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Superfund Record of Decision:

Hertel Landfill, NY

50272-101

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15. Supplementary Notes

16. Abstract (Limit: 200 words)

The 80-acre Hertel Landfill site consists of a 13-acre former municipal landfill and adjacent land in Plattekill, Ulster County, New York. Land use in the area is predominantly residential, with wetland areas adjacent to the site. The site overlies two natural aquifers. From 1963 to 1975, Hertel Enterprises used the site for the disposal of municipal solid waste. In 1975, the landfill was purchased by Dutchess Sanitation Services, which had been hauling and disposing of refuse from Dutchess County in the Hertel Landfill since 1970. It is estimated that 240,000 cubic yards of waste were disposed onsite during landfill operations. In 1976, the site was shut down for a variety of violations, including illegal dumping of industrial wastes and violating a town ordinance prohibiting the disposal of non-local waste. As a result of these improper disposal practices, a number of State investigations were conducted, which identified contamination by various organic compounds and metals in the onsite soil and ground water. This Record of Decision (ROD) addresses soil contaminated by landfill wastes, and ground water contaminated by landfill leachate. The primary contaminants of concern affecting the soil,

(See Attached Page)

17. Document Analysis a. Descriptors

Record of Decision - Hertel Landfill, NY
First Remedial Action - Final
Contaminated Media: soil, sediment, debris, gw
Key Contaminants: VOCs (benzene, toluene, xylenes), other organics (phenols), and metals (arsenic, chromium, lead)

b. Identifiers/Open-Ended Terms

c. COSATI Field/Group

18. Availability Statement	19. Security Class (This Report) None	21. No. of Pages 94
	20. Security Class (This Page) None	22. Price

Abstract (Continued)

sediment, debris, and ground water are VOCs including benzene, toluene, and xylenes; other organics including phenols; and metals including arsenic, chromium, and lead.

The selected remedial action for this site includes regrading and compacting the landfill mound to provide a stable foundation for cap placement; constructing a 13-acre multi-layer cap over the landfill with an associated gas venting system; sampling soil along the western portion of the disposal area to determine the need to extend the cap or to consolidate the soil beneath the cap; monitoring air to ensure that air emissions resulting from the cap construction meet ARARs; ground water pumping and treatment using an innovative treatment system consisting of precipitation and membrane microfiltration to remove metals and solids, and an ultraviolet light and hydrogen peroxide oxidation system to remove organics; performing a treatability study to demonstrate the effectiveness of the innovative technology; implementing a contingency remedy consisting of precipitation, clarification, and filtration to remove metals and suspended solids, and carbon absorption to remove organic compounds, if the treatability study indicates that the selected innovative ground water treatment technology is not effective; discharging the treated water onsite, and disposing of treatment residuals in accordance with RCRA Land Disposal Restrictions; evaluating and mitigating affected wetlands; conducting ground water monitoring to observe flow patterns above and below the landfill; and implementing institutional controls including deed restrictions, and site access restrictions such as fencing. The estimated present worth cost for this remedial action is $8,207,000, which includes an annual O&M cost of $267,000 for years 0-12, $162,800 for years 13-17, and $31,000 for years 18-30. The present worth cost for the contingency remedy is $8,774,000, with the same O&M costs.

PERFORMANCE STANDARDS OR GOALS: Capping will prevent direct contact exposure to contaminated soil, and will result in risks that are less than EPA's target levels of 10^{-6} for carcinogenic risks and an HI=1. Ground water clean-up goals are based on Federal and State standards, and include total xylenes 5 ug/l (State).

ROD FACT SHEET

SITE

Name:	Hertel Landfill
Location/State:	Plattekill, Ulster County, N.Y.
EPA Region:	II
HRS Score (date):	49.98 (June '83)
NPL Rank (date):	811 (March '91)

ROD

Date Signed: September 27, 1991

Selected Remedy

Soils:	Initiate the control of the sources of contamination through the construction of a NYS-6 NYCRR Part 360-landfill cap.
Groundwater:	Extraction and treatment for removal of metals by chemical precipitation and filtration, and for removal of organics by ultraviolet oxidation.
Capital Cost:	$ 3,995,000
O & M/ Year	$ 267,000 Yrs. 0-12 $ 162,800 Yrs. 13-17 $ 31,000 Yrs. 18-30
Present Worth:	$ 8,207,000

Contingency Remedy:

Soils:	No Change
Groundwater:	Removal of organics by activated carbon.
Capital Cost:	$ 3,989,000
O & M/Year:	$ 316,400 Yrs. 0-12 $ 162,800 Yrs 13-17 $ 31,000 Yrs 18-30
Present Worth:	$ 8,774,000

LEAD

Remedial, EPA
Primary Contact (phone): Richard Kaplan (212) 264-3819
Secondary Contact (phone): Doug Garbarini (212) 264-0109

WASTE

Type:	Groundwater-VOC's, ethylbenzene, phthalates, inorganics.
Medium:	Soil-inorganics.
Origin:	Pollution originated as a result of both deliberate and indirect disposal of hazardous substances at the landfill.

RECORD OF DECISION

Hertel Landfill Site
Town of Plattekill
Ulster County, New York

DECLARATION FOR THE RECORD OF DECISION

Site Name and Location

Hertel Landfill, Town of Plattekill, Ulster County, New York

Statement of Basis and Purpose

This decision document presents the selected remedial action for the Hertel Landfill site (the Site), located in the Town of Plattekill, Ulster County, New York, which was chosen in accordance with the requirements of the Comprehensive Environmental Response, Compensation, and Liability Act, 42 U.S.C. §§ 9601-9675, as amended, and to the extent practicable, the National Oil and Hazardous Substances Pollution Contingency Plan, 40 CFR Part 300. This decision document explains the factual and legal basis for selecting the remedy for the Site. The information supporting this remedial action decision is contained in the administrative record for the Site. The administrative record index is attached (Appendix III).

The New York State Department of Environmental Conservation ("NYSDEC") concurs with the selected remedy (Appendix IV).

Assessment of the Site

Actual or threatened releases of hazardous substances from the Site, 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 represents the entire remedial action planned for the Site. It addresses the principal threats posed by the Site through controlling the source of contamination and the migration of contaminated leachate, as well as providing for the capture and treatment of contaminated groundwater.

The major components of the selected remedy include:

* Capping of the landfill in accordance with 6 NYCRR Part 360 closure requirements for New York State solid waste landfills; the areal extent of the cap is expected to be approximately 13 acres although the exact extent of the cap will not be determined until the design phase of the project;

* Additional soil sampling along the western portion of the disposal area to determine the need to extend the cap or to consolidate these soils under the cap;

* Installation and monitoring of landfill gas vents throughout the landfill mound;

* Development and implementation of an on-site groundwater extraction and treatment system utilizing innovative treatment via membrane microfiltration and an ultraviolet light and hydrogen peroxide oxidation system;

* Performance of a treatability study to demonstrate that the innovative groundwater treatment system is effective. If the study demonstrates that this technology is not effective, then a contingency remedy which utilizes precipitation, filtration, and carbon adsorption for groundwater treatment will be implemented. The contingency remedy is identical to the selected remedy in all other aspects;

* Development and implementation of a groundwater monitoring program including additional sampling and analysis of residential wells and subsequent follow up actions as necessary;

* Construction of fencing around the perimeter of the approximately 13-acre landfill area part of the Site, as well as the Site area;

* Recommendations that ordinances be established or restrictions imposed on the deed to ensure that future use of the Site property will maintain the integrity of the cap; and

* Measures to mitigate potential disturbance of adjacent wetland.

Declaration

The selected remedy and contingency remedy are protective of human health and the environment, comply with federal and state requirements that are legally applicable or relevant and appropriate to the remedial action, and are cost effective. However, because treatment of the principal threats of the Site was not found to be practicable, this remedy and contingency remedy do not satisfy the statutory preference for treatment as a principal element of the source control portion of the remedy. The size of the landfill, and the fact that the remedial investigation did not identify on-site hot spots that represent the major sources of contamination, preclude a remedy in which contaminants could be excavated and treated effectively. However, the selected remedy and contingency remedy do call for the treatment of contaminated groundwater at the Site and hence satisfy the preference for treatment for this portion of the remedy.

The selected remedy and contingency remedy include a groundwater extraction and treatment system which reduces the toxicity and mobility of contaminated groundwater. The permanence of reduction in contaminated groundwater toxicity would be monitored upon discontinuation of the pump and treat system.

Since this remedy will result in hazardous substances remaining on-site above health-based levels, a review will be conducted no later than five years after commencement of the remedial action, and every five years thereafter, to ensure that the remedy continues to provide adequate protection of human health and the environment.

Constantine Sidamon-Eristoff
Regional Administrator

9/27/91
Date

DECISION SUMMARY
HERTEL LANDFILL SITE

TOWN OF PLATTEKILL
ULSTER COUNTY, NEW YORK

United States Environmental Protection Agency
Region II, New York

TABLE OF CONTENTS

ATTACHMENTS

SITE NAME, LOCATION AND DESCRIPTION

The Hertel Landfill (the Site) is located in the town of Plattekill, Ulster County, New York, just south of U.S. Route 44/NY Route 55 and approximately midway between Bedell Avenue and Tuckers Corner Road (see Figure 1). The property occupies approximately 80 acres and is oriented in a north-south direction; the entire 80-acre property is herein considered the Site. The landfill area occupies approximately 13 acres of the property. The 80-acre property is zoned for residential use.

A locked gate exists across the main access road near Route 44/55; however, there is no perimeter fence. There are no buildings on the Site. Private residences are located north of the Site on Route 44/55 (approximately 1200 feet from the landfill), and also east of the Site on Tuckers Corner Road (approximately 3000 feet from the landfill).

The topography of the Site is generally flat with a gentle overall slope descending to the east. Abundant vegetation covers most of the property with the exception of limited portions of the landfill. This landfill is located roughly at the center of the Site and is covered with vegetation, rocky soil, wastes and patches of grass and small shrubs. Previous investigations identified a number of waste disposal areas which comprise the landfill (see Figure 2).

Wetlands border the Site to the north, south, and east. Based on the Tentative Freshwater Wetlands Map of Ulster County (New York State Department of Environmental Conservation (NYSDEC), 1986), areas identified as potential wetlands also cover approximately 13 percent of the total area of the Site. A small unnamed stream crosses the southern and eastern area of the Site and flows in a northeasterly direction, bordering the east side of the fill area.

A total of five ecological community types have been identified on-site, including old field, forested upland, forested wetland, stream and open water (pond). The forested wetland is located in a basin in the southwest area of the Site; vegetation species that have been observed include tussock sedge, sphagnum moss and various hydrophytic perennials and annuals. Hydrophytic shrubs and herbaceous species were found in the stream area. The ponded wetland area in the northern section of the Site contains floating, submergent and emergent vegetation. Thirteen plant species, which are on the NYSDEC protected status list, exist on the Site.

There are no federally listed threatened or endangered species identified at the Site. One threatened species protected under the New York State Environmental Conservation Law, the red shouldered hawk, was identified on the Site.

Two aquifers exist beneath the Site. The bedrock material is the Austin Glen formation and described as a greywacke and shale; variegated light blue to blue-grey fine to medium grained sandstone (greywacke) with occasional seams of shale have been observed. The rock has well defined bedding planes and the upper few feet are slightly weathered. The overburden is a glacial till deposit consisting of an unsorted mixture of material (clay, silt, sand, gravel, and boulders) which widely range in size, shape, and permeability. Overlying the till deposit is a layer of light brown fine and or fine sand and silt.

A review of existing flood insurance maps indicated that no portions of the Site are located in either the 100- or 500-year flood zone.

