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Superfund
Record of Decision:

Industrial Drive, PA

50272-101

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15. Supplementary Notes

16. Abstract (Limit: 200 words)

The 30-acre Industrial Drive site is an active sanitary landfill and industrial facility in Williams Township, Northampton County, Pennsylvania. Land use in the area is industrial, residential, and agricultural. The site contains active and inactive sanitary landfills as well as active, inactive, and abandoned industrial facilities. The Lehigh River and Lehigh Canal are located northwest of the site, and a portion of the site rests upon the trace of a thrust plane known as the Musconetcong Fault. These conditions have created a complex geologic setting in which ground water flow is governed by topography. Prior to 1961, the site was used for iron ore mining, industrial activities, and agricultural purposes. In 1961, sanitary landfill operations began onsite, and the site accepted municipal solid waste for disposal in an unlined landfill. By 1980, the landfill had expanded to 30 acres. In the late 1970's, local residents alleged that the now inactive unlined landfill had accepted hazardous wastes that had contaminated local drinking water wells. Waste disposal in the unlined landfill ceased in 1986, but closure of the landfill has not been completed. In 1986, the State issued a permit for a 10-acre expansion of the landfill, which included a liner and leachate collection system.

(See Attached Page)

17. Document Analysis a. Descriptors

Record of Decision - Industrial Drive, PA
Second Remedial Action - Final
Contaminated Media: soil, debris, gw
Key Contaminants: VOCs (benzene, PCE, TCE), other organics, metals (chromium, lead)

b. Identifiers/Open-Ended Terms

c. COSATI Field/Group

18. Availability Statement	19. Security Class (This Report) None	21. No. of Pages 83
	20. Security Class (This Page) None	22. Price

(See ANSI-Z39.18) *See Instructions on Reverse* OPTIONAL FORM 272 (4-77) (Formerly NTIS-35) Department of Commerce

Abstract (Continued)

This expansion landfill is currently active, but there are no plans to further expand the landfill area. Contamination in local ground water wells was first detected in 1983. Subsequently, the site has been divided into two operable units (OUs) for remediation. A 1986 ROD addressed OU1, and provided for an alternate water supply by connecting numerous private well users to an existing municipal water supply. This ROD addresses OU2, the contaminated ground water and the low-level threat caused by the unlined municipal landfill. The primary contaminants of concern affecting the soil, debris, and ground water are VOCs including benzene, PCE, and TCE; other organics; and metals including chromium and lead.

The selected remedial action for this site includes closing and capping the unlined landfill area with a clay or synthetic cap; onsite pumping and treatment of contaminated ground water using an air stripper, followed by carbon adsorption with onsite discharge of the treated ground water to the Lehigh River; regenerating spent carbon offsite; and long-term monitoring of the closed landfill and ground water. If the selected remedy cannot meet the specified remediation goals, a contingency remedy will be implemented to prevent further migration of the plume, which will include a combination of containment technologies including ground water extraction and treatment, and institutional controls. The estimated present worth cost for this remedial action is $12,775,000, which includes an annual O&M cost of $536,000 for years 0-1 and $498,000 for years 2-45. There will be an additional O&M cost of $20,000 every 5 years.

PERFORMANCE STANDARDS OR GOALS: The goal of this remedial action is to remediate ground water to Background Levels as specified by the State Hazardous Waste Management Regulations. Chemical-specific goals include benzene 0.2 ug/l, PCE 0.03 ug/l, TCE 0.03 ug/l, chromium 50 ug/l, and lead 5 ug/l.

RECORD OF DECISION
INDUSTRIAL LANE
DECLARATION

Site Name and Location

Industrial Lane
Williams Township, Pennsylvania
Operable Unit 2

Statement of Basis and Purpose

This decision document presents the selected remedial action for the Industrial Lane Site in Williams Township, Pennsylvania, which was chosen in accordance with the requirements of the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA), as amended by the Superfund Amendments and Reauthorization Act of 1986 (SARA) and, to the extent practicable, the National Oil and Hazardous Substances Pollution Contingency Plan (NCP), 40 C.F.R. Part 300. This decision document explains the factual and legal basis for selecting the remedy for this site.

The Commonwealth of Pennsylvania concurs with the selected remedy. The information supporting this remedial action decision is contained in the Administrative Record for this site.

Assessment of the Site

Pursuant to duly delegated authority, I hereby determine, pursuant to Section 106 of CERCLA, 42 U.S.C. § 9606, that actual or threatened releases of hazardous substances from this site, as discussed in the Summary of Site Risks in this document, if not addressed by implementing the response action selected in this Record of Decision (ROD), may present an imminent and substantial endangerment to public health, welfare, or the environment.

Description of the Selected Remedy

This Operable Unit is the second of two Operable Units for the site. The remedy for the first Operable Unit consisted of connecting numerous private well users in Lucy's Crossing and Glendon Borough to existing water mains belonging to the Easton City Suburban Water Authority. The first Operable Unit addressed the principal exposure pathway, and as a result a waterline was extended to residences. Since no principal threats were identified at the site, the second Operable Unit addresses the contaminated ground water and the relatively low-level threat caused by the unlined municipal landfill. This remedy, which includes containment, results in hazardous substances being left onsite and that therefore will require long-term management.

The selected remedy includes the following major components:

- Closure of the unlined municipal landfill

- Extraction, treatment, and discharge of ground water to the Lehigh River
- Long-term monitoring of the closure and the ground water

Statutory Determinations

The selected remedy is protective of human health and the environment, complies with Federal and State requirements that are legally applicable or relevant and appropriate to the remedial action, and is cost-effective. This remedy utilizes permanent solutions and alternative treatment (or resource recovery) technologies to the maximum extent practicable, and it satisfies the statutory preference for remedies that employ treatment that reduces toxicity, mobility, or volume as a principal element.

Because this remedy will result in hazardous substances remaining onsite above health-based levels, a review will be conducted within five years after commencement of remedial action and every five years thereafter, as required by Section 121(c) of CERCLA, 42 U.S.C. § 9621(c), to ensure that the remedy continues to provide adequate protection of human health and the environment.

Edwin B. Erickson
Regional Administrator
Region III

3/28/91
Date

Decision Summary for the Record of Decision

I. Site Name, Location, and Description

The Industrial Lane Site is located in Williams Township, Northampton County, Pennsylvania, approximately 1 mile southwest of the center of south Easton (Figure 1). Although the site is listed as Industrial Lane on the National Priorities List (NPL), it is located on Industrial Drive. To avoid confusion, the site will be referred to as the "Industrial Lane site", or simply the "site". The site, which encompasses approximately 30 acres, borders on the city limits of Easton, and is located approximately 15 miles east of Allentown. The Lehigh River and Lehigh Canal are located to the northwest of the site. The communities of Glendon Borough and Lucy's Crossing are located west and southwest of the site, respectively. Morgan Hill is situated to the east and south of the site. The area population has been estimated at approximately 550 persons. The study area ,which includes the site, contains active and inactive sanitary landfills (Chrin Brothers Landfill) and various active, inactive, and abandoned industrial facilities. The site received attention during the late 1970s as a result of allegations by local residents that the now inactive unlined landfill had accepted hazardous wastes that were contaminating local drinking water wells. Since that time the area has been the focus of investigations by both Federal and state agencies and continues to be an area of concern for local residents.

The Industrial Lane site is located in an area of highly weathered and structurally deformed rocks of the Cambrian/Precambrian era. In addition, a portion of the site rests upon the trace of a thrust plane known as the Musconetcong Fault. These conditions have created a very complex geologic setting. Ground water flow throughout the area is, in general, governed by the topography. The Lehigh River acts as base level for this ground water system, which flows primarily under water-table conditions. Depth to ground water throughout the area varies from about 18 feet to greater than 200 feet below ground surface.

The area around the site is currently used for industrial, residential and limited agricultural purposes. The site is not located in a floodplain and does not contain wetlands.

The Northampton County Comprehensive Land Use Plan and corresponding Williams Township zoning ordinance requirements provide information on the proposed future land use of the area. The sector along Industrial Drive is currently zoned for light industry and residential. The Morgan Hill area is currently zoned residential, and proposed future zoning includes no further changes.

The most notable future change in land use in the area around the site may occur along the Interstate 78 (I-78) corridor, which extends east-west approximately 850 feet north of Industrial Drive near the Chrin Brothers Landfill. Future land use will most likely be influenced by proposed zoning changes, including the development of a commercial district along I-78.

II. Site History and Enforcement Activities

The 1874 Atlas of Northampton County depicts the area now known as the Chrin Brothers Landfill as undeveloped, with the exception of several iron mines. Aerial photographs from 1947 indicate that the area was used for agricultural purposes. Several small open areas observed in these photos appear to be the iron mine pits. Some of these areas are located in what is now the central area of the oldest portion of the unlined landfill.

The 1947 photos also reveal a variety of industrial activities on the adjoining property to the northeast identified as the former Pennsalt area, including a railroad spur. An electric company substation is also identifiable, with the remainder of the surrounding land used for residential or agricultural purposes.

Photos from 1958 show the landfill area as undeveloped and mostly wooded, with the iron ore extraction areas revegetated and possibly regraded. Industrial activities are continuing on the Pennsalt property.

Sanitary landfill operations began in 1961 and gradually grew in size. In 1975, the Pennsylvania Department of Environmental Resources (PADER) approved a permit for the site as a natural renovation sanitary landfill to receive municipal solid waste. No liner was required, and industrial wastes were not to be accepted without prior PADER approval. By 1980, the landfill had expanded to 30 acres. Disposal of wastes in this unlined area ceased in 1986, although closure of the site has not been completed. PADER issued a permit in 1986 for a 10-acre expansion of the Chrin Brothers Landfill; the expansion area has been developed east of the unlined landfill and includes a liner and leachate collection system. This expansion area is currently accepting waste for disposal, and the Chrin Brothers Landfill has recently applied for a permit to further expand the landfill area.

The U. S. Environmental Protection Agency (EPA) proposed Industrial Lane site for the National Priorities List (NPL) in 1983 after contamination was found in local wells; the site was placed on the NPL in 1984. A Remedial Investigation/Feasibility Study (RI/FS) was completed in 1986 pursuant to Section 104 of CERCLA, 42 U.S.C. § 9604. EPA issued a ROD in 1986 for the first operable unit (OU 1) at the site, which addressed the threat to human health in the area from drinking contaminated ground water. The remedy under the ROD for OU 1 consisted of connecting numerous private well users in Lucy's Crossing and Glendon Borough to existing water mains belonging to the Easton City Suburban Water Authority. This remedial action was completed in 1988.

In 1988, EPA had further ground water investigation done to gather additional information about the ground water contamination in the area. The report for this Ground Water Validation Study (GV Study) was issued in January 1989.

PADER notified the owner and operator of the Chrin Brothers Landfill in a letter dated November 23, 1990, that the inactive, unlined landfill area must be closed according to the Pennsylvania Municipal Waste Management Regulations (PA Code, Title 25, Chapter 271) and Regulations for Municipal Waste Landfills (PA Code, Title 25, Chapter 273). In January 1991, a Focused Feasibility Study (1991 FFS) addressing the contaminated ground water at the site was completed pursuant to Section 104 of CERCLA, 42 U.S.C. § 9604. The state closure requirement described above was integrated into the development and evaluation of remedial alternatives in the 1991 FFS.

III. Highlights of Community Participation

The 1991 FFS Report and the Proposed Plan for the second operable unit (OU 2) at the Industrial Lane site were released to the public for comment as part of the administrative record on February 12, 1991 in accordance with Sections 113(k)(2)(B), 117(a),and 121(f)(1)(G), 42 U.S.C. §§ 9613(k)(2)(B), 9617(a), and 9621(f)(1)(G). These two documents were made available to the public in the administrative record file maintained at the EPA Docket Room in Region III and at the Mary Meuser Library, 1803 Northampton Street, Easton. The notice of availability for these two documents was published in the Easton Express on February 12, 1991. A public comment period on the documents was scheduled to be held from February 12 to March 13, 1991. An extension request was received, and the comment period was extended to March 20, 1990. In addition, a public meeting was held on February 25, 1991. At this meeting, representatives from EPA and PADER answered questions about problems at the site and the remedial alternatives under consideration. A response to the comments received during this period is included in the Responsiveness Summary, which is part of this ROD.

IV. Scope and Role of Operable Unit or Response Action Within Site Strategy

As with many Superfund sites, the problems at the Industrial Lane site are complex. As a result, EPA has organized the remedial work at the site into two operable units.

The ROD for OU 1 was signed in September 1986, and addressed the threat to human health in the area from drinking contaminated ground water. This remedy consisted of connecting numerous private well users in Lucy's Crossing and Glendon Borough to existing water mains belonging to the Easton City Suburban Water Authority. This remedial action was completed in 1988.

This ROD authorizes the second and final planned remedial action at the site. The remedial action for OU 2 authorized by this ROD addresses the relatively low, long term threat posed by the unlined landfill. It also has the goal of restoring the ground water to beneficial uses. No principal threats, such as hot spot areas of highly toxic or highly mobile wastes, were found in conjunction with the site. The principal exposure pathway, ingestion and inhalation of volatile organic compounds (VOCs) in contaminated ground water, was addressed by OU 1.

V. Summary of Site Characteristics

The following data sources were used to characterize the nature and extent of ground water contamination at the Industrial Lane Site:

- Monitoring well data collected during the RI (1984-1986).
- Monitoring well data collected as a result of the 1989 GV Study.
- Monitoring well data collected as a result of sampling of the Chrin Brothers Landfill monitoring wells during 1989, by AGES, a consultant to the operator of the landfill.
- Monitoring well data collected as a result of sampling of the Chrin Brothers Landfill monitoring wells by PADER during 1988 and 1989.

EPA has concerns about VOC contamination since a number of contaminants found at the site are known or potential carcinogens. Similarly, certain inorganic contaminants pose threats to human health and the environment and must be examined and addressed.

The ground water data (VOC data only) collected during the GV Study are particularly relevant to characterizing the ground water contamination because VOCs are the principal site contaminants. The GV Study data present a recent picture of VOC concentrations in the ground water and were validated according to EPA protocols. Isoconcentration contour maps were plotted for selected VOCs detected during the GV study. These maps are included in the 1991 FFS. The contours were plotted to illustrate ground water contamination patterns at the Industrial Lane Site. The contour plots are not intended to define completely the limits of the VOC plume. Given the available ground water contamination information and within the limitations of the graphics used to plot the contours, many of the contour plots suggest that the wells immediately downgradient of the Chrin Brothers Landfill are a focal point for the VOC contamination. This suggests that the landfill is a primary contaminant source. Several of the contours (e.g., the chloroform map) further suggest that other contaminant sources may be contributing to the observed VOC contaminant plume. It should be noted that firm conclusions regarding contaminant plume size and contaminant source are difficult, given the location and limited number of wells sampled during the GV Study.

Data collected by AGES and PADER are also recent. The results presented in such data packages are not analyzed under the Contract Laboratory Program (CLP) and are not qualified in any manner to indicate that they have undergone a quality assurance review by an independent chemist. The AGES and PADER monitoring results provide the most recent inorganics data.

For purposes of the risk assessment and further discussion, the Industrial Lane site was divided into five areas around the unlined landfill (Figure 3):

- Area A - The area located northeast of the Chrin Brothers Landfill. Monitoring wells that characterize Area A are C-4, C-8, C-11, C-12, and N-7.

- Area B - The area located south of the Chrin Brothers Landfill. Monitoring wells that characterize Area B are C-2, C-6, C-10, and N-4.

- Area C - The area located north-northwest and immediately downgradient of the Chrin Brothers Landfill. Monitoring wells that characterize Area C are C-1, C-3, C-9, C-9A, N-2, N-8, M-12S, and M-15.

- Area D - The area located west-northwest of the Chrin Brothers Landfill (beyond Area C), including the community of Glendon. The monitoring wells which characterize Area D are N-1 and N-6. At least five private wells are located in Area D.

- Area E - The area located southwest of the Chrin Brothers Landfill including the community of Lucy's Crossing. Monitoring wells that characterize Area E are N-3 and N-5. At least nine private wells are located in Area E.

These five areas are somewhat distinct geographically. Contaminant levels differ significantly from area to area. The following paragraphs describe contaminant occurrence and distribution in each area.

Area A Ground Water Contamination

Table 1 summarizes the available ground water monitoring results for Area A. VOCs were the principal contaminants detected in the ground water in Area A. The results do not indicate that the VOC contamination is diminishing over time. While Area C is clearly downgradient of the site, water level results indicate that Area A may also be downgradient.

The GV Study was most sensitive to the VOC contamination because low analytical detection limits were employed. The results indicate that 1,1,1-trichloroethane, 1,2-dichloropropane, trichloroethene, 1,1-dichloroethane, and chloroform were the most frequently detected VOCs in Area A. Chrin Brothers Landfill monitoring well C-11, which is not located in the immediate vicinity of the landfill, was the most heavily contaminated well. Well C-11 is located on the property previously owned by Pennsalt, and currently owned by the Chrin Brothers Landfill. With the following exceptions, the VOC concentrations detected in one or more Area A ground water monitoring wells do not exceed available current or proposed Federal Safe Drinking Water Act (SDWA) maximum contaminant levels (MCLs): vinyl chloride; methylene chloride; tetrachloroethene; 1,2-dichloroethane; and benzene.

Semi-volatile organic compounds were detected infrequently in the ground water samples collected from Area A. Bis(2-ethylhexyl)phthalate, isophorone, and 4-chloro-3-methylphenol were each identified once at 410, 180, and 11 micrograms per liter (μg/L), respectively, in samples collected during the 1986 RI.

Recent AGES and PADER data indicates that chromium, iron, lead, manganese, and mercury concentrations detected in one or more unfiltered ground water samples exceed current or proposed Federal primary (health-based) or secondary (aesthetic-based) MCLs. Only the average concentration of mercury in the unfiltered samples exceeds a current primary MCL. The elevated iron and manganese concentrations in the unfiltered samples, as well as the turbidity levels noted in several samples, suggest that the metals concentrations noted are probably due, in part, to solids levels in the unfiltered samples.

Dissolved mercury concentrations reported by AGES for several filtered ground water samples exceed the current MCL; however, elevated mercury concentrations detected in the AGES samples were not noted in PADER samples collected during the same period. Other metals were not detected in filtered AGES or PADER samples in excess of current primary MCLs.

<u>Area B Ground Water Contamination</u>

Table 2 summarizes available ground water monitoring results for Area B. The pattern of ground water contamination noted in Area B is similar to that noted in Area A. In comparison to Area A, however, fewer VOCs were identified and the concentrations detected are generally lower in Area B. Chloroform was the VOC most frequently detected during the GV Study. However, only the maximum concentration of 1,2-dichloroethane detected as a result of AGES monitoring of the Chrin Brothers Landfill wells exceeds a MCL for VOCs. While Area C is clearly downgradient of the site, water level results indicate that Area B may also be downgradient.

Bis (2-ethyl-hexyl)phthalate was the only semi-volatile compound detected in ground water samples collected from Area B. The compound was detected in one monitoring well (N-4) sampled during the RI at a concentration of 38 µg/L.

Recent AGES and PADER data indicate that barium, chromium, iron, lead, manganese, and mercury concentrations detected in unfiltered ground water samples exceed current or proposed primary (health-based) or secondary (aesthetic-based) MCLs in one or more Chrin Brothers Landfill monitoring wells. However, the average concentrations of metals detected in unfiltered ground water samples do not exceed current primary MCLs. As noted in the discussion for Area A, elevated concentrations of iron and manganese, as well as elevated turbidity levels suggest that the metals concentrations are probably due, in part, to solids levels in unfiltered samples.

Mercury concentrations in excess of the current MCL were reported for one filtered ground water sample collected in 1989 by AGES from Area B. It is important to note that barium, chromium, and mercury concentrations reported for samples collected during the RI (1986) or by the PADER (1988-1989) are not in excess of current primary MCLs.

Area C Ground Water Contamination

Table 3 summarizes the available ground water monitoring results for Area C, which is immediately downgradient of the Chrin Brothers Landfill. As noted on the isoconcentration contour maps, VOC contamination in Area C is more prominent than in Areas A, B, D and E. In comparison to other areas sampled, Area C is most affected by VOC contamination potentially migrating from Chrin Brothers Landfill or other contaminant sources. The following VOCs were detected in one or more monitoring wells at concentrations exceeding current or proposed primary MCLs: vinyl chloride; methylene chloride; trans-1,2-dichloroethene; cis-1,2-dichloroethene; 1,2-dichloroethane; carbon tetrachloride; trichloroethene; benzene; tetrachloroethene; chlorobenzene; and 1,1-dichloroethene.

All of the VOCs listed above were also detected in leachate samples collected from the Chrin Brothers Landfill. The GV Study results indicate that tetrachloroethene, trichloroethene, 1,1,1-trichloroethane, and 1,1-dichloroethane were the most frequently detected VOCs reported for Area C wells. The data reveals that contaminant concentrations are not diminishing over time and that the GV Study was most sensitive (in comparison to the RI, AGES, and PADER studies) to the VOC contamination present.

With the exception of N-nitrosodiphenylamine, bis(2-ethylhexyl)phthalate, bis(2-chloroethyl)ether, and isophorone, semivolatile organics were not detected in Area C ground water samples. These four compounds were infrequently detected during the RI at maximum concentrations of 25, 160, 6.0, and 52 µg/L, respectively. As was the case in Areas A and B, semivolatile organic contamination is not widespread or prominent in Area C ground water.

Five metals were detected in unfiltered Area C ground water samples at concentrations exceeding current primary or secondary MCLs: chromium, iron, lead, manganese, and mercury.

With the exception of one chromium detection (AGES data) and one mercury detection (AGES data), metals concentrations in excess of current primary MCLs were not detected in filtered ground water samples collected from Area C. A health-based MCL has not been established for manganese. However, the maximum concentration detected in unfiltered and filtered ground water collected in Area C exceeds a concentration predicted to result in adverse noncarcinogenic health effects for chronic exposure. Manganese concentrations detected in Area C ground water samples were ten times the concentrations detected in Area A or Area B ground water samples. The maximum concentration of manganese in the leachate samples from the site was 83,170 µg/L.

Area D Ground Water Contamination

Table 4 summarizes the available ground water monitoring results for Area D, which is west-northwest of the Chrin Brothers Landfill and includes the community of Glendon. Monitoring wells and domestic wells within this area are not monitored routinely by AGES or by PADER.

