction is a technique for the removal of volatile organic compounds (VOCs) from the vadose (or unsaturated) zone of soils. The basic components of the system include extraction wells, monitoring wells, and high-vacuum pumps.

The in-situ vacuum extraction system operates by applying a vacuum through the production wells. The vacuum system induces air flow through the soil, stripping and volatilizing the VOCs from the soil matrix into the air stream. Along with gaseous VOCs, contaminated groundwater is generally extracted. (The quantity of extracted VOC-contaminated groundwater will depend on the moisture content of the soil in the vadose zone). The two-phase flow of contaminated air and water flows into a vapor-liquid separator, where the contaminated groundwater is removed. The groundwater will require subsequent treatment (e.g., carbon adsorption or air stripping). The

contaminated air stream is typically treated by utilizing an activated carbon bed.

Excavation and Off-site Disposal - Excavation is a well demonstrated and reliable technology for the removal of contaminated soil. Implementation is relatively simple, and no special equipment or materials are required. Due to the seasonally high groundwater levels groundwater seepage into excavation areas could impede excavation operations. However, groundwater extraction or cutoff techniques can be used to facilitate efficient removal of contaminated soils.

Excavation of soils containing VOCs presents the possibility of releasing the volatile contaminants into the atmosphere, in addition to the possibility of generating contaminant-laden dust. During excavation activities, air quality monitoring is required and dust and/or vapor control measures (e.g., foam or water) could be required. Soil sampling would be required upon completion of excavation to verify that all soil not meeting established cleanup goals has been removed. A problem with implementability is posed, however, since a significant amount of contaminated soil is located immediately adjacent to buildings that are currently in use. Removal of these buildings would pose an unacceptable burden on Carborundum's operations

C. The Preferred Alternative:

The preferred alternative based on the available information is:

- Extract the groundwater both on and off site
- Initially dispose of groundwater at NCSD
- Treat contaminated soil to 3 ppm TCE or less
- Monitor groundwater and soil gas

Remedial action at the Carborundum facility will be performed for soil (on-site) and groundwater (both on and off the site property). The preferred remedial alternative does not completely match any of the comprehensive alternatives described in the FS, although the component remedial technology (e.g. carbon adsorption) is identical to portions of specific alternatives.

Soil Remediation:

The preferred technique for soil remediation will most likely be in-situ vapor extraction. This would be implemented as described in Alternatives 4 and 5 of the FS [please refer to Table 5]. The selection of in-situ vapor extraction for soil remediation is contingent upon affirmative results from the vapor extraction pilot study currently being performed. Results are scheduled to be presented in a report in early summer 1991. Other soil treatment techniques (i.e., thermal desorption) may be used if the study ultimately finds that in-situ vapor extraction technology is not

effective. However, all results to date indicate that this vapor extraction technology will be effective.

Groundwater Remediation:

Contaminated groundwater exists in two hydrogeologically distinct locations: groundwater upgradient and groundwater downgradient of the subsurface hydrogeologic boundary located in the southwestern portion of the facility. Groundwater upgradient of the boundary will be extracted as described in all the alternatives in the FS except for the no action alternative. Groundwater downgradient of the hydrogeologic boundary will be extracted, but not as described in Alternatives 3, 5, and 7 of the FS [please refer to Table 5]. Extraction wells will likely be located on the north side of the railroad right of way near the DoD facility to decrease construction costs. Well locations and pumping rates will be determined by a hydrogeological investigation of the aquifer in this area. This study is scheduled to be performed in the Fall of 1991.

The extracted groundwater from on-site will initially be discharged to the Niagara County Sewer District #1 (NCSD) for treatment and disposal. After six months of groundwater remediation, the data on contaminant concentrations and optimum pump rates will be examined and the feasibility of installation of a treatment facility will be re-evaluated. Water will be discharged to the State Pollution Discharge Elimination System (SPDES) outfall if it is treated on-site. The decision to treat groundwater on-site and then discharge to the SPDES outfall or to continue to discharge to NCSD will be based on the evaluation which is planned after six months of operation.

Long-term monitoring will consist of sampling selected monitoring wells on a monthly basis upon initiation of site remediation. Currently the wells are monitored quarterly. The increased frequency will provide additional data to evaluate the progress of remediation. Monthly monitoring will only be implemented for one year following the start of remediation. The need for continued monthly monitoring will be evaluated at the end of one year. Other wells not included in the monthly schedule will continue to be monitored on a quarterly basis.

Additional monitoring requirements include the implementation of soil gas surveys twice per year for two years on the DoD housing area. Surveys will be performed in the winter and summer seasons. The sampling locations will monitor the area near the eastern boundary of the housing area and adjacent to homes in the southeast corner of DoD property where the bedrock plume exists beneath the soils. Monitoring results will be evaluated by the NYSDOH to assure that human health is being protected. Monitoring is scheduled to begin during the Summer 1991.

Monitoring of Cayuga Creek will be implemented on a yearly basis whenever the hydgogeology suggests there is even a remote possibility that the stream can be adversely impacted.

The other remedial actions (i.e. groundwater extraction and soil remediation) will be reviewed by NYSDEC at least once every five years after completion of the remedial action, to assure that human health and the environment are being protected. This review will take place in addition to the regularly scheduled monitoring and operation and maintenance, even if the monitoring data indicates that the implemented remedy meets the "clean up criteria or standards". The objective of the review will be to evaluate if the implemented remedy protects human health and the environment and to identify any "permanent" remedy for the site. Before taking or requiring such action, all interested parties including the responsible parties and the public shall be provided an opportunity to comment on NYSDEC's decision.

D. Rationale for Selection:

The final alternatives were evaluated against the following eight (8) criteria: 1) Compliance with New York State Standards, Criteria and Guidelines (SCGs), 2) Reduction of toxicity, mobility or volume, 3) Short-term impacts, 4) Long-term effectiveness and permanence, 5) Implementability, 6) Cost, 7) Community acceptance, and 8) Overall protection of human health and the environment.

- Compliance with SCGs:

Contaminant-specific SCGs consist solely of the groundwater quality standards. SCGs would likely be met within 5 years due to the removal of source contaminants via vapor extraction and groundwater extraction. Although the groundwater goal (i.e. 6 NYCRR Part 703) may not be met at or near source areas, it has been determined that federal groundwater standards are likely to be attained [please refer to Table 4]. Containment to prevent migration of contaminants and institutional controls will be used wherever necessary to protect public health and the environment.

Extracted water would be discharged to and treated by NCSD. The SCGs that apply include provisions under the Clean Water Act (40 CFR Part 403) which require Carborundum to meet the conditions of the permit before discharging to the sewer district. SCGs also provide a procedure for developing air emission permit levels. Since control equipment such as carbon adsorption or catalytic or thermal oxidization will be installed on the vapor extraction system, removing virtually all the contaminants, meeting the requirements of the permit issued by NYSDEC will be assured.

- Reduction of Toxicity, Mobility or Volume

The soils will most likely be treated by in-situ vapor extraction. As this technology is a physical treatment, the contaminants are transferred to another phase before they are eventually destroyed. The gas phase effluent would in turn be

trea ed by either catalytic or thermal oxidation of carbon adso ption. Oxidation would result in direct destruction, while carb n adsorption would lead to the destruction of the cont minants when the carbon was regenerated. The carbon would be c nsidered an F002 RCRA (Resource Conservation Recovery Act - a fe eral law identifying and requiring special handling of haza dous waste) waste by the "derived-from" rule and thus would nece sarily be treated to effectively destroy the absorbed cont minants during regeneration at a RCRA facility.

Groundwater: For the first six months, all contamination in the l lume would be discharged to the NCSD for treatment by biol gical and physical methods. Currently, the NCSD's influent cont ins TCE at levels comparable or above the levels that would be e pected in the extracted groundwater, and NCSD's effluent comp ies with its NYSDEC discharge permit. After six months, the data on contaminant concentrations and optimum pump rates will be exam ned and the feasibility of installing a treatment facility and d ischarging directly to Cayuga Creek will be evaluated. Trea ment of contaminated groundwater will be in conformance with a NY DEC discharge permit and most likely would include air stri ping or carbon adsorption. As noted above, the contaminants woul be destructed when the carbon was regenerated.

- Short-Term Impacts:

Groundwater: No adverse impacts during implementation. Extr cted contaminants remain in a closed system until treatment at P TW.

Soil: Contaminated vapors generated by the vapor extraction will be treated with carbon absorption or oxidation prior to disc arge to eliminate emissions.

- Long-Term Effectiveness and Permanence:

Since removal of the vast majority of chlorinated organics that would have migrated to the groundwater will be accomplished, this alternative is considered effective in the long-term.

- Implementability

Groundwater: Readily implementable, technical obstacles to construction and operation are non-existent. Remedy is easily monitored via the existing monitoring wells. Additional extraction wells could readily be installed if needed.

Soil: Soil treatment using vapor extraction is readily implementable since it requires proven techniques and off-the-shelf equipment. Difficulty may arise determining the optimum placements of soil vents to direct air from fissures through the contaminated zones. Installation of an impermeable surface cap over soil and injection probes will prevent air flow short circuiting.

- Cost:

Since the preferred alternative is actually a combination of various alternatives described in the FS a final cost estimate was not prepared. A detailed cost estimate is provided in the FS report for elements of the preferred alternative.

- Community Acceptance:

Community concerns are expected to focus on the remedial alternative which will be most protective of public health. A full assessment of community attitudes toward the preferred alternative and the other alternatives will be made following the formal public comment period and informational meeting.

- Overall Protection of Human Health and the Environment:

Subsurface contamination poses little threat to human health or the environment. The lack of receptors, either human or environmental to the contaminated groundwater, results in an absence of significant risks. However, the additional soil gas monitoring will further evaluate the air exposure pathway via soil gas at the DoD housing area. Future uses of land near the facility could theoretically include residences constructed on agricultural land southwest of the railroad and power company rights-of-way. Placing wells here for potable water is unlikely because the natural water quality of the bedrock aquifer is unsuitable for use and a public water supply is available for use.

Control of the upgradient plume and elimination of the downgradient plume eliminates the improbable theoretical exposure scenario of potable water well installation in agricultural land beyond railroad and power company rights-of-way.

VII. SUMMARY OF THE GOVERNMENT'S POSITION

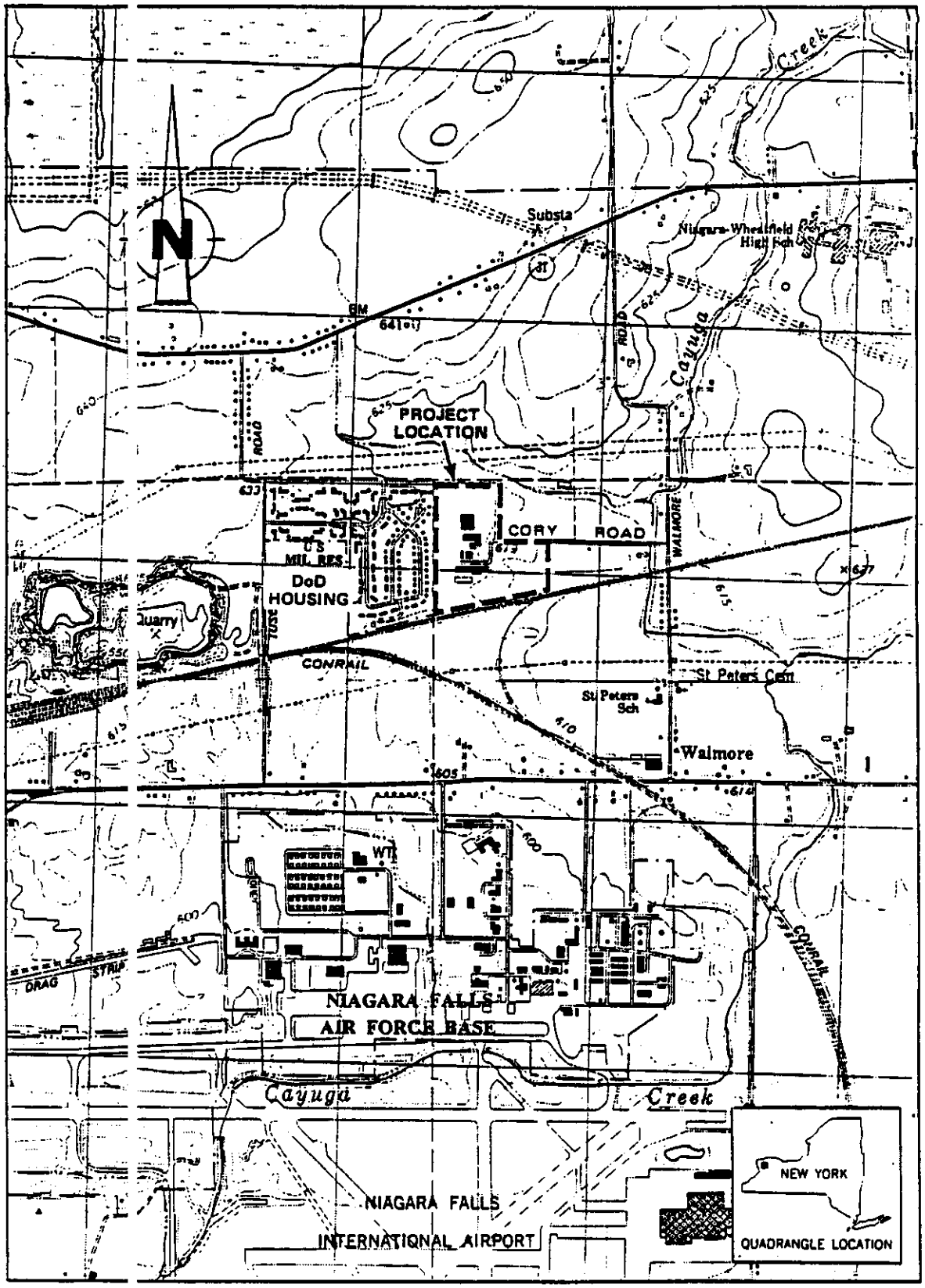
The basis for the Government's decision is Article 27, Title 13 of the Environmental Conservation Law. A public meeting is scheduled for May 1991 to present the Proposed Remedial Action Plan (PRAP). A responsiveness summary will be prepared addressing the comments and recommendations of the responsible parties and the public.

The NYSDEC and NYSDOH consider the preferred remedial alternative to provide the best balance among alternatives with respect to the criteria used to evaluate remedies. Based on the information available at this time, it is believed that the preferred alternative would be protective of human health and the environment, would be in compliance with applicable or relevant and appropriate requirements of other federal and State environmental statutes and would be cost effective.

A bibliography of correspondence between NYSDEC and Carborundum Company (represented in many cases by BP America and Ecology & Environment) pertaining to the review of the RI/FS reports are contained in the Administrative Record. Letters from the NYSDOH regarding the review of the RI/FS are also included in the Administrative Record.