SITE HISTORY AND ENFORCEMENT ACTIVITY

The Hertel Landfill was established in 1963 as a municipal waste landfill. Based upon an analysis of aerial photos it is believed that about 10 acres of the Site were used when the landfill was operating. Until 1975 the landfill was owned and operated by Carlo Hertel and later by his family (Hertel Enterprises). Around 1970, Dutchess Sanitation Services, Inc. began hauling refuse from Dutchess County to the Hertel Landfill and in 1975, Dutchess Sanitation Services, Inc. purchased the landfill.

In April 1976, the Ulster County Department of Health (UCDOH) revoked the landfill permit for a variety of violations, among which were allegations of illegal industrial dumping. The UCDOH action and a Town of Plattekill ordinance prohibiting the dumping of out-of-town garbage resulted in the permanent closing of the Site in March of 1977.

Ownership of the Site then passed from Dutchess Sanitation Services, Inc. through two subsequent parties [a partnership known as F.I.C.A. and then to Hudson Valley Environmental Services, Inc. (HVES)] to its current owner, Paul V. Winters and his corporation, Environmental Landfills, Inc. (ELI), based in New Windsor, New York. No landfilling operations or other activities are currently performed at the Site under the present proprietor, ELI.

During this time, the New York State Departments of Environmental Conservation, Health (NYSDOH), and Law (NYSDOL) had filed suit against F.I.C.A. and HVES for cleanup of the landfill Site; this action was subsequently discontinued following the placement of the Site on the National Priorities List (NPL) and the Environmental Protection Agency's (EPA's) assumption of the lead role for Site activities. However, the State did reserve the right to activate the case in the future. Previous investigations included the installation of five groundwater

monitoring wells in 1981, under the supervision of Wehran Engineering, Inc. and at the direction of the State of New York. In 1981, NYSDEC directed HVES to conduct groundwater monitoring. Sampling and analysis of groundwater in 1980 and 1982 revealed measurable amounts of various organic compounds and a number of metals. Three surface water samples, described as leachate, were collected in March and May of 1981 by the NYSDEC. Analyses indicated phenols, organic compounds and a number of metals. Based on these results, the NYSDEC placed the Hertel Landfill Site on the New York State List of Hazardous Waste Disposal Sites. In 1983, the Site was recommended for inclusion on the NPL by the NYSDEC and in October 1984, the EPA proposed the Hertel Landfill Site for inclusion on the NPL. In June 1986, the Hertel Landfill Site was placed on the final list of federal Superfund sites.

In 1987, Dynamac Corporation, on behalf of the current owner, ELI, initiated the preparation of a "Remedial Investigation/ Feasibility Study Work Plan/Scoping Document" under the guidance of the NYSDOL. ELI had intended to implement this Work Plan, but subsequently declined to do so. Therefore, the completion of the Work Plan and the necessary field work was performed by the EPA contractor, TAMS Consultants, Inc., beginning in April 1989. Field work began in September 1989 and was completed in August 1990.

The landfill is currently mainly covered with vegetative growth. However, previously buried materials are starting to become exposed; also, there is exposed rubbish, debris, etc.

On August 14, 1991, general notice letters were sent to sixteen entities who were determined at that time to be potentially responsible parties (PRPs) at the Site. The general notice letters informed these parties of their potential liability at the Site. It is anticipated that special notice letters will be sent to some or all of the PRPs with a copy of this ROD, in order to ascertain their interest in conducting the remedial design and remedial action.

HIGHLIGHTS OF COMMUNITY PARTICIPATION

On November 16, 1989, the EPA conducted the first public meeting concerning the Hertel Landfill Superfund Site at the Town of Plattekill Town Hall, Modena, New York. The meeting was designed to inform local officials and interested citizens about the Superfund process, to review current and planned remedial activities at the Site and to respond to any questions from area residents and other attendees.

The remedial investigation/feasibility study (RI/FS) reports and the Proposed Plan for the Site were released for public comment on July 25, 1991 and July 26, 1991 respectively. These documents

were made available to the public in the administrative record file at the EPA Docket Room in Region II, New York and the information repositories at the New York State Department of Environmental Conservation, Albany, New York, the Plattekill Town Hall, Modena, New York and Plattekill Public Library, Modena, New York. A press release announcing the availability of these documents was issued on July 31, 1991. The public comment period was set by EPA to end on August 26, 1991; however, at the request of a PRP, the comment period was extended to September 25, 1991.

During this comment period, EPA held a public meeting to present the RI/FS reports and the Proposed Plan, answer questions, and accept both oral and written comments. The public meeting was held in the Plattekill Town Hall, Modena, New York on August 14, 1991. At this meeting, representatives from the EPA, NYSDEC and NYSDOH answered questions about problems at the Site and the remedial alternatives under consideration. Responses to the comments received during the public comment period are included in the Responsiveness Summary (see Appendix V).

SCOPE AND ROLE OF OPERABLE UNIT

EPA has planned to implement the remedial work in a single phase. The major objective of this work is to control the source of contamination at the Site. Concurrently, it is intended to minimize the further contamination of the wetlands in the area and the downgradient migration of contaminants in groundwater.

Specifically, the purpose of the response action is to: 1) minimize the infiltration of rainfall or snow melt into the landfill, thus reducing the quantity of water percolating through the landfill materials and leaching out contaminants; 2) minimize any further contamination of the wetlands; and 3) reduce the movement and toxicity of the contaminated landfill leachate into groundwater and subsequent downgradient migration of contaminants.

This response action will utilize permanent solutions and alternative treatment technologies to the maximum extent practicable. However, because the treatment of the principal threats at the Site is not practicable, this response action does not satisfy the statutory preference for treatment as a principal element of the source control portion of the remedy. The size of the landfill, and the fact that the RI did not identify on-site hot spots in the soil that represent the major sources of contamination, preclude a remedy in which contaminants could be excavated and treated effectively.

It is noted that the listing of a release or threat of release on the NPL merely represents EPA's initial determination that a certain area may need to be addressed under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA).

However, as explained in 54 Federal Register 41002-3, 1989, the RI/FS and ROD for a CERCLA action may offer a useful indication to the public of contaminated areas at which the Agency is considering taking response action (based on information present at that time). To that extent this ROD does not identify a problem at, or seek to address, the 67 acres of the Site lying outside the actual 13 acre landfill area which is the only area intended for remedial action under CERCLA. The outlying area may therefore be used for purposes best determined by the local authorities given the close proximity to the Superfund site. However, it has not yet been determined whether adjoining areas may need to be utilized for treatment facilities or other ancillary facilities necessary to support remedial actions selected for the Site. The precise extent of such areas will be determined during the remedial design and remedial action phases of the project. In addition, since wastes will remain on-site above health-based levels, the protectiveness of the remedy will have to be evaluated every five years. These evaluations could result in a modification of the selected remedy resulting in the need to utilize additional land area to ensure that the remedy is protective of human health and the environment.

SUMMARY OF SITE CHARACTERISTICS

The Hertel Landfill was used for the disposal of municipal solid waste from 1963 until its closure in 1977. During the early 1970s, there were reports of industrial waste dumping as well as reports of improper operations relative to landfill operations and permits. Analyses of environmental samples taken from the Site demonstrate that hazardous substances were disposed of at the Site.

Sixteen feet or more of landfill material exists in some areas of the Site. It is estimated that a total of 240,000 cubic yards of refuse were disposed of at the Site.

The study area for the RI/FS was divided into environmental areas representing landfill as well as background, upgradient, and downgradient locations, with background conditions not considered to be within the groundwater flow path from the landfill. The locations of sampling stations are indicated in **Figure 3.**

A geophysical investigation, which included electromagnetic conductivity, magnetometry and metal detection, was conducted at the Site to identify areas within the landfill where buried metallic wastes might be present. Based on the results of this investigation, twenty-five test pits were excavated to observe the landfill material. Nothing other than debris typical of municipal landfills was observed in the fill material excavated. No buried drums were located.

The potential for direct human exposure as well as the potential for further contaminant migration to groundwater and surface water exists at the Site. There are no permanent controls in place to prevent contaminant migration.

Groundwater

As part of the groundwater investigation, a total of nineteen monitoring wells were installed. Fifteen wells were installed in the overburden aquifer and four in the bedrock aquifer. Two rounds of groundwater sampling were conducted. The groundwater samples were analyzed for volatile organics (VOC's), semi-volatile organics, pesticides and PCBs, inorganics and standard water quality parameters. A summary of the analytical results is given in **Table 1A.** Contaminants in the groundwater are listed and compared to Federal and/or State maximum contaminant levels in **Table 2A.** Several VOCs, BNAs and metals and other inorganics exceeded one or more standards. The following are some contaminants of concern and the highest concentrations detected: chlorobenzene (24 ppb), ethylbenzene (64 ppb), xylenes (240 ppb), benzoic acid (200 ppb), diethylphthalate (900 ppb), arsenic (44 ppb), barium (1980 ppb), and manganese (121,000 ppb).

Groundwater in the overburden aquifer appears to flow eastward toward the landfill base and the wetland which borders the landfilled area to the east. The direction of the groundwater gradient in the bedrock aquifer (based on very limited data) is generally toward the northeast or east.

Residential Wells

A total of nine area residential wells were sampled by EPA (see **Table 1F**) and NYSDOH. The results from initial and follow-up sampling indicated that the water supply was of satisfactory quality (i.e., State and Federal primary standards) for the analytical tests that were performed.

Surface Water

Surface water samples were collected to determine if the Site is impacting surface water or sediment quality and if components of on-site waste are being transported off-site. A summary of analytical results is given in **Table 1B.** Contaminants in surface water are listed and compared to standards in **Table 2B.**

Trace concentrations of VOCs, phenols, naphthalene and/or polyaromatic hydrocarbon (PAH) compounds were detected in several leachate seep samples. Many of the inorganic compounds and landfill leachate indicator parameters were present at elevated concentrations.

In on-site stream samples, inorganic compounds and leachate parameters (chlorides and bicarbonates) were present at levels approximately 2 to 35 times above background levels. Analogous results were obtained in samples collected from the pond/wetland area north of the fill and west of the Site access road. Surface water downgradient of the Site exhibited similar elevated results, but with decreased effects with increasing distance from the landfill.

Sediments

To evaluate the potential impact of on-site wastes being transported off-site by erosion and redeposition of sediment, samples were taken from seep locations along the eastern toe of the landfill, from the stream along the eastern side of the Site, from the northern wetland, and from the stream downgradient of the Site. A summary of analytical results is presented in **Table 1C** and a comparison to standards is given in **Table 2C.**

At the seep locations results were highly variable. In general, organic compounds were not detected at significantly elevated levels. The only inorganic analyte elevated significantly over background was cadmium. With respect to the sediment samples taken in the on-site stream and the northern wetland, the results were similar to these at the seep locations, i.e., cadmium appeared at significantly elevated levels. Sediments downgradient of the Site did exhibit the presence of several PAHs and BNA compounds, but these could readily be attributable to roadway (Route 44/55) runoff.

Soils

During the RI/FS field investigation, seven disposal areas were identified in the main fill area and an eighth disposal area was tentatively identified south of the main fill area. Surface and/or subsurface soil samples were collected from the waste disposal areas and from other areas of the fill to characterize contaminants in the fill and to provide some indication if the wastes are Resource Conservation and Recovery Act (RCRA) "characteristic" wastes, i.e. hazardous by RCRA definition. Subsurface soil samples were collected at selected boring locations to provide additional background data for subsurface soils.

Summaries of surface soil data and subsurface soil data are presented in **Tables 1D and 1E** respectively. Comparison of surface soil contaminant concentrations with RCRA facility investigation guidance values is presented in **Table 2D.** No Federal or State of New York standards exist for assessing contamination in surface or subsurface soils.