According to the RI and GV Study results, few VOCs were detected in the two monitoring wells located within Area D. With the exception of one benzene detection reported during the RI, VOC concentrations detected were not in excess of current MCLs. Chromium was the only metal detected (unfiltered sample-RI data) at a concentration exceeding a current primary MCL. Iron and manganese were detected at concentrations exceeding secondary MCLs; however, the manganese concentrations observed were tenfold less than those reported for Area C monitoring wells.

Minimal VOC contamination was noted in Area D. Benzo(k)fluoranthene, a polynuclear aromatic hydrocarbon detected in one domestic well, was not detected in monitoring wells sampled during the RI and, therefore, is probably not site related.

Area E Ground Water Contamination

Table 5 summarizes the available ground water monitoring results for Area E, which is southwest of the Chrin Brothers Landfill and Area C. The community of Lucy's Crossing is located within Area E. Monitoring wells and domestic wells within this area are not monitored routinely by AGES or PADER.

Generally, VOC concentrations detected in Area E monitoring wells during the GV Study are lower than those reported for Area C wells. However, the maximum concentration of benzene in monitoring well N-5 (15 µg/L) exceeds the maximum concentration detected in Area C wells (9.9 µg/L). Benzene was not detected in well N-3 (located between well N-5 and the Chrin Brothers Landfill) during the GV Study which suggests that contaminant sources other than the landfill are potentially contributing to the observed VOC contamination. According to the GV Study results, benzene was the only VOC detected in Area E wells at a concentration exceeding a current MCL.

The RI provides the most recent inorganics data for the Area E monitoring wells. Lead and chromium were each detected once in unfiltered ground water samples at a concentration marginally exceeding current or proposed primary MCLs. Inorganics concentrations exceeding MCLs were not reported in unfiltered ground water samples.

Summary of Occurrence and Distribution of Ground Water Contamination

The available information on the nature and extent of ground water contamination at the Industrial Lane Site may be summarized as follows:

- VOC contamination is most prominent in Area C, located immediately downgradient of the Chrin Brothers Landfill. In comparison to other areas adjoining or downgradient of the Chrin Brothers Landfill, Area C is most affected by VOC contamination potentially migrating from the landfill and other contaminant sources. All VOCs detected in Area C monitoring wells at concentrations exceeding current or proposed MCLs were also detected in leachate samples collected from the landfill.

- VOC contamination patterns noted in Areas A, B, and E suggest that contaminant sources in addition to the landfill are potentially contributing to the observed VOC contaminant plume. This is suggested by the fact that some VOCs were detected at higher concentrations in wells located distant or upgradient of the landfill in comparison to wells located immediately downgradient of the landfill.

- Based on all available ground water data, inorganics (metals) are infrequently detected at concentrations exceeding current primary MCLs. The most recent data indicate that metals concentrations in excess of current MCLs (chromium, mercury, lead, iron, manganese) were most frequently reported in unfiltered ground water samples. The pattern of contamination observed for the metals does not strongly implicate the Chrin Brothers Landfill as a contaminant source.

VI. Summary of Site Risks

Baseline Risk Assessment

Introduction

The objective of the risk assessment is to define actual (current) or potential risks to the public as a result of the hazardous substances (principally VOCs) in the ground water.

Identification of Chemicals of Potential Concern

The chemicals of concern should adequately characterize the potential for the noncarcinogenic effects and the carcinogenic risks associated with exposure to contaminated ground water at the Industrial Lane Site. The contaminant occurrence and distribution provide a basis for the selection of indicator compounds. The following factors were considered in selecting these indicator compounds:

- Occurrence and distribution of the contaminants across the site.
- Environmental fate and mobility.
- Toxicity.

Additionally, the concentration-toxicity (CT) screening procedure presented in the "Risk Assessment Guidance for Superfund Volume I, Human Health Evaluation Manual (Part A)" was used to identify those VOCs that are most likely to contribute significantly to risks associated with human exposure to contaminated ground water. Each VOC detected during the GV Study was assigned a risk factor (or chemical score), based on the maximum concentration of the chemical in the ground water and the toxicity criteria for the chemical.

The ratio of the risk factor for each VOC to the total risk factor for all VOCs is designated the relative risk for that VOC in the ground water. The relative risk value as well as the factors listed above were considered in the selection of volatile organic indicator chemicals (carcinogens and noncarcinogens were evaluated separately).

VOC Indicator Selection

The following halogenated alkane and alkene compounds are the principal VOCs detected as a result of the ground water monitoring conducted at the Industrial Lane Site:

- Vinyl chloride
- 1,1-dichloroethane
- 1,2-dichloroethene (cis-/trans-)
- chloroform
- 1,2-dichloroethane
- 1,1,1-trichloroethane

- carbon tetrachloride
- 1,2-dichloropropane
- trichloroethene
- tetrachloroethene
- 1,1-dichloroethene

These VOCs were detected in five or more monitoring wells sampled during the GV Study. Vinyl chloride is a Group A (human) carcinogen. Several others are Group B (probable human) carcinogens. Based on toxicity and frequency of detection, all of the VOCs listed above were selected as indicator compounds. Other halogenated alkane and alkene compounds (e.g., 1,1,2,2-tetrachloroethane) not selected as indicators were detected infrequently in the ground water and ranked low in the concentration-toxicity screening.

Benzene, chlorobenzene and 1,4-dichlorobenzene were the only other VOCs selected as chemicals of concern. These aromatic and chlorinated aromatic compounds were detected less frequently than halogenated alkane/alkene compounds. Benzene and 1,4-dichlorobenzene are Group A (human) and Group B (probable human) carcinogens, respectively. Chlorobenzene scored high in the concentration-toxicity screening relative to other aromatic compounds such as toluene and ethylbenzene.

Carbon disulfide and 2-butanone were infrequently detected in the ground water samples. Based on frequency of detection and the result of the CT screening, neither compound was selected as an indicator.

Semivolatile Indicator Chemical Selection

The two semivolatile compounds most frequently detected during the RI bis (2-ethyl-hexyl)phthalate and isophorone), were included as indicators. However, the risk assessment results subsequently presented for these compounds should be viewed in light of the following facts:

- The RI data available for these compounds does not strongly implicate the site as a contaminant source. The compounds were not detected in Area C wells at concentrations higher than concentrations detected in Areas A, B, D, and E wells.

- Comprehensive monitoring of the ground water in the vicinity of the site for semivolatile organics has not occurred subsequent to the RI.

Inorganic Indicator Chemical Selection

Based on a review of recent data, the following inorganics were detected in unfiltered ground water samples collected from one or more Chrin Brothers Landfill monitoring wells at concentrations exceeding proposed or current MCLs or health-based guidelines:

- Chromium
- Lead
- Mercury
- Manganese

With a few exceptions, inorganic concentrations in excess of current MCLs were not reported for ground water samples that were filtered prior to analysis. In many cases, elevated metals concentrations were associated with samples containing high turbidity or Total Dissolved Standards levels. As with the semivolatile compounds, the data for inorganics do not strongly implicate the site as a contaminant source. The metals are included as chemicals of concern in an effort to present a comprehensive baseline risk assessment for ground water quality in the vicinity of the Industrial Lane Site.

Exposure Assessment

The purpose of the exposure assessment is to evaluate the potential for human exposure to the hazardous substances (principally the VOCs) identified in the ground water associated with the Industrial Lane Site. This section identifies actual or potential routes of exposure, characterizes the exposed populations, and presents the methodology used to estimate the degree or magnitude of exposure.

To determine whether there is an actual exposure or a potential for exposure in the future, the most likely pathways of chemical release and transport and the human and environmental activity patterns near the site must be considered. A complete exposure pathway has three components: (1) a source of contaminants that can be released to the environment; (2) a route of contaminant transport through an environmental medium; (3) an exposure or contact point for a human or environmental receptor. These components are addressed in the following subsections.

Sources of Contamination

Sampling and analysis of ground water over the past 10 years has detected the presence of VOCs. VOCs were observed in all monitoring wells at the site. The data indicate that the VOC contamination is most prominent in the ground water immediately downgradient of the landfill. The predominant VOCs detected in the monitoring wells were also detected in landfill leachate samples. Based on these results, the site is the primary suspected contributing source of the VOC contamination detected in ground water. However, the identification of VOCs in monitoring wells upgradient of the landfill and the pattern of contamination upgradient and downgradient of the landfill suggests that other sources may also be present. Although Well C-11, which showed some of the highest concentrations of VOCs in Area A, is located on property previously owned by Pennsalt, it is currently owned by the owners of the Chrin Brothers Landfill. These potential additional sources may include past and existing commercial, industrial and/or private facilities as well as the possible past or present use of degreasing solvents in on-lot septic systems.

Semivolatile organics were infrequently detected in the ground water. Several metals (chromium, lead, mercury, iron, and manganese) were occasionally detected in recent unfiltered and filtered ground water samples at concentrations exceeding proposed or current standards, criteria, or guidelines. However, the pattern of contamination for the semivolatile organics and metals does not strongly implicate the site as a contaminant source. Generally, semivolatile organics and metals concentrations detected in Area C monitoring wells are not significantly different from those observed in Areas A, B, D, or E monitoring wells which are located upgradient or distant from the landfill. Additionally, because analytical results reported for filtered ground water samples only occasionally exceed current primary MCLs, it is possible that the naturally occurring metals content of the area soils may be contributing to the metals concentrations detected in the unfiltered ground water samples.

Receptor Identification and Exposure Routes

The principal public health concern for the Industrial Lane Site is the potential current or future domestic use of ground water downgradient of the landfill. Historically, residents in the three communities in the vicinity of the site (Morgan Hill, Lucy's Crossing, and Glendon) relied on private wells as a domestic water supply source. The Morgan Hill community is located upgradient of the Chrin Brothers Landfill. Monitoring results indicate that private wells in Morgan Hill have not been substantially affected by VOC contamination. Monitoring of private wells in the communities of Glendon and Lucy's Crossing during the RI detected VOCs. Although a public water system (the Eastern Area Suburban Water Company) currently services the communities of Lucy's Crossing and Glendon, not all residents in these communities are actually connected to the available community public water supply. Consequently, human receptors potentially exposed to site-related contaminants are as follows:

- Residents of Lucy's Crossing and Glendon who retain the use of private ground water wells.
- People who at some time <u>in the future</u> will rely on public or private wells drawing water from the contaminated ground water.

Individuals who may use the ground water in the affected area are likely to be exposed to contaminants in the ground water via normal household uses. Ingestion would be the primary route of exposure. Inhalation of VOCs during showering or bathing is a secondary route of exposure. Dermal absorption of VOCs could also occur. Although dermal absorption is often considered an insignificant exposure in contrast to ingestion or inhalation, there is indication that dermal absorption of VOCs can contribute significantly to the total contaminant dose received by a receptor exposed to contaminated ground water.

Exposure Assessment Methods and Assumptions

Exposure estimates for the baseline risk assessment were developed, based on guidance outlined in the "Risk Assessment Guidance for Superfund, Volume I, Human Health Evaluation Manual."

Several routes of exposure are associated with the household use of contaminated water. Receptors may be exposed via ingestion; via inhalation of volatiles and semi-volatiles emitted from showers, toilets, dishwashers, washing machines, and other turbulent sources; or via dermal contact during bathing. Of the possible inhalational exposures, showers account for the majority of an individual's dose.

A dose is defined as the amount of a compound in milligrams (mg) absorbed daily by a receptor per kilogram (kg) of body weight. Doses can be calculated for lifetime (for carcinogenic effects) or less than lifetime exposures (for noncarcinogenic effects).

Ingestion rates are specified as 2 liters/day for adults and 1 liter/day for children. Since exposures associated with ground water use could occur on virtually a daily basis, the exposure frequency is set at 365 days/year. The exposure duration and lifetime are specified as 70 years for adult receptors. These terms are used exclusively for characterization of long-term carcinogenic risks in this and all subsequent exposure routes. Body weights are specified as 70 kg for adults and 17.4 kg for children (ages 3 to 6).

Selection of Data for Risk Assessment/
Representative Exposure Concentrations

As discussed previously, ground water monitoring data for the Industrial Lane Site are available from several sources. The analytical methods (and associated method detection limits) used to analyze the samples varied. Data collected during the RI and GV Study were validated (i.e., evaluated by a chemist working independently of the analytical laboratory). The validation status of the PADER and AGES data is unclear.

Ideally, data used in a risk assessment should be recent and of a known quality. Based on these criteria, the VOC data collected during the GV Study were used in the risk assessment. However, the GV Study data are in rough agreement with the RI, PADER, and AGES data. Consequently, the selection of the GV Study data instead of other data sources did not significantly alter the results of the risk assessment.

Semivolatile organic and metals data are less critical to an evaluation of the Industrial Lane Site because VOCs are the principal contaminants of concern. Semivolatile organic data presented in the RI will be used in the risk assessment, since it is the only semivolatile organic data available for the majority of the site monitoring wells. Metals data provided by AGES and PADER will be used, since they are more recent and limited information (e.g., blank contaminants levels) was included in the data packages to allow at least a cursory evaluation of the quality of the data.

The selected exposure concentration (the representative concentration) is the 95 percent upper confidence limit on the average calculated in accordance with guidance referenced in the EPA "Risk Assessment Guidance for Superfund", Volume I. This is to provide a reasonable maximum exposure scenario.

Cancer potency factors (CPFs) have been developed by EPA's Carcinogenic Assessment Group for estimating excess lifetime cancer risks associated with exposure to potentially carcinogenic chemicals. CPFs, which are expressed in units of $(mg/kg\text{-}day)^{-1}$, are multiplied by the estimated exposure dose of a potential carcinogen, in mg/kg-day, to provide an upper-bound estimate of the excess lifetime cancer risk associated with that exposure level. The term "upper bound" reflects the conservative estimate of the risks calculated from the CPF. Use of this approach makes under estimation of the actual cancer risk highly unlikely. Cancer potency factors are derived from the results of human epidemiological studies or chronic animal bioassays to which animal-to-human extrapolation and uncertainty factors have been applied.

Reference doses (RfDs) have been developed by EPA for indicating the potential for adverse health effects from exposure to chemicals exhibiting noncarcinogenic effects. RfDs, which are expressed in units of mg/kg-day, are estimates of lifetime daily exposure levels for humans, including sensitive individuals, that are likely to be without an appreciable risk of adverse health effects. Estimated exposure doses of chemicals from environmental media (e.g., the amount of a chemical ingested from contaminated drinking water) can be compared to the RfD. RfDs are derived from human epidemiological studies or animal studies to which uncertainty factors have been applied (e.g., to account for the use of animal data to predict effects on humans). These uncertainty factors help ensure that the RfDs will not underestimate the potential for adverse noncarcinogenic effects to occur.

<u>Toxicity Assessment</u>

The purpose of the toxicity assessment is to identify the potential health hazards associated with exposure to the site indicator chemicals. A toxicological evaluation of each indicator chemical was conducted to characterize its inherent toxicity. The evaluation consisted of the review of scientific data to determine the nature and extent of the human health and environmental hazards associated with exposure to the various chemicals. Based on the scientific data review, a toxicity profile for each indicator chemical was developed. The toxicity profiles provide the qualitative weight-of-evidence for contaminants that may pose an increased cancer risk and/or pose potential non-carcinogenic hazards to human health and the environment at the site.

Toxic effects considered in these profiles include noncarcinogenic (toxic) and carcinogenic health effects and environmental effects. Noncarcinogenic health effects are generally assumed to occur only at doses exceeding a certain "threshold dose." Toxicological endpoints, routes of exposure, and doses in human and/or animal studies are discussed in the profiles.

Carcinogenic health effects are associated with exposure to a chemical capable of promoting, initiating, or causing a malignant neoplasm. Routes of exposure and doses in human and/or animal studies are considered. Another factor is the EPA's weight-of-evidence for a compound's carcinogenicity (i.e., Group A, known human carcinogens; Group B, probable human carcinogens; Group C, possible human carcinogens; Group D, not classifiable as to its carcinogenicity).

An important component of the risk assessment process is the relationship between the dose of a compound (amount to which an individual or population is exposed) and the potential for adverse health effects resulting from exposure to that dose. Dose-response relationships provide a means by which potential public health impacts may be evaluated.

Excess lifetime cancer risks are determined by multiplying the exposure level with the cancer potency factor. These risks are probabilities that are generally expressed in scientific notation (e.g., $1x10^{-6}$ or 1E-6). An excess lifetime cancer risk of $1x10^{-6}$ indicates that, as a plausible upper bound, an individual has a one in one million chance of developing cancer as a result of site-related exposure to a carcinogen over a 70-year lifetime under the specific exposure conditions at a site.

Potential concern for noncarcinogenic effects of a single contaminant in a single medium is expressed as the hazard quotient (HQ) (or the ratio of the estimated exposure dose derived from the contaminant concentration in a given medium to the contaminant's reference dose). By adding the HQs for all contaminants within a medium or across all media to which a given population may reasonably be exposed, the Hazard Index (HI) can be generated. The HI provides a useful reference point for gauging the potential significance of multiple contaminant exposures within a single medium or across media.

Risk Characterization

The objective of risk characterization is to estimate the potential incidence of adverse human health effects under the exposure scenarios. EPA guidelines for the use of dose-additive models are used to combine the risks for individual chemicals to estimate the cumulative risks for the mixtures found on site, assuming that the toxicologic end points are the same. This section characterizes the carcinogenic and noncarcinogenic risks at the Industrial Lane Site.

Carcinogenic Risk

Carcinogenic risks can be estimated by combining information on the strength or potency of a known or suspected carcinogen (carcinogenic slope factor) with an estimate of the individual exposure doses of a chemical.

The resulting number is an expression (risk/lifetime) of the individual's likelihood of developing cancer as a result of exposure to a carcinogenic chemical. This likelihood is in addition to the risks incurred by everyday activities. The risk (e.g., 1×10^{-6} or a 1 in 1,000,000 chance) can also be applied to a given population to determine the number of excess cases of cancer that could be expected to result from exposure (e.g., 1×10^{-6} is one additional case of cancer in 1,000,000 exposed persons).

The total risk for exposure to multiple compounds is presented as the summation of the risk for the individual contaminants. Risks can be calculated in this manner under the following assumptions:

- There are no antagonist/synergistic effects between chemicals.
- All chemicals produce the same results, ie. cancer.
- Cancer risks from various exposure routes are additive, if the exposed populations are the same.

Noncarcinogenic Risk

Potential health risks resulting from exposure to noncarcinogenic compounds are estimated by comparing the maximum daily dose calculated for an exposure to an acceptable reference dose, such as a chronic or subchronic reference dose. A subchronic reference dose is generally used if the exposure time is less than 90 days; a chronic reference dose (RfD) is used for longer time frames. If the ratio between an exposure dose and the reference dose exceeds unity, there is a potential health risk associated with exposure to that chemical. The Dose/RfD ratio is not a mathematical prediction of the severity or probability of toxic effects; it is simply a numerical indicator of the potential for adverse effects. The ratio of the exposure dose to the reference dose is sometimes referred to as the Hazard Quotient (HQ). The summation of HQs for several compounds is frequently referred to as the Hazard Index (HI).

Conservatively, a total Hazard Index (HI) for any exposure route is calculated by summing the Dose/RfD ratios (HQs) for the individual chemicals of concern. To provide a better indication of risks, Dose/RfD ratios should be summed according to the target organ affected (e.g., the Dose/RfD ratios for those chemicals affecting the liver should be summed separately from those chemicals affecting the nervous system).

Risk Analysis Results

Several contaminants detected in the ground water at the Industrial Lane Site exceed current or proposed primary MCLs. Contaminant concentrations are highest in those monitoring wells located immediately downgradient of the Chrin Brothers Landfill. VOCs, the principal site contaminants, have been detected in several private wells in the communities of Glendon and Lucy's Crossing.

Actual or threatened releases of hazardous substances from this site, if not addressed by implementing the response action selected in this ROD, may present an imminent and substantial endangerment to public health, welfare, or the environment.

The risk analysis results (Tables 7-11) for Areas A through E may be summarized as follows:

- Incremental cancer risks associated with the representative concentrations of VOCs detected in the ground water range from 3.3×10^{-6} (Area B) to 7.6×10^{-4} (Area C). Risks in excess of 1×10^{-4} are only predicted for Area C and for the VOC concentrations reported in Chrin Brothers Landfill Well C-11, Area A. (Cancer risks associated with VOC concentrations in Well C-11 were estimated separate from other Area A wells because C-11 was more highly contaminated. The excess lifetime cancer risk associated with the VOC concentrations detected in C-11 is 3.7×10^{-4}.) Vinyl chloride, methylene chloride, carbon tetrachloride, chloroform, benzene, and 1,2-dichloroethane are the contaminants that individually contribute a cancer risk level in excess of 1×10^{-5} for one or more of the five areas evaluated. The 1×10^{-4} to 1×10^{-6} cancer risk range is used by EPA in developing cleanup goals for CERCLA sites and in establishing regulatory standards.

- Estimated cancer risks for bis(2-ethylhexyl)phthalate (BEHP) and isophorone concentrations reported in the RI range from 7.9×10^{-5} (Area A) to 5.2×10^{-6} (Area B). Risk levels estimated for Area C, located immediately downgradient of the Chrin Brothers Landfill, are lower than risk levels estimated for Areas A, D, and E. As discussed previously, the RI results do not strongly implicate the Chrin Brothers Landfill as a source of semivolatile organic contamination at the Industrial Lane Site. These risks are within the EPA protective range of 1×10^{-4} to 1×10^{-6}.

- Cancer risk levels are not estimated for the metals evaluated in the risk analysis, as they are not currently classified as carcinogens via the ingestion route of exposure. The metals are not sufficiently volatile in ground water to create an inhalation hazard under the inhalation-during-showering exposure scenario.

- The noncarcinogenic risk analysis of representative concentrations of VOCs and semivolatiles indicate that organic concentrations are not high enough to produce a hazard quotient (HQ) or Hazard Index (HI) exceeding unity (1.0) when an adult is the receptor of concern. However, the HQs and HIs estimated for the ingestion route of exposure would increase by a factor of 2.0 if a 17.4 kg child was evaluated as the receptor of concern and 3.5 (approximately) if a small child (10 kg) is evaluated as the receptor of concern. Under these conditions the HI calculated for Area A and Area C would approach or exceed unity. Tetrachloroethene and carbon tetrachloride are the principal VOCs contributing to noncarcinogenic risk. Adverse noncarcinogenic health effects are possible when the HI (or HQ) exceeds unity.

- The HI values calculated to evaluate noncarcinogenic risk associated with representative metals concentrations (unfiltered metals results) range from 0.74 (Area A) to 2 (Area B) when an adult is evaluated as the receptor of concern. HQs and HIs do not exceed unity when filtered metals results are evaluated.