LIST OF ACRONYMS

1,1-DCA	-	1,1-Dichloroethane
CFR	-	Code of Federal Regulations
DCE	-	Dichloroethane also known as Dichloroethene
DNAPL	-	Dense Non-Aqueous Phase Liquid
DOD	-	Department of Defense Military Housing
ECL	-	Environmental Conservation Law
E&E	-	Ecology & Environment
EPA	-	Ecology & Environment
FS	-	Feasibility Study
IRM	-	Interim Remedial Measure
MCLs	-	Maximum Contaminant Levels
MC	-	Methylene Chloride
NCSD	-	Niagara County Sewer District No. 1
NYSDEC	-	New York State Department of Environmental Conservation
NYSDOH	-	New York State Department of Health
NYCRR	-	New York Code Rules and Regulations
PCE	-	Tetrachloroethylene also known as Perchloroethylene
ppm	-	Parts per million
ppb	-	Parts per billion
RA	-	Risk Assessment
RAOs	-	Remedial Action Objectives
RCRA	-	Resource Conservation and Recovery Act
RI	-	Remedial Investigation
SCGs	-	Standards, Criteria and Guidelines
SPDES	-	State Pollutant Discharge Elimination System
TCA	-	1,1,1-Trichloroethane
UV	-	Ultraviolet
ug/l	-	Micrograms per litre
VC	-	Vinyl Chloride
VOC	-	Volatile Organic Compound
TCA	-	1,1,1 - Trichloroethane
TCE	-	Trichloroethylene (also known as Trichloroethene)



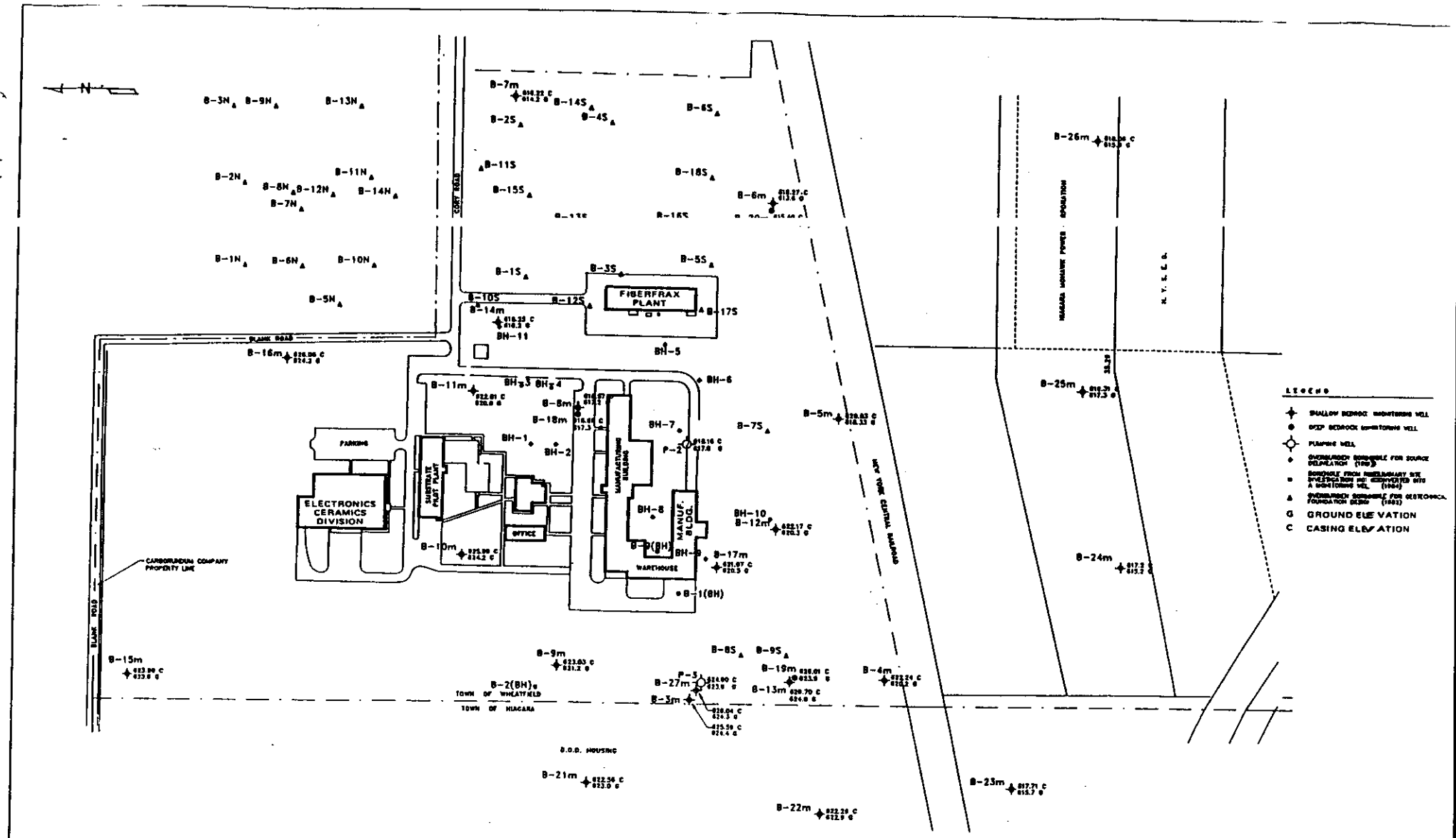
SOURCE: Ecology and Environment, 1986.

SCALE

0 ½ 1 MILE

0 5 1 KILOMETER

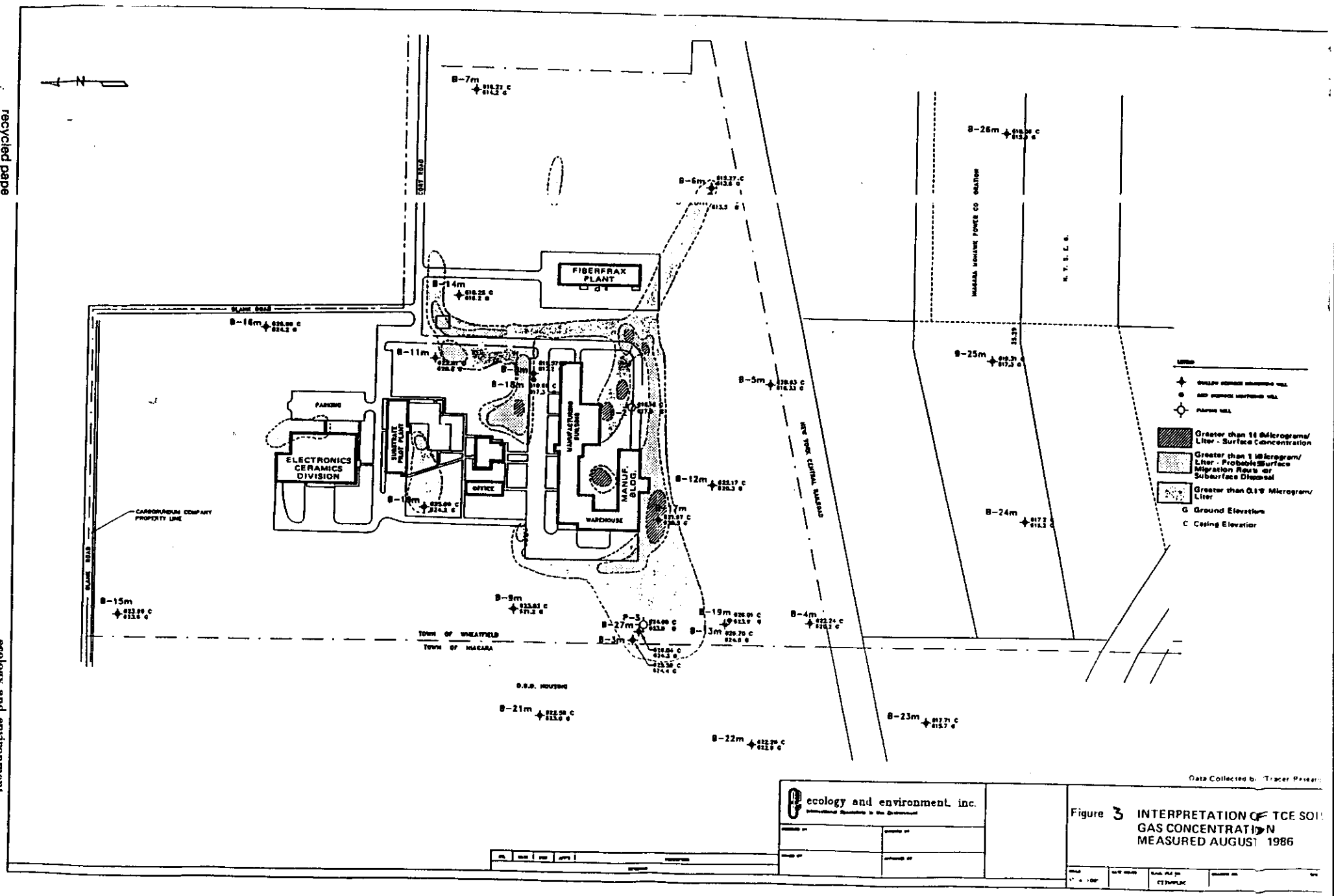
Figure 1 CARBORUNDUM FACILITY LOCATION MAP

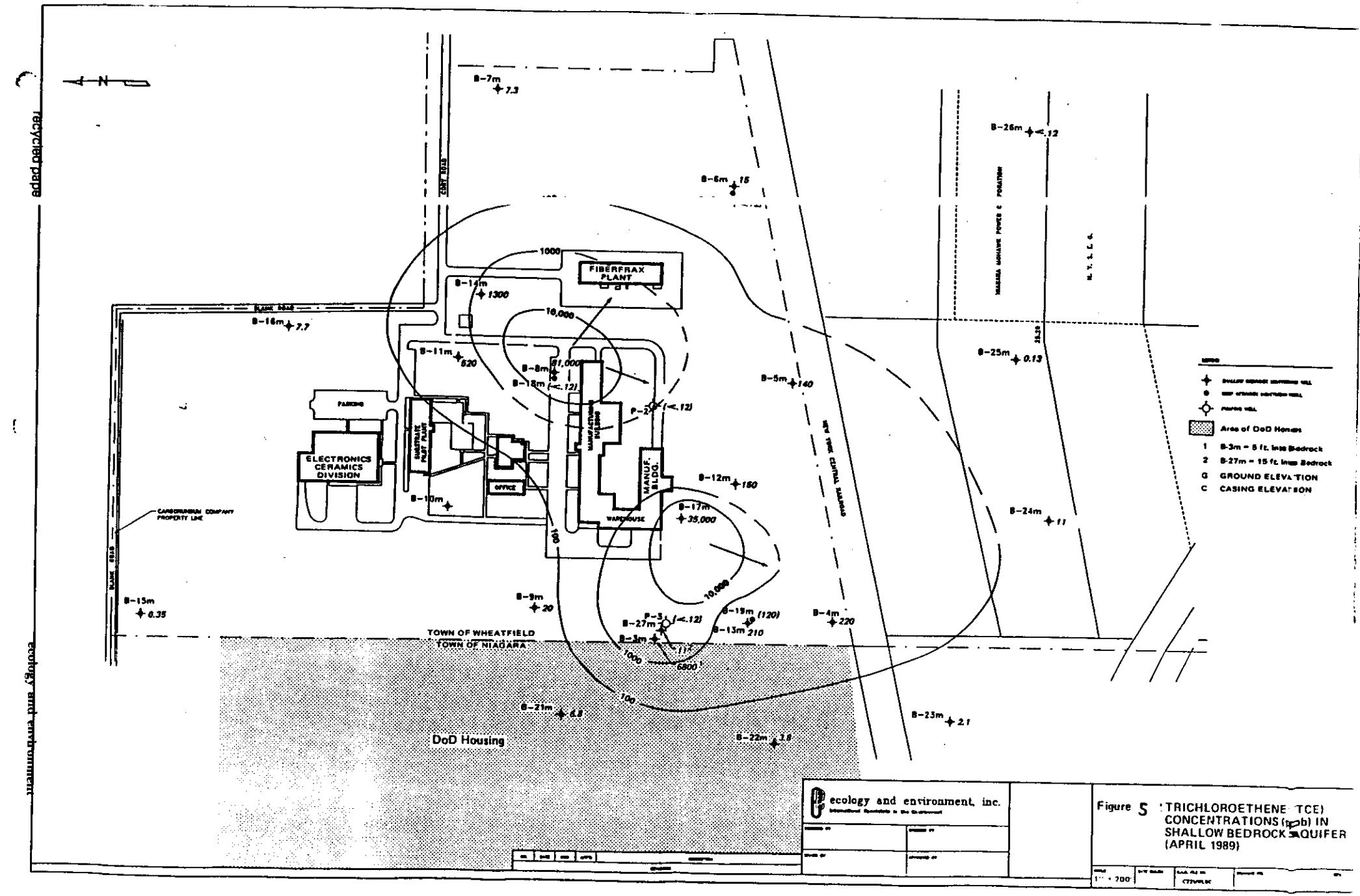


ecology and environment, inc.

Figure 2 FACILITY LAYOUT MAP

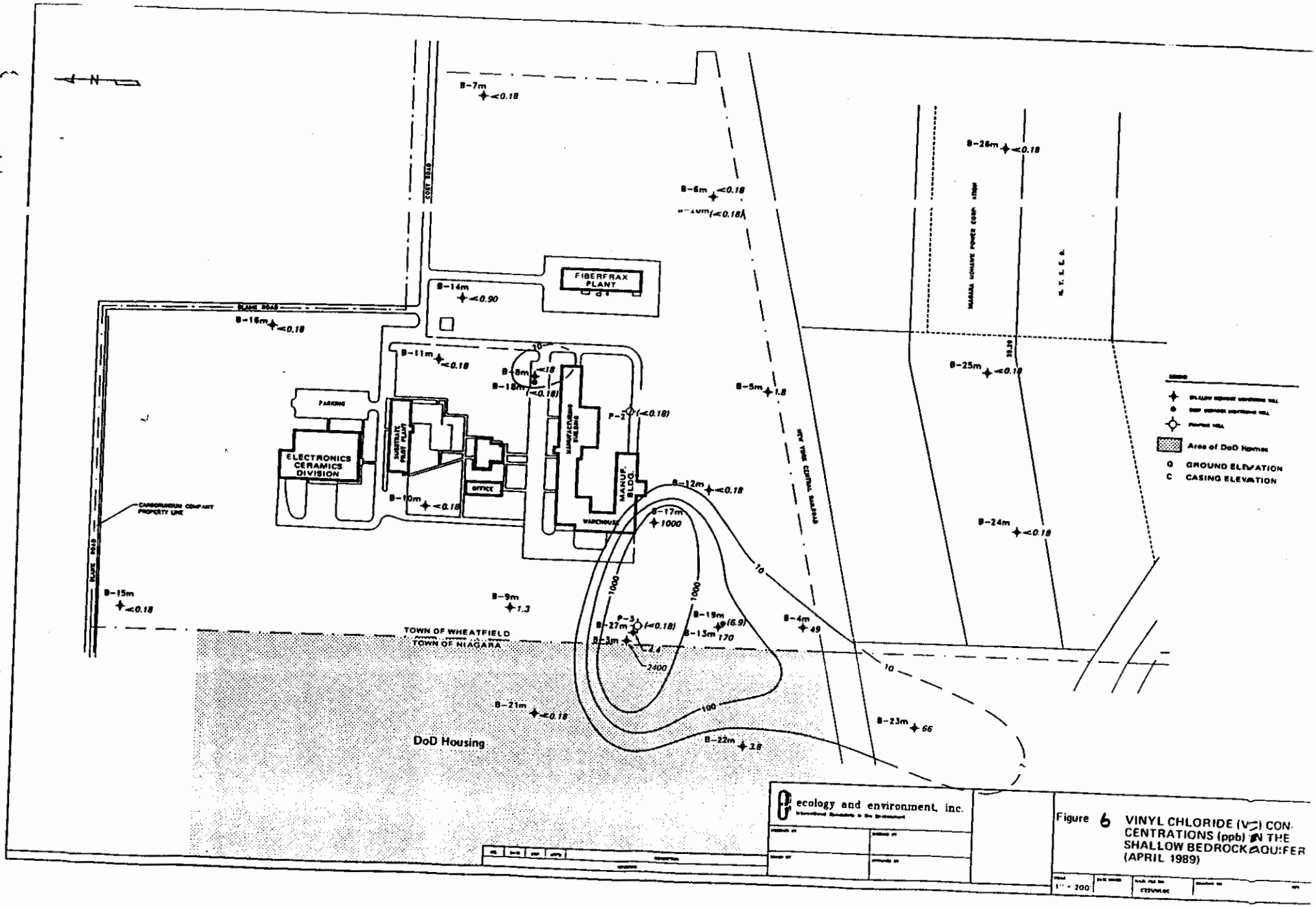
1" = 200'





ecology and environment, inc.