The range of compounds detected and their concentration levels were highly variable yet typical of what might be expected at a landfill. Further, none of the samples obtained yielded analyses which would indicate the presence of "hot spots". Samples were submitted for the EP toxicity test which prior to the promulgation of the Toxicity Characteristic (TC) rule (effective September 25, 1990), had been used to determine if a waste is hazardous by characteristic. Results were less than the limits previously used to characterize wastes as hazardous. These results and other knowledge of waste characteristics do not indicate that RCRA TC wastes are present.

Ecological Investigation

The scope of field investigations included the sampling/surveying of the following components: wetlands, macroinvertebrates, birds, fish, mammals, herpetofauna, and general vegetation.

There were no federal threatened or endangered species located on the Site. Thirteen species of plants were identified on-site which are protected by New York State. The red-shouldered hawk is the only New York State threatened species which was identified on-site. The benthic macroinvertebrate study conducted on-site was inconclusive; the potential exists for Site contaminants to produce adverse effects to aquatic organisms. Additionally, there is some indication that the potential exists for elevated inorganics (selenium, cadmium and mercury) in soil to produce adverse environmental effects.

SUMMARY OF SITE RISKS

EPA conducted a baseline Risk Assessment to evaluate the potential risks to human health and the environment associated with the Hertel Landfill Site in its current state. The Risk Assessment focused on contaminants in the groundwater, surface water, sediment and soil which are likely to pose significant risks to human health and the environment. A summary of the contaminants present in each matrix, along with their frequency-of-detection, range, and 95% Upper Confidence Limit, are presented in **Tables 1A-1E.** The summary of the contaminants of concern (COC) in sampled matrices is listed in **Table 3.**

Nine exposure pathways were evaluated under possible on-site present and future land use conditions and are summarized in **Table 4.** These exposure pathways were evaluated separately for adults and children. In addition, exposure of workers, in the event of future construction activities on the landfill, was evaluated. The exposure pathways considered under both current and future uses are: ingestion of groundwater from the overburden aquifers; inhalation of airborne chemicals adsorbed to dust; inhalation of volatiles in groundwater while showering; incidental ingestion of surface water; dermal absorption of

contaminants in surface water; ingestion of soils; ingestion of contaminants in soil and home dust (future use only); dermal absorption of contaminants in soils, and inhalation of contaminants in soils.

Under current EPA guidelines, the likelihood of carcinogenic (cancer causing) and non-carcinogenic effects due to exposure to Site chemicals are considered separately. It was assumed that the toxic effects of the site-related chemicals would be additive. Thus, carcinogenic and non-carcinogenic risks associated with exposures to individual compounds of concern were summed to indicate the potential risks associated with mixtures of potential carcinogens and non-carcinogens, respectively.

Non-carcinogenic risks were assessed using a hazard index (HI) approach, based on a comparison of expected contaminant intakes and safe levels of intake (Reference Doses). Reference doses (RfDs) have been developed by EPA for indicating the potential for adverse health effects. RfDs, which are expressed in units of mg/kg-day, are estimates of daily exposure levels for humans which are thought to be safe over a lifetime (including sensitive individuals). Estimated intakes of chemicals from environmental media e.g., the amount of a chemical ingested from contaminated drinking water are compared with the RfD to derive the hazard quotient for the contaminant in the particular medium. The hazard index is obtained by adding the hazard quotients for all compounds across all media.

A hazard index greater than 1 indicates that the potential exists for non-carcinogenic health effects to occur as a result of site-related exposures. The HI provides a useful reference point for gauging the potential significance of multiple contaminant exposures within a single medium or across media. A summary of the parameter values used to estimate exposure is provided in **Table 5.** The reference doses for the compounds of concern at the Hertel Landfill Site are presented in **Tables 6A-6D.**

A summary of the non-carcinogenic risks associated with these chemicals across various exposure pathways are found in **Tables 8C,D,G,H,& J.** It can be seen that non-carcinogenic risks to children in a future residential use scenario, such as the potential for damage to vital organs, are possible from exposure to Site contamination based on the calculated HI of 100. The estimated total non-carcinogenic hazard index is primarily due to ingestion of metals in Site groundwater including manganese (HI=80) and arsenic (HI=10). These calculations are based on the assumed future residential use of this Site using the contaminant levels detected in on-site monitoring wells and soil samples. The potential future risks posed via ingestion of Site groundwater, and the fact that contaminants were present in on-site groundwater samples above State and Federal drinking water

standards, make the groundwater contamination a primary concern at the Site.

Potential carcinogenic risks were evaluated using the cancer potency factors developed by EPA for the compounds of concern. Cancer slope factors (SFs) have been developed by EPA's Carcinogenic Risk Assessment Verification Endeavor for estimating excess lifetime cancer risks associated with exposure to potentially carcinogenic chemicals. SFs, which are expressed in units of $(mg/kg\text{-}day)^{-1}$, are multiplied by the estimated intake of a potential carcinogen, in mg/kg-day, to generate an upper-bound estimate of the excess lifetime cancer risk associated with exposure to the compound at that intake level. The term "upper bound" reflects the conservative estimate of the risks calculated from the SF. Use of this approach makes the underestimation of the risk highly unlikely. The SFs for the compounds of concern are presented in **Tables 7A & 7B.**

For known or suspected carcinogens, EPA considers excess upper bound individual lifetime cancer risks of between 10^{-4} to 10^{-6} to be acceptable. This level indicates that an individual has not greater than a one in ten thousand to one in a million chance of developing cancer as a result of site-related exposure to a carcinogen over a 70-year period under specific exposure conditions at the Site.

A summary of the carcinogenic risks associated with the compounds of concern across various exposure pathways under the reasonable maximum exposure scenario are found in **Tables 8A,B,E,F,& I.**

Under possible future land-use conditions, adults exposed to contamination from residing on the Site are at a potential total excess lifetime cancer risk of $7x10^{-3}$. This suggests that an individual has a seven in one thousand increased chance of developing cancer as a result of exposure to the Site. The estimated total carcinogenic risk is primarily due to dermal contact with arsenic in soil. Another exposure scenario which also presented a significant risk, and which is more likely to occur in the disposal areas than the establishment of residences, is the current/recreational use of the Site. Under this use, it was estimated that children and adults trespassing on the Site would be subject to carcinogenic risks of $5x10^{-4}$ and $4x10^{-4}$ respectively, due to dermal contact with arsenic in the soil.

The calculations were based on the contaminants detected in the soil and on-site monitoring wells. It was assumed that in the future these wells would be used for residential purposes. Calculations were developed by taking into account various conservative assumptions about the likelihood of residents being exposed to the various contaminated media.

Uncertainties

The procedures and inputs used to assess risks in this evaluation, as in all such assessments, are subject to a wide variety of uncertainties. In general, the main sources of uncertainty include:

- environmental chemistry sampling and analysis
- environmental parameter measurement
- fate and transport modeling
- exposure parameter estimation
- toxicological data

Uncertainty in environmental sampling arises in part from the potentially uneven distribution of chemicals in the media sampled. Environmental chemistry analysis errors can stem from several sources including the errors inherent in the analytical methods and characteristics of the matrix being sampled.

Uncertainties in the exposure assessment are related to estimates of how often an individual would actually come in contact with the chemicals of concern, the period of time over which such exposure would occur, and in the models used to estimate the concentrations of the chemicals of concern at the point of exposure.

Uncertainties in toxicological data occur in extrapolating both from animals to humans and from high to low doses of exposure, as well as from the difficulties in assessing the toxicity of a mixture of chemicals. These uncertainties are addressed by making conservative assumptions concerning risk and exposure parameters throughout the assessment. As a result, the Risk Assessment provides upper bound estimates of the risks to populations near the Landfill, and is highly unlikely to underestimate actual risks related to the Site.

More specific information concerning public health risks, including a quantitative evaluation of the degree of risk associated with various exposure pathways, is presented in the RI Report.

ENVIRONMENTAL ASSESSMENT

The environmental assessment evaluated potential exposure routes of the Site contamination to terrestrial and aquatic wildlife. An ecological survey was performed to identify any threatened or endangered species.

One threatened species protected under the NYS Environmental Conservation Law, the red-shouldered hawk, was identified on the Site. Thirteen plant species, which are on the NYSDEC protected status list, exist on the Site.

A general trend of elevated concentrations of organic and inorganic contaminants exists in one or more environmental media at the Site. Of the identified inorganics of concern in soils, selenium, cadmium and mercury present a potential for ecological effects. Similar conclusions were not drawn for organic compounds due to a paucity of ecotoxicological data on these compounds.

The wetlands in the vicinity of the Site were delineated preliminarily. The need to minimize the disturbance of these wetland habitats via migration of contaminants from the landfill, as well as via any future remediation activities, was identified as an important factor to be considered in the design of the Site remedy. Of particular concern were the leachate seeps located at the toe of the landfill. These seeps discharge to the surface and to an adjacent wetland. A definitive delineation of the wetlands and an evaluation of their functional value will be performed before the commencement of design activities for the Site.

Actual or threatened releases of hazardous substances from this Site, if not addressed by the selected alternative or one of the other remedial measures considered, may present a current or potential threat to the public health, welfare, and the environment through the continued leaching and migration of contaminants from the landfill and human exposure to contaminated soils.

DESCRIPTION OF ALTERNATIVES

Following a screening of remedial technologies in accordance with the National Contingency Plan (NCP), the following remedial alternatives were developed for the Site. The alternatives were further screened based on technical considerations such as effectiveness, implementability, and cost. Time to implement reflects the period following the ROD necessary to develop work plans, complete remedial designs, conduct construction activities, and also the time necessary to obtain comments/approvals, conduct negotiations with PRPs, issue inquiries, evaluate and select contractors, etc. as required by Federal and State regulations and procedures.

These alternatives are:

Alternative 1: No Action

Capital Cost: $58,100
O & M Cost: $132,200/yr.
Present Worth Cost: $2,509,000
Time to Implement: 9 months
Duration: 30 years

The NCP requires that the no-action alternative be considered as a baseline for comparison with the other alternatives. The no-action alternative does not include any physical remedial measures that address the contamination at the Site.

This alternative would consist of a long-term groundwater monitoring program that would provide data for the assessment of the impact on the underlying groundwater of leaving contaminated materials on-site. This program would utilize wells installed during the RI at the Site and six additional wells. Groundwater samples would be taken on a quarterly basis.

In addition, the no-action alternative would include the development and implementation of a public awareness and education program to enhance the community's knowledge of the conditions existing at the Site. This program would require the involvement of the local government, various health departments and environmental agencies.

Under this alternative, the Site would be reviewed every five years pursuant to CERCLA requirements. Using data from the groundwater sampling program, these five year reviews would include the reassessment of health and environmental risks due to the contaminated material left on-site. If justified by the review, remedial actions might be implemented.

Alternative 2: Site Use Restrictions and Capping

Capital Cost: $3,482,000
O & M Cost: $162,800/yr.
Present Worth Cost: $7,182,000
Time to Implement: 30 months
Duration: 30 years cap maintenance

As with Alternative 1, this alternative would include a groundwater monitoring program and public awareness program. However, this alternative would also provide for restricted Site access and capping of the landfill area.

A chain link fence would surround the perimeter of the capped area, thereby restricting access. Along the fence, at appropriate intervals, warning signs would be placed that would caution the public as to the Superfund status of the Site. One access gate would be provided, which would be kept locked, to allow access for groundwater sampling and review purposes. Institutional controls in the form of local ordinances, and/or deed restrictions would be recommended in an attempt to restrict future use of the land because of the threats posed by contamination.

The major feature of Alternative 2 would be the construction of a multi-layer closure cap over the landfill mound. This would minimize the infiltration of rainfall or snow melt into the landfill and reduce the movement of the contaminated leachate to the groundwater.