The carcinogenic and noncarcinogenic risks were calculated for VOC concentrations detected during the RI in private wells in Lucy's Crossing and Glendon. The estimated excess cancer risk levels never exceeded 2×10^{-5} and HIs never exceeded unity. An evaluation of VOC concentrations reported for one private well located between the Chrin Brothers Landfill and Lucy's Crossing (the Pfister well) resulted in an estimated cancer risk level of 5.1×10^{-5}. The VOCs concentrations reported for the Pfister well were higher than any other reported for private wells sampled during the RI.

In summary, the risk assessment for the principal site contaminants (the VOCs) predict cancer risk levels in excess of 1×10^{-4} for a theoretical human receptor using the ground water immediately downgradient of the Chrin Brothers Landfill as a domestic water supply source. Cancer risks associated with VOC contamination observed in other areas downgradient or adjoining the landfill are generally less than 1×10^{-4}. Adverse noncarcinogenic health effects are not predicted for an adult routinely exposed to the VOC levels in the ground water immediately downgradient of the site; however, they are possible if a small child is considered as the receptor of concern. Although recent monitoring data are not available for private wells in the communities of Lucy's Crossing and Glendon, an evaluation of VOC concentrations detected during the RI indicate that the excess lifetime cancer risk associated with the domestic use of ground water would not exceed 5.0×10^{-5}. As discussed previously, most residents in the communities of Lucy's Crossing and Glendon have access to or are connected to public water.

Uncertainty in Risk Assessment

Carcinogenic and noncarcinogenic health risks are estimated using various assumptions; therefore, the values presented in this section contain an inherent amount of uncertainty. The extent to which health risks can be characterized is primarily dependent upon the accuracy with which a chemical's toxicity can be estimated and the accuracy of the exposure estimates. The toxicological data that form the basis for all risk assessments contain uncertainty in the following areas:

- The extrapolation of non-threshold (carcinogenic) effects from the high doses administered to laboratory animals to the low doses received under more common exposure scenarios.

- The extrapolation of the results of laboratory animal studies to human or environmental receptors.

- The interspecies variation in toxicological endpoints used in characterizing potential health effects resulting from exposure to a chemical.

- The variations in sensitivity among individuals of any species.

The exposure scenarios and risk assessment methodology used in this risk assessment also contain uncertainty, for example:

- The exposure scenarios assume chronic exposure to contaminant levels that do not change with time. In reality, contaminant levels often change with time in response to source loading or depletion and physical/chemical/biological forces such as chemical or biochemical degradation.

- Two of the organic chemicals of concern (1,1-dichloroethene and isophorone) are designated as Class C carcinogens. Although these compounds are evaluated as carcinogens in the risk assessment, only limited evidence in animal studies supports their designation as carcinogens. Risk analysis results based on the evaluation of Class C carcinogens must be viewed with less certainty than analyses based on Class A, B1, or B2 carcinogens.

- Although lead, a chemical of concern, has been classified as a B-2 carcinogen, a carcinogenic slope factor has not been published by the EPA. This presents a data gap in the risk assessment. The main conclusions of the risk assessment are not impacted because lead is not a predominant contaminant at the site.

In addition to these sources of uncertainty, the chemical analytical data base has limitations in such areas as sample locations and sample representativeness. These uncertainties are present in every baseline risk assessment.

EPA guidelines were followed in the development and evaluation of exposure scenarios used in this risk assessment to obtain reasonable maximum exposure scenarios.

Environmental Risks

The number and diversity of terrestrial species present in the area surrounding the Industrial Lane site has probably been substantially reduced due to the extensive reduction of suitable habitats by urbanization and industrialization. The overall quality of the Lehigh River, however, is improving since the institution of pollution control regulations in recent years. No endangered species are known to permanently or seasonally reside in the site area, although two endangered bird species are known to migrate through the region. No portions of the site have been designated as critical habitat for either of these species.

Conclusion of Summary of Site Risks

Actual or threatened releases of hazardous substances from this site, if not addressed by implementing the response action selected in this ROD, may present an imminent and substantial endangerment to public health, welfare, or the environment.

VII. Description of Alternatives

This section provides an understanding of the remedial alternatives developed for this site and their components.

Closure of the Unlined Landfill

PADER notified the owner and operator of the Chrin Brothers Landfill in a letter dated November 23, 1990, that the unlined landfill area must be closed according to Chapters 271 and 273 of the Pennsylvania Municipal Waste Management Regulations (25 PA. Code Chapter 271 and 273). Under Section 273.234 of the Municipal Waste Management Regulations, 25 PA Code § 273.234, the landfill must be closed using a cap consisting of a uniform and compacted 1-foot layer of clay, a drainage layer over the cap, and a uniform and compacted layer of soil at least 2 feet in thickness over the drainage layer. In lieu of the clay cap, PADER may approve a synthetic material which has a permeability of no more than 1×10^{-7} cm/sec and meets the requirements set forth in Section 273.256 of the Pennsylvania Municipal Waste Management Regulations, 25 PA. Code 273.256.

The state closure requirements, estimated to cost $8,000,000, were integrated into the development and evaluation of the remedial alternatives for the site. The requirements of each alternative discussed below are therefore in addition to the closure requirements.

Alternative 1 No Action

This alternative was developed to provide a baseline to which the other remedial alternatives can be compared. This alternative involves taking no action at the Industrial Lane Site to remove, remediate, or contain the contaminated ground water. In compliance with the monitoring requirements of Chapter 273 of the Pennsylvania Municipal Waste Management Regulations (25 PA. Code Chapter 273), quarterly ground water monitoring of monitoring wells in the area of potential ground water contamination would be conducted to prevent contact (primarily ingestion and inhalation) with contaminated ground water. A number of assumptions were required regarding the present extent of the contaminated plume since the current extent of ground water contamination is uncertain. The assumed horizontal extent of ground water contamination is shown in Figure 4. For costing purposes, it was estimated that 11 monitoring wells would be sampled quarterly. Eight existing NUS monitoring wells would be used, and three additional monitoring wells would be installed in the downgradient area, north of the Chrin Brothers Landfill. The exact number and locations of the monitoring wells will depend on the actual extent of ground water contamination and will be determined during Remedial Design. In addition to the eleven monitoring wells, three residential wells in the Glendon area and three residential wells in Lucy's Crossing would be sampled on an annual basis. This alternative would result in hazardous substances, pollutants or contaminants remaining on site, therefore 5-year site reviews, pursuant to Section 121(c) of CERCLA, 42 U.S.C. § 9621(c), would be required to monitor the effectiveness of this alternative.

Effectiveness

Since no action would be taken to remediate the ground water under this alternative, the health risks remaining after implementation of this alternative would be identical to those presently posed by household use of contaminated ground water. For ground water users residing downgradient of the Chrin Brothers Landfill, ground water monitoring provides a minimal degree of long-term protection from exposure to contaminated ground water. With regard to reliability, monitoring is usually less effective in fractured bedrock (such as that at the site), than in more homogeneous, unconsolidated formations, since contaminants can potentially remain undetected by migrating beyond the monitoring wells in fractures.

With respect to environmental risks, the contaminants in the ground water would continue to migrate over time. The extent of ground water contamination is not well-defined, therefore the rate and direction of plume migration cannot be accurately predicted at this time. A high percentage, possibly all, of the ground water contamination may discharge into the Lehigh River, which would help to control plume migration. No impact of contaminated ground water on the Lehigh River was found during the RI. On the other hand, some contaminated ground water may currently, or in the future, flow beneath the river and into areas west of the site. The ground water monitoring program would be used to evaluate the current extent of ground water contamination and to predict the rate of future contaminant migration. Installation of additional downgradient monitoring wells could be necessary if it is predicted that the contaminant plume is potentially spreading beyond (west of) the Lehigh River.

This alternative would not reduce the toxicity, mobility, or volume of contaminants in the ground water. Over time, contaminant levels in the present areas of contamination may gradually decrease through natural dilution, although the current extent of ground water contamination may spread into uncontaminated areas. The low-permeability cap planned for the Chrin Brothers Landfill should significantly reduce the amount of leachate emanating from the site. The landfill, however, would continue to generate small quantities of leachate, which could act as a continuous source of contamination to the ground water. Therefore, even with the installation of a low-permeability cap, contaminant levels in the ground water could remain relatively constant over a long period.

Implementability

Ground water monitoring is widely used at hazardous waste sites. Monitoring wells could readily be installed and maintained at the site. As part of the state permit requirements, quarterly ground water monitoring is being conducted at the existing Chrin Brothers Landfill wells. This ground water sampling program could potentially be expanded to include the additional downgradient wells or a separate downgradient monitoring program could be implemented, if necessary.

Since the only remedial action involved with this alternative is the installation of monitoring wells, protection of workers and the community from exposure to contaminated materials during remedial actions is not a major consideration. Monitoring wells could be installed in approximately 1 month, once a field crew and equipment are mobilized.

Cost

Capital costs and periodic monitoring and maintenance costs associated with this alternative are summarized in Table 13. The capital cost for this alternative is estimated to be $ 108,000, plus $ 8,000,000 in capital costs for the closure of the landfill. The O & M costs in Table 13 do not include costs related to closure of the landfill. The present-worth cost estimate for this alternative is $2,027,000, not including closure of the landfill. The costs for 5-year site reviews are included in the Operation and Maintenance (O & M) and present-worth costs for this alternative.

<u>Alternative 2 Access Restrictions with Monitoring</u>

Access restrictions would include such institutional controls for controlling access to ground water as regulatory prohibitions, zoning regulations, and local ordinances. In Pennsylvania, the Borough Code specifically authorizes municipal regulation of water wells and ground water use, and all local governments have the power to adopt ordinances and regulations deemed necessary for the peace, health, safety and welfare of the municipality. In addition, the Pennsylvania Municipal Planning Act sets out a number of purposes for which zoning regulations may be employed, indicating that a zoning ordinance that restricts access to contaminated ground water is most likely authorized by law.

As in Alternative 1, ground water monitoring of monitoring wells in the area of potential ground water contamination would be conducted to control contact (primarily ingestion and inhalation) with contaminated ground water. For costing purposes, it was estimated that 11 monitoring wells would be sampled quarterly. Eight existing RI monitoring wells would be used, and three additional monitoring wells would be installed in the downgradient area, north of the site. The exact number and locations of the monitoring wells will depend on the actual extent of ground water contamination. In addition to the eleven monitoring wells, three residential wells in the Glendon area and three residential wells in Lucy's Crossing would be sampled on an annual basis. This alternative would result in hazardous substances, pollutants or contaminants remaining on site, therefore, 5-year reviews pursuant to Section 121(c) of CERCLA, 42 U.S.C. § 9621(c), would be required to monitor the effectiveness of this alternative.

Effectiveness

Since no action would be taken to remediate the ground water under this alternative, the health risks remaining after implementation of this alternative are identical to those presently posed by household use of contaminated ground water. Although the individual health risks associated with exposure to contaminated ground water would remain the same under this alternative, access restrictions would lower the potential or probability of a resident using contaminated ground water. The long-term effectiveness of this alternative is dependent on the ability of the state or local government to enforce regulations that prevent private well owners from using contaminated ground water.

For ground water users residing downgradient of the site, ground water monitoring would also decrease the likelihood of a resident's using contaminated ground water. With regard to reliability, monitoring is usually less effective in fractured bedrock (such as that present at the site), than in more homogeneous, unconsolidated formations, since contaminants can potentially remain undetected by migrating beyond the monitoring wells in discrete fractures.

With respect to environmental risks, the contaminants in the ground water would continue to migrate over time. The extent of ground water contamination is not well-defined, therefore the rate and direction of plume migration cannot be accurately predicted at this time. A high percentage, possibly all, of the ground water contamination may discharge into the Lehigh River, which would help to control plume migration. No impact of contaminated ground water on the Lehigh River was found during the RI. On the other hand, some contaminated ground water may currently, or in the future, flow beneath the river and into areas west of the site. The ground water monitoring program would be used to evaluate the current extent of ground water contamination and to predict the rate of future contaminant migration. Installation of additional downgradient monitoring wells could be necessary if it is predicted that the contaminant plume is potentially spreading beyond (west of) the Lehigh River.

This alternative does not reduce the toxicity, mobility, or volume of contaminants in the ground water. Over time, contaminant levels in the present areas of contamination may gradually decrease through natural dilution, although the current extent of ground water contamination may spread into uncontaminated areas. The low-permeability cap planned for the Chrin Brothers Landfill should significantly reduce the amount of leachate emanating from the facility. The landfill, however, would continue to generate small quantities of leachate, which could potentially act as a continuous source of contamination to the ground water. Therefore, even with installation of the low-permeability cap, contaminant levels in the ground water could remain relatively constant over a long period.

Implementability

Implementation concerns associated with access restrictions involve assessing the administrative and legal feasibility of imposing state or local restrictions on ground water use. Although the Pennsylvania Borough Code and Pennsylvania Municipal Planning Act suggest that zoning ordinances which restrict access to a polluted aquifer are authorized by law, few municipal entities within Pennsylvania have adopted such a zoning ordinance to date. An ordinance that restricts ground water use may be unpopular with local residents; and therefore, passing such an ordinance may be difficult. Establishment of access restrictions would most likely require coordination between EPA, PADER, and the local government.

Monitoring wells could be readily installed and maintained at the site. As part of the state permit requirements, quarterly ground water monitoring is being conducted for the existing Chrin Brothers Landfill wells. This ground water sampling program could potentially be expanded to include the additional downgradient wells, or a separate downgradient monitoring program could be implemented, if necessary.

Since the only remedial action involved with this alternative is the installation of monitoring wells, protection of workers and the community from exposure to contaminated materials during remedial actions is not a major consideration. Monitoring wells could be installed in approximately 1 month, once a field crew and equipment are mobilized.

Cost

Capital costs and periodic monitoring and maintenance costs associated with this alternative are summarized in Table 13. The capital cost for this alternative is estimated to be $ 108,000, plus $ 8,000,000 in capital costs for the closure of the landfill. The O & M costs in Table 13 do not include costs related to closure of the landfill. The present-worth cost estimate for this alternative is $2,027,000, not including closure of the landfill. The costs for 5-year site reviews are included in the O & M and present-worth costs for this alternative. Administrative and legal costs for implementing access restrictions are not included in the cost estimate because of the difficulty of estimating such costs.

Alternative 3 Aquifer Restoration and Discharge

The intent of this alternative is to remediate the ground water in compliance with the Pennsylvania Municipal Waste Management and Hazardous Waste Management Regulations, particularly those sections pertaining to ground water. The Municipal Waste Management Regulations, 25 PA. Code § 273.287, require that a ground water abatement plan be developed and implemented if ground water pollution is detected in one or more monitoring wells. The abatement plan must include specific methods to be used to abate ground water pollution from the facility and to prevent further ground water pollution from the facility.

The Pennsylvania Waste Hazardous Management Regulations, 25 PA. Code §§264.90 - 264.100, and in particular, §§264.97(i) and (j), and 264.100(a)(9), require that ground water containing hazardous substances be remediated to "background" quality. This requirement is further defined in a PADER policy memorandum concerning ground water remediation, dated December 20, 1990 from Arthur A. Davis, Secretary of PADER. This memorandum, which is a To Be Considered (TBC), specifies that in the absence of background quality data, the quality goal should be established at detection limits. Background cleanup levels for the extraction alternatives are listed in Table 12.

This alternative includes two sub-alternatives: Alternative 3A and Alternative 3B. These two sub-alternatives are for two different discharge options: 3A is extraction, treatment and discharge of ground water to the Lehigh River and 3B is extraction and discharge of ground water to the Publicly Owned Treatment Works (POTW).

The conceptual design of the extraction system, which could be used for either 3A or 3B, is shown in Figure 7. The total ground water extraction rate of these wells is estimated to be 772 gallons per minute. The actual pumping rate and number of wells are dependent on the results of a pre-design study, which will be required under Alternatives 3A and 3B. The actual extent of the contamination and hydraulic characteristics of the aquifer will be more clearly defined during the pre-design study. Any necessary treatability testing will also be done during the pre-design study. The actual location of these wells will be determined in the design phase. Therefore, a number of assumptions are included in these estimates of implementation times and costs.

The remediation time required to achieve the background levels is dependent on the extent of ground water contamination, aquifer properties (i.e., hydraulic conductivity), and source characteristics which are uncertain at this time. The implementation time frame for Alternatives 3A or 3B is estimated to be 45 years. An analytical mass balance model was used to predict the times required to restore the ground water to background. These treatment times were used for costing and alternative comparison purposes only. They are not intended to represent accurately the actual times required to restore the aquifer to the cleanup levels.

At the completion of remediation activities, there may be some residual contamination remaining in the ground water. Some of the ground water, most of which flows in fractured bedrock, may not be intercepted by the extraction well system. In addition, contaminants may migrate into fractures that are not interconnected (i.e., dead-end fractures), and, as a result, may not be readily extractable. At the completion of remediation, contaminants may reappear with time. For this reason, periodic ground water monitoring would be required, as discussed in Alternatives 1 and 2, to ensure protection of public health from exposure (primarily inhalation and ingestion) to contaminated ground water. This alternative would result in hazardous substances, pollutants or contaminants remaining on site (in the capped, unlined landfill), therefore, 5-year reviews pursuant to

Section 121(c) of CERCLA, 42 U.S.C. § 9621(c), would be required to monitor the effectiveness of this alternative.

<u>Alternative 3A Extraction, Treatment and Discharge to the Lehigh River</u>

This sub-alternative includes extracting contaminated ground water, treating the ground water on-site using an air stripper followed by carbon adsorption, and then discharging the treated ground water to the Lehigh River.

The air stripping column would consist of a packed column with forced draft air. The column height and diameter are dependent on the influent contaminant concentrations and flow rate as well as the required effluent concentrations, which would be determined by PADER during the design phase. Based on preliminary design calculations, the estimated column height required for treatment of the ground water is 15 feet and the column diameter is 6 feet. Preceding the air stripper, an equalization tank with a caustic feed and aeration system, followed by a sand filter, has been included for iron oxidation/removal as well as for the removal of suspended solids. These pretreatment steps would control clogging of both the air stripper packing and carbon adsorption units.

Under this alternative, a carbon adsorption unit is included as a final polishing step to achieve the required effluent limits for all contaminants. The estimated carbon usage rate is based on a number of assumptions concerning the amount of background, or naturally occurring, organic carbon material contained in the air stripper effluent. Verification of the assumptions is required prior to, or as part of, a remedial design. Should the actual concentration of organic carbon in the air stripper effluent exceed the assumed value, the use of carbon adsorption as a final polishing step may be cost-prohibitive. If necessary, a larger size air stripping unit could be used alone and in place of the air stripper/carbon adsorption system at a comparable cost.

Remedial actions used to remove VOCs from the ground water at the Industrial Lane Site are subject to plan approval review under the Pennsylvania Air Control Regulations, 25 PA. Code Chapter 127 (Construction, Modification, Reactivation and Operation of Sources). The various air quality permitting criteria are site-specific. Depending on site conditions, air pollution controls may be required for an air stripper at the Industrial Lane Site. EPA OSWER Directive 9355.0-28 requires offgas controls for air strippers with an emission rate in excess of 15 pounds of total VOCs per day. The anticipated VOC emission rate of the air stripper is less than 1 pound per day, so it is assumed that off-gas treatment would not be required. For this reason, an off-gas treatment unit was not included under this alternative. Should treatment of the air stripper off-gas be required to address any human health or environmental risks identified as a result of the design calculations, three general types of air pollution controls are available: vapor phase carbon adsorption, catalytic oxidation, and thermal oxidation. Of these three technologies, non-regenerable carbon adsorption would probably be the most economical option for the anticipated air flow rate and VOC concentrations.

Installation of a discharge pipe would be required to implement Alternative 3A. This alternative would consist of a 10-inch-diameter pipe, which would run from the ground water treatment system, under Interstate 78, and then to the Lehigh River (approximately 3,900 feet).

Effectiveness

Ground water extraction wells, pumps, conveyance systems, and ground water monitoring are widely used at hazardous waste sites and are highly reliable if periodic inspections and maintenance are performed. There would be minimal risk to workers and the community associated with implementation of Alternative 3A. Air strippers and carbon adsorption vessels are commonly used for water and wastewater treatment and are highly reliable if periodic inspections and maintenance are performed.

Ground water extraction, followed by air stripping, is an irreversible treatment process that would reduce the toxicity of the contaminated ground water by removing approximately 98 percent of the VOCs from the extracted ground water and then concentrating them in the off-gas. The remaining contaminants in the effluent from the air stripper would be almost completely removed (>99 percent) by the carbon adsorption unit. The contaminants collected on the carbon would be thermally destroyed when the carbon is regenerated off-site.

This alternative, over the long-term, could potentially restore ground water in the zone of contamination to background action levels. A low-permeability cap is planned for the Chrin Brothers Landfill, which should significantly reduce the amount of leachate emanating from the facility. The landfill, however, would continue to generate small quantities of leachate, which could potentially act as a continuous source of contamination to the ground water. Therefore, even with installation of the low-permeability cap, contaminant levels in the ground water could remain relatively constant over a long period.

Implementability

The components of the air stripping and carbon adsorption system are readily implementable using existing technologies. No special materials or equipment would be required. Air stripping units and carbon adsorption and regeneration systems are reliable, frequently-used technologies. O & M considerations include cleaning and replacement of wells and well pumps; maintenance of blower units and pumps; cleaning of fouled packing; regeneration of the carbon; and periodic disposal of sludge accumulated from daily backwashing of the sand filter. Also, monitoring of the effluent water and exhaust gas would be required to ensure compliance and reliability of the systems.

For discharge of stripper off-gas, a state air emission permit for new sources may also be required. For discharge of ground water into the Lehigh River, a National Pollutant Discharge Elimination System (NPDES) permit may be required, depending on whether the discharge is considered to be on-site or off-site. The Delaware River Basin Commission (DRBC) has requirements governing the extraction of ground water in the Delaware Basin which would have to be met.

Cost

The capital cost of this alternative is estimated to be $ 4,326,000, plus $ 8,000,000 in capital costs for the closure of the landfill. The O & M costs, other than the closure of the landfill, are estimated to be: $ 536,000 in year one, $ 498,000 per year in years two through forty-five; and an additional $ 20,000 every five years. The Present Worth of this alternative is estimated to be $ 12,775,000, not including costs associated with closure of the landfill (Table 13).