Figure 5 : TRICHLOROETHENE (TCE) CONCENTRATIONS (ppb) IN SHALLOW BEDROCK AQUIFER (APRIL 1989)



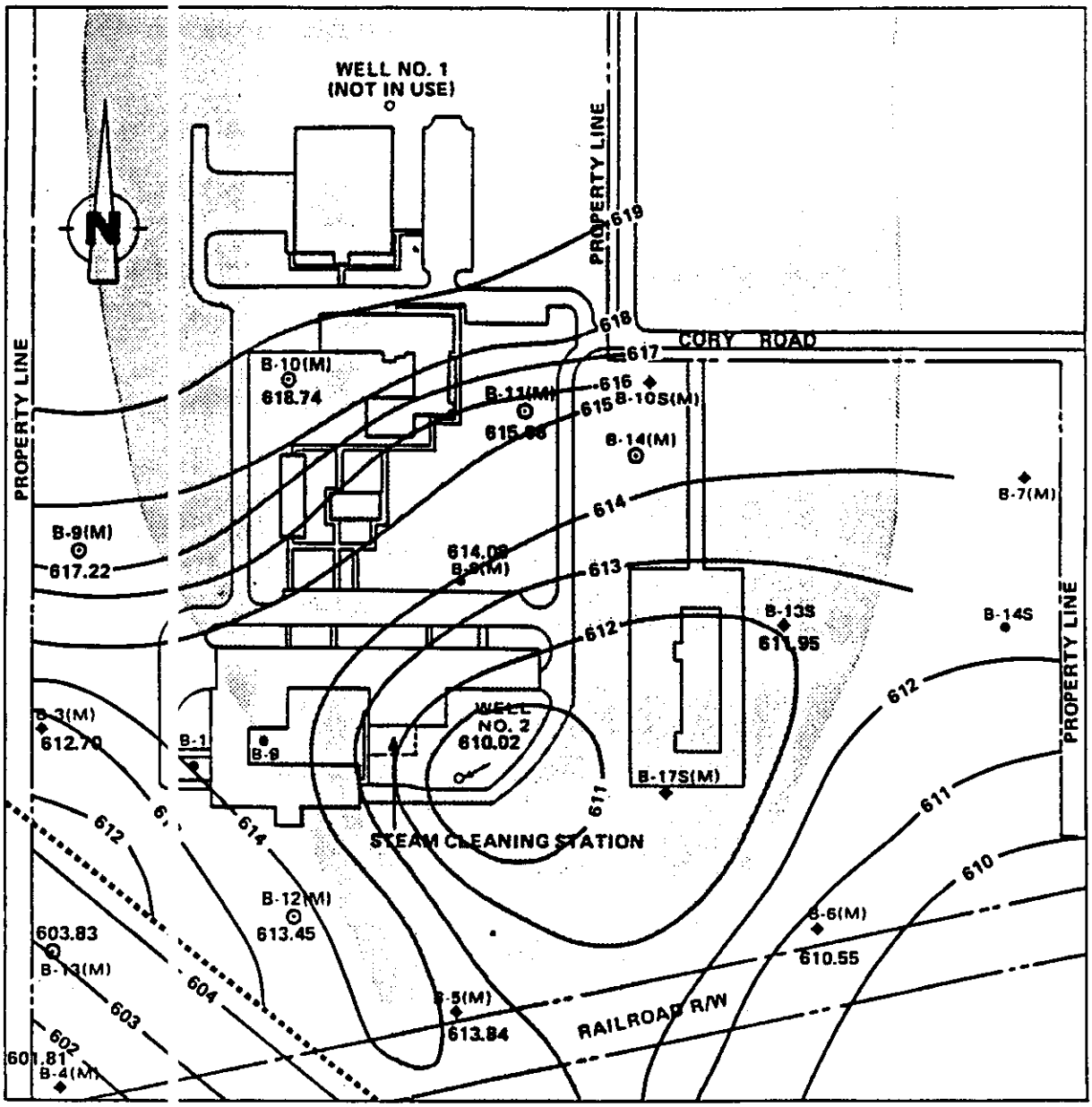
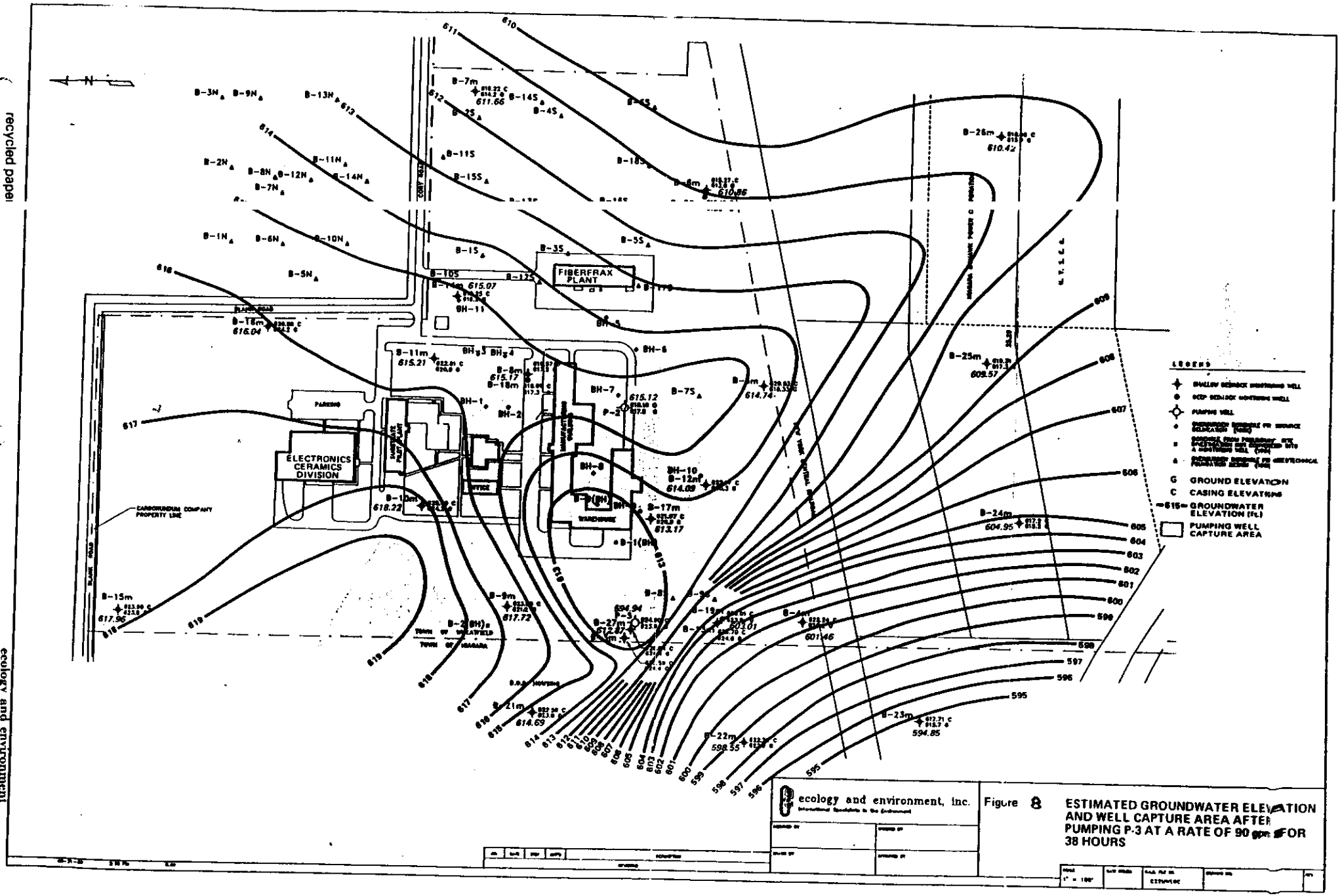


Figure 7

ESTIMATED GROUNDWATER ELEVATION AND WELL CAPTURE AREA
AFTER PUMPING P-2 AT A RATE OF 200 gpm FOR 24 HOURS



ecology and environment, inc.

Figure 8 ESTIMATED GROUNDWATER ELEVATION AND WELL CAPTURE AREA AFTER PUMPING P-3 AT A RATE OF 90 gpm FOR 38 HOURS

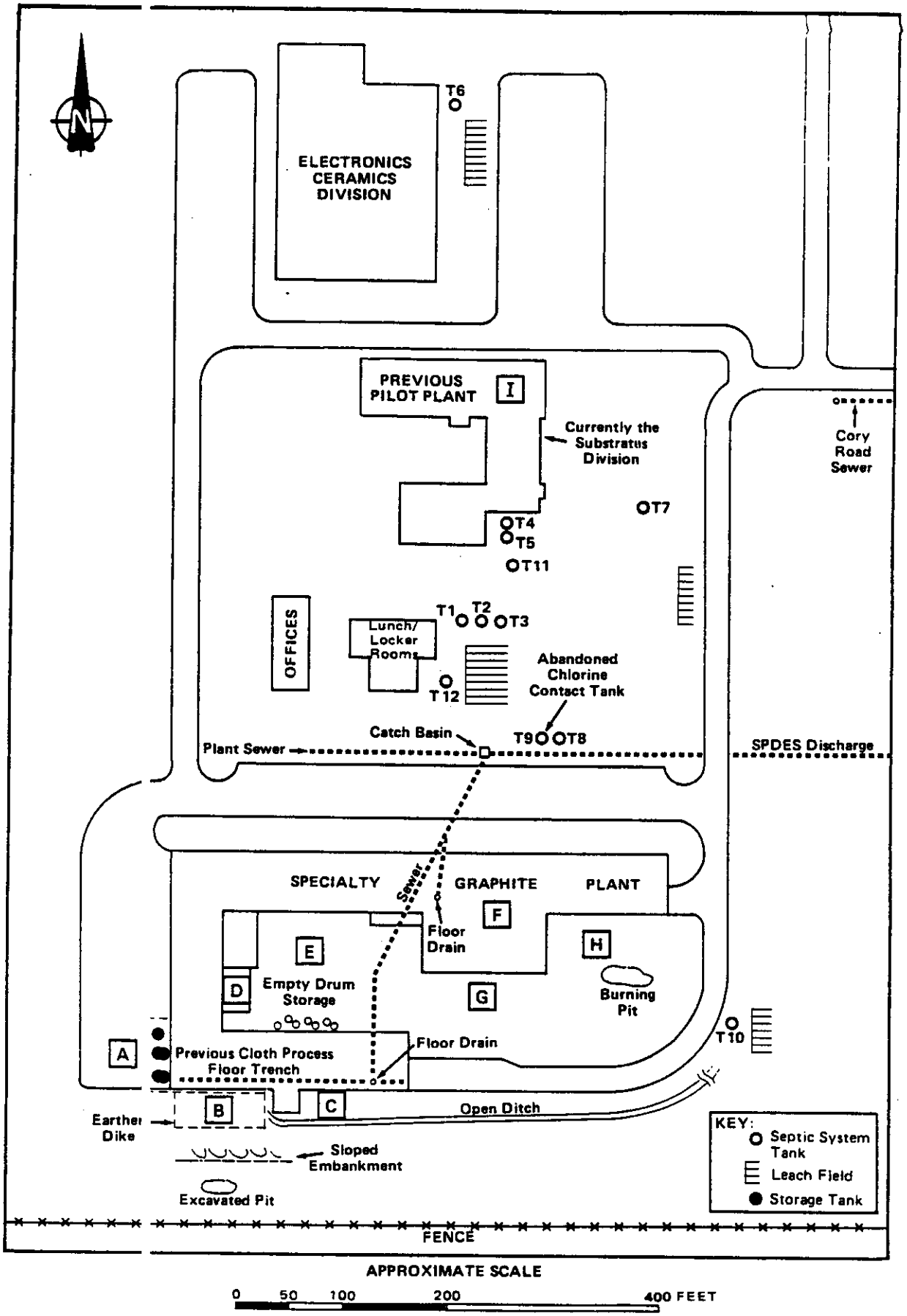


Figure 9 OVERBURDEN SOURCE AREAS

ecology and environment

Table 1

GROUNDWATER, SOIL GAS, AND ESTIMATED AMBIENT AIR
CHLORINATED ORGANIC CONCENTRATIONS USED TO ESTIMATE
[illegible]

Compound	Soil Gas Concentrations in DoD SG-26 (mg/m^3)	Well B-17M Area		Estimated Air Conc. in DoD Housing Area (mg/m^3)
		Average Groundwater Conc. at B-17M (ug/L)	Soil Gas Conc. Near B-17M (mg/m^3)	
1,1-Dichloroethane	3.5	135	--	3.85E-10
1,1-Dichloroethene	0.15	175	--	1.54E-11
1,2-Dichloroethene (total)	5	NU	15.6	4.87E-10
Tetrachloroethene	NA	NU	1.99	8.16E-12
1,1,1,-Trichloroethane	0.4	NU	2.03	4.28E-11
Trichloroethene	2	NU	970	4.52E-09
Vinyl Chloride	0.5	NU	1.6[a]	6.65E-11

[AD]CZ4140:D2467, #2395, PM = 22

NA = Not Analyzed.
NU = Not Used.

[a] = Estimated from total 1,2-DCE concentration in soil gas

Table 2

EXPOSURE MEDIA CHLORINATED ORGANIC CONCENTRATIONS
RESIDENTIAL WATER USAGE SCENARIO

	Downgradient Offsite (Wells B21M-26M, B28M)				Facility Boundary (Wells B3M-7M, 9M, 13M, 19M, 27M)				Entire Facility (All Wells)	
	Case 1: Current (1988-90) Average Concentrations		Case 2: Maximum Observed Concentrations		Case 3: Current (1988-89) Average Concentrations		Case 4: Maximum Observed Concentration		Case 5: Maximum Observed Concentration	
Compound	Water Conc. (mg/L)	Shower Stall Air Conc. (mg/m^3)	Water Conc. (mg/L)	Shower Stall Air Conc. (mg/m^3)	Water Conc. (mg/L)	Shower Stall Air Conc. (mg/m^3)	Water Conc. (mg/L)	Shower Stall Air Conc. (mg/m^3)	Water Conc. (mg/L)	Shower Stall Air Conc. (mg/m^3)
Carbon Tetrachloride	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.40E-04	2.85E-03	1.10E-02	1.31E-01	4.60E-01	5.46E+00
Chloroform	9.10E-04	1.14E-02	6.70E-02	8.35E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	4.00E-01	4.99E+00
1,1-Dichloroethane	1.30E-03	1.80E-02	2.50E-02	3.46E-01	4.93E-02	6.83E-01	9.70E-01	1.34E+01	1.20E+00	1.66E+01
1,1-Dichloroethene	9.00E-04	1.31E-02	1.90E-02	2.77E-01	1.55E-02	2.26E-01	2.30E-01	3.35E+00	5.80E-01	8.46E+00
1,2-Dichloroethene (total)	2.61E-01	3.72E+00	4.40E+00	6.28E+01	3.55E+00	5.07E+01	1.10E+02	1.57E+03	1.70E+02	2.43E+03
Methylene Chloride	2.10E-03	2.95E-02	7.10E-02	9.98E-01	1.40E-03	1.97E-02	9.60E-01	1.35E+01	2.30E+00	3.23E+01
Tetrachloroethene	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.00E-05	2.30E-04	2.90E-04	3.33E-03	9.90E-03	1.14E-01
1,1,1-Trichloroethane	3.00E-04	3.78E-03	1.70E-02	2.14E-01	1.95E-02	2.45E-01	1.10+00	1.38E+01	3.70E+00	4.66E+01
Trichloroethene	2.61E-02	3.28E-01	7.50E-01	9.42E+00	2.87E-01	3.61E+00	2.40E+01	3.02E+02	1.70E+02	2.14E+03
Vinyl Chloride	1.19E-02	2.10E-01	2.60E-01	4.59E+00	3.37E-01	5.94E+00	3.20E+00	5.64E+01	2.60E+01	4.59E+02

[AD]CZ4140:D2467, #2367, PM=2

Table 3

ARARs AND CHLORINATED ORGANIC
CONCENTRATIONS CORRESPONDING TO BENCHMARK RISK LEVELS
FOR THE GROUNDWATER AT THE CARBORUNDUM FACILITY

Compound	Category	Benchmark Risk Level Concentrations (µg/L)		EPA Method 8010 - Standard Detection Limits (µg/L)	ARARs and Other TBC Criteria	
		Equal Risk	Equal Conc.		SDWA MCL (a) (µg/L)	NYS WQS&G GA(b)(µg/L)
Carbon Tetrachloride	C	0.034	0.011	0.12	5	5
Chloroform	C	0.717	0.011	0.05	100(c)	100(c)
1,1-Dichloroethane	C	0.048	0.011	0.07	--	50(g)
1,1-Dichloroethene	C	0.007	0.011	0.13	7	0.07(g)
1,2-Dichloroethene	N	350	573	0.10	cis: 70(p) trans: 100(p)	-- 50(g)
Methylene Chloride	C	0.583	0.011	0.25	--	50(g)
Tetrachloroethene	C	0.086	0.011	0.03	5(p)	0.7(g)
1,1,1-Trichloroethane	N	1,575	573	0.03	200	50(g)
Trichloroethene	C	0.398	0.011	0.12	5	10
Vinyl Chloride	C	0.002	0.011	0.18	2	5

[AD]C24140:D2467, #2363, PM = 12

C: Carcinogen
N: Noncarcinogen

a: Safe Drinking Water Act Maximum Contaminant Level.
b: New York State Water Quality Standards and Guidance Values for Class GA Groundwater NYSDEC TOGS Series 1.1.1).
c: As trihalomethanes.
g: Guidance Value (other criteria to be considered).
p: Proposed value; will become an ARAR if it is adopted as final.

Table 4

GROUNDWATER SCGS
Carborundum Site No. 932102

Compound	Category	SDWA MCL (a) (ug/L)	NYS WQS&G GA(b)(ug/L)
Carbon Tetrachloride	C	5	5
Chloroform	C	100(c)	100(c)
1,1-Dichloroethane	C	--	5
1,1-Dichloroethene	C	7	5
1,2-Dichloroethene	N	cis: 70 (p) trans: 100 (p)	5 5
Methlene Chloride	C	--	5
Tetrachloroethene	C	5 (p)	5
1,1,1-Trichloroethane	N	200	5
Trichloroethene	C	5	5
Vinyl Chloride	C	2	2

C: Carcinogen
N: Noncarcinogen

a: Safe Drinking Water Act Maximum Contaminant Level.
b: 10 NYCRR Subpart 5-1
c: As tr halomethanes.
p: Proposed value; will become an SCG if it is adopted as final.