The design of the cap would comply with the standards of Title 6, New York State Compilation of Rules and Regulations (NYCRR), Part 360, which addresses New York State Solid Waste Management Facilities and landfill closure requirements. This facility would comply with all applicable or relevant and appropriate requirements (ARARs). Prior to construction of the cap, the landfill mound would have to be regraded and compacted to provide a stable foundation for placement of the various layers of the cap. The Part 360 standards include minimum liquid migration through the wastes, low cover maintenance requirements, efficient site drainage, high resistance to damage by settling or subsidence, and a low permeability cap. In addition to the various layers, the cap would include allowances for the installation of gas vents necessary for the escape of methane generated by the decomposition of landfill materials, and also provide for groundwater monitoring wells within the landfill mound. The cap would consist of a four layered system: an upper vegetative layer, a soil protective layer over a low permeability layer, and a gas vent/collection layer. The landfill mound surface area, including the side slopes, is estimated to be 13 acres.

Contaminated groundwater would be left to attenuate without any treatment, and groundwater monitoring wells would be installed within the landfill mound. Groundwater samples would be collected for analyses to evaluate the effect of the cap on the groundwater flow through the saturated portion of the landfill materials and on the surrounding aquifer. Emissions from landfill gas vents would also be monitored.

EPA believes that this alternative would result in achieving risk reduction to levels below 10^{-6} and a hazard index below 1 for carcinogenic and noncarcinogenic risks respectively. However, the potential for contaminants to migrate off-site, although lessened due to the landfill cap, would continue to exist and could impact nearby residential wells.

As with Alternative 1, a review of the Site's status would be conducted every five years.

Alternative 2A: Site Use Restrictions, Capping and Slurry Wall

Capital Cost: $8,406,000
O & M Cost: $170,800/yr.
Present Worth Cost: $13,238,000

Time to Implement: 36 months
Duration: 30 years cap maintenance

The scope of this alternative is the same as Alternative 2, except for the addition of a slurry wall. The purpose of the slurry wall would be to act as a barrier to groundwater flow and to lower the water table such that leachate breakout at the toe of the landfill would be eliminated.

The slurry wall design would be based on the use of a cement/bentonite construction rather than soil/bentonite due to slope. The wall would be located upgradient of the landfill area, approximately 1800 feet long, 3 feet in width and keyed into the underlying bedrock with an average depth of 40 feet.

EPA believes that this alternative would result in achieving risk reduction to levels below 10^{-6} and a hazard index below 1 for carcinogenic and non-carcinogenic risks, respectively. However, the potential for contaminants to migrate off-site, although lessened due to the landfill cap, would continue to exist and could impact nearby residential wells.

In order to monitor the effectiveness of this system 8 observation wells would be installed. These wells in addition to the existing monitoring wells in the fill area, would facilitate confirmation of the effectiveness of the slurry wall in maintaining the groundwater table at a level below the base of the fill material. In addition, a review of the Site's status would be conducted every 5 years.

Alternative 4: Site Use Restrictions, Capping, Groundwater Extraction with On-Site Treatment

Capital Cost: $3,989,000
O & M Cost: $316,400/yr. years 0-12
$162,800/yr. years 13-17
$31,000/yr. years 18-30
Present Worth Cost: $8,774,000
Time to Implement: 36 months
Duration: 12 years groundwater extraction and treatment;
30 years cap maintenance

This alternative is identical to Alternative 2, with the addition of a groundwater pumping system within the landfill mound to control leachate migration.

The groundwater extraction system would consist of a series of pumping wells installed around the inside of the landfill. The groundwater pumping wells would extend through the landfill material and end at bedrock. They would be screened through the entire saturated length. It is estimated that approximately 22 extraction wells would be required to provide capture of the

contaminated groundwater beneath the landfill. These wells would produce an estimated total removal rate of approximately 10 gallons per minute or 14,000 gallons per day. These estimates, presented in detail in the FS report, would be field verified via performance of an aquifer pumping test during the remedial design. Also, further studies may be conducted during that phase to optimize the number and location of extraction wells. Pulsed pumping may also be considered.

The extracted groundwater would be prefiltered to remove gross solids and then pumped nto an equalization tank. This tank would be utilized to equalize the groundwater flow and contaminant concentrations, which may be variable.

The collected groundwater would be treated in an on-site treatment system. This treatment system would use chemical precipitation and clarification followed by filtration to remove metals and suspended solids. A carbon adsorption system would be utilized to remove organic compounds from the filtration effluent.

The organic compounds and metals present in the extracted groundwater would be reduced to concentrations which are below the site-specific surface water discharge standards which would be determined in accordance with the New York State Pollutant Discharge Elimination System (SPDES). It is expected that the effluent groundwater would be discharged to the adjacent wetlands unless detrimental impacts would result from such an action. Other discharge options, such as reinjection, would be evaluated during the design of the remedy. Groundwater remediation would result in the attainment of State and Federal ARARs for groundwater and drinking water at the Site boundary.

EPA believes that this alternative would result in achieving risk reduction to levels below 10^{-6} and a hazard index below 1 for carcinogenic and non-carcinogenic risks, respectively.

Under Alternative 4, solids are expected to accumulate at a rate of approximately 24 pounds per day, for a total annual accumulation of 4 tons. Treatment residues generated would be disposed of in accordance with RCRA Land Disposal Restriction requirements. In addition, a review of the Site's status would be conducted every five years.

Alternative 4A: Site Use Restrictions, Capping, Groundwater Extraction with On-Site Innovative Treatment

Capital Cost: $3,995,000
O & M Cost: $267,000/yr. years 0-12
$162,800/yr. years 13-17
$31,000/yr. years 18-30
Present Worth Cost: $8,207,000

Time to Implement: 36 months
Duration: 12 years groundwater extraction & treatment;
30 years cap maintenance

This alternative is similar to Alternative 4. However, the treatment system to be employed would consist of a membrane microfiltration unit for inorganics removal and ultraviolet (UV) oxidation for organics removal.

The microfiltration system is an innovative treatment system being developed and is currently included in EPA's Superfund Innovative Technology Evaluation (SITE) program. Prior to the microfiltration stage, the groundwater is pretreated with lime to precipitate metals. Microfiltration is designed to remove solid particles from liquid wastes and consists of an automatic pressure filter combined with special filter material, and operates in a cyclical manner. Solids greater than one ten-millionth of a meter are retained as a filter cake. Pilot tests at the Palmerton Zinc Superfund site produced a filtrate with non-detectable levels of heavy metals.

UV oxidation would follow the membrane microfiltration unit. UV oxidation is a process in which UV light and hydrogen peroxide chemically oxidize organic contaminants dissolved in water. The combined UV light and hydroxy radicals (strong oxidizers formed from hydrogen peroxide) promote rapid breakdown of organics to carbon dioxide and water without the creation of air emissions or residual waste streams. The oxidation unit would be operated to reduce the contaminant levels in groundwater to Federal or State discharge requirements. Operation and maintenance of the unit consists of UV lamp replacement every four months and occasional replenishment of the hydrogen peroxide supply. As with Alternative 4 the groundwater would be remediated until ARARs are met.

EPA believes that this alternative would result in achieving risk reduction to levels below 10^{-6} and a hazard index below 1 for carcinogenic and non-carcinogenic risks respectively.

Treatment residues would be disposed of in accordance with RCRA Land Disposal Restriction requirements.

In addition, a review of the Site's status would be conducted every five years.

SUMMARY OF COMPARATIVE ANALYSIS OF ALTERNATIVES

All remedial alternatives were evaluated in detail utilizing nine criteria as set forth in the NCP and OSWER Directive 9355.3-01. These criteria were developed to address the requirements of Section 121 of CERCLA to ensure all important considerations are factored into remedy selection decisions.

The following "threshold" criteria are the most important and must be satisfied by any alternative in order to be eligible for selection:

Threshold Criteria
- Overall protection of human health and the environment; and
- Compliance with applicable or relevant and appropriate requirements.

The following "primary balancing" criteria are used to make comparisons and to identify the major trade-offs between alternatives:

Primary Balancing Criteria
- Long-term effectiveness and permanence;
- Reduction in toxicity, mobility, or volume through treatment;
- Short-term effectiveness;
- Implementability; and
- Cost.

The following "modifying" criteria are considered fully after the formal public comment period on the Proposed Plan is complete:

Modifying Criteria
- State/support agency acceptance; and
- Community acceptance.

The nine criteria are summarized below:

1. Overall protection of human health and the environment addresses whether or not a remedy provides adequate protection and describes how risks posed through each exposure pathway (based on a reasonable maximum exposure scenario) are eliminated, reduced, or controlled through treatment, engineering controls, or institutional controls.

2. Compliance with ARARs addresses whether or not a remedy would meet all of the applicable or relevant and appropriate requirements of Federal and State environmental statutes and requirements or provide grounds for invoking a waiver.

3. Long-term effectiveness and permanence refers to the ability of a remedy to maintain reliable protection of human health and the environment over time, once cleanup goals have been met. It also addresses the magnitude and effectiveness of the measures that may be required to manage the risk posed by treatment residuals and/or untreated wastes.

4. Reduction of toxicity, mobility, or volume through treatment is the anticipated performance of a remedial technology, with respect to these parameters, that a remedy may employ.

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

6. Implementability is the technical and administrative feasibility of a remedy, including the availability of materials and services needed.

7. Cost includes estimated capital and operation and maintenance costs, and the present worth costs.

8. State acceptance indicates whether, based on its review of the RI/FS and the Proposed Plan, the State supports, opposes, and/or has any identified reservations with the preferred alternative.

9. Community acceptance refers to the public's general response to the alternatives described in the Proposed Plan and the RI/FS reports. Factors of community acceptance to be discussed include support, reservation, and opposition by the community.

A comparative analysis of these alternatives based upon the evaluation criteria noted above, are as follows:

Overall Protection of Human Health and the Environment

Alternatives 4 and 4A provide the best approach to protection of human health and the environment. Alternative 4 relies on proven technologies, at a small cost increase, as compared to Alternative 4A which is based on innovative technologies.

All alternatives, except Alternative 1 are protective. However, Alternatives 2 and 2A rely on natural attenuation of contamination in groundwater and land use restrictions. In comparison Alternatives 4 and 4A provide additional protection by the active means of pumping and treating groundwater, thus reducing migration of contaminants from the Site. Although ultimate resumption of contact between the soil/waste and groundwater table is anticipated, the existence of the pump and treat system does provide means for resumed operation of treatment should it be deemed necessary at the completion of the extraction period.

Alternatives 2, 2A, 4 and 4A are all designed, via the cap, to prevent leachate seeps, thereby reducing surface water contamination levels.

Alternative 1, the no action alternative, is the least protective of human health and the environment. This alternative does not

limit site access or future site development and, therefore, does not address the principle threats posed by the Site.

Compliance with ARARs

Alternatives 4 and 4A are expected to meet chemical-specific ARARs for the groundwater. However, once pump and treat operations are discontinued, the resumption of contact between the soil/waste matrix and the groundwater may cause chemical specific groundwater ARARs to be exceeded. If this is the case, continued "pulsed" pumping and treatment of the groundwater may be necessary. The technologies employed under Alternative 4A may not be as effective in reaching ARAR-based cleanup levels for effluent discharge. However, based on the information available it is anticipated that ARARs will be achieved under this alternative.

Alternatives 2 and 2A rely on natural attenuation to attain chemical-specific ARARs for contaminants detected in the groundwater and are not expected to achieve ARARs for a significant amount of time. For Alternative 2A, the elimination of groundwater flow through the in-place waste materials may eventually result in reduced groundwater contaminant levels, but treatment of the currently detected contaminant levels would not be provided. Alternative 2 would take significantly longer to reach ARARs in groundwater than the other alternatives.

Alternatives 2, 2A, 4 and 4A would meet the action specific sanitary landfill closure ARARs as the final cap and surface drainage features would be constructed in accordance with New York Solid Waste Management Facility landfill closure regulations.