<u>Alternative 3B Extraction and Discharge to the POTW</u>

Under Alternative 3B, ground water extraction, followed by treatment at the POTW, is an irreversible treatment process that would reduce the toxicity of the contaminated ground water through aeration of the VOCs as well as through biodegradation to some extent. The extent of VOC removal at POTWs is not well documented and is dependent on the size and type of treatment facility. Volatilization of the contaminants would also occur during pumping and in the sewer line. No estimation of the degree of contaminant removal from the extracted ground water can be made at this time.

Effectiveness

Groundwater extraction, followed by treatment at the POTW, is an irreversible treatment process that would reduce the toxicity of the contaminated groundwater through aeration of the volatile contaminants as well as through biodegradation to some extent. The extent of VOC removal at POTWs is not well documented and is dependent on the size and type of treatment facility. Volatilization of the contaminants would also occur during pumping and in the sewer line.

Implementability

For Alternative 3B, the components of the extraction well system and discharge pipeline are implementable using existing technologies. No special materials or equipment would be required. Ground water extraction wells are reliable and relatively easy to construct. Since no new treatment system would be constructed or operated under this alternative, O & M considerations would mainly include periodic cleaning and replacement of wells and well pumps. The most difficult part of this alternative to implement would be the installation of approximately 2.5 miles of discharge pipe from the extraction well system to the POTW or possibly to an existing main sewer line in the South Easton area. Installation of the pipe would involve substantial excavation and road repair as well as tunneling under Interstate 78 and appropriate Pennsylvania Department of Transportation and Federal permits.

A major implementability consideration of Alternative 3B is the available hydraulic capacity of the Easton Area POTW. The POTW is currently rated as a 7.3 mgd (million gallon per day) facility and is presently operating at approximately 5.5 mgd. At this capacity, the POTW may have difficulty accepting the extracted ground water at the proposed rate of 1.1 mgd (772 gallons per minute). The POTW is to upgrade to a 10 mgd capacity, which would have a better chance of accommodating the proposed flow rate.

The administrative implementability of Alternative 3B must also be considered. Discharge of ground water to the POTW must comply with any POTW pretreatment ordinances and may also require a permit from the POTW. The DRBC has requirements governing the extraction of ground water in the Delaware Basin which would have to be met.

Cost

The capital cost of this alternative is estimated to be $ 3,093,000, plus $ 8,000,000 in capital costs for closure of the landfill. The O & M costs, other than closure of the landfill, are estimated to be: $ 2,475,000 in year one, $ 2,453,000 per year in years two through forty-five; and an additional $ 20,000 every five years. The Present Worth of this alternative, other than closure of the landfill, is estimated to be $ 44,318,000 (Table 13).

<u>Alternative 4 Extraction, Treatment, Reinjection</u>

This alternative was developed to achieve the same background action levels as Alternative 3, and is similar to Alternative 3A. The difference is that Alternative 4 has 16 proposed extraction wells which would be used for ground water extraction, and the treated ground water would be reinjected into injection wells rather than discharged to a surface water receptor. Under Alternative 4, six injection wells would be installed between the two lines of extraction wells as shown in Figure 8. The implementation time frame for this alternative is estimated to be 22 years. As described in Alternative 3A, air stripping and carbon adsorption are the selected treatment technologies.

As with the previous alternatives, quarterly monitoring of 11 monitoring wells in the area of potential ground water contamination would be conducted to prevent contact, primarily ingestion and inhalation, with contaminated ground water. In addition, 3 residential monitoring wells in the Glendon area and 3 residential wells in Lucy's Crossing would be sampled on an annual basis. This alternative would result in hazardous substances, pollutants or contaminants remaining on site (in the capped, unlined landfill), therefore, 5-year reviews pursuant to Section 121(c) of CERCLA, 42 U.S.C. § 9621(c), would be required to monitor the effectiveness of this alternative.

Effectiveness

Ground water extraction, followed by air stripping, is an irreversible treatment process that would reduce the toxicity of the ground water by removing approximately 98 percent of the VOCs from the extracted ground water, and then concentrating them in the off-gas. The contaminants in the effluent from the air stripper would be almost completely removed (>99 percent), by the carbon adsorption unit. The contaminants collected on the carbon would be thermally destroyed when the carbon is regenerated off-site.

The required remediation time to achieve the remedial action levels is dependent on the extent of ground water contamination and aquifer properties. As in Alternative 3, a pre-design study will be needed to gather further information.

The ground water injection wells establish a hydraulic gradient, which reduces dilution of the contaminant plume by controlling the influx of adjacent waters. This action of the injection wells serves to shorten the ground water remediation time.

Implementability

As described in Alternative 3A, the components of the treatment system are readily implementable technologies.

At the Industrial Lane Site, where different areas of ground water contamination surround the Chrin Brothers Landfill, it would be desirable to create a closed system, using the ground water extraction and injection wells, in which all reinjected water is controlled and eventually captured by the extraction wells. Establishment of a closed system in fractured bedrock may be difficult, however. Reinjected water that is transported in discrete fractures may not be captured by the extraction wells and could potentially force contaminated ground water into lesser contaminated areas.

For reinjection of treated ground water, a State permit may be required. Permits may also be required if the treatment system is located off-site. DRBC requirements will have to be addressed.

Cost

The capital cost of this alternative is estimated to be $ 4,834,000, plus $ 8,000,000 in capital costs for closure of the landfill. The O & M costs, other than closure of the landfill, are estimated to be: $ 551,000 in year one, $ 512,000 per year in years two through twenty-two; $ 121,000 in years twenty-three through thirty; and an additional $ 20,000 every five years. The Present Worth of this alternative, not including closure of the landfill, is estimated to be $ 11,937,000 (Table 13).

VIII. Summary of Comparative Analysis of Alternatives

A detailed analysis was performed on all of the alternatives using the nine criteria specified in the NCP in order to select a remedy for OU 2. The following is a summary of the comparison of each of the alternative's strengths and weaknesses with respect to the nine criteria. The nine criteria are summarized in Table 14.

Overall Protection of Human Health and the Environment

Alternatives 1 and 2, which do not include any type of ground water cleanup activities, would not provide any additional reduction in the risks associated with household use of contaminated ground water other than that offered by natural attenuation and dilution. For ground water users residing outside of the current extent of contamination, however, Alternatives 1 and 2 would help to reduce the potential or likelihood of future exposure to contaminated ground water. Thus, these two alternatives would achieve this criterion to a minimal degree.

If access restriction regulations can be implemented and enforced, then Alternative 2 would provide a higher degree of overall protection of human health than Alternative 1, No Action.

Alternatives 1 and 2 would not actively help to protect uncontaminated ground water for current and future use.

These two alternatives would not actively restore the contaminated ground water to acceptable drinking water levels.

Alternatives 3 (3A or 3B) and 4 could potentially restore contaminated ground water to the background levels. A low-permeability cap is planned for the Chrin Brothers Landfill, which should significantly reduce the amount of leachate emanating from the facility. The landfill, however, would continue to generate small quantities of leachate, which could potentially act as a continuous source of contamination to the ground water. Therefore, even with installation of a low-permeability cap, contaminant levels in the ground water could remain relatively constant over a long period.

Following startup of the ground water extraction system in Alternatives 3 and 4, a hydraulic gradient or barrier would be established by the pumping system. This hydraulic barrier would help to contain the contaminant plume and therefore reduce the potential for migration of contaminants into uncontaminated ground water. Upon completion of ground water remediation, Alternatives 3 and 4 would achieve protection of human health from future exposure (ingestion and inhalation) to contaminated ground water. Until the aquifer is restored to the background levels, only ground water users residing outside of the area of contamination would be protected by the extraction and treatment system. Any ground water users residing within the current extent of contamination would continue to be at risk (approximately 7.8×10^{-4} cancer risk for Area C) until the background levels are achieved. Alternatives 3 and 4 would achieve a greater degree of overall protection of human health and the environment than Alternatives 1 and 2.

The primary remedy and the contingency measures afforded by closure of the unlined landfill and by Alternatives 3A, 3B or 4 provide overall protection of human health and the environment, either by reducing contaminants to background or other remediation goals, or through a combination of mass reduction, institutional and/or engineering controls.

Compliance with ARARs

CERCLA requires that remedial actions meet applicable or relevant and appropriate requirements (ARARs) of other federal and state environmental laws. These laws may include: the Toxic Substances Control Act, the Clean Water Act, the Safe Drinking Water Act, and the Resource Conservation and Recovery Act.

A "legally applicable" requirement is one which would legally apply to the response action if that action were not taken pursuant to Sections 104, 106, or 122 of CERCLA. A "relevant and appropriate" requirement is one that, while not "applicable", is designed to apply to problems sufficiently similar that their application is appropriate.

For the chemicals of concern (Table 6), Alternatives 1 and 2 would not meet the MCLs and Maximum Contaminant Level Goals (MCLGs), nor the risk-based levels (Tables 7 - 11), all of which are referenced by the NCP (40 C.F.R. Part 300) as acceptable ground water cleanup criteria, depending on the circumstances of the site. These alternatives would also not comply with the requirements of the Pennsylvania Hazardous Waste Management Regulations (25 PA. Code Chapter 264), which require contaminated ground water to be remediated to background levels.

With respect to location-specific ARARs, Alternatives 1 and 2 would not comply with the EPA's Ground Water Protection Strategy policy for an aquifer that is a current source of drinking water, a "To Be Considered" (TBC) type requirement.

Alternatives 1 and 2 would comply with the ground water monitoring requirements of Chapters 271 and 273 of the Pennsylvania Municipal Waste Management Regulations (25 PA. Code Chapters 271 and 273). However, these alternatives would not comply with the water quality monitoring regulations that require a ground water abatement plan to be developed and implemented if ground water pollution is detected in one or more monitoring wells.

Alternatives 3A, 3B, and 4 require remediating the ground water to the Pennsylvania ARAR background levels.

With respect to location-specific ARARs, Alternatives 3 and 4 comply with the EPA's Ground Water Protection Strategy policy for an aquifer that is a current source of drinking water, a TBC, by protecting current and potential sources of drinking water and waters having other beneficial uses.

Under Alternatives 3 and 4, OSHA standards (29 C.F.R. Parts 1910, 1926, and 1904), especially standards governing worker safety during hazardous waste operations (29 C.F.R. Part 1910.120), would be followed during all site work.

On-site treatment (Alternatives 3A and 4) and transportation of any treatment residuals off-site would comply with the various RCRA regulations as well the Department of Transportation (DOT) Rules for Hazardous Materials Transport (49 C.F.R. Parts 107 and 171-179).

Alternatives 3A, 3B, and 4 would fully comply with the ground water monitoring requirements of Sections 264.90 - 264.100 of the Pennsylvania Hazardous Waste Management Regulations (25 PA. Code §§ 264.90 - 264.100), which require contaminated ground water to be remediated to background levels.

For Alternative 4, subsurface reinjection should not require compliance with the LDR requirements, since the alternative is a CERCLA remedial response action.

Operation of the onsite treatment system (Alternatives 3A and 4), would comply with EPA OSWER Directive 9355.0-28, as well as with the various air quality permitting criteria of Chapter 127 (Construction, Modification, Reactivation and Operation of Sources) of the Pennsylvania Air Quality Control Act, 25 PA Code Chapter 127).

Under Alternatives 3 and 4, discharge of treated ground water would comply with all state and Federal NPDES discharge regulations (40 C.F.R. Part 122) and DRBC requirements.

Long-Term Effectiveness and Permanence

Since no actions would be taken to remediate the ground water under Alternatives 1 and 2, the health risks remaining after implementation of this alternative would be identical to those presently posed by household use of contaminated ground water. For ground water users residing downgradient of the Chrin Brothers Landfill, ground water monitoring provides a minimal degree of long-term protection from exposure to contaminated ground water.

The long-term effectiveness of Alternative 2 is dependent on the ability of state or local government to enforce regulations that prevent private well owners from using contaminated ground water. If adequate enforcement can be implemented, Alternative 2 would achieve a higher degree of long-term effectiveness than Alternative 1, No Action.

Alternatives 3 and 4, through ground water extraction and treatment, would achieve a higher degree of long-term effectiveness than Alternatives 1 and 2. At the completion of remediation activities, the cancer risks associated with the residual contaminant concentrations is 1×10^{-7} for Alternatives 3 and 4.

Reduction of Toxicity, Mobility, or Volume through Treatment

Alternatives 1 and 2 would not reduce the toxicity, mobility, or volume of contaminants in the ground water. Over time, contaminant levels in the present areas of contamination may gradually decrease through natural dilution, although the current extent of ground water contamination may spread into uncontaminated areas.

Alternatives 3 and 4, over the long-term, could potentially restore ground water in the area of contamination to the background action levels, assuming all sources of contamination are controlled. Unlike Alternatives 1 and 2, Alternatives 3 and 4 would provide an irreversible treatment process that would significantly reduce the toxicity of the contaminated ground water.

Short-Term Effectiveness

Since the only remedial action involved with Alternative 1 and 2 is the installation of monitoring wells, protection of workers and the community from exposure to contaminated materials during remedial actions is not a major consideration for these two alternatives. Monitoring wells could be installed in approximately 1 month, once a field crew and equipment are mobilized.

With respect to Alternatives 3A and 4, air strippers, carbon adsorption vessels, ground water extraction wells, and ground water monitoring are widely used at hazardous waste sites and are highly reliable if periodic inspections and maintenance are performed. There may be some degree of inhalation risk to workers and the community associated with failure of the off-gas collection and treatment system. Perimeter air monitoring and breathing zone monitoring in work areas would be performed during operation of the air stripper to determine whether steps are needed to protect the community and workers from adverse air emissions during implementation and operation of this alternative. Careful monitoring and maintenance of the process controls would minimize exposure risks associated with failures of the treatment system.

Implementability

Implementation concerns associated with Alternative 2, Access Restrictions, involve assessing the administrative and legal feasibility of imposing state or local restrictions on ground water use. Establishment of access restrictions would most likely require coordination between EPA, PADER, and the local government. Any ordinance that restricts ground water use may be unpopular with local residents; therefore, passing such an ordinance may be difficult. For these reasons, implementation of Alternative 2 would be significantly more difficult than implementation of Alternative 1.

Based on modeling analysis, the estimated remediation time is approximately 45 years for Alternatives 3A and 3B and 22 years for Alternative 4 assuming the unlined landfill undergoes closure.

Because Alternatives 3 and 4 involve the extraction and treatment of ground water, there are more implementability and operation considerations associated with these two alternatives than with Alternatives 1 and 2. A major implementability consideration of Alternative 3B is the available hydraulic capacity of the Easton Area POTW, which may not be sufficient enough to accept the extracted ground water. With respect to administrative implementability, discharge of ground water to the POTW must comply with any pretreatment ordinances and may require a permit from the POTW.

The components of the air stripping and carbon adsorption system (Alternatives 3A and 4) are readily implementable using existing technologies. No special materials or equipment would be required. O & M considerations include cleaning and replacement of wells and well pumps; maintenance of blower units; cleaning of fouled packing; and regeneration of the liquid and vapor phase carbon units. Also, monitoring of the effluent water and exhaust gas would be required to ensure compliance and reliability of the systems.

With respect to Alternative 4, it would be desirable to create a closed system using the ground water extraction and injection wells in which all reinjected water is controlled and eventually captured by the extraction wells. Establishment of a closed system in fractured bedrock may be difficult, however. Reinjected water that is transported in fractures may not be captured by the extraction wells and could potentially force contaminated ground water into lesser contaminated areas. Therefore, ground water reinjection could potentially interfere with any future ground water remedial actions taken in the vicinity of the Industrial Lane Site. This factor is the major detraction from the advantages of Alternative 4.

Implementation of Alternatives 3A, 3B and 4 should not interfere with any future source control actions or any additional ground water remedial actions taken in the vicinity of the Industrial Lane Site.

With respect to permits, no permits would be required to implement Alternatives 1 and 2, whereas state and local permits may be needed for Alternatives 3 and 4 to discharge treated water to either the POTW, the Lehigh River or the subsurface, as well as to discharge air stripper off-gas.

Cost

Present-worth costs for the four alternatives and associated subalternatives are summarized in Table 13.

State Acceptance

The Commonwealth of Pennsylvania has concurred with the selected remedy. The Commonwealth has also stated: "PADER agrees with the proposed remediation which provides that "background" quality is the objective of the ground water remediation plan. In the event that EPA modifies its position on the cleanup standard, and deviates from background quality as a remediation goal, DER will withdraw its concurrence. At that time, EPA must demonstrate the impracticability of achieving background quality, and give DER a meaningful opportunity to reconcur by way of an Explanation of Significant Differences (ESD) or a ROD amendment."

Community Acceptance

Community acceptance is assessed in the attached Responsiveness Summary. In general, the community is in agreement with the selected remedy. Concerns, such as the effect of the extraction of ground water on local wells, will be addressed in the pre-design study. The Responsiveness Summary provides a thorough review of the comments received on the 1991 FFS and the Proposed Plan.

IX. Selected Remedy

The ground water portion of the remedy selected by EPA is Alternative 3A, extraction, treatment and discharge to the Lehigh River. The containment portion of the selected remedy is closure of the unlined landfill.

Containment

PADER has notified the owner and operator of the Chrin Brothers Landfill in a letter dated November 23, 1990, that the unlined landfill area must be closed according to Chapters 271 and 273 of the Pennsylvania Municipal Waste Management Regulations (25 PA. Code Chapters 271 and 273). The containment portion of the selected remedy requires compliance with these state closure regulations, estimated to cost $8,000,000, as described in Section X of this ROD, in the subsection entitled Compliance with Applicable or Relevant and Appropriate Requirements.

Ground Water

Alternative 3A requires extraction, treatment and discharge of ground water to the Lehigh River, as described in Section VII of this ROD.

The goal of this remedial action is to restore the ground water to background levels in the area of attainment. The area of attainment is at and beyond the boundary of the unlined landfill and throughout the contaminant plume. Based on the information obtained during the RI, and the analysis of the remedial alternatives, EPA and the Commonwealth of Pennsylvania believe that the selected remedy may be able to achieve this goal. Ground water contamination may be especially persistent in the immediate vicinity of the contaminants' source, where concentrations are relatively high. The ability to achieve cleanup goals at all points throughout the area of attainment, or plume, cannot be determined until the extraction system has been implemented, modified as necessary, and plume response monitored over time. If the selected remedy cannot meet the specified remediation goals, at any or all of the monitoring points during implementation, the contingency measures and goals described in this section may replace the selected remedy and goals for these portions of the plume. Such contingency measures will, at a minimum, prevent further migration of the plume and include a combination of containment technologies typically ground water extraction and treatment, and institutional controls. These measures are considered to be protective of human health and the environment, and are technically practicable under the corresponding circumstances.

The selected remedy requires ground water extraction, treatment and discharge to the Lehigh River for an estimated period of 45 years, during which time the system's performance will be carefully monitored on a regular basis and adjusted as warranted by the performance data collected during operation. Modifications may include but are not limited to the following:

a) at individual wells where cleanup goals have been attained, pumping may be discontinued;

b) alternating pumping at wells to eliminate stagnation points:

c) pulse pumping to allow aquifer equilibration and encourage adsorbed contaminants to partition into ground water; and

d) installation of additional extraction wells to facilitate or accelerate cleanup of the contaminant plume.

To ensure that cleanup levels continue to be maintained, the aquifer will be monitored at those wells where pumping has ceased yearly following discontinuation of ground water extraction.

If it is determined, by EPA in consultation with PADER that on the basis of the preceding modifications and the system performance data, that certain portions of the aquifer cannot be restored to background levels, attempts would be made to remediate the ground water to its beneficial use, which would be use as a drinking water source. If the aquifer can not be restored to its beneficial use, all of the following measures involving long-term management may occur, as determined by EPA in consultation with PADER, for an indefinite period of time, as a modification of the existing system:

a) engineering controls such as physical barriers, or long-term gradient control provided by low level pumping, as containment measures;

b) chemical-specific ARARs will be waived for the cleanup of those portions of the aquifer based on the technical impracticability of achieving further contaminant reduction;

c) institutional controls will be provided/maintained to restrict access to those portions of the aquifer which remain above remediation goals;

d) continued monitoring of specified wells; and

e) periodic reevaluation of remedial technologies for ground water restoration.

The decision to invoke any or all of these measures may be made by EPA in consultation with PADER, during a periodic review of the remedial action, which occurs at least every five years, in accordance with Section 121(c) of CERCLA, 42 U.S.C. § 9621 (c).

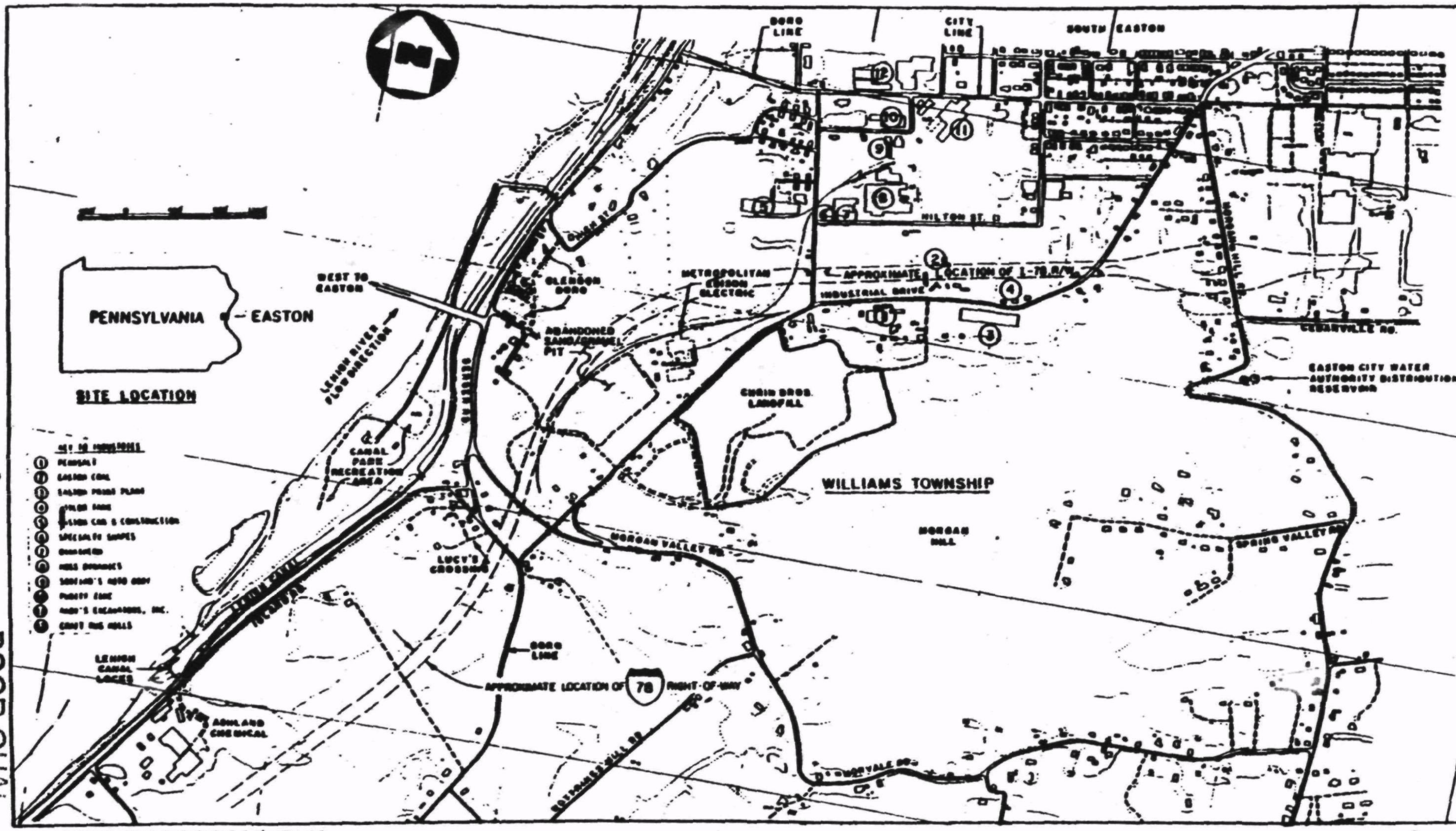
The goal of the selected remedy is to achieve the background levels (Table 12) for the Chemicals of Concern (Table 6) in the ground water, which is a relevant and appropriate requirement under the PA Hazardous Waste Management Regulations. The Pennsylvania ARAR for ground water for hazardous substances is that all ground water must be remediated to "background" quality

FIGURE I

LOCATION MAP
INDUSTRIAL LANE STUDY AREA
NORTHAMPTON CO., PA

NUS CORPORATION

POOR QUALITY
ORIGINAL



BASE MAP PREPARED BY GREENHORNE & O'MARA, INC.