TABLE 5

SUMMARY OF REMEDIAL ALTERNATIVES
FEASIBILITY STUDY, OCTOBER 1990, ECOLOGY & ENVIRONMENT
Carborundum Company Site No. 932102

Alternative 1	No action
Alternative 2	Extraction of Groundwater Upgradient of the Hydrogeologic Boundary, Treatment by Carbon Adsorption, No Soil Treatment.
Alternative 3	Extraction of Groundwater both Upgradient and Downgradient of the Hydrogeologic Barrier, Treatment by Carbon Adsorption, No Soil Treatment.
Alternative 4	Extraction of Groundwater Upgradient of the Hydrogeologic Barrier, Discharge to and Treatment by NCSD, In-Situ Vapor Extraction of Source Area Soils.
Alternative 5	Extraction of Groundwater both Upgradient and Downgradient of the Hydrogeologic Barrier, Treatment by Carbon Adsorption, In-Situ Vapor Extraction of Source Area Soils.
Alternative 6	Extraction of Groundwater Upgradient of the Hydrogeologic Boundary, Discharge and Treatment by NCSD, Excavation of Source Area Soils, Treatment by Thermal Desorption, Backfilling on Site.
Alternative 7	Extraction of Groundwater both Upgradient and Downgradient of the hydrogeologic Barrier, Treatment by Carbo Absorption, Excavation of Source-Area Soils, Treatment by Thermal Desorption, Backfilling on Site.

EXHIBIT A

Additional Information Describing Source Areas
Carborundum Company Site No. 932102

Two soil gas surveys were conducted on the plant grounds in an attempt to identify probable source areas. The initial survey performed by SOHIO (parent company of Carborundum) in 1984 was conducted as a screening technique. A more thorough survey was conducted by Tracer, Inc. in 1986. A third survey was conducted by Tracer in April and May of 1989 on the grounds of the DoD housing subdivision which borders the western plant boundary. The purpose of the third survey was to determine what potential risk, if any, soil gas vapors may pose to residents of the DoD housing subdivision.

The interpretation of these results are presented on Figure 3. The two gas surveys agreed well with each other and with the results of the borehole drilling. They all identified source areas in the grassy area northeast of the manufacturing building and around the southwest corner of the manufacturing building. The drainage ditch directly to the west of the manufacturing area, the area south of the manufacturing building, and the courtyard also show concentrations above background (see Figure 3). Low levels of chlorinated organics were found extending out of the west of the manufacturing building in the vicinity of B-3M. Monitoring well B-3M, a shallow bedrock well, also contains high concentrations of chlorinated organics in groundwater Only well B-17M and B-8M have higher concentrations.

TCE was the major chlorinated organic used by Carborundum in their carbon and graphite cloth manufacturing process from 1963 to 1983. However, TCA was used on a one time trial basis. Carborundum shut down the cloth manufacturing facility due to market conditions in 1983. Employee interviews were conducted to acquire information about past handling practices and potential source areas. The potential sources areas are depicted in Figure 9. The results of these interviews are summarized in the following paragraphs.

The major sources of chlorinated organics are to the south and west of the cloth manufacturing building, designed as locations A, B, and C on Figure 9; and the area of the septic system tanks and the leach fields north of the manufacturing building.

Area A contained an aboveground tank farm on a concrete pad adjacent to the west wall of the building. The concrete pad was surrounded by an earthen dike. There were three tanks, one to store virgin process oil, one to store waste process oil, and one for TCE

still bottoms and waste process oil. Drums of still bottoms and waste process oil were taken from the cloth building and stored in the areas immediately west of the pad prior to pumping into the waste tanks. The contents of the waste tanks were periodically removed for off-site disposal. Some of the drums were periodically left open and allowed to collect precipitation, resulting in displacement of the contents from the drums. In addition, during tank loading and unloading, the residual contents of the hoses were allowed to run out onto the grounds. Periodically, the crushed stone and dirt covering the drum storage areas were removed and used to level the courtyard and the area immediately east of the courtyard, which are depicted as areas E and G on Figure 9

Area B where the highest levels of chlorinated organics are found in groundwater at well B-17M, contained an earthen dike which and a scrubber for oil fumes from the baking furnaces, an underground tank to store and collect water/oil mixture from the scrubber, and an outside exhaust fan and stack connected to hoods over the top of the TCE degreasing tanks located in the cloth building. The underground tank, which was removed, was not directly used to store TCE; however, small amounts were possibly introduced from the residuals left over from the periodic cleaning of the baking furnaces with TCE. This tank was reported to have overflowed several times into the earthen dike. The oil was skimmed off the top and the water, which contained a small amount of TCE, was pumped into the excavated pit south of the earthen dike and allowed to evaporate. In the colder months, TCE was reported to condense in the stack and run down the stack wall and out of the bottom of the stack and fan. In addition, TCE still bottoms were periodically pumped out of the stills directly onto the embankment south of the earthen dike rather than placed in drums and subsequently pumped in the waste tank.

Area C also had an outside exhaust fan and stack for TCE degreasing tanks located in the building. As in Area B, condensed TCE ran out of the bottom of the stack and fan on to the ground in the winter. The open ditch between Area B and C and continuing east past Area C allowed the transport of surface runoff containing TCE.

Area D was a covered concrete storage area utilized to store drums of virgin TCE. No releases from this area were reported.

Area E, the courtyard, was graded off with dirt and gravel containing chlorinated organics from Area A. Empty TCE drums were stored on the north courtyard wall of the cloth building. In addition, an exhaust fan and stack was located on the outside north wall of the cloth building which exhausted TCE fumes from a small yarn degreasing unit. As in Areas B and C, condensed TCE from the stack and fan ran out of the bottom during the winter.

Area F was the initial location of the cloth process prior to building the new building to the southwest. Drums of virgin TCE, waste TCE, and empty drums were stored on all three exterior sides of this location. TCE from process leaks and still bottoms was periodically discharged to the building sewer which went into the plant sewer north of the building.

Area G was a dirt and gravel storage area for drums. Dirt and gravel from Area A was also used to level Area. G. Several drums of TCE or TCA were reported to have been stored there, rotted, and discharged their contents.

Area H contained an excavated burning pit that was utilized for disposal of waste process oil. Periodically during colder weather, the waste process oil was thinned with TCE to facilitate pumping of the oil from drums into the burning pit.

Area I was a pilot plant for the cloth process and utilized TCE as a degreaser. A reclaiming still was also located in this area. No further information is available on this area and the handling practices in use. TCE was suspected to be discharged to the septic tanks that were used at this time.

Within the cloth building along the south wall is a concrete trench into the floor. A drain in the west end of the trench discharged into the plant sewer system to the north. Periodically, oil on the floor was washed with small amounts of TCE and the liquids rinsed into the floor drain.

Potential sources in the grassy area north of the manufacturing building include several abandoned septic system tanks and leach fields. Very high levels of TCE have been found in monitoring well B-8M in this area ranging up to 170,000 ppb. In addition, to the buried septic system tanks, a central plant "catch basin" is located in this area. Waste waters, including those from the cloth building and Area F, were piped into this basin. All of the septic system tanks were sampled on two occasions. In both sampling events, TCE concentrations were found to be high. TCE in Tank 9, the abandoned chlorine contact tank, was as high as 900,000 ppb. It is likely that some of these tanks and sewers may leak slightly, resulting in the presence of very high levels of chlorinated organics in the groundwater beneath the grassy area northeast of the manufacturing building.

The southeast side of the manufacturing building is another potential source area. An abandoned septic system tanks 10E and 10W, which contains levels of TCE up to 47,000 ppb, and leach field also are located in this area. The ditch along the south side of the manufacturing building discharged into this area. Only low levels of TCE and MC have been found in the boreholes drilled in this vicinity to date.

The SPDES discharge ditch, which runs just north of the Fiberfrax plant to Cayuga Creek, and the buried sanitary sewer lines, which run along Cory Road to the Niagara County Sewer District 1 Wastewater Treatment Plant, may have also provided avenues for chlorinated organic migration.

EXHIBIT B

STATE OF NEW YORK
DEPARTMENT OF HEALTH

Corning Tower The Governor Nelson A. Rockefeller Empire State Plaza Albany, New York 12237

David Axelrod, M.D.
Commissioner

OFFICE OF PUBLIC HEALTH

Linda A. Randolph, M.D., M.P.H.
Director

William F. Leavy
Executive Deputy Director

August 6, 1990

Mr. Martin Doster
NYS Dept. of Environmental Conservation
Region 9
600 Delaware Avenue
Buffalo, New York 14202

RE: Carborundum Facility
Wheatfield (T), Niagara County
Site ID #9-32-102

Dear Mr. Doster:

We have completed our review of the Remedial Investigation (RI) report for the above site and feel that it contains enough information to generally characterize the site. The health assessment section of the report will not be reviewed by department risk assessors and formal comments will not be provided. However, that does not mean that we agree with their assessment of soil/gas vapors on the Department of Defense housing area. Also, using risk assessment numbers alone for cleanup standards in soils is not recommended. Cleanup standards in soils should consider several factors including background levels, what levels in soil can still contaminate groundwater, and risk assessment.

As you know, the soil/gas survey at the DoD housing area was undertaken instead of installing overburden groundwater wells as requested by NYSDOH The conclusion drawn by the RI is that soil gas vapors do not migrate to the surface over most of the site. This conclusion may be premature since only one soil/gas survey was undertaken.

Based on the Remedial Investigation, including the soil/gas survey, the following facts are known:

1. **There is an upper bedrock groundwater plume that contains** trichloroethene, 1,2-dichloroethene, and vinyl chloride and flows under several homes in the southeast section of the DoD housing facility. The groundwater monitoring results from wells B-3, B-22m, and B 23m shows seasonal variations and that the levels of contamination seem to be increasing.

2. The overburden is not saturated. Therefore, there is no confining layer in the overburden to prevent vapors from migrating up through the soil.

3. The soil/gas survey found that vapors could flow through the soil.

Therefore, an argument can be made that vapors from the plume can migrate to the surface in areas around the housing facility.

Several of the sample results, DoD-1, DoD-2, DoD-20, and DoD-21 reported results for 1,1,1-trichloroethane that appear to be ambient air, not soil/gas vapors. Does Carborundum propose to resample these sites? If not, how do they the explain results?

The soil/gas vapors are a public health concern and need to be monitored in the southeasterly part of the DoD housing facility. The Coast Guard report concluded that soil gases are present at the site and that the gases can be released into houses. Their conclusion is based upon their soil/gas survey and inspection of houses. In the houses the Coast Guard found that the concrete slabs are not one solid piece but contain several openings used for air intakes for the forced hot air furnace system.

Any remedial action needs to include a monitoring plan to monitor for soil/gas vapors in the southeastern section of the DoD housing area, particularly in the areas around monitoring well B-22m. The sampling should be done quarterly until the remedial action has shown to reduced the levels of contaminants in the groundwater. If the monitoring shows that any house is being impacted at any time by soil gas vapors then the houses would have to be sampled and if needed the people moved out of the houses.

If you have any questions please, contact me at 518-458-6309.

Sincerely,

David C. Mead
Program Research Specialist, III
Bureau of Environmental Exposure
Investigation

jlf/0211011

cc: Mr. Tramontano
Mr. Waleman/Ms. Shaw
Dr. Smith-Blackwell
Mr. O'Connor
Mr. Buchi
Mr. Belmore

EXHIBIT C

ecology and environment, inc.
BUFFALO CORPORATE CENTER
368 PLEASANT VIEW DRIVE, LANCASTER, NEW YORK 14086, TEL. 716/684-8060
International Specialists in the Environment

February 6, 1991

Mr. Martin Doster, P.E.
Division of Hazardous Waste
Site Remediation
New York State Department of
Environmental Conservation
600 Delaware Avenue
Buffalo, NY 14202

Re: Carborundum Company, Wheatfield, Site No. 932102
Response to Feasibility Study (FS) Comments

Dear Mr. Doster:

Ecology and Environment, Inc. (E & E) is writing this letter on behalf of our client BP America Inc. (BP) for their Carborundum Company (CC) facility which is referenced above. The purpose of this letter is to address comments which have been prepared by the New York State Department of Environmental Conservation (NYSDEC) (letter from M. L. Doster to T. E. Ferrao, dated 23 January, 1991) pertaining to its review of the Draft FS. Our response to NYSDEC's comments are as follows:

1. MCLs, developed under the Safe Drinking Water Act, were referenced throughout the approved RI and the Risk Assessment as ARARs for groundwater. BP was not made aware until January 24th that the very strict standards from 10 NYCRR Subpart 5-1 would be required as Remedial Action Objectives (RAOs) for groundwater. The New York State standards will be included in the FS as RAOs under the condition that the Record of Decision (ROD) will state the uncertainty at meeting these more stringent objectives and will also provide a means to petition the state for higher levels should these standards prove unattainable. This approach regarding the ROD was reviewed with BP by M. Doster, NYSDECs project officer for this site, at a meeting held at New York State Department of Health (NYSDOH) headquarters on 25 January, 1991.

2. Soil Gas Data: This issue was reviewed by BP, E & E, NYSDEC and the New York State Department of Health (NYSDOH) in meetings held in Buffalo on 7 December, 1990 and in Albany on 25 January, 1991. BP proposes to do soil gas monitoring on a biannual basis (2 times) for one year. A

total of ten sampling locations will be selected. Four of the locations will monitor the area around sampling point (SG-26), the only location with a positive response during the soil gas survey in the Spring of 1990 at the Department of Defense (DoD) housing facility. The additional 6 locations will be placed adjacent to homes near the southeast corner of the DoD as the groundwater plume is beneath this area. All sampling locations will be temporary points which will be removed following each sampling. As discussed in the 25 January, 1991 meeting, sampling and analytical protocols will be similar to the protocols used in the Spring 1990 survey. A formal work plan will be completed upon approval by NYSDEC of the points outlined in this response.

3. **Groundwater Monitoring Program:** BP will implement a groundwater monitoring program on a monthly basis for at least one-year after initiation of groundwater extraction. An evaluation of the period of monitoring will be completed by BP after one year. Changes in the schedule of monitoring will be proposed, as appropriate. The current monitoring program (i.e., well network) will be reviewed for effectiveness after the onset of groundwater remediation when steady-state aquifer conditions are developed. The monitoring program will be referenced in the other FS alternatives. A discussion of the four new monitoring wells, to be installed to the southwest of the facility, will be included.

4. **Extraction Flow Rates:** The RI stated that the maximum flow rate for on-site capture was 300 gallons per minute (gpm). The FS evaluated two flow rates, 100 gpm for on-site capture and an additional 100 gpm for off-site capture. Both of these statements were made with qualifying explanations. Regarding the on-site rate for the RI, the following statement (p 4-75 of the RI) was made:

> "The maximum necessary rate to establish this zone (of capture) will be about 300 gpm. However, it is possible that a much lower rate will be sufficient to establish an effective capture area for containment and remediation of chlorinated organics in the groundwater beneath the facility."

The two on-site recovery wells P-2 and P-3 could be pumped, at least initially, at a combined rate of 300 gpm. However, as was observed in pumping tests conducted separately on both wells, the capture area continued to enlarge, even after 40 hours of groundwater extraction (in the P-3 test).

In both cases, E & E estimated that several weeks of extraction would be necessary to reach steady-state conditions. Recovery during both tests was very slow and incomplete. Groundwater levels in both wells never approached pre-test elevations, even after 48 hours of observation. These two characteristics have led E & E to believe that the hydraulic conductivity (k) decreases markedly upgradient of the site. Thus, extraction rates will be much lower once the on-site aquifer, which has a much higher k, is dewatered. This information is, supported by regional data from Johnson (1964) which indicates that the average k for the Lockport Dolomite is about 20 gpd/ft^2 which is two orders of magnitude less than the range of k's observed during the P-2 and P-3 tests (i.e., 1990-2390 gpd/ft^2).

In summary, it is believed that the k of the bedrock aquifer beneath Carborundum is much higher than that of the recharge area and as a consequence extraction rates will decrease as the aquifer approaches steady-state conditions.

For the purpose of developing reasonable cost estimates for the FS, the likely on-site and off-site extraction rates were estimated to be 100 gpm each. Interpretation of the results of the pumping tests at P-2 and P-3, suggests these numbers are reasonable estimates. E & E recognizes that there is some uncertainty in the flow rate parameters for the groundwater design. However, this is not regarded as a serious problem, because of the plan to initiate groundwater extraction and direct discharge to the Niagara County Public Owned Treatment Works (POTW). More exact data of parameters such as extraction rates and contaminant concentrations will emerge when this program is initiated. This philosophy is stated in paragraph 2, page 2-33 of the FS.