Hazardous treatment residues that may be generated in Alternatives 4 and 4A would be disposed of in accordance with RCRA Land Disposal Restriction requirements.

Alternative 1, the no action alternative, is not expected to attain chemical-specific ARARs for the groundwater in a reasonable time frame. No location-specific or action-specific ARARs would be applicable under the no action alternative.

Location-specific ARARs may potentially be triggered for wetlands which cover some portions of the Site. It appears as though all of the action alternatives could impact the wetlands to a similar degree. However, based on preliminary identification, most of the wetlands will not be impacted by the remediation activities evaluated herein. The extent of the impact to the wetlands will be determined during the design phase of the project. Wetlands that might be impacted by the remediation activities would be restored to the maximum extent practicable in compliance with the appropriate wetlands and discharge regulations.

Long-Term Effectiveness and Permanence

None of the alternatives actively address remediation of contaminants currently detected in surface water or sediment (other than contamination associated with leachate seeps). Therefore, all alternatives could present some residual risk based on incidental ingestion and dermal contact with sediments under a recreational use scenario. These calculated risks, however, are within the acceptable risk ranges and are not considered to seriously impact the long-term effectiveness of the alternatives, especially with respect to those alternatives for which site access will be limited for an extended period based on the long-term operation of on-site remedial systems.

Alternative 2A would result in minimal residual risk through the containment rather than treatment of on-site contaminants. The combination of the cap and slurry wall minimize contact with soil contaminants and potential exposure pathways associated with on-site groundwater contamination, although potential exposure to surface water/sediment would exist if access to the Site is not fully controlled e.g., if the Site is used as a recreational area following capping. The slurry wall would minimize contact of the groundwater table with in-place waste materials, thereby minimizing future contamination of groundwater. These containment features are expected to be highly reliable with minor maintenance or monitoring; if they should fail, replacement or repair would not be exceptionally difficult.

Alternatives 4 and 4A provide comparable levels of long-term protectiveness. While treating the groundwater and reducing dermal exposure risks through containment features, these alternatives do not provide for treatment of the source of contamination. Therefore, the long-term effectiveness of these alternatives in maintaining reduced groundwater contaminant levels following discontinuation of the pump and treat system operation is not guaranteed. The water table can be expected to return to a level within the waste materials when pumping is discontinued, thereby potentially allowing for future groundwater contamination. If this is determined to be the case, pulsed pumping of the system might be warranted. These alternatives also require long-term management in the form of cap maintenance and groundwater treatment system monitoring and operation. Because of the ongoing operation of the groundwater treatment system, use of the Site for recreation and the associated potential exposures are not considered to apply to these alternatives.

Alternative 2 would not treat the source of contamination or the contaminated groundwater on-site, although it would provide protection against dermal exposures to soil contaminants through its capping containment feature. This alternative requires minimal long-term management in the form of cap maintenance and

monitoring. Potential exposure to surface water/sediment contaminants will exist under this alternative if access to the site is not fully controlled e.g., if the Site is used as a recreation area following capping.

Alternative 1, the no action alternative, offers no long-term effectiveness in terms of protection against current risks associated with dermal contact with soil contaminants or future groundwater ingestion scenarios.

Reduction in Toxicity, Mobility, or Volume

Alternative 2A provides a reduction of contaminant mobility, without treatment, through its containment features. The alternative utilizes a cap and slurry wall to isolate in-place waste materials from exposure via direct contact and from precipitation, infiltration and consequent groundwater migration. While the waste materials are not treated, their isolation limits the potential risks they pose.

Alternatives 4 and 4A reduce the toxicity of groundwater through treatment and reduce the mobility of soil contaminants through containment. The reduction in groundwater toxicity may not be permanent, however, due to the lack of treatment of the soil/waste matrix and the ability of the groundwater table to return to a level within the waste materials upon discontinuation of operation of the pump and treat system. Subsequently, a pulse pumping system may be considered.

Alternative 2 only reduces the mobility of the soil contaminants through containment measures. It does not address groundwater contamination or limit additional contamination of groundwater due to continued contact of waste materials with the water table. Alternative 1 provides no reduction in toxicity, mobility or volume of contaminants of any media through treatment. Residual risks are identical to those identified by the baseline risk assessment. Future risks posed by the Site will depend on future Site usage.

Short-Term Effectiveness

In general, all alternatives except the no action alternative require clearing of vegetation from the landfill area, road improvements or other activities involving disturbance of contaminated soils. These alternatives pose, at a minimum, non-cancer risks which exceed acceptable risk ranges to on-site remedial workers due to inhalation of contaminants adsorbed to fugitive dust. This pathway of exposure can be minimized through the use of personal protection equipment. Once remedial activities are completed, this exposure pathway ceases to exist for these alternatives.

The no action alternative can be considered to be the most effective alternative with respect to short-term risks. Because no remediation is proposed under this alternative, no disturbance of existing contamination occurs and no short-term risks are realized. It should be emphasized, however, that while no increases in risks result in the short-term, no protection against the principle site threats is achieved.

For alternatives that involve site remediation, Alternatives 2 and 2A provide the greatest short-term effectiveness. They pose the least amount of risk to on-site remedial workers and achieve protection against dermal contact risks within the shortest time frame. Alternative 2, however, does not provide the same degree of protection against groundwater contaminant migration.

Alternatives 4 and 4A also provide good short-term effectiveness. They pose additional risk to on-site workers due to the installation of groundwater extraction wells within contaminated areas, but they also meet remedial response objectives within a limited time frame, with exposures to groundwater contamination reduced through groundwater pumping and on-site treatment. The additional handling of contaminated groundwater and required discharge to surface water increases the potential risks and environmental impacts associated with remediation, and makes these alternatives less effective in the short-term than Alternative 2A. These alternatives also have longer remedial time frames associated with achievement of cleanup goals.

Implementability

Technical Feasibility

Wetlands regulations will impact the implementation of all alternatives except the no action alternative to varying degrees. Alternatives involving groundwater extraction and discharge to wetlands/surface water (Alternatives 4, 4A) will require compliance with regulatory requirements for surface water discharges. Alternatives 2, 2A, 4, and 4A would require site use and groundwater use restrictions. The responsibility for the implementation of such restrictions would be left to State and local authorities.

Alternative 1, the no action alternative, is the most implementable because it requires only the installation of additional monitoring wells.

Alternatives 2 and 2A follow Alternative 1 in implementability, respectively. Capping construction methods are well developed and easily implemented. The construction of a slurry wall under Alternative 2A would also be relatively easy to implement, although existing Site conditions could hamper construction.

Alternatives 4 and 4A are similar to Alternative 2, involving the construction of a cap, but also include the construction of a groundwater extraction and treatment system. The construction of such a system would be relatively easy. Minimal technical problems would be expected in the implementation of Alternative 4. The innovative groundwater treatment technologies included in Alternative 4A could pose additional technical problems; a treatability study would be necessary to ensure that these problems were not significant. The lack of general availability of the innovative treatment technologies could also limit the availability of treatment systems and experienced operational personnel relative to the other alternatives.

Administrative Feasibility

All of these alternatives would involve some degree of institutional management. Alternative 1 would require administrative coordination of the groundwater monitoring program and the five year site status reviews, along with the development of the public education program.

The administrative requirements for Alternatives 2 and 2A include the groundwater monitoring program, and the security fence inspection. In addition to these activities, the structural integrity and impermeability of the closure cap and subsurface barrier must be maintained through a program of periodic surveillance and necessary repairs. Because of the large land area of the landfill, this item could be fairly substantial.

In addition to the above, Alternatives 4 and 4A require an extensive monitoring program, as well as the operation and maintenance of the groundwater treatment facility. Their administrative elements are extensive because they include equipment maintenance schedules, system effluent monitoring to comply with the SPDES requirements and to adjust operating parameters, and transportation and disposal of hazardous process residuals in compliance with regulations.

Availability of Services and Materials

Most services and materials required for implementation of any of these potential remedial alternatives are readily available. Standard construction equipment and practices can be employed for equipment installation and site work activities for all alternatives. Most of the materials and equipment required for these alternatives may be obtained in the locality of the Site. However, excavations necessary for the installation of the subsurface barrier (Alternative 2A) may require that specialized operations and equipment be obtained from non-local sources.

Because the work would be taking place on a Superfund site, all on-site personnel must have approved health and safety training. Many companies are available to provide this training to contractors. The engineering and design services required for implementation of Alternatives 2, 2A, 4 and 4A may be obtained from many vendors. Hazardous waste transportation and disposal is also commercially available.

Cost

Cost estimates were developed for each of the five alternatives.

Present worth cost estimates consider a 5% discount rate and operational periods as noted herein. The costs are as follows:

	Capital Cost	Annual O&M	Total Present Worth
1.	$ 58,000	$132,200	$ 2,509,000
2.	$ 3,482,000	$162,800	$ 7,182,000
2A.	$ 8,406,000	$170,800	$13,238,000
4.	$ 3,989,000	Refer to Text	$ 8,774,000
4A.	$ 3,995,000	Refer to Text	$ 8,207,000

State Acceptance

The State of New York, through the NYSDEC, concurs with EPA's selected remedy. See Appendix IV.

Community Acceptance

EPA believes that the selected remedy has the support of the affected community. Community comments can be reviewed in the public meeting transcript which is included in the administrative record. A Responsiveness Summary which summarizes all comments received during the public comment period and answers the questions and concerns raised at the public meeting on August 14, 1991 is attached as Appendix V to this document.

SELECTED REMEDY

Based upon consideration of the requirements of CERCLA, the detailed analysis of the alternatives, public comments, and NYSDEC's comments, EPA has determined that Alternative 4A, Capping and Groundwater Treatment (via microfiltration and UV oxidation) System, is the appropriate remedy for the Hertel Landfill Site. A treatability study will be performed to demonstrate that the innovative groundwater treatment remedy is effective. If the study demonstrates that the innovative treatment is not effective, then Alternative 4 will be implemented as a contingency remedy.

The selected alternative will achieve substantial risk reduction through source control and a groundwater treatment system.

The major components of the selected remedy are as follows:

* Construction of a multi-layer cap consistent with New York State Part 360 solid waste landfill closure requirements; the areal extent of the cap is expected to be approximately 13 acres, although the exact extent of the cap will not be determined until the design phase;

* Additional soil sampling along the western portion of the disposal area in the vicinity of soil sample "SS-22" to determine the need to extend the cap or consolidate soils from the area beneath the cap;

* Regrading and compaction of landfill mound to provide a stable foundation for the placement of the cap prior to its construction;

* Construction of a gas venting system;

* Performance of air monitoring prior to, during, and following construction at the Site, to ensure that air emissions resulting from the cap construction meet ARARs;

* Quarterly groundwater monitoring program using existing groundwater monitoring wells, and six additional wells to be installed beyond the capped area, to observe the effects of groundwater flow patterns through the saturated portion of the landfill and to monitor the movement of contaminants beneath the landfill. The monitoring program will include sampling of selected residential wells with subsequent follow-up actions as necessary;

* Construction of fencing around the perimeter of the capped area;

* Recommendations that ordinances be established or restrictions imposed on the deed to ensure that future use of the Site property will maintain the integrity of the cap;

* Installation of a groundwater extraction and treatment system to control leachate migration. A series of wells would extract approximately 14,000 gallons per day of groundwater from the overburden aquifer. The treatment system would comprise two innovative steps. Metals and suspended solids would be chemically

precipitated and removed by membrane microfiltration in a unique, automatic, cyclically operated pressure filter. Organics would then be removed in a UV oxidation system utilizing UV light and hydrogen peroxide to chemically oxidize organic contaminants.

* Definitive delineation and evaluation of the wetlands and the drainage channels flowing through these wetlands adjacent to the landfill.