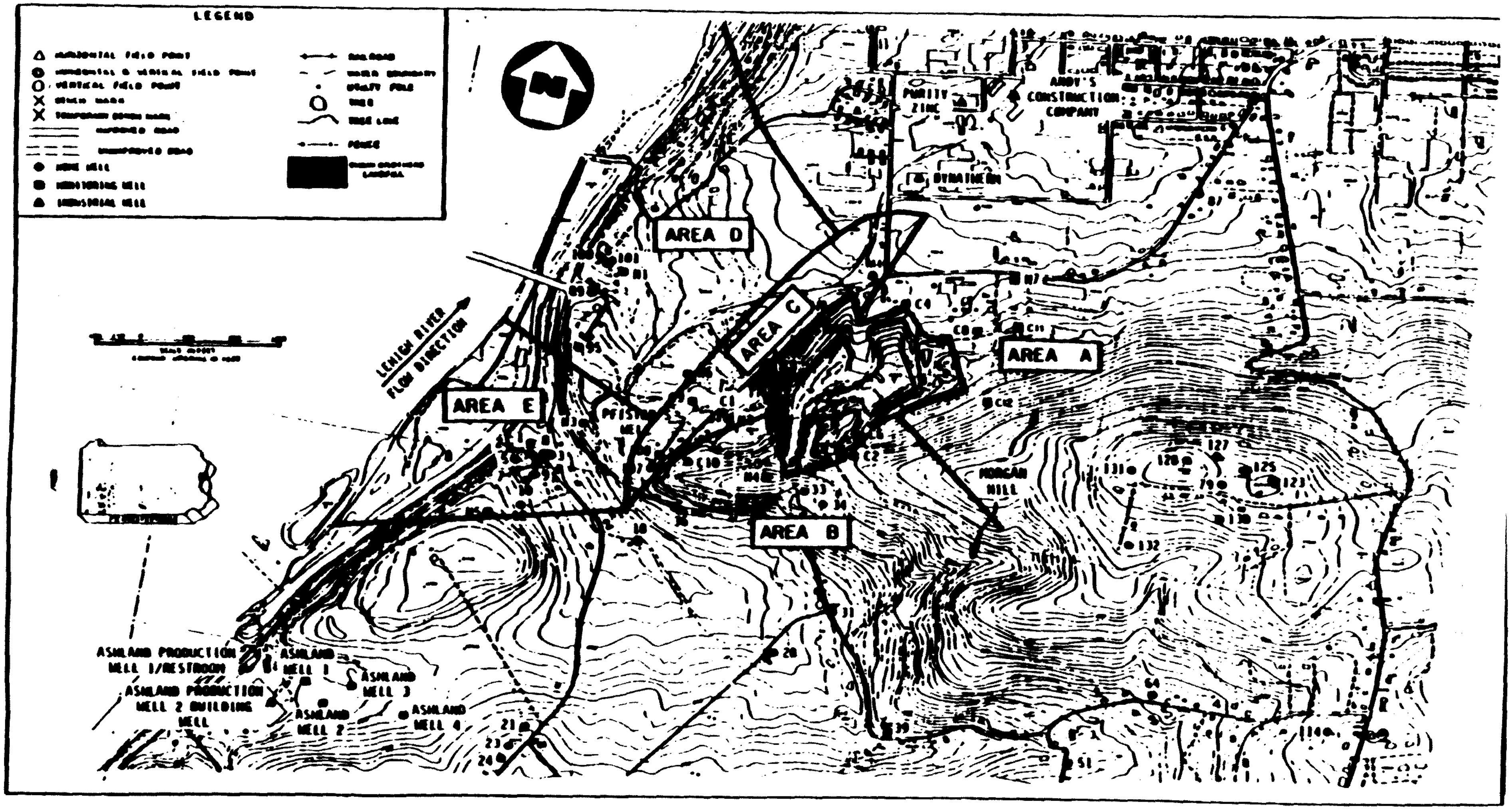
SITE STUDY AREA

INDUSTRIAL LANE STUDY AREA, NORTHAMPTON CO., PA

(SCALE ABOVE)

FIGURE 2

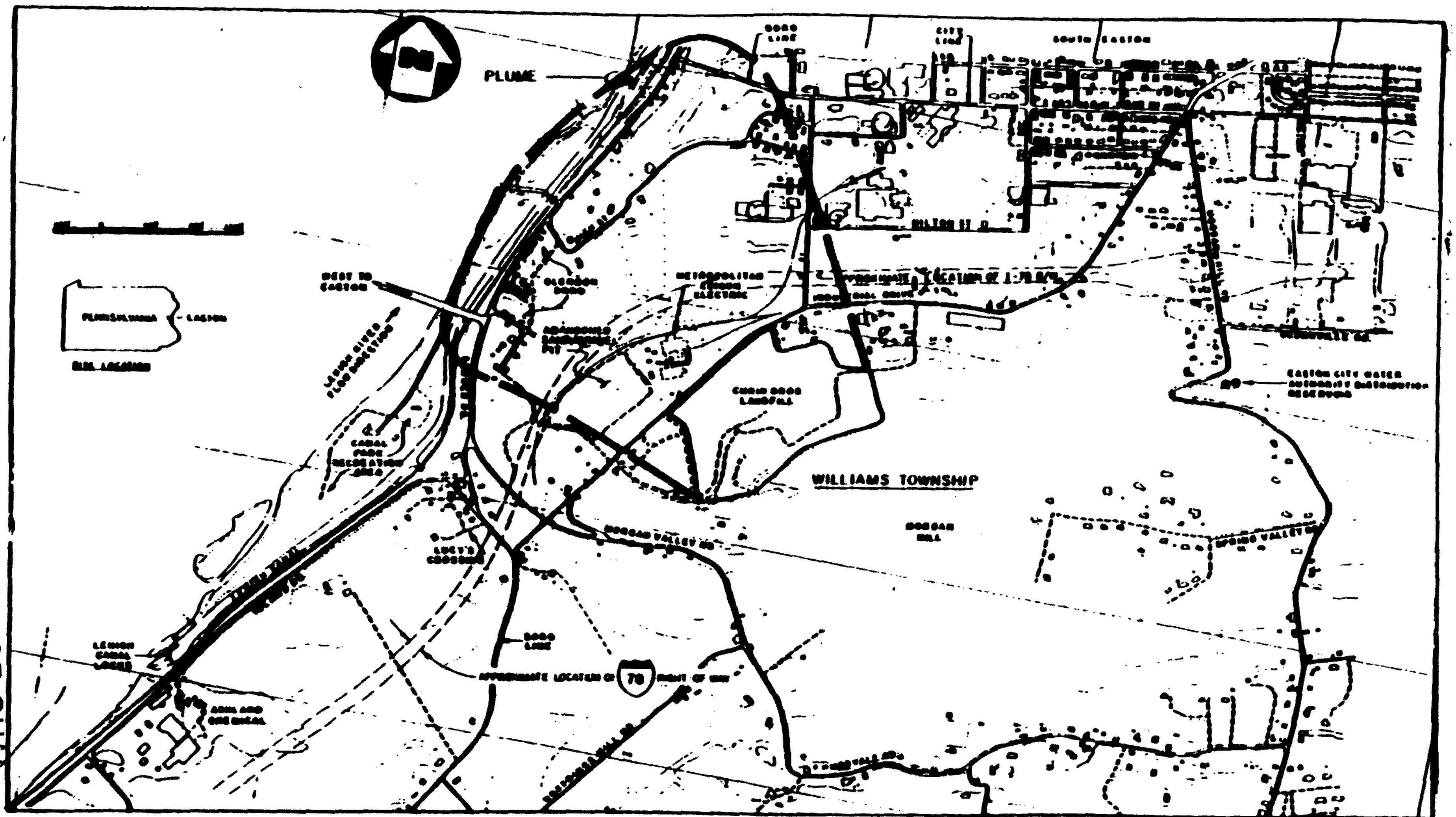
NUS CORPORATION



GROUNDWATER CONTAMINATION AREAS OF CONCERN
INDUSTRIAL LANE STUDY AREA, NORTHAMPTON CO., PA
(SCALE ABOVE)

FIGURE 3

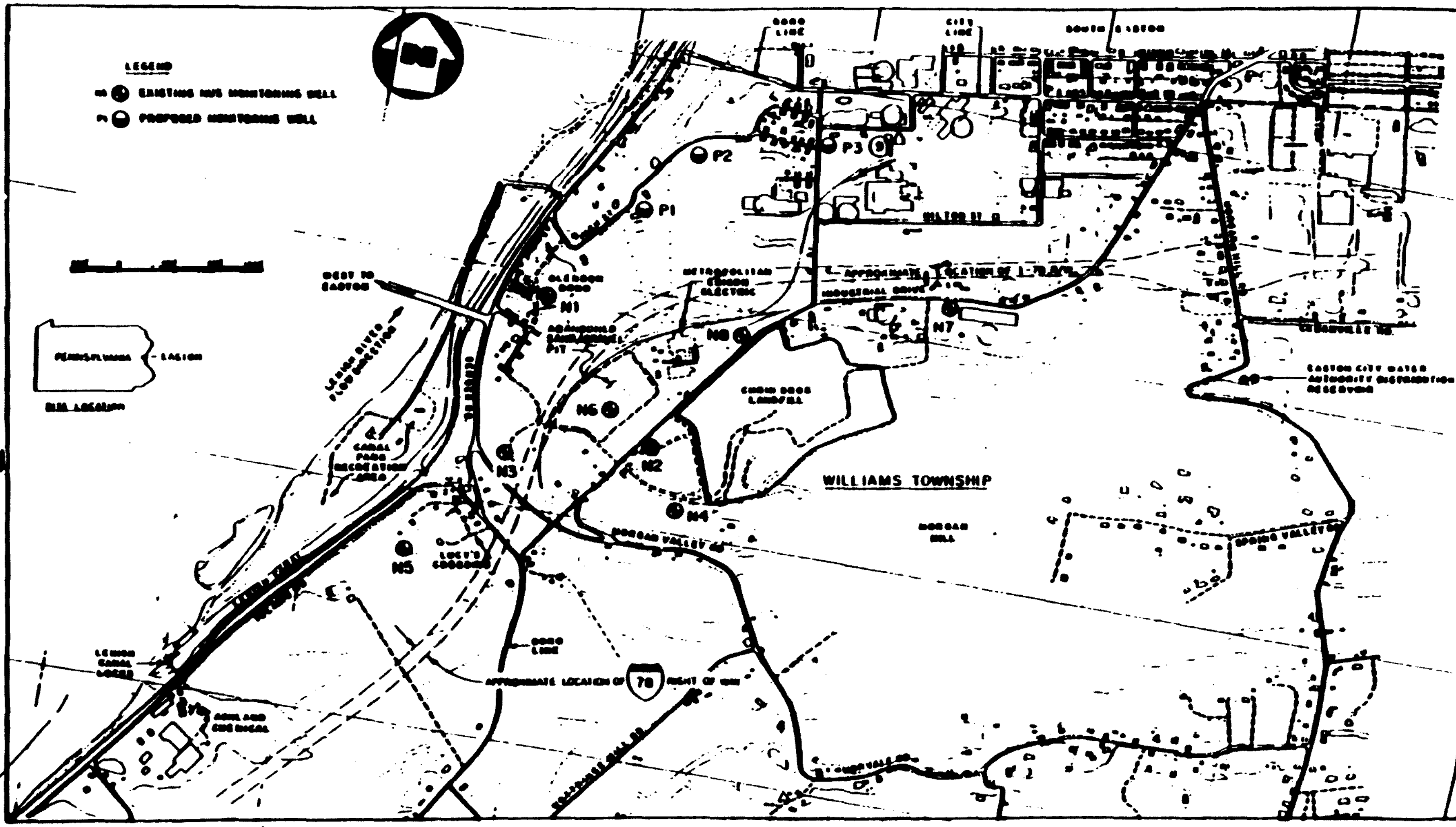
NUS CORPORATION



ASSUMED EXTENT OF CONTAMINANT GROUNDWATER PLUME
INDUSTRIAL LANE STUDY AREA, NORTHAMPTON CO., PA
(SCALE ABOVE)

Figure 4

NUS CORPORATION



BASE MAP PREPARED BY GREENHORNE & O'MARA, INC

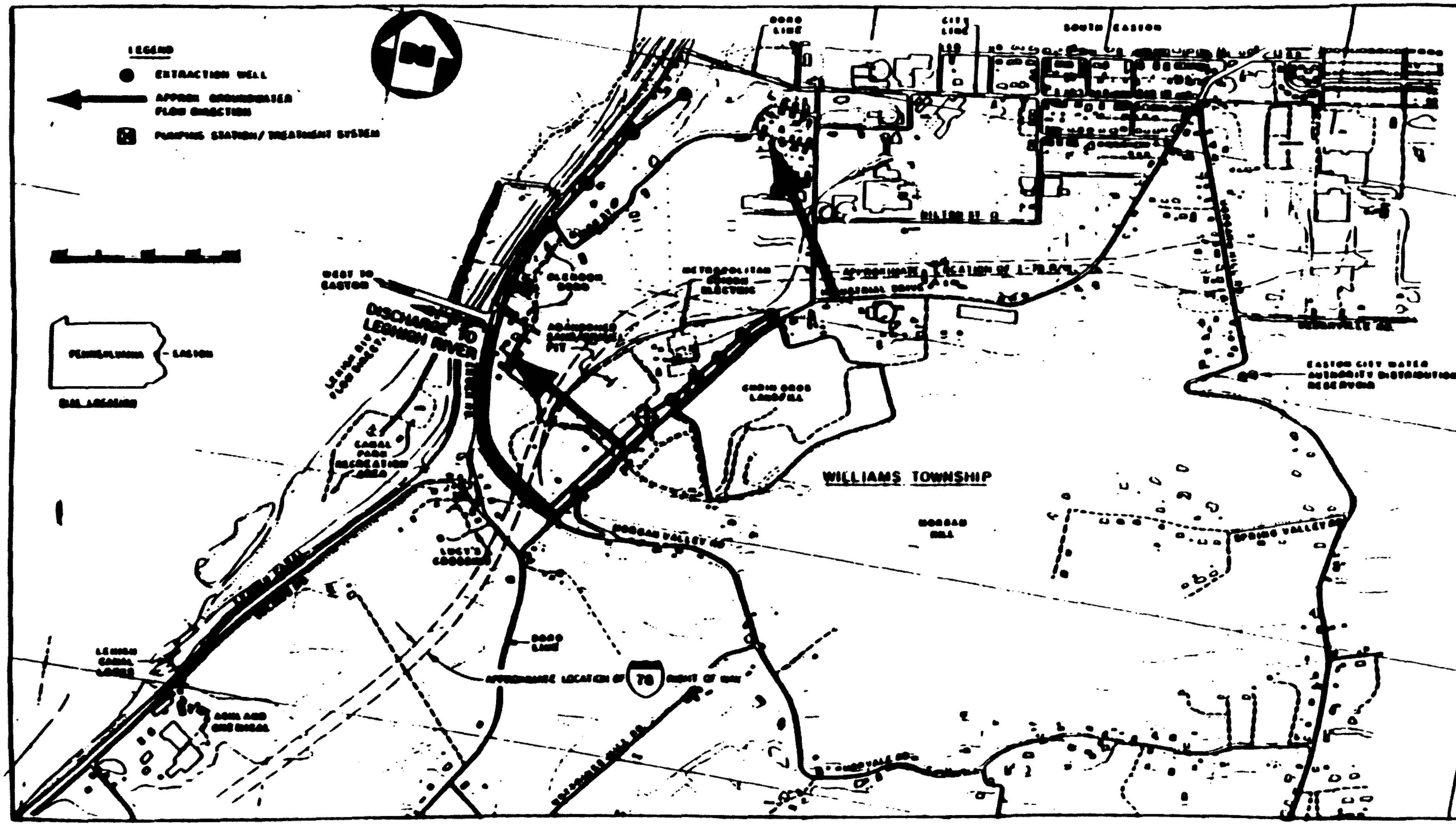
PRELIMINARY GROUNDWATER MONITORING SYSTEM

INDUSTRIAL LANE STUDY AREA, NORTHAMPTON CO., PA

(SCALE ABOVE)

Figure 5

NUS CORPORATION

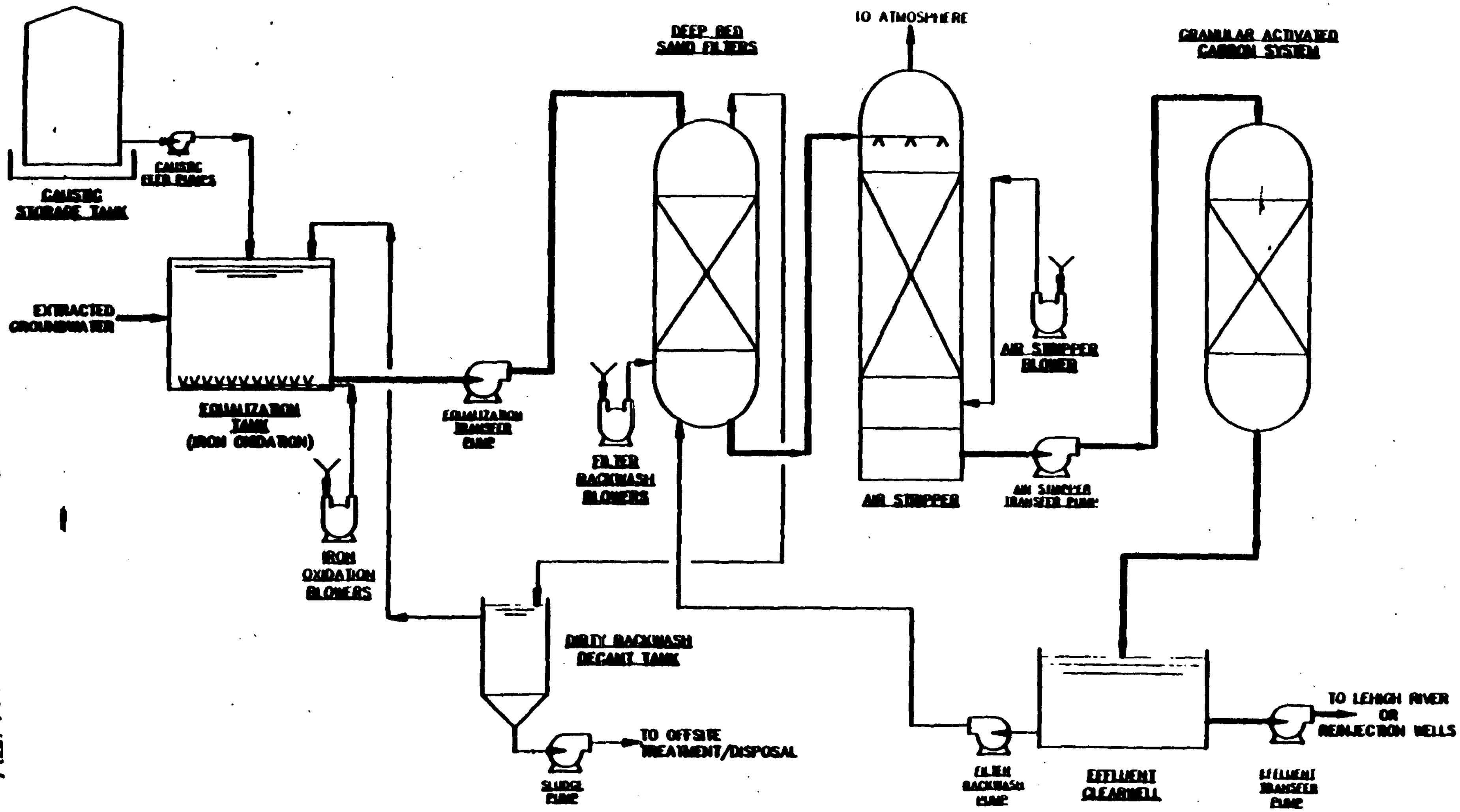


BASE MAP PREPARED BY GREENHORNE & O'MARA, INC

Figure 6

PRELIMINARY EXTRACTION WELL LOCATIONS
INDUSTRIAL LANE STUDY AREA, NORTHAMPTON CO., PA
(SCALE ABOVE)