Analytical data generated from the P-3 pumping tests will be used to contribute to estimating organic loading.

5. **Groundwater Discharge - POTW and SPDES Outfall:**

Presently there are no plans to do pre-treatment of groundwater discharged to the Niagara County Sewer District No. 1. The on-going pilot study uses carbon because the water is extremely contaminated relative to other areas of the site (it is beneath an overburden source area) and because Carborundum does not have a current permit to discharge all the contaminants in the groundwater to the POTW. NYSDEC has previously supported Carborundum's plan to do direct discharge of groundwater from P-2 and P-3, which has not been pre-treated, to the POTW, at least in the form of an

Interim Remedial Measure (IRM). The levels of chlorinated organics expected to be observed during extraction, based on previous pumping tests, were considered sufficiently low by the POTW, not to require treatment. Pre-treatment has never been discussed previously and it seems that this comment suggests a reversal of previous discussions between BP, E & E and the NYSDEC. BP would like clarification of why NYSDEC favors pre-treatment prior to addressing any related changes to the FS.

E & E is presently working with all appropriate divisions of NYSDEC, the Niagara County Sewer District (NCSD) #1 and the Carborundum facility to develop appropriate plans for groundwater discharge from both the POTW and the SPDES Outfall.

6. **De minimus Levels:** As noted the reference to the NYSDEC in Section 2.4.2.1.2 regarding who can set de minimus levels, will be changed to the USEPA.

7. **Downgradient Remediation Period:** Data gathered from on-site hydrogeologic evaluations indicates that minimal contaminant velocities for the site are about 3 feet/day or 1,100 feet/year. Approximately 3 volumes of groundwater per year or 15 volumes of groundwater in 5 years could be passed through the bedrock aquifer with properly sited recovery wells. This process coupled with source area remediation to halt contaminants from leaching into the aquifer and destruction in the bedrock aquifer through biodegradation would result in significant decreases in contaminant concentrations and possible compliance of the plume within a 5 year period. However, it cannot be certain that groundwater standards will be met in this timeframe. Thus, contingencies for 10 year extraction period have been included in the FS to address this concern.

The 10 year period for natural attenuation assumes that the three major contaminants of concern (TCE, Cis-1,2-DCE and VC) in the off-site plume will undergo dispersion and biodegradation throughout this period and that further migration of the chlorinated organics to the downgradient plume will be arrested by the on-site remediation program. Estimates of the half-lives of the transformation of TCE to 1,2-DCE for two on-site wells, B-3M and B-4M, averaged about 1.2 years (see page 4-107 of the RI). The transformation rates of 1,2-DCE to VC and the destruction of VC appear to progress at about the same rate as evidenced by the fact that neither compound is "building" in the downgradient plume. Rather the downgradient plume is in a

somewhat cyclical and steady-sate condition. By applying the above noted half-life of 1.2 years, the following contaminant decline rate can be estimated for the off-site area from well B-23M, a well immediately downgradient of the southwest facility boundary. (Decline rate assumes source is eliminated by on-site remediation. Concentration at time zero is the average concentration in B-23M over two years.)

Time/Yrs.	TCE µg/l	1, 2 DCE µg/l	VC µg/l
*0	24.9	1,065	70
1.2	12.4	532	35
2.4	6.2	266.2	17.5
3.6	3.1	133.1	8.7
4.8	1.6	66.6	4.3
6.0		33.3	2.2
7.2		16.6	1.1
8.4		8.3	0.5
9.6		4.2	

* Onset of upgradient remediation

This estimate is not meant to show that SGCs will be obtained in exactly ten years. The exact time period may be greater or less than 10 years. However, the estimate does indicate that a substantial reduction in downgradient plume concentrations would occur over a ten year period through natural attenuation. We expect that off-site plume concentration will approach SGC's within this period. Projected data between the furthest downgradient monitoring wells, B-29M and B-30M, and Lockport Road appears to support this estimate. Based on reasonable groundwater velocities, the plume should have impacted residential wells along Lockport Road 10 years ago. However, no chlorinated organics attributable to the facility have been detected along Lockport Road. This information along with the decline of the three major contaminants within the downgradient plume with increasing distance from the source, suggests that the plume reaches non-detectable levels between the furthest downgradient monitoring wells, B-29M and B-30M, and Lockport Road. The plume attenuates through destruction and dispersion within the interval. Four new monitoring wells within this area will be installed to test this hypothesis.

8. **Source Area Remediation/Delineation:** The report detailing source area delineation which uses data from the November 1990 soil gas investigation is presently being completed and should be available to the NYSDEC in several weeks. E & E does not see a need to include the report in the final FS. It is more efficient to incorporate this information into a revised design cost estimates for in-situ soils remediation when Terra Vac's extended pilot study is complete and evaluated in April of 1991.

   Groundwater levels in bedrock monitoring wells are really not effected by vacuum extraction in the overburden. The principal recharge area for groundwater at the site is the Niagara escarpment which is located to the north of the Carborundum facility. The dual vacuum extraction system was fairly successful at lowering groundwater elevations in the saturated overburden during the early phase of the study; however, these wells had no noticeable effect on bedrock elevations.

   The letter which identifies soil clean-up standards for the site will be forthcoming in late February 1991. E & E will need clarification and backup from the NYSDEC regarding how the proposed levels of 3.2 ppm for Cis-1,2-DCE, 0.63 ppm for TCE and 0.5 ppm for 1,1-DCE were determined, to respond further to this question. Specifically, were these standards determined from regulatory precedence (i.e. levels set at other sites) or were they determined from site derived data?

9. **Downgradient Remediation:** The issue of the five year extraction period was addressed in response 7. Regarding specific design assumptions, most of these details should be left to a period of preliminary design of the treatment system. The optimization of siting recovery wells will require further detailed hydrogeologic investigations to identify an area of suitably high permeability for their location.

   We understand that from discussion with M. Doster that NYSDEC may prefer a limited off-site groundwater remediation program. Clarification of this requirement and its basis would help in responding to questions and further discussions.

10. **Recommendation of a Preferred Alternative:** Under a current understanding of the configuration of the downgradient plume, contamination in this area is not perceived to be a significant threat to human health nor a serious impact to business or development. The aquifer in the site area is

of very poor quality and the majority of off-site property where the plume is located is on utility land. However, it is recognized that the NYSDEC may regard these issues as economically or socio-economically significant risks and, may request downgradient groundwater remediation. Clarification regarding the issue of downgradient remediation is requested as well as discussions as to specifics of what combination of alternatives NYSDEC feels are most appropriate.

There are a number of issues that need further clarification for proper responses. BP suggests that a meeting be held to clarify the issues. Please contact me at your earliest convenience to set a meeting date.

Sincerely,

Thomas E. Ferraro
Project Manager

TEF:djb:991

cc: H. Aldis - E & E
J. Sundquist - E & E
R. M. Frankoski - BP
R. Speas - CC
CZ-5000 File

EXHIBIT D

ecology and environment, inc.

BUFFALO CORPORATE CENTER
368 PLEASANT VIEW DRIVE, LANCASTER, NEW YORK 14086, TEL. 716/684-8060
International Specialists in the Environment

March 26, 1991

Mr. Martin L. Doster, P.E.
New York State Department of
Environmental Conservation
Division of Hazardous Waste Remediation
600 Delaware Avenue
Buffalo, NY 14202-1073

RE: Soil Gas Monitoring, DOD Housing Facility
Carborundum Site (Site No. 932102)

Dear Mr. Doster:

On March 25, 1991, Mr. Al Wakeman, P.E. of the New York State Department of Health (DOH) and I discussed the soil gas sampling schedule on the DOD. It was agreed during our conversation that the first sampling event for the program would begin during a dry period in July or August of 1991. Thereafter, an additional three sampling events would be performed on a bi-annual basis for two years in the winter and summer. A work plan detailing specific elements of the sampling program will be forthcoming in the June of this year.

Please contact me at 684-8060 should you have any questions regarding the proposed schedule.

Sincerely,

Thomas E. Perraro
Project Manager

TEF:djb
L/CZ-5010
[ENVSHARE]#1349

cc: R.M. Frankoski (BP)
A. Wakeman (DOH)
H. Allis (E & E)
CZ-5000 File

EXHIBIT B

ecology and environment, inc.
BUFFALO CORPORATE CENTER
368 PLEASANTVIEW DRIVE, LANCASTER, NEW YORK 14086, TEL. 716/684-8060
International Specialists in the Environment

March 7, 1991

Mr. Martin L. Doster, P.E.
Division of Hazardous Waste Remediation
New York State Department of
Environmental Conservation
600 Delaware Avenue
Buffalo, NY 14202-1073

RE: Development of a Soil Clean-up Standard for Overburden Soil Source Areas Which Contain TCE, Carborundum Facility, Sanborn, New York (Site No. 932102)

Dear Mr. Doster:

Ecology and Environment, Inc. (E & E) is writing this letter on behalf of our client BP America, Inc. (BP) for their Carborundum facility, located in Wheatfield, New York. The purpose of this letter is to propose a clean-up standard for source area soils which contain high levels of TCE.

Soils data from the vacuum extraction pilot study that is being performed in the source area on the south side of the manufacturing building has been used for assistance in the development of the soils standard. An initial attempt to develop standards by using the Toxicity Characteristic Leaching Procedure (TCLP) data has proved to be largely ineffective. This is due to the fact that the samples subjected to TCLP analysis produced widely erratic results when compared to duplicate soil samples analyzed by standard EPA approved methodology. These results are summarized in a letter from T. Ferraro of E & E to M. Doster of the NYSDEC on February 27, 1990. Thus, it has become apparent that an alternative approach to predicting a soil clean-up standard must be developed. This approach, which relies heavily on observed field conditions, is discussed below.

ESTIMATION APPROACH

From studies of contaminant migration patterns at the Carborundum site over the past four years, it appears that two predominant factors control the distribution and the nature of the plume: 1) flushing of the residual trichloroethene (TCE), which remains in the overburden, by seasonal groundwater fluctuations, and 2) biodegradation of TCE into cis-1,2-dichloroethene (1,2-DCE) and then into vinyl chloride (VC) in the bedrock aquifer. Dilution of the plume as it mixes into the faster moving bedrock aquifer, and dispersion and retardation of the plume as it migrates downgradient both play significant, although perhaps

secondary r les, in affecting migration patterns. These processes are all interre ated and consequently cannot be readily quantified independently a some of the solution techniques worked with demonstrated. Consequentl , it was concluded that studying this system as a whole will provide est mates that include the effects of all these interrelated processes.

The prelimi ary goal of the soil clean-up is to reduce soil concentrations to a low enough level such that the resulting bedrock groundwater conce trations at the Carborundum property boundary will decrease to Applicab e or Relevant and Appropriate Requirements (ARARs). Three contaminant: , TCE, 1,2-DCE and VC comprise greater than 95% of the groundwater contamination found at the facility. The overburden soils are predomi antly contaminated by TCE. TCE then biodegrades under anaerobic c nditions to 1,2-DCE and VC in the bedrock aquifer.

ASSUMPTIONS INVOLVED

It is assume d that the levels of contamination at the site boundary are directly pr portional to the levels of contamination at the source. This assump ion inherently involves three conditions:

- Plum e migration has existed for "long enough" (approximat ly 20 years) for a steady state relationship between the source contaminant influx and the downgradient plume dime nsions and concentrations to have been established. (This appears to be an accurate assumption based on the past 7 years of groundwater monitoring.)

- A direct proportionality between source area soil concentration and concentrations in the groundwater plume at the site boundary requires that all the chemical and hydrological processes going on in between be linearly related. This concept has been addressed earlier in this letter and it was concluded that the proposed site-specific empirical **appr oach may be more accurate than attempts to describe each process individually when there are such wide data rang es noted at the site.**

- Conc ntrations in the source area soils were never any high r than currently observed. It is very unlikely that this assumption is correct. Soils concentrations, or at leas : the rate of TCE entering the aquifer, were probably high r at some time in the past than they are at present. This fact tends to result in a clean-up standard that is some hat conservative.

DETERMINATION OF SOURCE AREA SOIL CONCENTRATIONS

The soils adjacent to the southwest corner of the Manufacturing building comprise one of the most contaminated source areas on the site. In addition, it is the closest source area to the downgradient site boundary. Soil gas data shows there to be two "hot spots" in this area, one directly west of the corner of the Manufacturing building, and one directly south, in the vicinity of B-17M (see Figure 1). Fifty-seven soil samples were collected during the installation of nine vacuum extraction wells from the B-17M area. The wells were installed for the the vacuum extraction pilot study being conducted by Terra Vac. Infield analytical results from these samples show the soil concentrations in the more contaminated areas to be on the order of 400 to 2900 mg/kg while lab analyzed data (by EPA Methods 5030/8010) show these concentrations to be 50 to 660 mg/kg. Clearly there is a large difference in these data sets. Terra Vac's in-field technique is used primarily as an in-field screening technique for the purpose of selecting soil venting intervals. It relies on estimating partitioning ratios of soil to water and water to air and thus is not regarded as an absolute measure of soil contamination. EPA Methods 5030/8010 are approved GC Methods for analysis of purgeable halocarbons. It is suspected, however, that volatile loss during sampling and analysis may have biased the 5030/8010 results low

An independent approach for determining the soil concentrations in the B-17M source area uses Terra Vac's observed TCE extraction rates, the total volume of TCE extracted to date and theoretical decline curves for the vacuum extraction procedure. As of February 25, 1991, a total of 700 pounds of TCE has been extracted from this area. The technique for estimating soil concentrations does not rely on the somewhat difficult procedure of analyzing soil samples for volatile organics. Terra Vac used measured TCE extraction data to estimate the initial mass of TCE. From this, the extraction decline curves were plotted on logarithmic graph paper and linearly extrapolated. Based on these plots, the initial mass of TCE was estimated to be 1250 lbs.

For estimating the volume of contaminated soils, an area of 2000 ft^2 was chosen. This area encompasses the wells DVE-1, DVE-3, DVE-5 and DVE-6 (see Figure 2). More than 90% of the recovered TCE was extracted from these four wells.

Assuming a thickness of contaminated soils of six feet and bulk density of 2000 kg/m^3 for the soil, the average concentration of TCE is calculated as follows:

1250 lt TCE = 567 kg TCE

12000 $ft.^3$ = 340 m^3 soil

Soil bulk density = 2000 kg/m^3

$$\text{Soil TCE} = \frac{(567\ \text{kg})\ (1)\ (10^6\ \text{mg})}{(340\ m^3)\ (2000\ \text{kg}/m^3)\ (\text{kg})}$$

$$= 833\ \frac{\text{mg TCE}}{\text{kg soil}}$$

This estimated average 833 mg/kg falls between the measured in-field and lab analyzed source area soil concentrations and thus seems to be a reasonable estimate of the source area soil concentrations.

DETERMINATION OF GROUNDWATER CONCENTRATIONS AT THE SITE BOUNDARY

The most conservative approach to determine concentrations at the site boundary is to evaluate concentrations at the monitoring wells closest to the point at which it is estimated that contaminants migrating from the source will first cross the site boundary. The property line west of the Manufacturing building is the closest property boundary downgradient of a source area. Two highly contaminated wells, B-3M and B-13M, are located along the fence line. B-13M, however, is more immediately downgradient of the B-17M source area than is B-3M (see Figure 1). Very little gradient exists between B-17M and B-3M. It is likely then that dissolved phase contamination in B-13M is in better hydraulic communication with the B-17M source area than is dissolved phase contamination in B-3M. Thus, average data from B-13M was used to represent dissolved phase plume at the site boundary.

The average concentrations of the three primary contaminants from data collected during eight monitoring events between November 1988 through October 1990 and their respective ARARs are:

	B-13M	ARARs
TCE	477 ppb	5 ppb
1,2-DCE	9422 ppb	70 ppb
VC	920 ppb	2 ppb

ESTIMATION OF SOIL CLEANUP CRITERIA

The ARARs for the three primary contaminants of concern are listed in the preceding table. They are 2 µg/l for VC, 5 µg/l for TCE and 70 µg/l for 1,2-DCE. These ARARs are based on Maximum Contaminant Levels (MCLs) established by the Safe Drinking Water Act. To meet the ARARs at the site boundary the following reductions are needed in the contaminant concentrations in well B-13M:

	B-13M
TCE	5/477 = 1/95
DCE	70/9422 = 1/135
VC	2/920 = 1/460

Clearly VC is the limiting contaminant of concern since VC requires the largest concentration reductions (1/460th). If the soil is cleaned up sufficiently to meet the VC ARAR, then the ARAR for TCE and 1,2-DCE will also be met. The source area soils have been estimated to have a concentration of 833 mg/kg before remediation. Based on the above assumptions, the concentrations of VC must be reduced by 1/460th to meet ARARs in groundwater.