* In addition, a full evaluation of the wetlands prior to remediation activities to determine any measures which may be necessary to mitigate potential negative impacts to the wetlands.

* Performance of a treatability study to demonstrate the effectiveness of the innovative technology.

* Disposition of treatment residuals in accordance with RCRA Land Disposal Restrictions.

* Implementation of Alternative 4 as a contingency remedy should the treatability study indicate that the innovative groundwater treatment technology is not effective. Alternative 4 is identical to Alternative 4A with the exception that the groundwater treatment system would consist of precipitation and clarification, followed by filtration to remove metals and suspended solids and carbon adsorption to remove organic compounds.

REMEDIATION GOALS

The purpose of this response action is to reduce the present risk to human health and the environment due to contaminants leaching from the landfill mound. The capping of the landfill will minimize the infiltration of rainfall and snow melt into the landfill, thereby reducing the potential for contaminants leaching from the landfill and negatively impacting the wetlands habitat and groundwater quality. Capping will prevent direct contact exposure to contaminated soils, and as such will result in risks which are less than EPA's target levels of 10^{-6} and 1 for carcinogenic risks and the non-carcinogenic hazard index, respectively.

Pumping and treating the groundwater will contain the groundwater contamination within the Site boundary and will ensure that groundwater beyond the Site boundary meets applicable or relevant and appropriate requirements of the Safe Drinking Water Act (maximum contaminant levels) and State laws and regulations (10 NYCRR Part 5, 6 NYCRR Part 703). The extracted groundwater will be treated to meet SPDES discharge standards if discharged to

nearby surface water; or will meet appropriate reinjection standards if reinjection is selected as the means of discharge.

An example of some of the ARARs for groundwater remediation at this Site are:

CHEMICAL	REQUIREMENT	REFERENCE
Ethylbenzene	5 ug/l	10 NYCRR Part 5
Total xylenes	5 ug/l	10 NYCRR Part 5
Dichlorobenzene	5 ug/l	10 NYCRR Part 5

The goal of the groundwater portion of the selected remedy is to restore groundwater at the perimeter of the waste disposal area of the Site to its most beneficial use, which is as a supply of potable water. Based on information obtained during the RI and on a careful analysis of remedial alternatives, EPA believes that the selected remedy will achieve this goal. It may become apparent, during implementation or operation of the groundwater extraction system, that contaminant levels have ceased to decline and are remaining constant at levels higher than the remediation goal over some portion of the contaminated plume. In such a case, the system performance standards and/or the remedy may be reevaluated.

The selected remedy will include groundwater extraction for an estimated period of 12 years, during which 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 any or all of the following:

- Discontinuing pumping at individual wells where cleanup goals have been attained
- Alternating pumping at wells to eliminate stagnation
- Pulse pumping to allow aquifer equilibration and to allow adsorbed contaminants to partition into groundwater
- Installing additional extraction wells to facilitate or accelerate cleanup of the contaminant plume

During the performance of long-term monitoring, EPA may determine that a remedial action objective has been met. For the long-term groundwater monitoring program, EPA will continue to monitor on a semi-annual basis for at least 2 years after cleanup levels are achieved and groundwater extraction/treatment has ceased in order to ensure that cleanup levels are maintained. Upon meeting all remedial objectives, or determining that the Site has been

sufficiently purged of contaminants so that public health is no longer threatened by exposure to the Site, EPA will initiate proceedings to delete the Site from the National Priorities List.

The response action also reduces the movement and toxicity of the contaminated landfill leachate into groundwater, and subsequent downgradient migration of contaminants.

STATUTORY DETERMINATIONS

Under its legal authorities, EPA's primary responsibility at Superfund sites is to undertake remedial actions that achieve protection of human health and the environment. In addition, Section 121 of CERCLA establishes several other statutory requirements and preferences. These specify that when complete, the selected remedial action for this Site must comply with applicable or relevant and appropriate environmental standards established under Federal and State environmental laws unless a statutory waiver is justified. The selected remedy also must be cost-effective and utilize permanent solutions and alternative treatment technologies or resource recovery technologies to the maximum extent practicable. Finally, the statute includes a preference for remedies that employ treatment that permanently and significantly reduces the volume, toxicity, or mobility of hazardous wastes, as available. The following sections discuss how the selected remedy meets these statutory requirements. The contingency remedy would meet these requirements in the same fashion, the only difference being the means of groundwater treatment.

Protection of Human Health and the Environment

Alternative 4A and the contingency remedy are considered to be fully responsive to this criterion and to the identified remedial response objectives. Capping the landfill protects human health and the environment by reducing the mobility of contaminated materials off-site. The leaching of contaminants into the wetlands and aquifers will be significantly reduced. In addition, capping the landfill will eliminate threats posed to trespassers utilizing the Site. The extraction and treatment of contaminants in groundwater will prevent the off-site groundwater from being contaminated above drinking water standards, thereby ensuring that the community continues to have a potable supply of drinking water.

Compliance with ARARs

Attainment of chemical-specific ARARs for groundwater will be hastened due to reduced leaching following construction of the cap and the extraction and treatment of ground water. The source of surface water contamination (leachate seeps) will be

eliminated. Action-chemical-and location-specific ARARs will be complied with during implementation.

Action-specific ARARs:

* New York State Solid Waste Management Facilities 6 NYCRR Part 360

* National Emissions Standards for Hazardous Air Pollutants (NESHAP)

* 6 NYCRR Part 257 Air Quality Standards

* 6 NYCRR Parts 750-758 - State Pollutant Discharge Elimination System

* RCRA 40 CFR Part 261 - Identification of Hazardous Wastes

* RCRA 40 CFR Part 262 - Standards Applicable to Generators of Hazardous Waste

* RCRA 40 CFR Part 263 - Standards Applicable to Transporters of Hazardous Waste

* RCRA 40 CFR Part 264 - Subpart F Applicable to Groundwater Monitoring at Hazardous Waste Facilities - Subpart J Applicable to Tank Systems at Hazardous Waste Facilities

* RCRA 40 CFR Part 268 - Land Disposal Restrictions on Regulated Hazardous Waste

* 6 NYCRR Part 372 - Hazardous Waste Manifest System and Related Standards for Generators, Transporters and Facilities

* 6 NYCRR Part 373-2 - Final State Standards for Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal Facilities

Chemical-specific ARARs:

The selected remedy will enable drinking water maximum contaminant levels (MCLs) to be met off-site and will ensure that the landfill does not negatively impact the nearby residential wells.

* Safe Drinking Water Act MCLs

* 6 NYCRR Part 703.5 Groundwater Quality Regulations

* 6 NYCRR Part 703.6 Effluent Standards and/or Limitations for Discharges to Class GA Waters.

* 6 NYCRR Part 702 Surface Water Standards

* 10 NYCRR Part 5 State Sanitary Code

Location-specific ARARs:

* Clean Water Act Section 404, 33 USC 1344

* Fish and Wildlife Coordination Act 16 USC 661

* National Historic Preservation Act 16 USC 470

* New York State Freshwater Wetlands Law ECL Article 24, 71 in Title 23

* New York State Freshwater Wetlands Permit Requirements and Classification 6 NYCRR 663 and 664

* New York State Endangered and Threatened Species of Fish and Wildlife Requirements 6 NYCRR 182

Other Criteria, Advisories, or Guidance To Be Considered:

* New York Guidelines for Soil Erosion and Sediment Control

* New York State Sediment Criteria December 1989

* New York State Air Cleanup Criteria January 1990

Cost Effectiveness

The selected remedy provides overall effectiveness proportional to its cost. The total capital and present worth costs for the remedy are estimated to be $3,955,000 and $8,207,000, respectively. For the contingency remedy the corresponding costs are $3,989,000 and $8,774,000. A detailed breakdown of the estimated costs of the selected remedy is provided in Table 9.

Utilization of Permanent Solutions and Alternative Treatment Technologies to the Maximum Extent Practicable

The selected remedy and contingency remedy utilize permanent solutions and alternative treatment technologies to the maximum extent practicable. Note that Alternative 4A groundwater treatment is considered to be innovative. The selected remedy represents the best balance of trade-offs among the alternatives with respect to the evaluation criteria. The State and the community also support the selected remedy.

The extraction and subsequent treatment of groundwater will permanently and significantly reduce the toxicity, mobility, and volume of contaminants in the groundwater. A treatability study will be performed to demonstrate that the innovative technology selected for treating the groundwater is effective. If the treatability study indicates that this technology is not effective, then the contingency remedy, Alternative 4, shall be implemented.

With the construction of the landfill cap, the direct contact risk to the soils will be eliminated. No technological problems should arise since the technologies for capping the landfill are readily available.

Preference for Treatment as a Principal Element

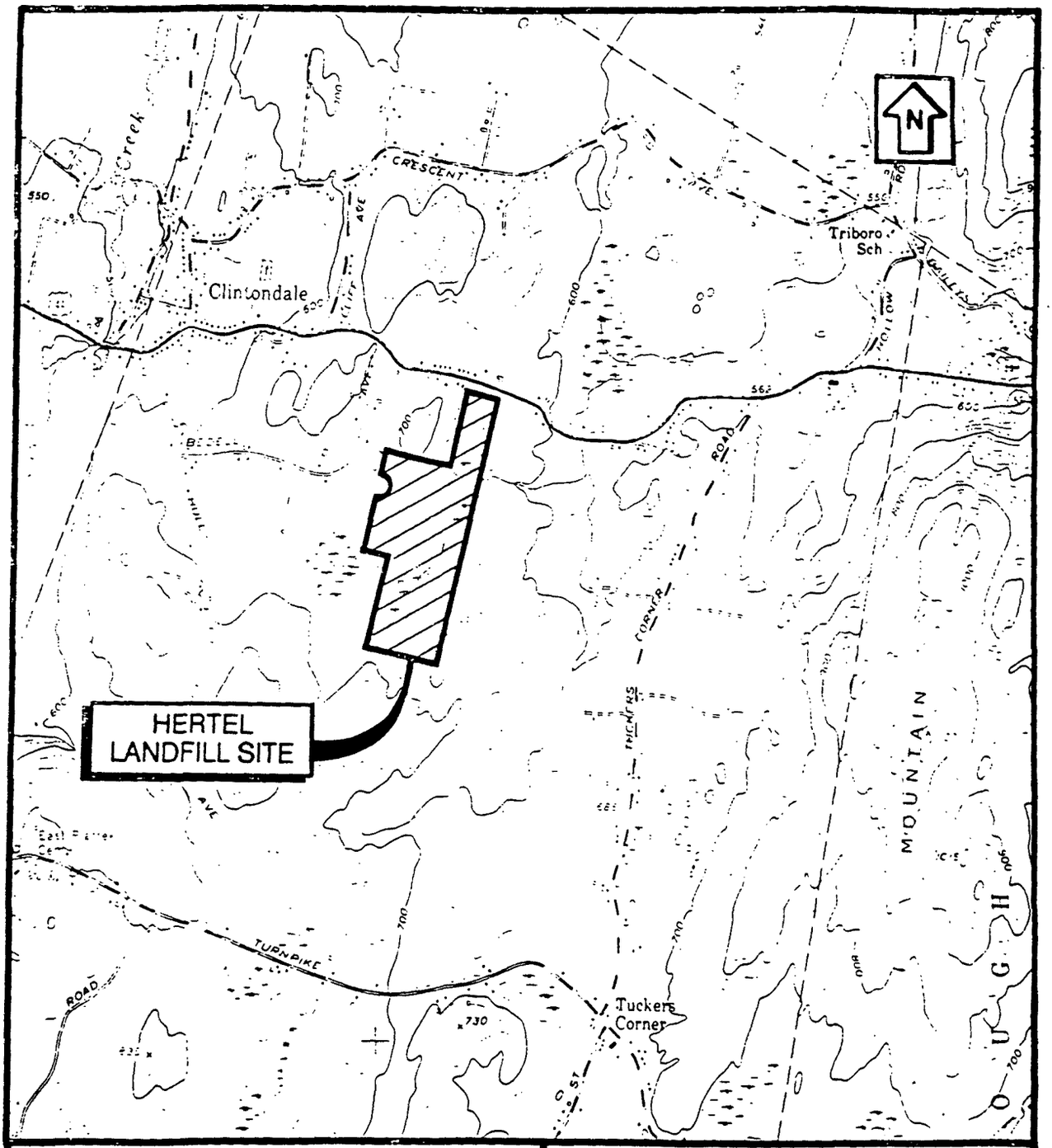
The statutory preference for remedies that employ treatment as a principal element cannot be satisfied for the source area i.e. the landfill itself. Treatment of the landfill material is not practicable. The size of the landfill and the fact that there are no identified on-site hot spots that represent the major sources of contamination preclude a remedy in which contaminants could be excavated and treated effectively. However, the selected remedy and contingency remedy do call for the treatment of contaminated groundwater at the Site and hence do satisfy the preference for treatment for this portion of the remedy.