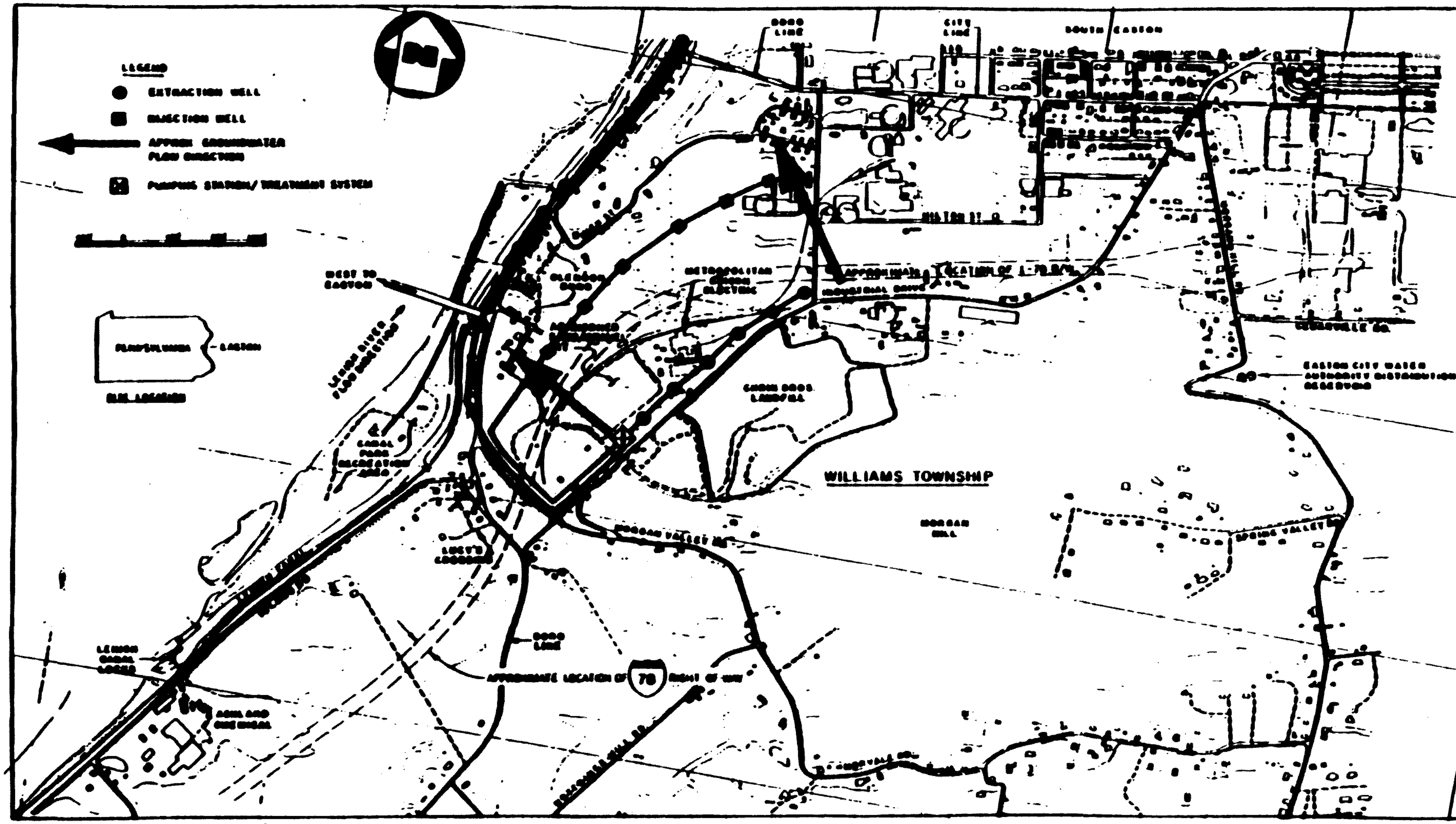
NUS CORPORATION



CONCEPTUAL GROUNDWATER TREATMENT SYSTEM
PROCESS FLOW DIAGRAM
INDUSTRIAL LANE SITE, NORTHAMPTON Co., PENNSYLVANIA

Figure 7

NUS CORPORATION



BASE MAP PREPARED BY GREENHORNE & O'MARA, INC

Figure 8

PRELIMINARY GROUNDWATER INJECTION/EXTRACTION WELL LOCATIONS

INDUSTRIAL LANE STUDY AREA, NORTHAMPTON CO., PA

(SCALE ABOVE)

NUS CORPORATION

TABLE 1

COMPARISON OF AVAILABLE DATA FOR AREA A (μg/L)
INDUSTRIAL LANE SITE
NORTHAMPTON COUNTY, PENNSYLVANIA

Parameter	RI Data[1] (1984-1986)			AGES Data[2] (1989)			PADER Data[3] (1988, 1989)			GV Study Data[4] (1988)			Standard/ Criteria
	Q.L.	Range Detected	Average	Q.L.	Range Detected	Average	Q.L.	Range Detected	Average	Q.L.	Range Detected	Average	
Vinyl chloride	10			1			1			0.10	2.4	0.32	2 PMCL (P)
Methylene chloride	5			1			1			0.25	5.4	0.65	5 PMCL (T)
1,1-Dichloroethane	5	4.0	2.9	1	3.0-4.0	0.9	1	2.2-3.0	1.6	0.07	0.4-76	13.3	NAvail
trans-1,2-Dichloroethene	5			1			1			0.10	1.6-4.2	1	100 PMCL (T)
cis-1,2 Dichloroethene	5			1			1			NL	0.9-3.0	0.43	70 PMCL (P)
Chloroform	5	1.0-3.0	2.3	1			1			0.05	1.2-2.6	0.76	100 NIPDWR
1,2-Dichloroethane	5			1	2.0-24	2.1	1			0.03	0.1	0.02	5 PMCL (P)
1,1,1-Trichloroethane	5	1.0	2.6	1	1.0-9	1.7	1	5.0	1.6	0.03	0.3-66	12.0	200 PMCL (P)
Carbon tetrachloride	5			1	5.0	0.9	1	1-3.1	1,1	0.12	0.9-1.0	0.4	5 PMCL (P)
1,2-Dichloropropane	5	3.4-3.0	2.0	1	2.0	0.8	1	1.1-4.4	1.6	0.04	0.7-3.0	1.4	5 PMCL (P)
Trichloroethene	5	2.0	2	1	2.0	0.8	1	1.0-2.9	1.2	0.03	0.5-5.0	1.0	5 PMCL (P)
Benzene	5			1	3.0-25	2.9	1			0.2	2.5	0.34	5 PMCL (P)
Tetrachloroethene	5			1			1			0.03	0.1-17	2.9	5 PMCL (P)
Toluene	5			1	2.0-20	2.1	1			0.2	4.6-15	3.1	2,000 PMCL (P)
Total xylenes	5			1			1			NL	0.3	0.05	10,000 PMCL (P)
1,2-Dichlorobenzene	10			1			1			0.4	0.0-3.1	0.55	600 PMCL (P)
1,4-Dichlorobenzene	10			1			1			0.3	1.2-3.4	0.50	75 PMCL (P)
Bromodichloromethane	5			1			1			0.09	2.9	0.33	100 NIPDWR
Chlorobenzene	5			1			1			0.25	4.1-9.2	1.4	100 PMCL (P)
Chloromethane	10			1			1			0.08	1.4	0.10	NAvail
1,1-Dichloroethene	5			1			1			0.13	4.0	0.1	7 PMCL (F)
Trichlorofluoromethane	NL			1			1			NL	2.1-2.3	0.52	NAvail
Chloroethane	10			1			1			0.52	9.5	1.2	NAvail

TABLE 1
COMPARISON OF AVAILABLE DATA FOR AREA A (µg/L)
INDUSTRIAL LANE SITE
NORTHAMPTON COUNTY, PENNSYLVANIA
PAGE TWO

Parameter	RI Data[1] (1984-1986)			AGES Data[2] (1989)			PADER Data[3] (1988, 1989)			GV Study Data[4] (1988)			Standard/ Criteria
	Q.L.	Range Detected	Average	Q.L.	Range Detected	Average	Q.L.	Range Detected	Average	Q.L.	Range Detected	Average	
1,1,2,2-Tetrachloroethane	5			1			1			0.03	0.2-3.2	0.35	NAvail
2-Butanone	10			1			1			NL	0.3	2	NAvail
Carbon disulfide	5			1			1			NL	0.4-0.6	0.08	NAvail
cis-1,3-Dichloropropene	5			1			1			0.34	2.5	0.4	NAvail
trans-1,3-Dichloropropene	5			1			1			0.20	1.7	0.26	NAvail
Bromoform	5			1			1			0.20	0.2-2.4	0.34	NAvail
Bis(2-ethylhexyl) phthalate	10	410	55.6	NA	----	----	NA	----	----	NA	----	----	NAvail
Isophorone	10	100	26.9	NA	----	----	NA	----	----	NA	----	----	NAvail
4-Chloro-3-methylphenol	10	11	5.0	NA	----	----	NA	----	----	NA	----	----	NAvail
Aluminum	200	526,000-654,500 (522,000-635,700)	147,637 (144,707)	NA	----	----	NA	----	----	NA	----	----	50 SMCL (P)
Arsenic	10	430-1,205 (400)	200 (65.4)	1	1-7 (1-2)	1.3 (0.8)	4-10	ND	ND	NA	----	----	50 NIPDWR
Barium	200	13-37 (12-47)	44 (46.5)	4-20	10-60 (14-114)	25.1 (22.4)	10	10-27 (10-17)	16 (12.3)	NA	----	----	1,000 NIPDWR 5,000 PMCL (P)
Cadmium	5	5.5-12 (0.5-12)	4.1 (4.4)	1-20	ND	ND	0.2	0.98-1.02 (0.99)	0.3 (0.3)	NA	----	----	10 NIPDWR 5 PMCL (P)
Calcium	5,000	1,470-101,000 (1,520-100,000)	39,961 (40,146)	10	1,030-77,300 (2,700-71,000)	30,263 (27,730)	NL	1,300-70,000 (1,300-87,700)	32,296 (35,775)	NA	----	----	NAvail
Chromium	10	26-32 (ND)	10	8-20	60-80 (10-30)	15 (6.7)	4	4.1-7.6	3.6	NA	----	----	50 NIPDWR 100 PMCL (P)

TABLE 1
COMPARISON OF AVAILABLE DATA FOR AREA A (µg/L)
INDUSTRIAL LANE SITE
NORTHAMPTON COUNTY, PENNSYLVANIA
PAGE THREE

Parameter	RI Data[1] (1984-1986)			AGES Data[2] (1989)			PADER Data[3] (1988, 1989)			GV Study Data[4] (1988)			Standard/ Criteria
	Q.L.	Range Detected	Average	Q.L.	Range Detected	Average	Q.L.	Range Detected	Average	Q.L.	Range Detected	Average	
Copper	25	26-171 (25)	71.0 (14.1)	6	60-156 (52 132)	27.5 (24.3)	10	15.0-104 (15-104)	41.4 (35.5)	NA	- --	----	1,000 SMCL (F) 1,300 PMCL (P)
Iron	100	34,000- 115,000 (807- 75,000)	65,500.8 (16,984)	20	590- 27,000 (160- 9,300)	8,629	NL	69-19,700 (36-6,360)	8,846 (1,915)	NA	----	----	300 SMCL (F)
Lead	5	7.4-173 (8.1-113)	60.4 (18)	1	1-10 (ND)	1.3	4	5.4-63.5	13.4	NA	----	----	50 NIPDWR 5 PMCL (P) at source
Magnesium	5,000	2,500- 71,700 (2,240- 72,200)	25,537 (25,250)	30	100- 54,000 (30- 46,000)	8,240 (6,319)	NL	1,980- 54,000 (1,040- 62,200)	21,336 (23,200)	NA	- -	- -	NAvail
Manganese	15	293-3,212 (92-3,060)	1,215 (1,054)	2	51-1,140 (5-990)	399 (326)	10	98-982 (153-722)	412 (365)	NA	---	----	50 SMCL (F)
Mercury	0.2	0.41 (ND)	0.14	0.4-0.5	0.6-13.0 (0.7-8.6)	3.0 (1.5)	1			NA	----	- -	2 NIPDWR 2 PMCL (P)
Nickel	40	25-134 (13-114)	60 (41.5)	NA	----	----	NA	----	----	NA	----	----	100 PMCL (P)
Potassium	5,000	2,000- 17,400 (1,340- 16,900)	9,221 (8,885)	10	140- 14,000 (120- 12,760)	4,030 (3,200)	NL	1,400- 16,000 (1,450- 15,600)	7,458 (6,845)	NA	----	-- -	NA
Selenium	5	54 (30)	8.9 (6.9)	2-80	15-40 (ND)		6-30			NA	-- -	----	10 NIPDWR 50 PMCL (P)
Silver	10	4.4-12 (ND)	5.7	1-7	15-40 (10)	11 (1.3)	10			NA	----	----	50 NIPDWR
Sodium	5,000	17,200- 29,600 (16,10- 34,700)	13,521 (14,202)	200	9,400- 19,200 (7,000- 17,100)	11,469 (11,393.8)	NL	7,220- 15,800 (7,220- 14,000)	11,890 (11,630)	NA	----	----	NAvail

TABLE 1
COMPARISON OF AVAILABLE DATA FOR AREA A (µg/L)
INDUSTRIAL LANE SITE
NORTHAMPTON COUNTY, PENNSYLVANIA
PAGE FOUR

Parameter	RI Data(1) (1984-1986)			AGES Data(2) (1989)			PADER Data(3) (1988, 1989)			GV Study Data(4) (1988)			Standard/ Criteria
	Q.L.	Range Detected	Average	Q.L.	Range Detected	Average	Q.L.	Range Detected	Average	Q.L.	Range Detected	Average	
Vanadium	50	5.8-13 (5.3)	17.1 (22.5)	NA	----	----	NA			NA	----	----	NAvail
Zinc	20	106-1,030 (59-1,010)	350 (264)	2	211-231 (151-209)	75 (44.9)	10	29-199 (25-162)	61 (49.3)	NA	----	----	5,000 SMCL (F)
Beryllium	5	44-52.2 (12 51.2)	13.9 (9.0)	NA	----	----	NA	----	----	NA	----	----	200 DWEL
Cobalt	50	14-90.0 (4.5-84)	36.9 (31)	NA	----	----	NA	----		NA	----	----	NAvail
Tin	NL	56		NA	----	----	NA	----	----	NA	----	----	NAvail

Filtered metals results presented in parentheses. Arithmetic average calculated using 1/2 detection limit.
P Proposed.
F Final.
T Tentative.
QL Quantitation limit.
NL QL not listed.
PMCL Federal Safe Drinking Water Act (SDWA) Primary Maximum Contaminant Levels.
SMCL Federal SDWA Secondary Maximum Contaminant Level.
DWEL Drinking Water Equivalent Level.
NIPDWR National Interim Primary Drinking Water Regulation.
NAvail Indicates not available.
NA or ---- Indicates samples were not analyzed.
A blank space or ND indicates that the chemical was not detected.
(1) Data collected during 1984-1986 Remedial Investigation conducted by NUS Corporation. Contract required detection limits (CRDL) presented.
(2) Data collected quarterly for the owners of Chrin Brothers Sanitary Landfill by Applied Geotechnical and Environmental Service Corporation (AGES). Quantitation limits are those observed in data package.
(3) Data collected by the Pennsylvania Department of Environmental Resources (PADER). Quantitation limits are those observed in data package.

TABLE 2

COMPARISON OF AVAILABLE DATA FOR AREA B (μg/L)
INDUSTRIAL LANE SITE
NORTHAMPTON COUNTY, PENNSYLVANIA

Parameter	RI Data (1984-1986)			AGES Data (1989)			PADER Data (1988, 1989)			GV Study Data (1988)			Standard/ Criteria
	Q.L.	Range Detected	Average	Q.L.	Range Detected	Average	Q.L.	Range Detected	Average	Q.L.	Range Detected	Average	
1,1-Dichloroethane	5			1	2.0	0.61	1			0.07			NAvail
cis-1,2-Dichloroethene	5			1			1			NL	0.4	0.09	70 PMCL (P)
Chloroform	5			1			1			0.05	0.7-1.4	0.44	100 NIPDWR
1,2-Dichloroethane	5	4.0	2.7	1	20	1.9	1			0.03	0.4	0.06	5 PMCL (P)
1,1,1-Trichloroethane	5			1			1	1.0	0.7	0.03	0.1	0.09	200 PMCL (P)
Benzene	5			1	3-4	0.93	1			0.2	0.4	0.14	5 PMCL (P)
Tetrachloroethene	5			1			1			0.03	0.1	0.03	5 PMCL (P)
Toluene	5			1			1			0.2	0.6	1.2	2,000 PMCL (P)
Chloromethane	10			1			1			0.08	1.5	0.41	NAvail
Trichlorofluoromethane	NL			1			1			NL	0.4	0.14	NAvail
2-Butanone	10			1			1			NL	5.0-9.5	2.0	NAvail
Bis(2-ethylhexyl) phthalate	10	30	0.3	NA	----	----	NA	----	----	NA	----	----	NAvail
Aluminum	200	291-699 (389)	253	NA	----	----	NA	----	----	NA	----	----	50 SMCL (P)
Arsenic	10			1	1-2 (1-2)	0.0 (0.9)	4-10			NA	----	----	50 NIPDWR
Barium	200	10-126 (16-120)	82.7	4-20	13-4,060 (10-140)	422 (59)	10	22-254 (21-174)	94.6 (66.7)	NA	----	----	1,000 NIPDWR 5,000 PMCL (P)
Cadmium	5			1-20			0.2	0.23	0.1	NA	----	----	10 NIPDWR 5 PMCL (P)
Calcium	5,000	8,232-86,250 (8,031-79,600)	37,844	10	8,120-52,000 (8,400-40,900)	22,220 (21,171)	NL	9,570-40,700 (10,700-39,700)	23,714 (27,366)	NA	----	----	NAvail
Chromium	10	4.4-24.0	7.7	8-20	60-120 (10-30)	23 (6.7)	4	4.7	2.5	NA	----	----	50 NIPDWR 100 PMCL (P)

TABLE 2
COMPARISON OF AVAILABLE DATA FOR AREA B (μg/L)
INDUSTRIAL LANE SITE
NORTHAMPTON COUNTY, PENNSYLVANIA
PAGE TWO

Parameter	RI Data (1984-1986)			AGES Data (1989)			PADER Data (1988, 1989)			GV Study Data (1988)			Standard/ Criteria
	Q.L.	Range Detected	Average	Q.L.	Range Detected	Average	Q.L.	Range Detected	Average	Q.L.	Range Detected	Average	
Copper	25	12-70	10.2	6	57-222 (46-212)	63 (52.3)	10	2.0-80 (15-70)	50 (37)	NA	----	-	1,000 SMCL (F) 1,300 PMCL (P)
Iron	100	1,070-18,470	4,605	20	979-6,400 (130-5,130)	1,902 (931)	NL	310-1,060 (42-234)	943 (145)	NA	----	----	300 SMCL (F)
Lead	5	5.0-6.7	3.2	1	2-337	30.4	4	7.0-20.4 (5.5)	10.5 (3.2)	NA	----	----	50 NIPDWR 5 PMCL (P) at source
Magnesium	5,000	2,480-7,694 (2,440-7,081)	4,532	30	50-4,500 (30-3,000)	1,122 (964)	NL	2,370-3,010 (2,580-3,760)	2,990 (3,250)	NA	----	----	NAvail
Manganese	15	32-314 (9-309)	111	2	17-427 (14-362)	85.1 (66)	10	12-224 (10-224)	87 (80)	NA	----	----	50 SMCL (F)
Mercury	0.2			0.4-0.5	0.5-9.6 (1.0-6.5)	1.3 (0.9)	1			NA	----	----	2 NIPDWR 2 PMCL (P)
Nickel	40	7.6-16.0	17.4	NA	----	----	NA	----	----	NA	----	----	100 PMCL(P)
Potassium	5,000	1,000-2,630 (1,392-2,320)	2,055	10	120-1,050 (90-1,930)	1,059 (1,027)	NL	1,500-1,960 (1,520-1,900)	1,660 (1,740)	NA	----	----	NAvail
Selenium	5			2-80			6-30			NA	----	----	10 NIPDWR 50 PMCL (P)
Silver	10	3.2-4.1	4.7	1-7	0.0	1.1	10			NA	----	----	50 NIPDWR
Sodium	5,000	7,126-9,396 (7,403-8,490)	4,286	200	6,300-10,000 (5,500-8,600)	2,280 (3,587)	NL	4,600-5,800 (5,150-5,720)	5,106 (5,450)	NA	----	----	NAvail

TABLE 2
COMPARISON OF AVAILABLE DATA FOR AREA B (µg/L)
INDUSTRIAL LANE SITE
NORTHAMPTON COUNTY, PENNSYLVANIA
PAGE THREE

Parameter	RI Data (1984-1986)			AGES Data (1989)			PADER Data (1988, 1989)			GV Study Data (1988)			Standard/ Criteria
	Q.L.	Range Detected	Average	Q.L.	Range Detected	Average	Q.L.	Range Detected	Average	Q.L.	Range Detected	Average	
Vanadium	50	4.9	23	NA	----	----	NA	----	----	NA	----	----	NAvail
Zinc	20	48-185 (56-180)	48	2	(119-133)	(42)	10	10-72 (16-93)	37.6 (30)	NA	----	----	500 SMCL (F)
Tin	NL	24		NA			NA	----	----	NA	----	----	NAvail
Beryllium	5	1.8	2.4	NA	----	----	NA	----	----	NA	----	----	200 DWEL

Filtered metals results presented in parentheses. Arithmetic mean calculated using 1/2 detection limit.
P Proposed.
F Final.
T Tentative.
QL Quantitation limit.
NL QL not listed.
PMCL Federal Safe Drinking Water Act (SDWA) Primary Maximum Contaminant Levels.
SMCL Federal SDWA Secondary Maximum Contaminant Level.
DWEL Drinking Water Equivalent level.
NIPDWR National Interim Primary Drinking Water Regulation.
NAvail Indicates not available.
NA or ---- Indicates samples were not analyzed.
A blank space or ND indicates that the chemical was not detected.
(1) Data collected during 1984-1986 Remedial Investigation conducted by NUS Corporation. Contract required detection limits (CRDL) presented.
(2) Data collected quarterly for the owners of Chrin Brothers Sanitary Landfill by Applied Geotechnical and Environmental Service Corporation (AGES). Quantitation limits are those observed in data package.
(3) Data collected by the Pennsylvania Department of Environmental Resources (PADER). Quantitation limits are those observed in data package.
(4) Data collected as a result of Groundwater Validation Study conducted by ICF Technology, Inc. (1988). EPA 601/602 quantitation limits presented.