Using the above calculated criteria, and assuming the initial concentration of the soil in the source area is 833 mg/kg, and that all the processes occurring in the soil and the aquifer retain the same relative proportions at all concentrations, then the cleanup criteria for TCE in the soil is:

$$833 \text{ mg/kg} * (1/460) = 1.8 \text{ mg/kg}$$

However, these concentrations are increased by documented changes in partition ratios between soils at high concentrations, compared to those at low concentrations. This concept is more fully discussed below.

SORPTION EFFECTS

The TCE content in the soil is quite high in the source area, apparently above the point where the TCE sorbed to the soil and the TCE in the soil water would no longer partition according to a constant coefficient (Kd = Concentration in the soil/Concentration in the water) because all the sorption sites are occupied. (Karickhoff, 1981) states "if the equilibrium aqueous phase pollutant concentration is kept below 10E-5 M or below one half the water solubility (whichever is lower), sorption isotherms to natural sediments were linear." Corroboration of this phenomena of nonlinearity is provided in Jackson et al. 1985 and Rao and Davidson 1979 who state that sorption would be expected to be strongly nonlinear in heavily contaminated nonporous media. Since the solubility of TCE is approximately 1100 mg/l at 25 C and less at lower temperatures, the Kd isotherm becomes nonlinear above approximately 550 mg/l.

The estimated source area concentration of 833 mg/kg, is almost 300 mg/kg above the concentration of nonlinearity. Nonlinearilty of the Kd isotherm means that above approximately 550 mg/l the amount of TCE sorbed to the soil versus the amount that occurs in the soil water is not constant. At high concentrations the organic carbon sorption sites are saturated and there are high concentrations in the pore water. As the source concentrations drops below approximately 550 mg/l a larger percentage of the total soil concentration is expected to be held to the soil particles by sorption and less is free to migrate to the aquifer from the soil pore water.

The organic carbon data from the soil borings in the B-17M area between 4 and 10 feet range from 1% to 2.7%. An average fraction organic carbon over this interval would be about 2%. The resulting Kd for TCE is equal to two. The 1/460th reduction in source concentration applies to the soil in its current saturated state where the soil pore water has concentrations apparently as high as the sorbed concentrations on the soil (Kd=1). Once the soil concentration is lowered below one half the solubility of TCE (<550 mg/l), twice as much of the total TCE in the source area will be sorbed to the soil (Kd=2) and unable to migrate into the deeper aquifer. Therefore, twice as high a total soil concentration will still result in concentrations in groundwater below MCLs at the soil boundary.

Thus, assuming a Kd of 2 L/Kg and a pore water concentration of 1.8 mg/L, the clean-up goal can be calculated as follows:

$$Cs = Kd * Cw$$
$$Cs = (2\ L/Kg)\ (1.8\ mg/l)$$
$$Cs = 3.6\ mg/kg$$

Cs = Concentration of Soil
Cw = Concentration of pore water
Kd = partition coefficient

Therefore, because of increased sorption as the soil concentrations are reduced, the final clean-up goals for TCE in the soil are 3.6 mg/kg.

SUMMARY

A clean-up goal for source area soils at Carborundum of 3.6 mg/kg has been proposed. The clean-up goal has been based on the relationship between source area soil concentrations and groundwater concentrations at the site boundary. E & E feels that the clean-up goals proposed are relatively conservative. Two other methods -- one, which uses a different equation to estimate Kd after Schwarzenbach and Westfall (1981), and a second which uses the concept of the nonlinearity of retardardation as remediation proceeds -- would result in clean-up goals which range from 6-9 mg/kg TCE in soils. A greater mass of TCE which may

have existed in the source areas in the past, would also have resulted in a clean-up goal at a higher concentration. None of these arguments was proposed because they involve more currently unverified assumptions than the approach outlined in this letter. It is also important to begin to consider a soil sampling and analysis approach to verify soil concentrations during and at the end of remediation. E & E recommends that a statistical sampling approach which considers an average soil concentration of 3.6 mg/kg for separate source areas be evaluated as an overall goal for soils remediation. Specifics regarding the quantification program can be developed once E & E receives NYSDEC's concurrence regarding the overall approach and clean-up goal.

E & E looks forward to further discussion with the NYSDEC regarding soil clean-up standards. Please contact me at (716) 684-8060 with your questions and comments.

Sincerely,

Thomas E. Ferraro
Project Manager

TEF:djb
L/CZ-5010
[ENV]#1122

cc: R.M. Frankoski (BP America)
H. Aldis (E & E)
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A. Steiner (E & E)
CZ-5010 File
A. Shroff 3/21/91
A. Wakeman
J. Kelleher 3/21/91

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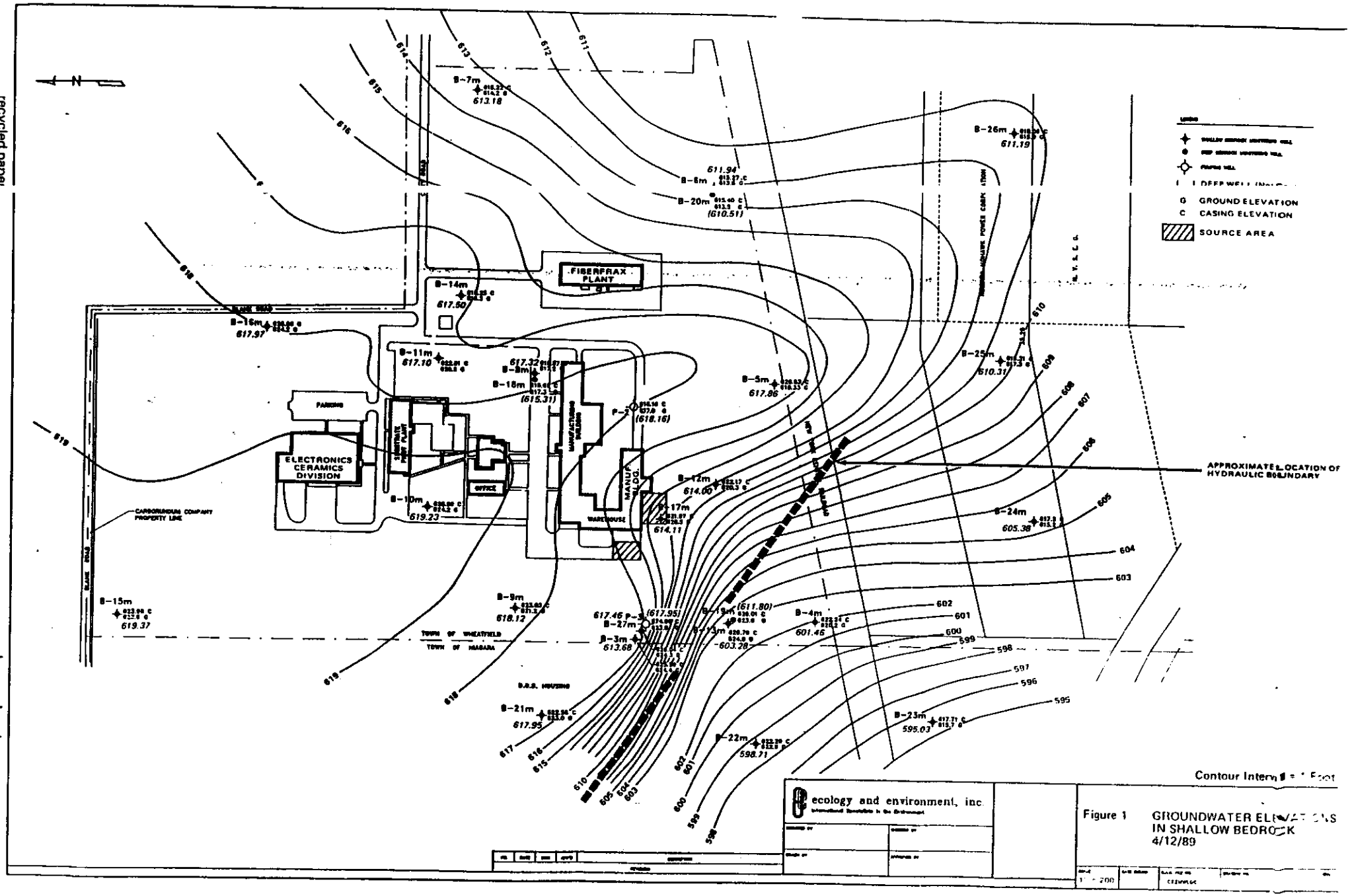
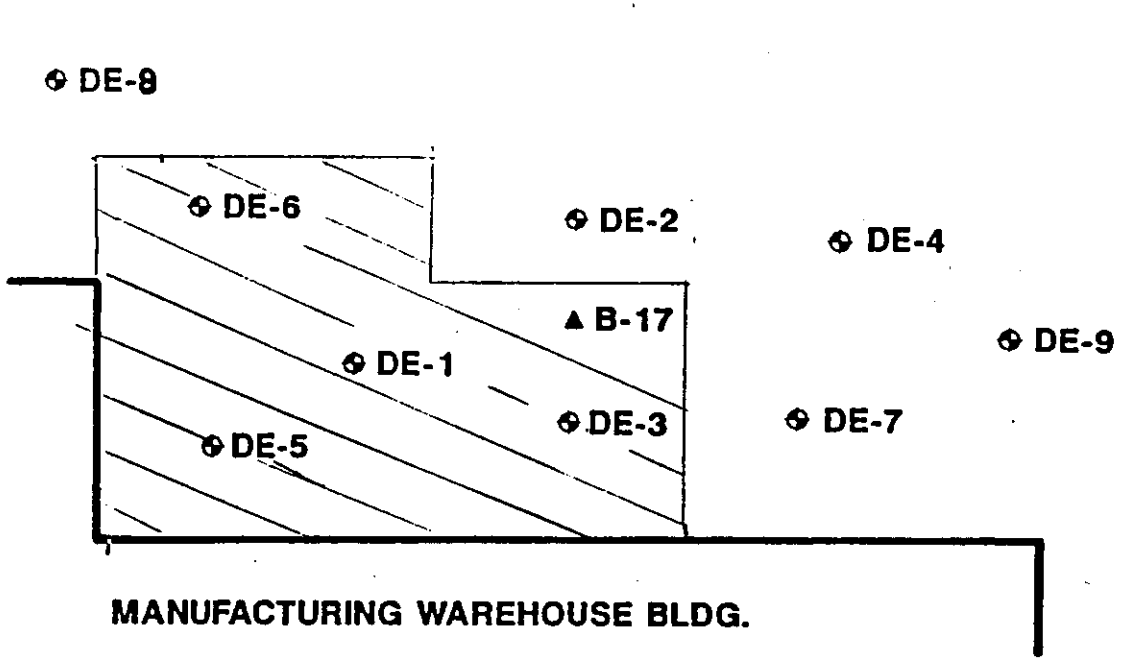


ecology and environment, inc.

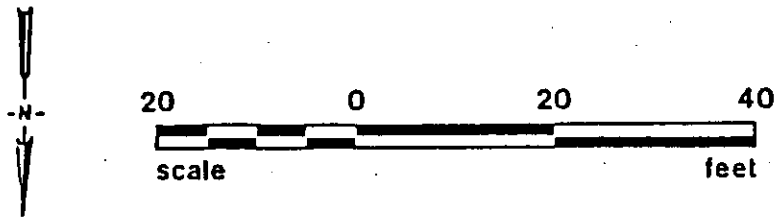
Figure 1 GROUNDWATER ELEVATIONS IN SHALLOW BEDROCK 4/12/89

1" = 200'



LEGEND:

- DUAL VACUUM EXTRACTION WELL
- ▲ GROUNDWATER MONITORING WELL
- HIGHLY CONTAMINATED AREA



REV.	DATE	DESIGN ENG.	REMARKS

TERRA VAC

Figure 2 SITE PLAN

DUAL VACUUM EXTRACTION CARBORUNDUM FACILITY

DWN. | DWG NO.

SCALE

15 (12-75)

EXHIBIT F

New York State Department of Environmental Conservation

MEMORANDUM

TO: Martin Doster, RHWRE, Region 9
FROM: Ajay Shroff, Technology Section, BPM
SUBJECT: Carborundum Co. Site, Site No. 9-32-102

DATE: MAR 29 1991

As per our phone conversation on March 18, the following please find my response regarding the soil cleanup goals at the referenced site.

Based on the submitted information, the attached Table 1 provides soil cleanup goals for organic contaminants at the site. The proposed cleanup goals are based on the revised ground water standards (TOGS 1.1.1 dated September 25, 1990), and the new procedure developed by the Technology Section for developing soil cleanup goals. The Technology (TS) has considered the following in developing soil cleanup goals; (a) human health based criteria that correspond to excess lifetime cancer risks of one in a million for class A and B carcinogens, or one in 100,000 for class c carcinogens; (b) human health based criteria for systemic toxicants, calculated from Reference Doses (RfDs); (c) environmental concentrations which would be protective of groundwater quality; (d) laboratory method detection limits. Water/soil partitioning is used to determine soil cleanup criteria which would be protective of groundwater quality for its best use.

Please note that the recommended cleanup goals are for soil organic carbon content of 1%. If the soil organic carbon content at the referenced site is 3 %, the soil cleanup goals for Trichloroethylene, cis-1,2-Dichloroethene and Vinyl Chloride would be 3 ppm., 1 ppm., and 0.5 ppm. respectively.

Soil cleanup goals for the organic contaminant is determined to be protective of public health (USEPA health based), and/or protective of New York State groundwater quality. It is my recommendation that you review these cleanup criteria with the Department of Health (DOH).

Please note that these recommended cleanup criteria should be treated as cleanup goals. The economic and engineering feasibility of attaining the recommended cleanup goals should be addressed during the screening and evaluation of remedial alternatives.

If you have any further questions, please contact me at 457-3957.

cc: P. Buechi

DRAFT

TABLE 1
Recommended Soil Cleanup Goals (mg/kg or ppm)
for Organic Compounds
Carborundum Co. Site, # 9-32-102

ntaminants	JSEPA Health (ppm) Carcinogens	Based Systemic Toxicants	Protect water Quality (ppm)	Contract Lab. Detection Limit (ppb)	Rec. soil Clnup Goal (ppm)
ichloroethylene	64	N/A	0.7	5	1.0
-1,2-Dichloroethene	N/A	N/A	0.25	5	0.3
inyl Chloride	N/A	N/A	0.12	10	0.15

: Soil cleanup goals are for soil organic carbon content of 1%.

Table 1 (Cont.)

Compound	B-21M										
	11/88	12/88	1/89	4/89	7/89	10/89	1/90	4/90	[illegible]	10/90	1/91
[illegible]ethane	<1.0	<0.2	<0.1	<0.1	<1.2	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Chloroform	<1.0	<0.2	R	<0.05	<0.5	<0.5	1.0	<0.5	<0.5	<0.5	<0.5
1,1-dichloroethane	<1.0	<0.2	<0.07	<0.07	<0.7	<0.7	<0.7	<0.7	<0.7	<0.7	<0.7
1,1-dichloroethene	<1.0	<0.4	<0.1	<0.03	<1.3	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Methylene chloride	2.0	1.2	0.1	<0.1	<2.5	<1.0	<5.0	<5.0	<5.0	<1.0	<5.0
Trans-1,2-dichloroethene	—	—	<0.1	<0.1	<0.1	<0.1	<1.0	<1.0	<1.0	<1.0	<1.0
Cis-1,2-dichloroethene	—	—	<1.0	2.0	<1.0	<1.0	24	<1.0	<1.0	<1.0	<1.0
Total-1,2-dichloroethene	3.2	<0.2	<1.0	2.0	<1.0	<1.0	24	<1.0	<1.0	<1.0	<1.0
1,1,1-trichloroethane	<1.0	<0.2	<0.03	<0.03	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	0.3
Trichloroethene	8.2	<0.2	2.0	6.8	<1.2	<1.0	4.5	<1.0	<1.0	<1.0	<1.0
Vinyl chloride	<1.0	<0.6	<0.2	<0.2	<1.8	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Tetrachloroethene	—	—	<0.03	<0.03	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3

Key at end of table.

Table 1 (Cont.)