DOCUMENTATION OF SIGNIFICANT CHANGES

There are no significant changes from the preferred alternative presented in the Proposed Plan.

APPENDIX I

FIGURES



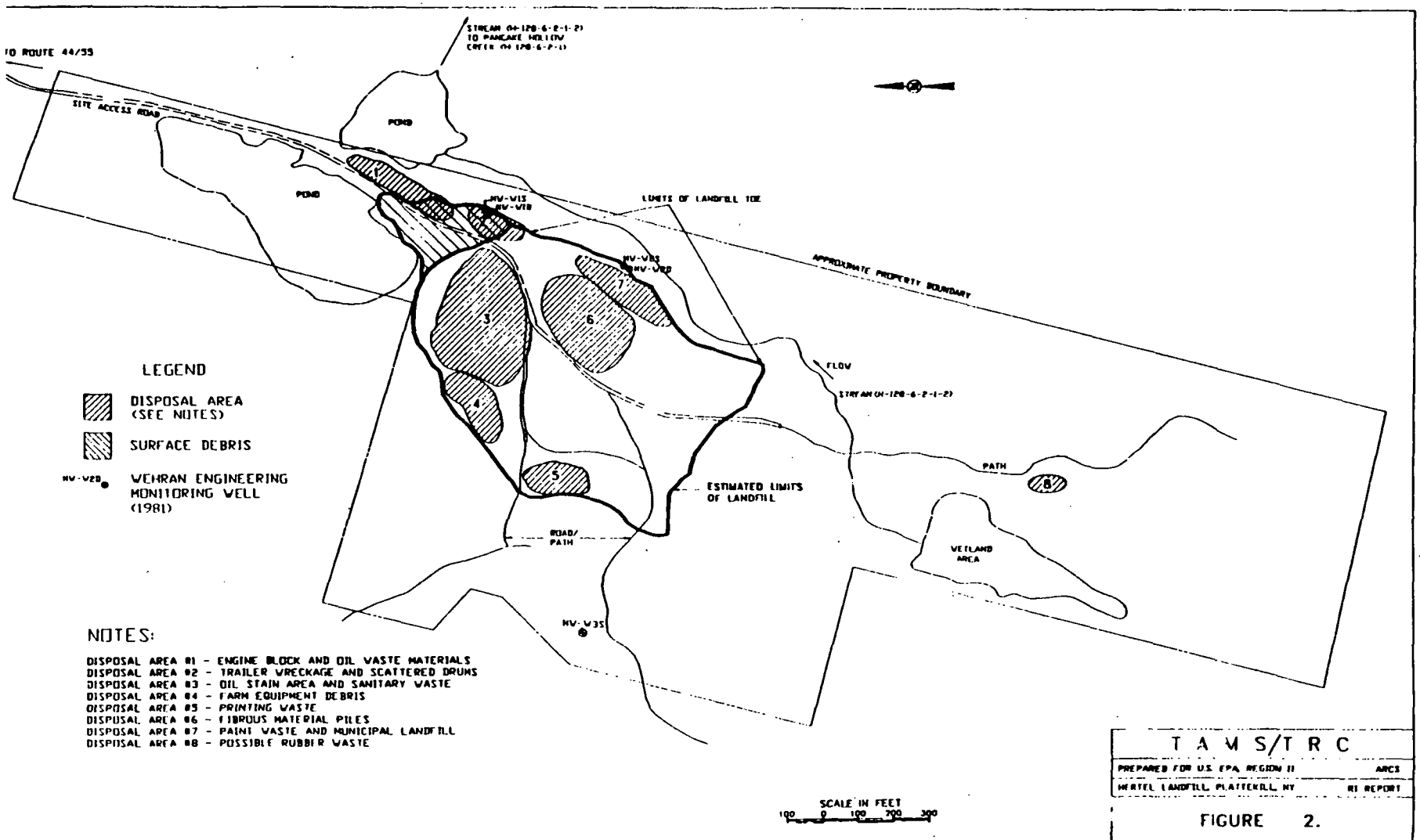
From Clintondale, NY U.S.G.S. 7.5' Topographic Map, 1957

T A M S/T R C

PREPARED FOR U.S. EPA, REGION II	ARCS
HERTEL LANDFILL, PLATTEKILL, NY	FS REPORT

FIGURE 1

SITE LOCATION MAP



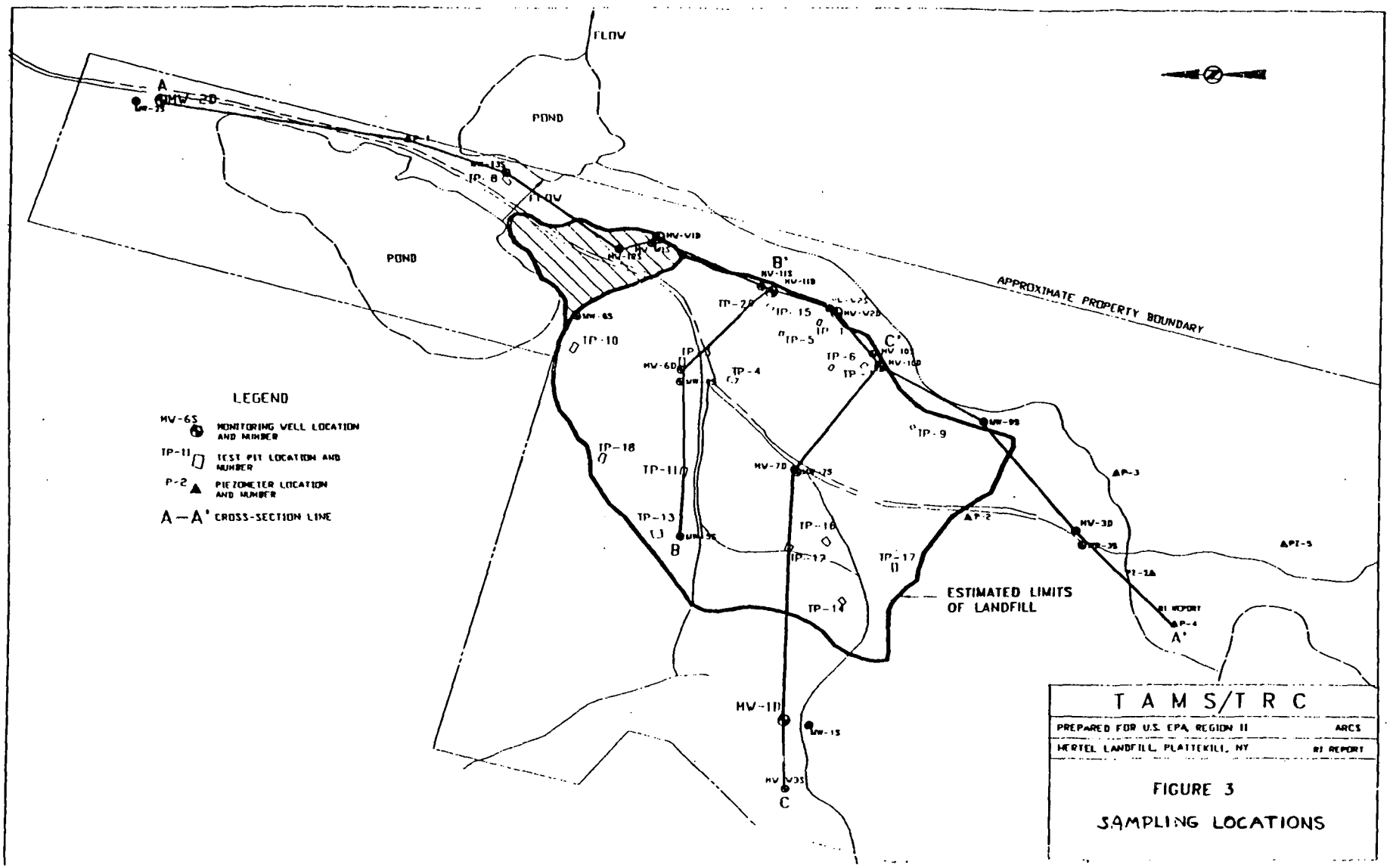
T A M S/T R C

PREPARED FOR U.S. EPA, REGION II — ARCS

HERTEL LANDFILL, PLATTEKILL, NY — RI REPORT

FIGURE 2.

HERTEL LANDFILL SITE MAP (DISPOSAL AREAS)