TABLE 3

COMPARISON OF AVAILABLE DATA FOR AREA C (µg/L)
INDUSTRIAL LANE SITE
NORTHAMPTON COUNTY, PENNSYLVANIA

Parameter	RI Data(1) (1984-1986)			AGES Data(2) (1989)			PADER Data(3) (1988, 1989)			GV Study Data(4) (1988)			Standard/ Criteria
	Q.L.	Range Detected	Average	Q.L.	Range Detected	Average	Q.L.	Range Detected	Average	Q.L.	Range Detected	Average	
Vinyl chloride	10			1	19	1.7	1	48	8.4	0.18	0.3-9.5	2.9	2 PMCL (F)
Methylene chloride	5	83	7.0	1	30	2.3	1	4.6-130	28.0	0.25	0.2-130	24	5 PMCL (T)
1,1-Dichloroethane	5	4.0-51	10.6	1	10-210	41.4	1	15-103	60.4	0.07	1.3-129	37.3	NAvail
trans-1,2-Dichloroethene	5	1.0-79	10.8	1	2-107	16.5	1	1.2-18	8.5	0.10	0.1-2.7	0.4	100 PMCL (P)
cis-1,2-Dichloroethene	5			1			1	3.8-79	37.8	NL	3.2-79	14.5	70 PMCL (P)
Chloroform	5	1.0-5.0	2.8	1	0.9-7.0	2.3	1	1.1-6.7	4.0	0.05	0.4-14.3	1.9	100 NIPDWR
1,2-Dichloroethane	5	4.0-22	4.4	1	1.0-7.0	2	1	2.8	1.9	0.03	1.3-3.3	0.7	5 PMCL (F)
1,1,1-Trichloroethane	5	6.0-188	24.4	1	2.0-41	10.9	1	3.8-60	30.4	0.03	2-53	13.6	200 PMCL (F)
Carbon tetrachloride	5			1			1	3.8-4.1	1.9	0.12	0.5-5.6	0.9	5 PMCL (F)
1,2-Dichloropropane	5	2.2-2.4	2.5	1	1.0-3.0	0.9	1	2.7-3.9	2.6	0.04	1.6-3.7	1.3	5 PMCL (P)
Trichloroethene	5	1.0-26	7.2	1	2.0-140	24.6	1	5.7-139	51.5	0.03	0.8-107	20	5 PMCL (F)
Benzene	5	2.0-19	5.1	1	2.0-17	4.5	1	2.2-18	9.6	0.2	1.1-9.9	3.1	5 PMCL (F)
Tetrachloroethene	5	2.0-50	10	1	3.0-66	15.3	1	9.9-109	33.6	0.03	0.6-88	17	5 PMCL (P)
Toluene	5	0.5-5.0	2.7	1	0.4-4.0	0.7	1			0.2	1.4	0.21	2,000 PMCL (P)
Ethylbenzene	5	1.0-10.0	2.8	1	2.0	0.6	1			0.2	0.6	0.14	700 PMCL (P)
Total xylenes	5	8.0-460	34.0	1	6.0-10.0	1.4	1	12	2.0	NL	0.1-6.1	4.2	10,000 PMCL (P)
1,2-Dichlorobenzene	10			1			1	4.7	1.3	0.4	0.5	0.23	600 PMCL (P)
1,4-Dichlorobenzene	10	5.3	5	1			1	17	3.8	0.3	0.7-25	3.1	75 PMCL (F)
Dibromochloromethane	5			1	7.0-11	1.9	1			0.9			100 NIPDWR
Chlorobenzene	5	1.5-52	8.3	1	137	11.9	1	1.8-125	50	0.25	0.9-2.9	0.04	100 PMCL (P)
Chloromethane	10	0.5-53	9	1			1			0.08	39	3.3	NAvail
1,1-Dichloroethene	5	2.0-11	3.3	1			1	1.0-10	0.9	0.13	0.8-3.4	0.07	7 PMCL (F)
Trichlorofluoromethane	NL			1			1	9.6	2.3	NL	0.8-10	1.4	NAvail
Chloroethane	10	5.2	5.01	1			1	1.8-5.6	1.0	0.52	2.3	0.43	NAvail

TABLE 3
COMPARISON OF AVAILABLE DATA FOR AREA C (μg/L)
INDUSTRIAL LANE SITE
NORTHAMPTON COUNTY, PENNSYLVANIA
PAGE TWO

Parameter	RI Data[1] (1984-1986)			AGES Data[2] (1989)			PADER Data[3] (1988, 1989)			GV Study Data[4] (1988)			Standard/ Criteria
	Q.L.	Range Detected	Average	Q.L.	Range Detected	Average	Q.L.	Range Detected	Average	Q.L.	Range Detected	Average	
1,1,2,2-Tetrachloro-ethane	5			1			1			0.03	2.6	0.23	NAvail
2-Butanone	10			1	0.4	0.5	1			NL			NAvail
Carbon disulfide	5			1			1			NL	0.2	0.06	NAvail
Bromodichloromethane	5			1	0.8	0.53	1						100 NIPDWR
4-Methyl-2-pentanone	10			1	0.4-0.5	0.5	1						NAvail
n-Butylbenzene	NL			1	0.2	0.48	1						NAvail
2-Hexanone	10			1	0.5	0.5	1						NAvail
Bromoform	5			1			1			0.20			NAvail
1,1,2-Trichloroethane	NL			1			1			0.20	2.7	0.23	NAvail
Vinyl acetate	10			1	1.0-2.0	0.8	1						NAvail
N-nitrosodiphenylamine	10	24-25	7.2	NA	----	----	NA	----	----	NA	----	----	NAvail
Bis(2-ethylhexyl) phthalate	10	6-160	17.7	NA	----	----	NA	----	----	NA	----	----	NAvail
Bis(2-chloroethyl)ether	10	3.0-6.0	5	NA	----	----	NA	----	----	NA	----	----	NAvail
Isophorone	10	27-52	13.0	NA	----	----	NA	----	----	NA	----	----	NAvail
o-Xylene	5			1	6.0-10.0	1.0	1						NAvail
sec-Butylbenzene	NL			1	0.7-3.0	0.73	1						NAvail
tert-Butylbenzene	NL			1	0.2	0.48	1						NAvail
1,2,4-Trimethylbenzene	NL			1	0.9-1.0	0.58	1						NAvail
1,3,5-Trimethylbenzene	NL			1	0.9	0.53	1						NAvail
Aluminum	200			NA	----	----	NA	----	---	NA	----	----	50 SMCL (P)
Arsenic	10			1	1.0-8.0 (1.0-2.0)	1.6 (0.9)	4-10			NA	----	----	50 NIPDWR
Barium	200	23-239 (26-213)	129 (112)	4-20	20-150 (30-130)	70.3 (47)	10	25-171 (23-135)	65 (55)	NA	----	----	1,000 NIPDWR 5,000 PMCL (P)

TABLE 3
COMPARISON OF AVAILABLE DATA FOR AREA C (µg/L)
INDUSTRIAL LANE SITE
NORTHAMPTON COUNTY, PENNSYLVANIA
PAGE THREE

Parameter	RI Data[1] (1984-1986)			AGES Data[2] (1989)			PADER Data[3] (1988, 1989)			GV Study Data[4] (1988)			Standard/ Criteria
	Q.L.	Range Detected	Average	Q.L.	Range Detected	Average	Q.L.	Range Detected	Average	Q.L.	Range Detected	Average	
Cadmium	5	5.1-10.0 (5.2)	3.5 (2.7)	1-20			0.2	0.4-4.2 (0.2-2.2)	1.9 (1.2)	NA	----	----	10 NIPDWR 5 PMCL (P)
Calcium	5,000	5,300-163,000 (4,090-161,000)	56,670 (57,723)	10	59,050-88,940 (50,000-81,000)	72,413 (66,650)	NL	63,200-101,000 (65,000-87,000)	78,733 (75,000)	NA	----	----	NAvail
Chromium	10	8-94 (4.4)	21 (5)	8-20	40-100 (10-60)	21.1 (12.6)	4	6.2-9.0	4.9	NA	----	----	50 NIPDWR 100 PMCL (P)
Copper	25	8-551	53.9	6			10	11.0-30.0 (11-12)	16.1 (9.0)	NA	----	----	1,000 SMCL (F) 1,300 PCML (P)
Iron	100	13,400-149,000 (213-66,400)	56,061 (13,104)	20	1,480-25,500 (260-10,400)	9,021 (3,073)	NL	990-41,100 (551-2,050)	12,518 (1,230)	NA	----	----	300 SMCL (F)
Lead	5	12.5-100	23.4	1	9-10	2.1	4	30.5-103.0	31.0	NA	----	----	50 NIPDWR 5 PMCL (P) at source
Magnesium	5,000	10,700-110,000 (14,000-110,000)	34,051 (35,705)	30	2,970-60,000 (2,610-62,000)	10,500 (17,052)	NL	35,600-75,200 (35,600-43,200)	44,670 (39,550)	NA	----	----	NAvail
Manganese	15	90-11,330 (111-10,300)	2,796 (2,749)	2	5.0-9,190 (4.0-7,580)	2,765 (2,410)	10	15-9,750 (449-9,630)	4,769 (5,657)	NA	----	----	50 SMCL (F)
Mercury	0.2	0.2-1.0	0.3	0.4-0.5	3.0-14.6 (1.2-4.0)	3.6 (1)	1			NA	----	----	2 NIPDWR 2 PMCL (P)
Nickel	40	13-125 (15-107)	59 (36)	NA	----	----	NA	----	----	NA	----	----	100 PMCL (P)
Potassium	5,000	3,030-10,310 (1,500-11,930)	5,924 (5,619)	10	270-6,600 (240-5,500)	2,694 (2,345)	NL	3,150-7,660 (3,040-4,500)	4,289 (3,720)	NA	----	----	NAvail

TABLE 3
COMPARISON OF AVAILABLE DATA FOR AREA C (µg/L)
INDUSTRIAL LANE SITE
NORTHAMPTON COUNTY, PENNSYLVANIA
PAGE FOUR

Parameter	RI Data(1) (1984-1986)			AGES Data(2) (1989)			PADER Data(3) (1988, 1989)			GV Study Data(4) (1988)			Standard/ Criteria
	Q.L.	Range Detected	Average	Q.L.	Range Detected	Average	Q.L.	Range Detected	Average	Q.L.	Range Detected	Average	
Selenium	5			2-80			6-30	6.9	3.4	NA	----	----	10 NIPDWR 50 PMCL (P)
Silver	10	5.4-12.0 (5.7-6.9)	6 (5.2)	1-7	8.0-37 (7.0)	5.5 (1.1)	10			NA	----	----	50 NIPDWR
Sodium	5,000	27,010-76,800 (27,620-77,600)	46,760 (40,061)	200	7,900-72,000 (6,000-71,000)	33,260 (32,660)	NL	9,100-70,700 (8,110-39,700)	29,717 (23,920)	NA	----	----	NAvail
Vanadium	50	4.7-22.0 (5.0-5.4)	21.4 (22.7)	NA	----	----	NA	----	----	NA	----	----	NAvail
Zinc	20	83-3,970 (67-757)	604 (194)	2	159-925 (121-799)	350 (253)	10	34-1,260 (110-812)	502 (515)	NA	----	----	5,000 SMCL (F)
Tin	NL	35		NA	----	----	NA	----	----	NA	----	----	NAvail
Beryllium	5	1.0-1.9	2.4	NA	----	----	NA	----	----	NA	----	----	200 DWEL
Cobalt	50	4.3-25 (11-18)	21.3 (23.2)	NA	----	----	NA	----	----	NA	----	----	NAvail

Filtered metals results presented in parentheses. Arithmetic average calculated using 1/2 detection limit.
P Proposed.
F Final.
T Tentative.
QL Quantitation limit.
NL QL not listed.
PMCL Federal Safe Drinking Water Act (SDWA) Primary Maximum Contaminant Levels.
SMCL Federal SDWA Secondary Maximum Contaminant Level.
DWEL Drinking Water Equivalent level.
NIPDWR National Interim Primary Drinking Water Regulation.
NAvail Indicates not available.
NA or ---- Indicates samples were not analyzed.
A blank space or ND indicates that the chemical was not detected.
(1) Data collected during 1984-1986 Remedial Investigation conducted by NUS Corporation. Contract required detection limits (CRDL) presented.
(2) Data collected quarterly for the owners of Chrin Brothers Sanitary Landfill by Applied Geotechnical and Environmental Service Corporation (AGES). Quantitation limits are those observed in data package.
(3) Data collected by the Pennsylvania Department of Environmental Resources (PADER). Quantitation limits are those observed in data package.
(4) Data collected as a result of Groundwater Validation Study conducted by ICF Technology, Inc. (1988). EPA 601/602 quantitation limits presented.

TABLE 4

COMPARISON OF AVAILABLE DATA FOR AREA D (µg/L)
INDUSTRIAL LANE SITE
NORTHAMPTON COUNTY, PENNSYLVANIA

Parameter	RI Data[1] (1984-1986)			GV Study Data[2] (1988)			Standard/ Criteria
	Q.L.	Range Detected	Average	Q.L.	Range Detected	Average	
Methylene chloride	5			0.25	11.2	5.7	5 PMCL (T)
Chloroform	5			0.05	11.9	6.9	100 NIPDWR
Trichloroethene	5			0.03	3.9	2	5 PMCL (F)
Benzene	5	2.0-9.0		0.2			5 PMCL (F)
Toluene	5			0.2	1.2	0.65	2,000 PMCL (P)
Bis(2-ethylhexyl)phthalate	10	63-67	35	NA	----	----	NAvail
Isophorone	10	12	6.8	NA	----	----	NAvail
Aluminum	200	467-699	439	NA	----	----	50 SMCL (P)
Arsenic	10			NA	----	----	50 NIPDWR
Barium	200	33-41 (20-34)	35.8 (28.8)	NA	----	----	1,000 NIPDWR 5,000 PMCL (P)
Cadmium	5			NA	----	----	10 NIPDWR 5 PMCL (P)
Calcium	5,000	43,100-101,000 (39,000-97,300)	62,332 (54,923)	NA	----	----	NAvail
Chromium	10	38-64	51	NA	----	----	50 NIPDWR 100 PMCL (P)
Copper	25	12-41	20	NA	----	----	1,000 SMCL (F) 1,300 PMCL (P)
Iron	100	8,429-51,500 (153)	31,767 (76)	NA	----	----	300 SMCL (F)
Lead	5	6.9-15.4	6.8	NA	----	----	50 NIPDWR 5 PMCL (P) at source
Magnesium	5,000	18,200-50,500 (16,720-48,400)	37,378 (35,758)	NA	----	----	NAvail

ABLE 4
COMPARISON OF AVAILABLE DATA FOR AREA D (µg/L)
INDUSTRIAL LANE SITE
NORTHAMPTON COUNTY, PENNSYLVANIA
PAGE TWO

Parameter	RI Data(1) (1984-1986)			GV Study Data(2) (1988)			Standard/ Criteria
	Q.L.	Range Detected	Average	Q.L.	Range Detected	Average	
Manganese	15	77-744 (14-146)	396 (77)	NA	----	----	50 SMCL (F)
Mercury	0.2			NA	----	----	2 NIPDWR 2 PMCL (P)
Nickel	40	33-42	20.8	NA	----	----	100 PMCL (P)
Potassium	5,000	19,420-39,440 (18,850-40,170)	26,390 (26,505)	NA	----	----	NAvail
Selenium	5	21 (27-36)	7.1 (17)	NA	----	----	10 NIPDWR 50 PMCL (P)
Silver	10	3.3	4.6	NA	----	----	50 NIPDWR
Sodium	5,000	34,470-47,690 (36,240-48,440)	39,715 (40,695)	NA	----	----	NAvail
Vanadium	50	6.0-6.5	15.6	NA	----	----	NAvail
Zinc	20	72-1,130 (345)	466 (94)	NA	----	----	5,000 SMCL (F)
Cobalt	50	5.4	20.1	NA	----	----	NAvail

Arithmetic average calculated using 1/2 detection limits.
P Proposed.
F Final.
T Tentative.
Filtered metals results presented in parentheses.
PMCL Federal Safe Drinking Water Act (SDWA) Primary Maximum Contaminant Levels.
SMCL Federal SDWA Secondary Maximum Contaminant Level.
QL Quantitation limit.
NIPDWR National Interim Primary Drinking Water Regulation.
NAvail Indicates not available.
NA or ---- Indicates samples were not analyzed.
A blank space or ND indicates that the chemical was not detected.
(1) Data collected during 1984-1986 Remedial Investigation conducted by NUS Corporation. CRDL quantitation limits presented.
(2) Data collected quarterly for the owners of Chrin Brothers Sanitary Landfill by Applied Geotechnical and Environmental Service Corporation (AGES). Quantitation limits observed in data package.

TABLE 5
COMPARISON OF AVAILABLE DATA FOR AREA E (μg/L)
INDUSTRIAL LANE SITE
NORTHAMPTON COUNTY, PENNSYLVANIA

Parameter	RI Data(1) (1984-1986)			GV Study Data(2) (1988)			Standard/ Criteria
	Q.L.	Range Detected	Average	Q.L.	Range Detected	Average	
1,1-Dichloroethane	5	2.7-3.0	2.8	0.7	0.3-6.8	3.1	NAvail
trans-1,2-Dichloroethene	5			0.10	0.7-1.3	0.53	100 PMCL (P)
cis-1,2-Dichloroethene	5			NL	2.0	0.54	70 PMCL (P)
Chloroform	5	5.0	3.1	0.05	1.0-3.8	1.9	100 NIPDWR
1,1,1-Trichloroethane	5	3.0-7.0	4.2	0.03	0.6-4.7	2.8	200 PMCL (F)
1,2-Dichloropropane	5			0.04	1.1	0.29	5 PMCL (P)
Trichloroethene	5	1.0	2.1	0.03	2.4-4.2	2.5	5 PMCL (F)
Benzene	5	4.2-25	8.6	0.2	15	4.0	5 PMCL (F)
Tetrachloroethene	5	10	4.4	0.03	1.6-3.0	1.8	5 PMCL (P)
Toluene	5			0.2	2.2	0.63	2,000 PMCL (P)
Dibromochloromethane	5			NL	1.1	0.31	100 NIPDWR
1,1-Dichloroethene	5			0.13	0.7-0.9	0.43	7 PMCL (F)
1,1,2,2-Tetrachloroethane	5			0.03	5.8	1.5	NAvail
Bis(2-ethylhexyl)phthalate	10	73-94	44	NA	----	----	NAvail
Isophorone	10	66-140	54	NA	----	----	NAvail
Aluminum	200	673-3,200	1,303	NA	----	----	50 SMCL (P)
Barium	200	22-32 (15-23)	46 (20)	NA	----	----	1,000 NIPDWR 5,000 PMCL (P)
Calcium	5,000	24,250-48,600 (15,700-31,800)	35,340 (22,795)	NA	----	----	NAvail
Chromium	10	34-104	52	NA	----	----	50 NIPDWR 100 PMCL (P)
Copper	25	17-34	21	NA	----	----	1,000 SMCL (F) 1,300 PMCL (P)
Iron	100	2,802-16,100	8,204	NA	----	----	300 SMCL (F)

TABLE 14

The nine criteria for the evaluation of remedial alternatives are summarized below.

Overall Protection of Human Health and the Environment: whether each alternative provides adequate protection of human health and the environment and describes how risks posed through each exposure pathway are eliminated, reduced or controlled through treatment, engineering controls, or institutional controls.

Compliance with ARARs: whether each alternative will meet all of the Applicable or Relevant and Appropriate Requirements (ARARs) of Federal and State environmental laws and/or justifies invoking a waiver; whether a remedy complies with advisories, criteria and guidance that EPA and PADER have agreed to follow.

Long-term Effectiveness and Permanence: the ability of a remedy to maintain reliable protection of human health and the environment over time, once clean-up goals have been met.

Reduction of Toxicity, Mobility, or Volume through Treatment: addresses the statutory preference for selecting remedial actions that employ treatment technologies that permanently and significantly reduce the toxicity, mobility or volume of hazardous substances.

Short-term Effectiveness: the period of time needed to achieve protection and any adverse impacts on human health and the environment that may be posed during the construction and implementation period, until clean-up goals are achieved.

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

Cost: estimated capital, operation & maintenance (O&M), and net present worth costs.

State/Support Agency Acceptance: whether the state concurs with, opposes, or has no comment regarding the preferred alternative.

Community Acceptance: the public's general response to the alternatives which will be assessed in the Record of Decision following a review of the public comments received on the administrative record and the proposed plan.

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF ENVIRONMENTAL RESOURCES
Office of Environmental Protection
90 East Union Street - 2nd Floor
Wilkes-Barre, Pennsylvania 18701-3296
(717) 826-2511

March 29, 1991

Mr. Edwin B. Erickson
Regional Administrator
U. S. Environmental Protection Agency
Region III
841 Chestnut Building
Philadelphia, PA 19107

Dear Mr. Erickson:

The Record of Decision received March 28, 1991 for the second operable unit, which addresses groundwater contamination at the Industrial Lane Site, in Williams Township, Northampton County, has been reviewed by the Department.

The major components of the selected remedy include:

* Closure and capping of the unlined area of the Chrin Landfill according to PA DER Municipal Waste Management Regulations.

* Groundwater extraction, treatment, and discharge to the Lehigh River. The clean-up goal for the groundwater is "background" concentrations as defined by the detection limits of EPA Methods 601 and 602 for volatile organics.

* Long-term monitoring of the closure and the ground water.

I hereby concur with the EPA's proposed remedy with the following conditions:

* The Department will be given the opportunity to concur with decisions related to the design of the Remedial Action for the Groundwater Operable Unit, to assure compliance with DER cleanup ARARs and design specific ARARs.

* The Department will be given the opportunity to concur with decisions related to subsequent operable units (if identified), and evaluate appropriate remedial alternatives to assure compliance with DER cleanup ARARs and design specific ARARs.

* EPA will assure that the Department is provided an opportunity to fully participate in any negotiations with responsible parties.

* The Department will reserve our right and responsibility to take independent enforcement actions pursuant to state law.

* This concurrence with the selected remedial action is not intended to provide any assurances pursuant to SARA Section 104(c)(3).

* The Department agrees with the proposed remediation which provides that "background" quality is the objective of the groundwater remediation plan. In the event that EPA modifies its position on the cleanup standard, and deviates from background quality as the remediation goal, DER will withdraw its concurrence. At that time, EPA must demonstrate the impracticability of achieving background quality, and give DER a meaningful opportunity to reconcur by way of an Explanation of Significant Differences or a Record of Decision Amendment.