Compound	B-22M										
	11/88	12/88	2/89	4/89	7/89	10/89	1/90	4/90	7/90	10/90	[illegible]
Carbon tetrachloride	<1.0	[illegible]	[illegible]	<0.1	<10	<1.0	<1.0	<10	<10	<1.0	<1.0
Chloroform	<1.0	<1.0	R	67	<5.0	<0.5	<0.5	<5.0	<5.0	<0.5	<0.5
1,1-dichloroethane	<1.0	<1.0	<0.07	3.3	19	<0.7	25	14	<7.0	<0.7	3.3
1,1-dichloroethene	<1.0	<2.0	<0.1	2.9	12	<1.0	19	<10	<10	<1.0	<1.0
Methylene chloride	3.0	3.5	<0.1	<0.1	<10	<1.0	<5.0	<50	<50	<1.0	<5.0
Trans-1,2-dichloroethene	--	--	0.5	5.3	15	<1.0	24	<10	<10	<1.0	7.2
Cis-1,2-dichloroethene	--	--	24	280	2800	17	4400	1600	630	48	430
Total-1,2-dichloroethene	220	130	25	290	2800	17	4400	1600	630	48	440
1,1,1-trichloroethane	<1.0	<1.0	<0.03	<0.03	17	<0.3	<0.3	<3.0	<3.0	<0.3	5.5
Trichloroethene	23	12	4.5	19	360	<1.0	750	160	55	1.5	110
Vinyl chloride	<1.0	<3.0	2.3	3.8	260	<1.0	93	58	<10	<1.0	<1.0
Tetrachloroethene	--	--	<0.03	<0.03	<3.0	<0.3	<0.3	<3.0	<3.0	<0.3	<0.3

Key at end of table.

Table 1 (Cont.)

Compound	B-28M 1/90	4/90	7/90	10/90	1/91	B-29M 1/90	4/90	7/90	10/90	1/91
Carbon tetrachloride	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Chloroform	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
1,1-dichloroethane	<0.7	<0.7	<0.7	<0.7	<0.7	1.3	<0.7	<0.7	2.3	<0.7
1,1-dichloroethene	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	1.0
Methylene chloride	<5.0	<5.0	<5.0	<1.0	<5.0	<5.0	<5.0	<5.0	<1.0	<5.0
Trans-1,2-dichloroethene	<1.0	<1.0	<1.0	<1.0	<1.0	3.6	<1.0	2.9	4.1	<1.0
Cis-1,2-dichloroethene	<1.0	<1.0	<1.0	<1.0	2.6	290	73	110	250	23
Total-1,2-dichloroethene	<1.0	<1.0	<1.0	<1.0	2.6	300	73	110	250	23
1,1,1-trichloroethane	<0.3	<0.3	<0.3	<0.3	0.3	<0.3	<0.3	<0.3	<0.3	<0.3
Trichloroethene	<1.0	<1.0	<1.0	<1.0	<1.0	12	2.8	6.3	15	<1.0
Vinyl chloride	<1.0	<1.0	<1.0	<1.0	<1.0	16	2.6	13	15	<1.0
Tetrachloroethene	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3

Key at end of table.

DRAFT

TABLE 1a

Development of soil cleanup goals
Carborundum Co. Site, # 9-32-102

ntaminant	Solubility mg/l or ppm S	Partition coefficient Koc	Groundwater Standards/ Criteria mic.gm/l or ppb. Cw	Allowable Soil conc. ppm. Cs	Soil Cleanup ** Goals to Protect GW Quality (ppm)
richloroethylene	1,100	126	5 ***	0.007	0.7
s-1,2-Dichloroethene	3,500	49 *	5	0.0025	0.25
inyl Chloride	2,670	57	2	0.0012	0.12

a. Allowable Soil Concentration Cs = f x Cw x Koc
b. Soil cleanup goal = Cs x DAM

Partition coefficient is calculated by using the following equation:
log Koc = -0.55 log S - 3.64. Other values are experimental values.
Dilution and attenuation factor (DAM) is taken from Appendix C, TAGM#
Part 5 DOH drinking water standards.

ADMINISTRATIVE RECORD

Carborundum Company Site No 932102

Proposed Remedial Action Plan

Preliminary Hydrogeological Assessment, Standard Oil November, 1984

Niagara County Health Department, Residential Sampling Results October, 1985. Seismic Refraction Survey, Dunn GeoScience, September, 1986 "Year in Review" Report July 22, 1987.

Letter - September 4, 1987, NYSDEC Confirmation of Additional Study Requirements Geophysical Survey Report, E&E April, 1988.

Letter - August 15, 1988, NYSDEC to BP America, Listing on Registry.

Public Fact Sheet - October, 1988, Residential Well - Sump Sampling.

Remedial Investigation Work Plan, E&E November, 1988.

Letter - January 12, 1989, E&E to NYSDEC Re: Private Well & Sump Sampling.

Letter - April 18, 1989, Carborundum to NYSDEC - Re: Repository Citizen Participation Plan - May, 1989.

Pump Test Report - June 12, 1989

Letter June 26, 1989 - Carborundum to NYSDEC Re: Residential Sampling Results.

IRM Work Plan - Septic Tank Closure July 26, 1989.

Health & Safety Plan, E&E July 1989

Draft RI Report - August 18, 1989.

NYSDEC Comments on RI Report September 27, 1989

Letter 10/ 3/89 - Carborundum to NYSDEC - Response to Comments

Letter 11/ 0/89 - Carborundum to NYSDEC - Resolution of Comments on RI

Letter 11/ 5/89 - Work Plan for Phase II RI Activities.

Letter 11/ 1/89 - Soil Gas Survey Work Plan

Technical Proposal - Dual Vacuum Extraction Pilot Study - April, 1990, Terra-Vac.

Letter 6/11/90, E&E to NYSDEC Re: Outline for FS

Remedial Investigation Report - 6/90, E&E

Soil Gas Investigation - DoD area, 7/90, Tracer Research

NYSDOH comments on RI, 8/6/90.

NYSDEC letter to E&E, 8/16/90 - Comments and Approval of RI

NYSDEC Public Information Fact Sheet, August 30, 1990.

Letter - October 2, 1990, E&E to NYSDEC - Response to NYSDEC comments

Feasibility Study Report - October, 1990, E&E.

NYSDOH Letter, November 2, 1990 - response to E&E letter.

NYSDOH Letter, November 16, 1990 - Comments on FS

NYSDEC Memorandum - December 4, 1990 - Comments on FS.

Final Report - Dual Vaccum Extraction Treatability Study, December 10, 1990.

NYSDEC Letter - January 23, 1991 - Comments on FS.

Letter - February 6, 1991, E&E to NYSDEC - Response to FS comments.

Letter - February 27, 1991, E&E to NYSDEC - Comparions of TCLP to Total Soils Data

Letter - March 7, 1991, E&E to NYSDEC - Development of Soil Clean up Value .

NYSDEC Memorandum - March 20, 1991, Development of Soil Clean up Value.

Letter - March 26, 1991, E&E to NYSDEC - Agreement on Soil Gas Monitoring.

Letter - April 3, 1991, E&E to NYSDEC - Re: PRAP

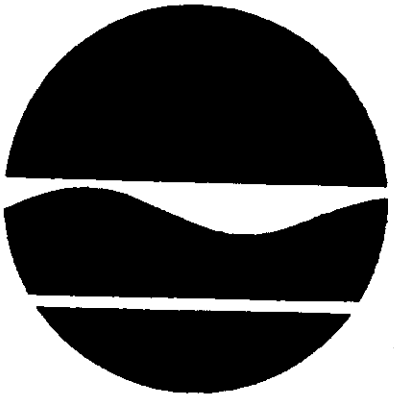
Carborundum Company

Site No. 9-32-102

Responsiveness Summary

Prepared by:

New York State
Department of Environmental Conservation



August 1991

RESPONSIVENESS SUMMARY

A public meeting was held on May 16, 1991 at the Niagara County Community College to discuss the results of the Remedial Investigation and Feasibility Study (RI/FS) and to answer questions, and to gather comments from interested citizens. In addition, a number of comments were received during the comment period which was established during the month of May 1991.

Approximately 20 people, including nearby residents, local officials, interested citizens and professional consultants working on a similar study near to the Carborundum facility, attended the meeting. The following are questions asked at the meeting or presented in writing to the NYSDEC, accompanied by responses. In some cases we have combined or summarized questions that were similar.

Question 1: Was a cancer study done for Carborundum facility as part of the project?

Answer: A cancer cluster study was not performed by the NYSDOH at this site. A Baseline Risk Assessment performed as part of the Remedial Investigation (RI) suggests potential exposures to chlorinated organics via airborne pathways under existing conditions do not pose any significant risks to human health. However, it is noted that the New York State Department of Health (NYSDOH) has required additional study on this pathway before making any final conclusions regarding public health risks. Additionally, groundwater in the area of the site would pose a health risk <u>if</u> it were to be used for domestic supply purposes such as drinking, showering or bathing. However, the groundwater is <u>not</u> used for these purposes, and as such, the estimated risks associated with groundwater usage are not applicable to any residents around the site.

Question 2: Has the old wastewater/stormwater discharge from the facility been discontinued?

Answer: Yes. The surface water discharges as well as the cooling water discharges were eliminated by diverting the discharge to the Niagara County Sewer District No. 1 Wastewater Treatment Facility in June 1984.

Question 3: Have wells in the area been inventoried and has action been taken to close private wells near the site?

Answer: Yes. Groundwater from 22 private residential wells was sampled by the Niagara County Health Department in 1985 and 1988. Later in 1988, Carborundum sampled all residential wells and sumps that could be identified within a 3/4 mile radius of the site. Sampling results from these events allow us to conclude that residential wells are not being impacted by the contamination found at the site at this time. Residents included in the survey were notified of the results and conclusions.

Question 4: Which way does groundwater flow?

Answer: Groundwater moves away from the site to the south, southeast and southwest. The primary migration of the plume is to the southwest.

Question 5: Is there any concern for the contaminants being discharged to the sanitary sewer?

Answer: The current discharge of the surface water and planned discharge of extracted groundwater to the sanitary sewer is subject to provisions of the federal Clean Water Act. What this means is that the discharge is regulated by a permit with the Sewer District to limit the amount of contaminants being discharged. This permit limit is predicated upon many factors, such as the ability of the treatment plant to treat the wastewater, worker safety both at the plant and in the sewers, etc. This permit is also reviewed by the NYSDEC to ensure compliance with the Sewer District's permit to discharge treated water to the Niagara River.

Question 6: Can equipment used on-site track contaminants off-site?

Answer: Yes. That is why decontamination of equipment is taken very seriously and all decontamination is to be in accordance with NYSDEC approved procedures. Sampling methods and equipment are selected to minimize decontamination requirements. For example, all drilling equipment is decontaminated after drilling each monitoring well by steam cleaning, followed by scrubbing with brushes if soil remains on equipment and a final steam cleaning.

Question 7: How will the soil be treated to remove the hazardous contaminants?

Answer: The contaminated soil, which is present on the site, is expected to be remediated using in-situ vapor extraction technology. This technology operates by applying a vacuum to contaminated soils which draws the contaminants from the soil to a treatment system. A pilot-scale study was performed at the site on the most contaminated portion of the site, was found to work satisfactorily, and is expected to meet the clean-up goals established for this site.

Question 8: Why wasn't a "French" drain installed as part of the groundwater collection system?

Answer: A "French" drain or installation of drainage tile to recover groundwater in a bedrock setting is not as effective as the grundwater recovery wells that are proposed. The groundwater recovery wells proposed have been shown in pump tests to form a barrier which will prevent contamination from moving off-site.

Question 9: What did the pump tests reveal?

Answer: Pumping tests have indicated that pumping the existing extraction wells at the facility will collect that portion of the plume upgradient of a hydrogeological barrier located in the southwest corner of the site. It also revealed the plume downgradient of the barrier is in poor communication with the "on-site" plume. This will require the siting of additional wells downgradient of the barrier to effectively capture the entire plume.

Question 10: What is the geology of the site?

Answer: The near surface geology at the Carborundum site consists of approximately 7 to 20 feet of unconsolidated glacial lake sediments underlaid by dolomitic bedrock. Shallow horizontal and vertical fractures in the weathered uppermost section of the bedrock comprise the primary aquifer beneath the facility. This weathered zone ranges in thickness from about 10 to 20 feet and appears to be the predominant route for migration within and off the site.

Question 11: Is the plume located under the Department of Defense (DoD) housing facility?

Answer: The plume is located under the extreme southeast corner of the DoD facility as can be seen on Figures 4, 5 and 6 in the Proposed Remedial Action Plan (PRAP).

Question 12: **Has there been any thought of indoor air sampling at the DoD homes?**

Answer: The results of soil gas analysis on the DoD property has not indicated a problem exists with vapors coming up from the groundwater. However, the soil gas will continue to be monitored for two years while remediation is on-going. Before consideration could be given to sampling indoor air, a problem must be apparent in the soil gas. Indoor air sampling analysis is difficult to interpret due to the various chemicals used in the home which would be picked up by the sensitive monitoring equipment used. It is the NYSDEC's understanding that the Department of the Navy has conducted limited analysis of indoor air and has reviewed the results with the residents.

Question 13: **Would steam be useful in the vacuum extraction technology?**

Answer: One of the requirements for this technology to work is to have pathways for the contaminants to follow so they can be "vacuumed" up and treated. The soil at this site is rich in clay and is fairly tight. In order for the contaminants to move through the soil to be treated, it is necessary to dry out the soil and create dessication cracks or pathways for the air to follow. The use of steam, which is water, would in effect block these pathways and hinder the remedial efforts. However, at sites where the soil is more granular in nature, the use of steam has been shown to be beneficial.

Question 14: **What is the estimated amount of contamination in the soil area?**

Answer: It is estimated that the amount of chlorinated organics in the soils on-site near well B-17 (the most contaminated area) is approximately 1200 pounds. Plant-wide the amount could be approximately four times this amount.

Question 15: **What are the expected contaminated loadings to the POTW and will treatment be required?**

Answer: The Niagara County Sewer District No.1 (NCSD) has issued the Carborundum facility a permit which will allow the discharge of groundwater to the sanitary sewer. The permit limits the concentration of chlorinated organics to 500 parts per billion, which at the estimated flow rate of 300 gallons per minute will approximate 2 pounds per day. It is not expected that treatment will be required to meet these limits.

Question 16: Was DNAPL found at the site?

Answer: No. Depth specific groundwater samples were collected in July 198? from the bottom of monitoring wells B-8M and B-17M to determin? if chlorinated organics were present in groundwater as a dense ?on-aqueous phase liquid (DNAPL). These wells were selected because they contain the highest levels of chlorinated organics in groundwater beneath overburden source areas. Concentr?tions of chlorinated organics were comparable to levels measured on a quarterly basis and were below the solubility of each ind?vidual contaminant.

Question 17: Does groundwater reach up into the overburden?

Answer: Gro?ndwater will rise up into the overburden during periods of high ?nfiltration (i.e. during the rainy periods of the year). However, the overburden will not transmit significant quantities of groun?water and hence, chlorinated organics. This is based on the fact that groundwater will readily travel in the weathered bedrock ?hich has a hydraulic conductivity several orders of magnitud? greater than that of the silt and clay overburden.

Question 18: Are animals present which could contact surface water?

Answer: The only surface water available to wildlife in the immediat? area is Cayuga Creek and tributary ditches, which have been tes?ed for chemical contamination. The results indicate there is no impact from the site; however Cayuga Creek will continue to be monitored during the remediation period. Other areas wh?ch have periodic surface water are within the fenced area of ?he site and are currently being collected and sent to the sani?ary sewer for treatment.

Question 19: Was the nearby quarry sampled, and what were the results?

Answer: Yes The quarry wall was sampled in 1986 and upon analysis no conta?ination related to the site was found. In fact, Well B-28M, l?cated 1,040 feet to the west of the site and in a direct line bet?een the quarry and the site, has yielded no chlorinated organics This leads us to believe the predominate groundwater flow is ?o the southwest rather than to the west.

Question 20: Will residents of the area be notified periodically of results of remedial work?

Answer: Yes The NYSDEC will send timely notices to interested persons ?s work progresses such as when the final design document? are available in the document repository, etc. If you know of ?omeone who would like to receive updates on the site, please c?ntact Ms. Patricia Nelson at NYSDEC - phone (716) 847-4585.

Question 21: How are the chemicals being transformed in the groundwater?

Answer: Over the past 5 to 10 years numerous reports have appeared in the literature indicating that, under reducing conditions, chlorinated one and two carbon alkanes and alkenes can undergo successive dehalogenation in soil and groundwater (Bouwer, et al. 1981; Parsons, et al. 1984; Wilson and Wilson 1985 etc.). Results of sampling at the Carborundum site have documented the biodegradation of trichloroethylene (TCE) to 1,2-dichloroethylene (1,2-DCE and vinyl chloride (VC).

Question 22: Was the backfill in the sewer trench sampled?

Answer: Yes A well point, a temporary stainless steel monitoring well, was installed immediately adjacent to the sanitary sewer line along Cory Road. Groundwater was in contact with the sewer trench and analysis indicated the concentrations were lower than the average concentration for the known plume in this area.

The following questions and comments were submitted by the Department of Navy in a letter dated May 31, 1991. The Navy is responsible for the Department of Defense Housing facility (DODHF) adjacent to the Carborundum site.