Thank you for the opportunity to concur with this EPA Record of Decision. If you have any questions regarding this matter, please do not hesitate to contact me.

Sincerely,

Ed Shoener
Regional Environmental
Protection Director

TABLE 12

GROUND WATER CLEANUP LEVELS (ug/l)

INDUSTRIAL LANE SITE
NORTHAMPTON COUNTY, PENNSYLVANIA

Contaminant	Background Scenario(1)
Vinyl chloride	0.18
Methylene chloride	0.25
1,1-Dichloroethane	0.07
trans-1,2-Dichloroethene	0.10
cis-1,2-Dichloroethene	0.12(2)
Chloroform	0.05
1,2-Dichloroethane	0.03
1,1,1-Trichloroethane	0.03
Carbon tetrachloride	0.12
1,2-Dichloropropane	0.04
Benzene	0.2
Tetrachloroethene	0.03
1,4-Dichlorobenzene	0.3
Chlorobenzene	0.2
1,1-Dichloroethene	0.13
Trichloroethene	0.03

(1) Method 601/602 Detection Limits (40 CFR Part 136) used except where noted.

(2) Method 524.2 Detection Limit (40 CFR Part 141).

TABLE 13

INDUSTRIAL LANE

ESTIMATED REMEDIAL ACTION COSTS

(IN DOLLARS)

Alternative	*Capital	*O & M	*Present Worth
1. No Action	108,000	121,000 annual 20,000 every 5 yrs.	2,027,000
2. Access Restrictions	108,000	121,000 annual 20,000 every 5 yrs.	2,027,000
3A. Extraction/ Treatment/ Discharge to Lehigh River	4,326,000	536,000(yr.1) 498,000 (yr.2-45) 20,000 every 5 yrs.	12,775,000
3B. Extraction/ Treatment/ Discharge to POTW	3,093,000	2,475,000 (yr.1) 2,453,000 (yr.2-45) 20,000 every 5 yrs.	44,318,000
4. Extraction/ Treatment/ Reinjection	4,834,000	551,000 (yr. 1) 512,000 (yr.2-22) 121,000 (yr.23-30) 20,000 every 5 yrs.	11,937,000

Municipal Landfill Cap (Clay) - $8,000,000 (Capital Costs only)

* Exclusive of landfill closure costs.

TABLE 11

SUMMARY OF RISK ANALYSIS RESULTS FOR AREA E[1]
INDUSTRIAL LANE SITE
NORTHAMPTON COUNTY, PENNSYLVANIA

Parameter	Hazard Quotients			Excess Lifetime Cancer Risk		
	Route of Exposure		Total	Route of Exposure		Total
	Ingestion/Dermal Contact During Bathing	Inhalation During Showering		Ingestion/Dermal Contact During Bathing	Inhalation During Showering	
Benzene	-	-	-	1.3×10^{-5}	6.2×10^{-6}	1.9×10^{-5}
1,1,1-Trichloroethane	1.5×10^{-3}	1.8×10^{-4}	1.7×10^{-3}	-	-	-
1,1-Dichloroethane	1.9×10^{-3}	8.8×10^{-4}	2.8×10^{-3}	—	—	—
Tetrachloroethene	8.6×10^{-3}	-	8.6×10^{-3}	4.4×10^{-6}	1.0×10^{-7}	4.5×10^{-6}
Trichloroethene	-	-	-	1.3×10^{-6}	8.2×10^{-7}	2.1×10^{-6}
1,1-Dichloroethene	2.9×10^{-3}	-	2.9×10^{-3}	1.6×10^{-5}	1.4×10^{-5}	3.0×10^{-5}
1,2-Dichloroethene	9.5×10^{-3}	-	9.5×10^{-3}	-	-	-
Chloroform	1.1×10^{-2}	-	1.1×10^{-2}	6.6×10^{-7}	3.6×10^{-6}	4.2×10^{-6}
1,2-Dichloropropane	-	-	-	2.1×10^{-6}	-	2.1×10^{-6}
TOTAL FOR VOCs			0.04			6.2×10^{-5}
Bis(2-ethylhexyl)phthalate	1.3×10^{-1}	-	1.3×10^{-1}	3.8×10^{-5}	-	3.8×10^{-5}
Isophorone	$1. \times 10^{-3}$	-	1.9×10^{-3}	1.5×10^{-5}	-	1.5×10^{-5}
TOTAL FOR SEMIVOLATILES			0.13			5.3×10^{-5}

TABLE 11
SUMMARY OF RISK ANALYSIS RESULTS FOR AREA E[1]
INDUSTRIAL LANE SITE
NORTHAMPTON COUNTY, PENNSYLVANIA
PAGE TWO

Parameter	Hazard Quotients			Excess Lifetime Cancer Risk		
	Route of Exposure		Total	Route of Exposure		Total
	Ingestion/Dermal Contact During Bathing	Inhalation During Showering		Ingestion/Dermal Contact During Bathing	Inhalation During Showering	
Chromium	5.8×10^{-1} (ND)	-	5.8×10^{-1}	-	-	-
Lead	9.9×10^{-1} (ND)	-	9.9×10^{-1}	-	-	-
Mercury	- (ND)	-	-	-	-	-
Manganese	1.9×10^{-2} (ND)	-	1.9×10^{-2}	-	-	-
TOTAL FOR METALS			1.6			
TOTAL FOR ALL CHEMICALS OF CONCERN		Hazard Index	1.77 (0.17)		Cancer Risk	1.1×10^{-4}

[1] Refer to footnotes presented on Table 1-21

TABLE 9
SUMMARY OF RISK ANALYSIS RESULTS FOR AREA C
INDUSTRIAL LANE SITE
NORTHAMPTON COUNTY, PENNSYLVANIA
PAGE TWO

Parameter	Hazard Quotients			Excess Lifetime Cancer Risk		
	Route of Exposure		Total	Route of Exposure		Total
	Ingestion/Dermal Contact During Bathing	Inhalation During Showering		Ingestion/Dermal Contact During Bathing	Inhalation During Showering	
Bis(2-ethylhexyl)phthalate	5.5×10^{-2}	-	5.5×10^{-2}	1.6×10^{-5}	-	1.6×10^{-5}
Isophorone	2.9×10^{-4}	-	2.9×10^{-4}	2.3×10^{-6}	-	2.3×10^{-6}
TOTAL FOR SEMIVOLATILES			5.5×10^{-2}			1.8×10^{-5}
Chromium	1.5×10^{-1} (1.0×10^{-1})	-	1.5×10^{-1} (1.0×10^{-1})	-	-	-
Lead	5.5×10^{-1} (ND)	-	5.5×10^{-1}	-	-	-
Mercury	4.1×10^{-1} (1.3×10^{-1})	-	4.1×10^{-1} (1.3×10^{-1})	-	-	-
Manganese	6.1×10^{-1} (5.8×10^{-1})	-	6.1×10^{-1} (5.8×10^{-1})	-	-	-
TOTAL FOR METALS			1.72 (0.81)	TOTAL CANCER RISK		
TOTAL FOR ALL CHEMICALS OF CONCERN		Hazard Index	2.3 (1.4)		Cancer Risk	7.8×10^{-4}

1 Refer to footnotes presented on Table 1-21

TABLE 10

SUMMARY OF RISK ANALYSIS RESULTS FOR AREA D[1]
INDUSTRIAL LANE SITE
NORTHAMPTON COUNTY, PENNSYLVANIA

Parameter	Hazard Quotients			Excess Lifetime Cancer Risk		
	Route of Exposure		Total	Route of Exposure		Total
	Ingestion/Dermal Contact During Bathing	Inhalation During Showering		Ingestion/Dermal Contact During Bathing	Inhalation During Showering	
Trichloroethene	-	-	-	1.2×10^{-6}	7.8×10^{-7}	2.0×10^{-6}
Chloroform	3.4×10^{-2}	-	3.4×10^{-2}	2.1×10^{-6}	1.1×10^{-5}	1.3×10^{-5}
Methylene Chloride	5.3×10^{-3}	1.7×10^{-4}	5.5×10^{-3}	2.4×10^{-6}	2.0×10^{-6}	4.5×10^{-6}
TOTAL FOR VOCs			4×10^{-2}			1.9×10^{-5}
Bis(2ethylhexyl)phthalate	9.6×10^{-2}	-	9.6×10^{-2}	2.7×10^{-5}	-	2.7×10^{-5}
Isophorone	1.7×10^{-4}	-	1.7×10^{-4}	1.4×10^{-6}	-	1.4×10^{-6}
TOTAL FOR SEMIVOLATILES			0.1			2.8×10^{-5}
Chromium	3.7×10^{-1} (ND)	-	3.7×10^{-1}	-	-	-
Lead	2.9×10^{-1} (ND)	-	2.9×10^{-1}	-	-	-
Mercury	-	-	-	-	-	-
Manganese	1.1×10^{-1} (2.4×10^{-2})	-	1.1×10^{-1} (2.4×10^{-2})	-	-	-
TOTAL FOR METALS			0.77 (2.4×10^{-2})			
TOTAL FOR ALL CHEMICALS OF CONCERN			0.87 (0.16)		Cancer Risk	4.7×10^{-5}

1 Refer to footnotes presented on Table 1-21

TABLE 8

SUMMARY OF RISK ANALYSIS RESULTS FOR AREA B[1]
INDUSTRIAL LANE SITE
NORTHAMPTON COUNTY, PENNSYLVANIA

Parameter	Hazard Quotients			Excess Lifetime Cancer Risk		
	Route of Exposure		Total	Route of Exposure		Total
	Ingestion/Dermal Contact During Bathing	Inhalation During Showering		Ingestion/Dermal Contact During Bathing	Inhalation During Showering	
Benzene	-	-	-	2.9×10^{-7}	1.4×10^{-7}	4.3×10^{-7}
1,1,1-Trichloroethane	2.9×10^{-5}	3.5×10^{-6}	3.2×10^{-5}	-	-	-
1,2-Dichloroethane	-	-	-	8.9×10^{-7}	3.4×10^{-7}	1.2×10^{-6}
Tetrachloroethene	2.6×10^{-4}	-	2.6×10^{-4}	1.3×10^{-7}	3.2×10^{-9}	1.4×10^{-7}
1,2-Dichloroethene	9.7×10^{-4}	-	9.7×10^{-4}	-	-	-
Chloroform	4.0×10^{-3}	-	4.0×10^{-3}	2.5×10^{-7}	1.3×10^{-6}	1.5×10^{-6}
TOTAL FOR VOCs			5.3×10^{-3}			3.3×10^{-6}
Bis(2ethylhexyl)phthalate	1.9×10^{-2}	-	1.9×10^{-2}	5.2×10^{-6}	-	5.2×10^{-6}
TOTAL FOR SEMIVOLATILES			1.9×10^{-2}			5.2×10^{-6}
Chromium	1.6×10^{-1} (5.5×10^{-2})	-	1.6×10^{-1} (5.5×10^{-2})	-	-	-
Lead	1.6 (ND)	-	1.6	-	-	-
Mercury	2.4×10^{-1} (1.8×10^{-1})	-	2.4×10^{-1} (1.8×10^{-1})	-	-	-
Manganese	2.1×10^{-2} (1.8×10^{-2})	-	2.0×10^{-2} (1.8×10^{-2})	-	-	-
TOTAL FOR METALS			2 (0.25)			
TOTAL FOR ALL CHEMICALS OF CONCERN		Hazard Index	2.0 (0.27)		Cancer Risk	8.5×10^{-6}

1 Refer to footnotes presented on Table 1-21.

TABLE 9

SUMMARY OF RISK ANALYSIS RESULTS FOR AREA C[1]
INDUSTRIAL LANE SITE
NORTHAMPTON COUNTY, PENNSYLVANIA

Parameter	Hazard Quotients			Excess Lifetime Cancer Risk		
	Route of Exposure		Total	Route of Exposure		Total
	Ingestion/Dermal Contact During Bathing	Inhalation During Showering		Ingestion/Dermal Contact During Bathing	Inhalation During Showering	
Benzene	-	-	-	6.5×10^{-6}	3.1×10^{-6}	9.6×10^{-6}
Chlorobenzene	3.4×10^{-3}	5.7×10^{-3}	9.1×10^{-3}	-	-	-
1,4-Dichlorobenzene	-	7.6×10^{-4}	7.6×10^{-4}	9.9×10^{-6}	-	9.9×10^{-6}
1,1,1-Trichloroethane	1.1×10^{-2}	1.3×10^{-3}	1.2×10^{-2}	-	-	-
1,1-Dichloroethane	2.5×10^{-2}	1.1×10^{-2}	3.5×10^{-2}		-	
1,2-Dichloroethane	-	-	-	5.5×10^{-6}	2.1×10^{-6}	7.6×10^{-6}
Tetrachloroethene	1.2×10^{-1}	-	1.2×10^{-1}	5.8×10^{-5}	1.4×10^{-6}	6.0×10^{-5}
Trichloroethene	-	-	-	1.6×10^{-5}	1.0×10^{-5}	2.6×10^{-5}
1,1-Dichloroethene	8.0×10^{-3}	-	8.0×10^{-3}	4.3×10^{-5}	4.0×10^{-5}	8.2×10^{-5}
1,2-Dichloroethene	1.9×10^{-1}	-	1.9×10^{-1}	-	-	-
Vinyl chloride	-	-	-	4.8×10^{-4}	3.3×10^{-5}	5.1×10^{-4}
Carbon tetrachloride	1.2×10^{-1}	-	1.2×10^{-1}	1.0×10^{-5}	4.0×10^{-6}	1.4×10^{-5}
Chloroform	2.0×10^{-2}	-	2.0×10^{-2}	1.2×10^{-6}	6.6×10^{-6}	7.8×10^{-6}
Methylene chloride	3.2×10^{-2}	9.8×10^{-4}	3.3×10^{-2}	1.4×10^{-5}	1.2×10^{-5}	2.6×10^{-5}
1,2-Dichloropropane	-	-	-	5.5×10^{-6}	-	5.5×10^{-6}
TOTAL FOR VOCs			0.55			7.6×10^{-4}

TABLE 7

SUMMARY OF RISK ANALYSIS RESULTS FOR AREA A(1)

INDUSTRIAL LANE SITE

NORTHAMPTON COUNTY, PENNSYLVANIA

Parameter	Hazard Quotients			Excess Lifetime Cancer Risk		
	Route of Exposure		Total	Route of Exposure		Total
	Ingestion/Dermal Contact During Bathing	Inhalation During Showering		Ingestion/Dermal Contact During Bathing	Inhalation During Showering	
1,1,1-Trichloroethane	1.8×10^{-3}	2.2×10^{-4}	2.0×10^{-3}	-	-	-
1,1-Dichloroethane	5.8×10^{-4}	2.5×10^{-4}	8.3×10^{-4}	-	-	-
1,2-Dichloroethane	-	-	-	2.3×10^{-7}	9.0×10^{-8}	3.2×10^{-7}
Tetrachloroethene	2.6×10^{-4}	-	2.6×10^{-4}	1.3×10^{-7}	3.2×10^{-9}	1.4×10^{-7}
Trichloroethene	-	-		2.8×10^{-7}	1.8×10^{-7}	4.6×10^{-7}
1,2-Dichloroethene	1.1×10^{-2}	-	1.1×10^{-2}	-	-	-
Carbon tetrachloride	7.0×10^{-2}	-	7.0×10^{-2}	6.4×10^{-6}	2.4×10^{-6}	8.8×10^{-6}
Chloroform	7.4×10^{-3}	-	7.4×10^{-3}	4.5×10^{-7}	2.4×10^{-6}	2.9×10^{-6}
1,2-Dichloropropane	-	-	-	5.8×10^{-6}	-	5.8×10^{-6}
TOTAL FOR VOCs			0.09			1.8×10^{-5}
Bis(2ethylhexyl)phthalate	2.5×10^{-1}	-	2.5×10^{-1}	7.0×10^{-5}	-	7.0×10^{-5}
Isophorone	1.1×10^{-3}	-	1.1×10^{-3}	8.8×10^{-6}	-	8.8×10^{-6}
TOTAL FOR SEMIVOLATILES			0.25			7.9×10^{-5}

TABLE 7

SUMMARY OF RISK ANALYSIS RESULTS FOR AREA A(1)
INDUSTRIAL LANE SITE
NORTHAMPTON COUNTY, PENNSYLVANIA
PAGE TWO

Parameter	Hazard Quotients			Excess Lifetime Cancer Risk		
	Route of Exposure		Total	Route of Exposure		Total
	Ingestion/Dermal Contact During Bathing	Inhalation During Showering		Ingestion/Dermal Contact During Bathing	Inhalation During Showering	
Chromium	1.1×10^{-1} (4.9×10^{-2})	-	1.1×10^{-1} (4.9×10^{-2})	-	-	-
Lead	2.4×10^{-1} (ND)	-	2.4×10^{-1}	-	-	-
Mercury	3.2×10^{-1} (2.1×10^{-1})	-	3.2×10^{-1} (2.1×10^{-1})	-	-	-
Manganese	6.8×10^{-2} (6.5×10^{-2})	-	6.8×10^{-2} (6.5×10^{-2})	-	-	-
TOTAL FOR METALS			0.74 (0.32)			-
TOTAL FOR ALL CHEMICALS OF CONCERN		Hazard Index	1.08 (0.66)		Cancer Risk	1.0×10^{4}

Risk analysis calculations presented in Appendix C. The exposure doses for the ingestion and dermal contact route of exposure were calculated as presented in Appendix C, summed, and then evaluated using the RfD for the oral route of exposure.
Risk analysis results for filtered metals presented in parentheses.
'-' indicates toxicity criteria not available.
(1) Cancer risks associated with VOC concentrations in C-11 were estimated separate from other Area A wells because C-11 was more contaminated with VOCs than other Area A wells. The cancer risk associated with the VOC concentrations detected in C-11 is 3.7×10^{-4}:

Benzene - 3.1×10^{-6}	Vinyl Chloride - 1.7×10^{-4}	Methylene Chloride 2.1×10^{-6}
1,4-Dichlorobenzene - 2.3×10^{-6}	Chloroform - 1.8×10^{-6}	Trichloroethene - 2.6×10^{-6}
Tetrachloroethene - 2.5×10^{-5}	1,2-Dichloropropane - 7.4×10^{-6}	1,1-Dichloroethene - 1.6×10^{-4}

The hazard quotients associated with the VOC concentrations detected in C-11 are:

Chlorobenzene - 3.5×10^{-2}	1,1-Dichloroethane - 3.1×10^{-2}	1,2-Dichloroethene - 2.0×10^{-2}
1,4-Dichlorobenzene - 1.8×10^{-4}	Tetrachloroethene - 4.9×10^{-2}	Chloroform - 4.6×10^{-3}
1,1,1,-Trichloroethane - 2.4×10^{-2}	1,1-Dichloroethene - 1.5×10^{-2}	Methylene Chloride - 2.7×10^{-3}

TABLE 6

CHEMICALS OF CONCERN
INDUSTRIAL LANE SITE
NORTHAMPTON COUNTY, PENNSYLVANIA

Contaminants That Are Known or Probable Carcinogens*		Noncarcinogenic Contaminants
Vinyl chloride	A	1,2-Dichloroethene (cis-/trans-)
Methylene chloride **	B2	1,1,1-Trichloroethane
1,1-Dichloroethane **	C	Chlorobenzene
Chloroform **	B2	Mercury
1,2-Dichloroethane	B2	Manganese
Carbon tetrachloride **	B2	
1,2-Dichloropropane	B2	
Trichloroethene	B2	
Benzene	A	
Tetrachloroethene **	B2	
1,4-Dichlorobenzene	B2	
1,1-Dichloroethene **	C	
Bis(2-ethylhexyl)phthalate	B2	
Isophorone	C	
Chromium (VI)***	A	
Lead **	B2	

* Carcinogens are classified by the EPA according to the following weight-of-evidence categories:

A Human Carcinogen:
Sufficient evidence from epidemiologic studies to support a causal association between exposure and cancer.

B1 Probable Human Carcinogen:
Limited evidence of carcinogenicity of humans from epidemiologic studies.

B2 Probable Human Carcinogen:
Sufficient evidence of carcinogenicity in animals; inadequate evidence of carcinogenicity in humans.

C Possible Human Carcinogen:
Limited evidence of carcinogenicity in animals.

** These compounds also have EPA established reference doses that allow evaluation of potential adverse noncarcinogenic effects.

*** Chromium (VI) is not carcinogenic via the ingestion route of exposure.

TABLE 5
COMPARISON OF AVAILABLE DATA FOR AREA E (μg/L)
INDUSTRIAL LANE SITE
NORTHAMPTON COUNTY, PENNSYLVANIA
PAGE TWO

Parameter	RI Data(1)			GV Study Data(2)			Standard/ Criteria
	Q.L.	Range Detected	Average	Q.L.	Range Detected	Average	
Lead	5	7.3-57	17.3	NA	----	----	50 NIPDWR 5 PMCL (P) at source
Magnesium	5,000	8,981-33,800 (8,377-18,400)	20,300 (13,574)	NA	----	----	NAvail
Manganese	15	54-136 (6.4)	98.3 (7.2)	NA	----	----	50 SMCL (F)
Nickel	40	26-69	34	NA	----	----	100 PMCL (P)
Potassium	5,000	5,260-6,100 (2,480-6,662)	4,950 (4,396)	NA	----	----	NAvail
Sodium	5,000	4,012-13,290 (4,683-14,320)	5,776 (6,080)	NA	----	----	NAvail
Vanadium	50	4.1-8.1	15.6	NA	----	----	NAvail
Zinc	20	47-67	33.5	NA	----	----	5,000 SMCL (F)
Cobalt	50	5.7-7.8	15.5	NA	----	----	NAvail
Thallium	10	10 (10)	2.9	NA	----	----	NAvail

Arithmetic average calculated using 1/2 detection limit.
P Proposed.
F Final.
T Tentative.
QL Quantitation limit.
Filtered metals results presented in parentheses.
PMCL Federal Safe Drinking Water Act (SDWA) Primary Maximum Contaminant Levels.
SMCL Federal SDWA Secondary Maximum Contaminant Level.
DWEL Drinking Water Equivalent level.
NIPDWR National Interim Primary Drinking Water Regulation.
NAvail Indicates not available.
NA or ---- Indicates samples were not analyzed.
A blank space or ND indicates that the chemical was not detected.
(1) Data collected during 1984-1986 Remedial Investigation conducted by NUS Corporation. CR. quantitation limits presented.
(2) Data collected quarterly for the owners of Chrin Brothers Sanitary Landfill by Applied Geotechnical and Environmental Service Corporation (AGES). Quantitation limits are those observed in data package.