Question 23: Please specify that 3 monitoring wells (B-21M, B-22M, and B-28) were installed on the DODHF Niagara property by the Carborundum facility to map the western boundary of their plume. An agreement between the Carborundum facility and the DODHF Niagara made the installation and sampling possible.

Answer: It is so noted in this responsiveness summary.

Question 24: The third paragraph stated; "....Migration of the plume is most likely controlled by the hydraulic gradient to the southwest. Chlorinated organics, principally 1,2-DCE and VC, have been found in monitoring wells to the southwest at levels which exceed drinking water standards....".

Please clarify in the text that the Carborundum facility plume traverses the southeastern corner of the DODHF Niagara property. Also, quantify the levels of contaminants in the DODHF Niagara monitoring wells which exceed the drinking water standards.

Answer: It is so noted in this responsiveness summary. Attached are tables which summarize the data for wells B21, B22 and B28 which are located on DODHF property.

Question 25: Please include the locations of the downgradient receptors (domestic wells) beyond the current monitoring network on Figures 4, 5, and 6.

Answer: The 22 residential wells identified and sampled in 1985 and 1988 are along Tuscarora Road, Saunders Settlement Road, Walmore Road, Cory Road and Lockport Road. The locations of the homes would be off the maps depicted in Figures 4, 5 and 6 shown in the PRAP. However, by viewing Figure 1, one can obtain a perspective of the relative locations of these residential properties as compared to the known contaminant plume shown in Figures 4, 5 and 6.

Question 26: The risk assessment assignment of low risk levels (one in 100 billion to 1 in 10 billion) is made without sufficient justification and basis. As discussed in the NYSDOH letter of August 6 1990, soil conditions may allow vapor migration from the contaminated plume to the surface in the DODHF Niagara area. Accordingly, without further soil gas sampling and assessment, a much greater risk level should be determined. Further, these soil gas studies (and the vapor migration) should be evaluated prior to initiating contaminated groundwater extraction operations.

Answer: The justification and basis for the risk assessment values are found in the Remedial Investigation - Chapter 5. As discussed in the PRAP, the issue of potential migration of soil vapors will be addressed by additional soil gas sampling consisting of biannual samples taken during the summer (dry months) and winter (months of frozen soil) for 2 years. This sampling will assess the potential for soil gas migration in the DoD housing area under the worst case scenarios. These conditions are known to be the most conducive for migration of soil gas. There is no need to delay the start of remediation, since extraction of contaminated groundwater from under the DoD housing area will only <u>lessen</u> the potential risks posed by the contamination.

Question 26: The meeting sponsored by the Navy on 29 August 1990 was a Residents Meeting not a public meeting.

Answer: It is so noted.

Question 27: The PRAP discusses the uncertainty in predicting the ultimate effectiveness of the cleanup yet states that it is unlikely that the on-site groundwater cleanup can meet state groundwater standards. The PRAP proposes a lesser cleanup standard (federal Maximum Contaminant Levels) for the on-site groundwater cleanup. Because of the uncertainty of cleanup effectiveness, it is requested that the state groundwater standards be used as a cleanup goal until it can be adequately proved that this standard is unattainable.

Answer: Page 8, Section V of the PRAP states "For groundwater, NYSDEC remediation goals are to attain New York State groundwater standards throughout the contaminated plume".

Question 28: The Preferred Alternative included an off-site (downgradient) ground water remediation program. Section C emphasized primarily the on-site remediation program. The estimated on-site capture zones of P-2 and P-3 (figures 7, and 8) would not recover contaminated ground water which has moved onto the DODHF Niagara property. The PRAP indicated that a portion of the aquifer within the DODHF Niagara may not fall with the zone of capture of the ground water recovery system. EXHIBIT C (page 5, response 7) estimated, by on-site capture only, the time period to reach SCGs may be 10 years for well B-23M. Should this occur, contaminants in any uncaptured portion of the DODHF Niagara aquifer are expected to dissipate by natural means over time (10 years) to levels that are protective of human health and the environment.

The ultimate goal should be to restore ground water quality at the DODHF Niagara to SCGs. The remediation program should properly site recovery wells to include, and expedite to the extent possible, remediation of the DODHF Niagara property. The Record of Decision should include a figure of the estimated zone of capture for upgradient and downgradient wells as well as a process flow diagram for the remediation system.

Answer: The goal of the remedial program is to restore groundwater at the DoD housing area to New York State groundwater standards. The remedial program will properly site recovery wells to ensure that the goals are attained. The Record of Decision (ROD) cannot include a figure of the estimated capture zone at this time until the recovery well is designed and pump tests are run. A process flow diagram will be available when the design work begins, which should be later this year.

Question 29: The Navy believes the achievable concentration of any constituent in ground water cannot be predicted with certainty, and despite extensive recovery efforts, very low concentrations of dissolved constituents may persist in the aquifer, and concentrations may decline to a low level beyond which future reduction cannot be achieved.

Should the Navy, or ensuing property owner, decide in the future to develop a supplemental water supply system (potable or industrial) at the DODHF Niagara, the Carborundum facility must control the health risks within acceptable levels by implementation of a ground water treatment system or other measures approved by the Navy and the NYSDEC.

Answer: The remedial program described in the PRAP is based upon an evaluation of exposure pathways that currently exist. This analysis included the identification of current exposures and exposures that could occur in the future if no action was taken at the site. The Remedial Investigation/Feasibility Study was based upon reasonable maximum exposure scenarios which reflect the type(s) and extent of exposures that could occur based on the likely or expected use of the site in the future. The use of local groundwater for potable purposes is not likely given the fact that groundwater quality is naturally poor and municipal water is readily availble.

Question 30: Due to on-going work at the Carborundum facility, the PRAP fails to define the design and performance criteria, permits and agreements, and operations and effectiveness monitoring requirements of the preferred alternative. It appears that a soils and ground water remediation system will be installed using a phased construction approach. But the PRAP does not clearly identify the strategy. The Navy can not judge the effectiveness of the preferred alternative as presented.

The Navy requests that a Remedial Action Workplan (monitoring plan and schedule) be developed and submitted to the Navy for review and approval during the remedial design phase for soils and ground water remediation. The work plan should consist of (1) a remedial action monitoring plan and (2) a quality assurance project plan. The purpose is to document the specific operations and effectiveness monitoring techniques. The Remedial Action Workplan should be used in conjunction with the startup and operation of the soil and ground water remediation effort.

The Record of Decision should mention the contents of the plan. The ensuing reports of the Remedial Action Monitoring Plan must be provided to the Navy for review and comment.

Answer: The PRAP outlines the goals for the remedial program and the selected remedial alternative as a result of the Feasibility Study. The purpose of the PRAP is not to detail the design of the system nor attempt to gauge its effectiveness beyond what is provided in the Feasibility Study (which does provide information as to short and long term effectiveness, cost etc.). The Remedial Action Workplan will be developed as part of an agreement with Carborundum to implement the remedy. This workplan is currently being prepared and will be submitted after the Record of Decision is executed by the NYSDEC and after an agreement is signed by NYSDEC and Carborundum.

Question 31: The Navy requests the opportunity to review the following: vapor extraction pilot study scheduled for early summer 1991; and the downgradient hydrogeological study work plan scheduled for the Fall of 1991.

Answer: The Vapor Extraction Pilot Study Report will be available in August 1991, which details the study done performed over 1990/91. The downgradient hydrogeological workplan is expected after the Record of Decision (ROD) and Order on Consent is signed which should be in the Fall 1991. The Navy will be notified of the availability of these documents.

Question 32: The preferred remedial action alternative is inadequately defined in the PRAP. The Preferred Alternative does not specifically identify remedial actions and processes that will be used in cleanup of the contaminated soil or treatment/disposal of contaminated groundwater. Soil remediation action is contingent upon results from the vapor extraction pilot study currently being performed. Additionally, groundwater remedial action is contingent upon further feasibility study, soil gas studies, and review by the Niagara County Sewer District #1. Accordingly, it is felt that the selection of the Preferred Alternative is premature and the PRAP should be delayed to incorporate the findings of these studies. If test extraction is required in order to fully assess contaminant levels and pump rates it is requested that this be performed as an Interim Remedial Action until a detailed PRAP can be developed.

Answer: The PRAP adequately defines the remedy and is specific regarding the selected remedial alternatives. Contingencies are included in the event that a selected alternative is unable to reach the goals of the remedial program. It is not true that the groundwater remedial action is contingent upon further feasibility study, soil gas study, nor review by the Niagara County Sewer District. The selected alternative is groundwater extraction and the remaining decisions deal only with the way the water is treated, whether by the sewer district or by treatment at the site with a discharge directly to Cayuga Creek. The design of an effective extraction system will require pump tests however, the remedy will continue to be groundwater extraction, therefore the designation as an interim remedial action is inappropriate.

Question 33: The PRAP identifies an interim groundwater remediation action (pump and discharge to the POTW) for 6 months until sufficient data on contaminant concentration and pump rates can be examined and the feasibility of an on-site treatment facility can be evaluated. It is felt that upon completion of the test extraction period, that extraction should be ceased until the above factors are evaluated. Also, monitoring must be performed during the test extraction period and assessed in order to ensure the protection of human health and the environment. During the assessment of on-site treatment feasibility the following concerns should be addressed:

A. Identify potential health hazards and risk levels associated with the treatment operation.

B. Identify quantities, contaminant levels, and on-site storage period of treatment waste generated during the process.

C. Identify contingency response actions to ensure adjacent resident safety in the event of contaminant spills or other releases during the extraction or distribution of the groundwater to the POTW.

D. Identify specific air emission control equipment and contaminant emission levels for extraction and treatment processes.

E. Identify air emission monitoring methods and episode plans in the event that Clean Air Act standards are exceeded. Episode Plans should include procedures to cease operations, inform affected parties, and evaluate system improvements for such contingencies.

F. Perform a risk analysis based upon contaminant levels to be discharged to surface water.

G. Provide the treatment feasibility study for Navy review prior to further implementation or resumption of discharge to the POTW.

Answer: The groundwater extraction remedy is a positive measure to prevent further migration of the contaminants from the site and to speed up the remediation of the groundwater. The remedial system need not be stopped while the associated reviews of alternate treatment schemes are made. In fact, the stoppage of pumping could be detrimental to any achievements made in reducing the groundwater concentrations of contaminants. The assessment of the alternate treatment systems will incorporate the concerns outlined in the Navy's comments. The reports generated by this review will be made available to the Navy. The concerns dealing with the extraction process will be addressed in the initial Remedial Design Work Plan.

Question 34: The PRAP states that certain wells will be monitored monthly for only one year following the initiation of remedial action. Long-term periodic monitoring of groundwater from monitoring wells on and adjacent to DODHF Niagara property is required to ensure public health and safety. It is requested that monthly monitoring of wells near the DOD property be met, and quarterly monitored for the period up to and five years after meeting the state groundwater cleanup standards. The monitoring requirements should be identified in a Remedial Action Workplan (see comment #11).

Answer: The monitoring program will be outlined in the Remedial Design workplan. The workplan will include plans and schedules for the implementation of the remedial design.

Question 35: The design and operating procedures for the interim extraction test wells and connection to the POTW are requested to be made available for review by the Navy.

Answer: The Remedial Design Workplan will be made available to the Navy.

Question 36: The PRAP identifies additional soil gas surveys in the DODHF Niagara area (twice a year for 2 years). It is felt that these surveys must be completed and results assessed prior to initiation of and during test extraction actions to evaluate potential resident health risk assessment levels caused by vapor migration. The period for continued soil gas monitoring should be identified as relating to cleanup milestones instead of a specific period. It is requested that quarterly soil gas surveys be conducted, per NYSDOH letter dated August 6, 1990, at the DODHF Niagara quarterly until SCGs are met. Then once every five years thereafter. The monitoring requirements should be identified in a Remedial Action Workplan (see comment #11).

All soil gas surveys must be coordinated with the Navy and results must be provided to the Navy within 7 days of receipt. Further, immediate notification of residents shall be required if any potential health hazards are identified.

Answer: The logic behind the timing of the soil gas studies is explained in the answer to question #26. The need for additional soil gas sampling will be evaluated based upon the results obtained from the 2 year program. The soil gas survey program will be coordinated with the Navy and the results provided to the Navy as soon as possible after receipt from Carborundum. Should potential health hazards be identified the Navy and residents will be notified, and appropriate responses implemented.

Question 37: The PRAP suggests that Cayuga Creek will be monitored annually only if hydrogeology suggests there is a possibility of adverse impacts from remediation efforts. A schedule should be established, and included in a Remedial Action Workplan, to periodically monitor water quality in Cayuga Creek until such time as further hydrogeology studies prove their is no potential for adverse impacts. At a minimum, quarterly monitoring should be performed.

Answer: To clarify, the sampling will be done on an annual basis, during times when groundwater has the potential to impact Cayuga Creek. This time period is expected to be in the spring of the year. It is important to note that contaminant levels far to the east are fairly low, in fact many times the levels are below groundwater standards. The likelihood of an adverse impact on the creek is minimal, however the stream will be monitored on a regular basis.

Question 38: Periodic or continuous monitoring of air emissions from groundwater extraction and treatment processes must be performed in order to ensure the adjacent resident's health and safety. Include the monitoring specification in the Remedial Action Workplan. Immediate notification or residents shall be required if any potential health hazards are identified.

Answer: Any air emissions from treatment processes will be regulated by the NYSDEC and will be in accordance with applicable air regulations. Notification of residents of potential health hazards will be addressed in the Health and Safety Plan for the site.

Question 39: Periodic ambient air monitoring should be performed on and adjacent to DODHF Niagara property throughout the cleanup process to ensure no atmospheric releases or vapor migration of contaminants. A schedule of this monitoring should coincide with cleanup milestones and be coordinated with the Navy via a Remedial Action Workplan. At a minimum, quarterly monitoring should be performed. Further, immediate notification of residents shall be required if any potential health hazards are identified.

Answer: All remedial activities that could have a release to the air will conform with applicable air regulations such as 6NYCRR Part 211 and 212. In addition, the potential releases will be evaluated using guidance such as USEPA's Air/Superfund National Technical Guidance Study Series, July 1989. Of course, if a health hazard exists as determined by the NYS Department of Health, the residents would be notified.

The following questions/comments were submitted by Ecology & Environment in a letter dated May 31, 1991. E&E is the consultant to BP America Inc. for this project.

Question 40: Soil Gas Vapors at DOD (p. 7): The potential for soil gas vapors which would volatilize from groundwater and impact DOD residents was evaluated in the Risk Assessment for the Remedial Investigation by BPA. It was determined from this evaluation that the maximum risks posed by soil gas vapors to DoD residents were at least 10,000 times less than what is typically regarded by the EPA as a reasonably acceptable risk. NYSDOH has also done an evaluation of risk from soil gas vapors and has determined that the risk to DOD residents is somewhat higher than was determined by BPA. The NYSDOH risk assessment has been reviewed by BPA; a copy of the review is attached to this letter. BPA has agreed to do soil gas monitoring on a biannual basis for two years. However, BPA does not agree with the NYSDOH position that potential soil gas vapors at the DOD are a public health concern.

Answer: The additional soil gas monitoring program will help resolve any differences regarding the potential exposure of DoD residents to soil gas vapors. The data will be evaluated by NYSDOH to ensure that residents will not be adversely impacted should soil gas vapors be found.

Question 41: Institutional Controls (pages 9 and 15): Discussions regarding groundwater remediation on both of these pages refer to institutional controls that will be implemented if groundwater within the area of attainment cannot be returned to its beneficial use. A definition or examples of what constitutes these controls in New York State has not been clarified. Please cite some examples of institutional controls that would be implemented if groundwater ~~could not be returned~~ to its most beneficial use.

Answer: Institutional controls that could be put into place at this site would include; 1). access restrictions, such as deed restrictions for property in the area of influence to prevent the use of wells, 2). extension of existing municipal water supply to serve residents in the area of influence, 3). groundwater monitoring.

Question 42: Review Periods; Soils and Groundwater Remediation: A review schedule in the Record of Decision (ROD) is needed to maximize operating efficiencies of the remediation systems. This would enable all parties to evaluate the progress of soils and groundwater remediation several times during both remediation periods. Suggested review periods are listed as follows:

Soils: Review period of 1 year after start-up and at half year increments thereafter.

Groundwater: Review period at 6 months after start-up, at 2.5 years and at 2 year increments thereafter.

The purpose of the review periods are to evaluate the progress of remediation and to adjust the operation of each design system if appropriate. Also, clean-up goals would be evaluated during each review period to determine if these goals can be obtained or if other goals or institutional controls should be considered. BP would also like to have the opportunity to petition the NYSDEC at any time should soil or groundwater meet clean-up goals.

Answer: The review periods and evaluation criteria will be addressed in the Remedial Design. The Remedial Design format will be outlined in the Order on Consent which is currently under review by NYSDEC and BP America Inc.