T A M S/T R C	
PREPARED FOR U.S. EPA, REGION II	ARCS
HERTEL LANDFILL, PLATTEKILL, NY	RI REPORT

FIGURE 3

SAMPLING LOCATIONS

APPENDIX II

TABLES

Table 1A

SUMMARY OF GROUND WATER DATA - ROUND I

	FREQUENCY OF DETECTION	SAMPLES RANGE OF SQL (ug/l)	RANGE OF DETECTION (ug/l)	95% UCL (ug/l)	RANGE OF ON-SITE BACKGROUND LEVELS (ug/l)	U.S. BACKGROUND LEVELS (ug/l)
SEMIVOLATILE ORGANICS						
1,2-Dichlorobenzene	0/25	0.01	NA	NA	NA	NA
1,4-Dichlorobenzene	1/25	0.01	0.002	0.002*	0.01	NA
2,4-Dimethylphenol	3/25	0.01	0.003-0.005	0.005*	0.01	NA
4-Methylphenol	2/25	0.01	0.031-0.044	0.044*	0.01	NA
Acenaphthene	0/25	0.01	NA	NA	NA	NA
Anthracene	0/25	0.01	NA	NA	0.01	NA
Benzoic acid	3/25	0.05	0.014-0.2	0.2*	0.05	NA
Benzo(a)anthracene	0/25	0.01	NA	NA	0.01	NA
Benzo(a)pyrene	0/25	0.01	NA	NA	0.01	NA
Benzo(b)fluoranthene	0/25	0.01	NA	NA	0.01	NA
Benzo(ghi)perylene	0/25	0.01	NA	NA	NA	NA
Benzo(k)fluoranthene	0/25	0.01	NA	NA	0.01	NA
Benzyl alcohol	0/25	0.01	NA	NA	NA	NA
Bis(2-ethylheryl)phthalate	1/25	0.01	0.003	0.018	0.006-0.01	NA
Butylbenzylphthalate	0/25	0.01	NA	NA	NA	NA
Chrysene	0/25	0.01	NA	NA	0.01	NA
Dibenzoanthracene	0/25	0.01	NA	NA	NA	NA
Diethylphthalate	1/25	0.01	0.01	0.01*	0.01	NA
Di-N-Butylphthalate	0/25	0.01	NA	NA	0.01	NA
Di-n-octylphthalate	1/25	0.01	0.069	0.069*	0.01	NA
Fluoranthene	0/25	0.01	NA	NA	0.01	NA
Fluorene	0/25	0.01	NA	NA	0.01	NA
Indeno(123cd)pyrene	0/25	0.01	NA	NA	0.01	NA
Naphthalene	5/25	0.01	0.004-0.039	0.012	0.01	NA
Phenanthrene	0/25	0.01	NA	NA	0.01	NA
Phenol	3/25	0.01	0.018-0.072	0.072*	0.01	NA
Pyrene	0/25	0.01	NA	NA	0.01	NA
VOLATILES						
1,1-Dichloroethane	0/25	0.005-0.01	NA	NA	0.005	NA
1,2-Dichloroethene	0/25	0.005-0.01	NA	NA	0.005	NA
Benzene	0/25	0.005	NA	NA	0.005	NA
Carbon disulfide	0/25	0.005	NA	NA	0.005	NA
Chlorobenzene	3/25	0.005	0.001-0.024	0.008	0.005	NA
Chloroethane	1/25	0.01	0.004	0.004*	0.01	NA
Chloroform	1/25	0.005	0.001	0.001*	0.005	NA
Ethylbenzene	4/25	0.005	0.001-0.064	0.012	0.005	NA
Toluene	3/25	0.005	0.016-0.033	0.033*	0.005	NA
Xylenes	2/25	0.005	0.062-0.2	0.2*	0.005	NA
INORGANICS						
Aluminium	25/25	NA	0.649-252	144.19	1.37-28.5	NA
Antimony	3/25	0.02-0.03	0.029-0.041	0.041*	0.023-0.03	NA
Arsenic	24/25	0.0022	0.001-0.041	0.024	0.001-0.009	NA
Barium	25/25	NA	0.034-1.98	1.05	0.034-0.651	NA
Beryllium	11/25	0.001-0.003	0.0013-0.015	0.051*	0.0016-0.0066	
Cadmium	5/25	0.002-0.004	ND(0.002)-0.006	0.004	0.003-0.004	NA
Calcium	25/25	NA	181-1460	407.45	196-412	NA
Chromium	19/25	6	0.0036-0.538	0.337	0.006-0.086	NA
Cobalt	20/25	0.007-0.009	0.007-0.22	0.071	0.007-0.054	NA
Copper	25/25	NA	0.0047-0.846	0.418	0.0047-0.123	NA
Iron	25/25	NA	2.29-482	314.09	7.08-97.8	NA
Lead	18/25	NA	0.0047-0.288	0.228	0.0611-0.084	NA
Magnesium	25/25	NA	2.27-133	76.558	0.282-21.6	NA
Manganese	25/25	NA	0.159-212	68.009	0.159-7.65	NA
Mercury	16/25	0.0002	0.0002-0.002	0.001	0.0002-0.001	NA
Nickel	16/25	0.016-0.028	0.0154-0.49	0.182	0.0002-0.118	NA
Potassium	25/25	NA	0.851-41.7	22.98	0.851-5.33	NA
Selenium	1/25	0.0011-0.02	ND(0.0011)-0.002	0.003	0.002-0.004	NA
Sodium	25/25	NA	2.18-112	131.28	2.1-6.79	NA
Thallium	6/25	0.001-0.002	ND(0.001)-0.003	0.002	0.002-0.002	NA
Vanadium	20/25	0.01	0.0037-0.319	0.112	0.005-0.059	NA
Zinc	25/25	NA	0.0234-2.88	0.932	0.0234-0.186	NA
PESTICIDES/PCB						
4,4'-DDD	0/25	0.0001	NA	NA	0.0001	NA
4,4'-DDE	0/25	0.0001	NA	NA	0.0001	NA
4,4'-DDT	0/25	0.0001	NA	NA	0.0001	NA

ND: NOT DETECTED
NA: NOT APPLICABLE
*: MAXIMUM DETECTED VALUE

Table 1B

SUMMARY OF SURFACE WATER DATA INCLUDING LEACHATE SAMPLES

	FREQUENCY OF DETECTION	SAMPLES RANGE OF SQL (ug/l)	RANGE OF DETECTION (ug/l)	95% UCL (ug/l)	RANGE OF ON-SITE BACKGROUND LEVELS(ug/l)	U.S. BACKGROUND LEVELS (ug/l)
SEMIVOLATILE ORGANICS						
1,2-Dichlorobenzene	0/20	0.01	NA	NA	0.01	NA
1,4-Dichlorobenzene	0/20	0.01	NA	NA	0.01	NA
4-Methylphenol	2/20	0.01	0.007-0.11	0.018	0.01	NA
Acenapthene	0/20	0.01	NA	NA	0.01	NA
Anthracene	0/20	0.01	NA	NA	0.01	NA
Benzoic Acid	1/20	0.01-0.05	0.009	0.01*	0.01	NA
Benzo(a)anthracene	0/20	0.01	NA	NA	0.01	NA
Benzo(a)pyrene	0/20	0.01	NA	NA	0.01	NA
Benzo(b)fluoranthene	0/20	0.01	NA	NA	0.01	NA
Benzo(g,h,i)perylene	0/20	0.01	NA	NA	0.01	NA
Benzo(k)fluoranthene	0/20	0.01	NA	NA	0.01	NA
Benzyl Alcohol	1/20	0.01	0.01	0.01	0.01	NA
Bis(2-ethylhexyl)phthalate	2/20	0.01	0.002-0.005	0.005	0.01	NA
Butylbenzylphthalate	0/20	0.01	NA	NA	0.01	NA
Chrysene	0/20	0.01	NA	NA	0.01	NA
Dibenzo(a,h)anthracene	0/20	0.01	NA	NA	0.01	NA
Diethylphthalate	0/20	0.01	NA	NA	0.01	NA
Di-N-Butylphthalate	1/20	0.01	0.003	0.003*	0.01	NA
Di-n-octylphthalate	1/20	0.01	0.003	0.003*	0.003-0.01	NA
Fluoranthene	1/20	0.01	0.002	0.002*	0.01	NA
Fluorene	0/20	0.01	NA	NA	0.01	NA
Indeno(123cd)pyrene	0/20	0.01	NA	NA	0.01	NA
Naphthalene	1/20	0.01	0.004	0.004*	0.01	NA
Phenanthrene	2/20	0.01	0.001-0.002	0.002*	0.01	NA
Phenol	1/20	0.01	ND(0.01)-0.021	0.012	0.01	NA
Pyrene	1/20	0.01	0.002	0.002*	0.01	NA
VOLATILES						
Carbon Disulfide	2/20	0.005	0.005-0.008	0.005	0.005	NA
Chlorobenzene	4/20	0.005	0.001-0.008	0.006	0.005	NA
Chloroethane	1/20	0.010	0.005	0.005	0.010	NA
1,1-Dichloroethane	1/20	0.005	0.003	0.003	0.005	NA
Ethylbenzene	2/20	0.005	0.001-0.004	0.005	0.005	NA
Toluene	3/20	0.005	0.001-0.004	0.005	0.005	NA
Xylenes	2/20	0.005	0.002-0.007	0.006	0.005	NA
INORGANICS						
Aluminium	13/20	0.02-0.096	ND(0.02)-20.4	86.22	0.0415-0.628	NA
Antimony	2/20	0.010-0.023	ND(0.01)-0.015	0.011	0.010	NA
Arsenic	7/20	0.01-0.02	ND(0.001)-0.012	0.005	0.002	NA
Barium	20/20	NA	0.008-3.58	1.85	0.008-0.025	NA
Beryllium	0/20	0.01-0.04	NA	NA	0.001	NA
Calcium	20/20	NA	11.7-317	118.02	11.7-19.3	NA
Cadmium	8/20	0.02-0.05	0.002-0.178	0.101	0.002	NA
Chromium	3/20	0.03-0.06	ND(0.003)-0.316	0.027	0.005	NA
Cobalt	6/20	0.04-0.09	ND(0.004)-0.016	0.009	0.004	NA
Copper	10/20	0.02-0.04	ND(0.002)-0.370	0.064	0.003-0.009	NA
Iron	20/20	NA	0.013-836	836	0.178-1.63	NA
Lead	13/20	0.001-0.010	ND(0.001)-0.454	0.441	0.0038-0.031	NA
Magnesium	20/20	NA	0.853-18.6	14.55	0.853-1.27	NA
Manganese	20/20	NA	0.033-25.3	35.75	0.0326-0.087	NA
Mercury	5/20	0.0002	ND(0.0002)-0.004	0.0006	0.0002	NA
Nickel	6/20	0.005-0.022	ND(0.005)-0.116	0.028	0.005-0.006	NA
Potassium	17/20	0.445-0.780	ND(0.445)-28.3	13.25	0.780-0.794	NA
Selenium	2/20	0.002-0.003	ND(0.002)-0.0028	0.0028	0.003	NA
Silver	0/20	0.002-0.006	NA	NA	0.004	NA
Sodium	20/20	NA	1.730-79.8	36.37	1.73-1.88	NA
Thallium	0/20	0.001-0.020	NA	NA	0.002	NA
Vanadium	8/20	0.003-0.004	ND(0.003)-0.055	0.0098	0.003-0.010	NA
Zinc	10/20	0.007	0.0022-11.2	11.2	NA	NA
Cyanide	2/20	0.010-0.0125	ND(0.010)-0.085	0.018	0.010-0.013	NA
PESTICIDES						
4,4'-DDE	0/20	ND(0.0001)	NA	NA	0.0001	NA
4,4'-DDD	0/20	ND(0.0001)	NA	NA	0.0001	NA
4,4'-DDT	0/20	ND(0.0001)	NA	NA	0.0001	NA

ND: NOT DETECTED
NA: NOT APPLICABLE
*: MAXIMUM DETECTED VALUE

Table 1C

SUMMARY OF SEDIMENT DATA

	FREQUENCY OF DETECTION	RANGE OF SQL (ug/kg)	RANGE OF DETECTION (ug/kg)	95% UCL (ug/kg)	RANGE OF ON-SITE BACKGROUND LEVELS (ug/kg)	U.S. BACKGROUND LEVELS (ug/kg) A
SEMIVOLATILE ORGANICS						
1,2-Dichlorobenzene	1/21	0.450-5.1	0.120	0.120*	0.90-4.70	NA
1,4-Dichlorobenzene	0/21	0.45-9.4	NA	NA	0.90-4.70	NA
2,4-Dimethylphenol	0/21	0.45-9.4	NA	NA	0.90-4.70	NA
4-Methylphenol	1/21	0.45-9.4	ND(0.45)-0.59	0.059*	0.90-4.70	NA
Acenaphthene	1/21	0.45-0.58	0.28	0.280*	0.90-4.70	NA
Anthracene	0/21	0.45-9.4	NA	NA	0.90-4.70	NA
Benzoic acid	0/21	2.2-46	NA	NA	4.3-23	NA
Benzo(a)anthracene	1/21	0.45-4.9	ND(0.45)-1.0	1.15	0.90-4.70	NA
Benzo(a)pyrene	0/21	0.45-9.4	NA	NA	0.90-4.70	NA
Benzo(b)fluoranthene	1/21	0.45-4.2	ND(0.45)-0.77	0.799	0.90-4.70	NA
Benzo(g,h,i)perylene	0/21	0.45-9.4	NA	NA	0.90-4.70	NA
Benzo(k)fluoranthene	0/21	0.45-9.4	NA	NA	0.90-4.70	NA
Bis(2ethylhexyl)phthalate	6/21	0.45-9.4	0.10-2.90	2.23	0.90-4.70	NA
Butylbenzylphthalate	0/21	0.45-9.4	NA	NA	0.90-4.70	NA
Chrysene	2/21	0.45-4.9	0.28-0.93	1.02	0.90-4.70	NA
Dibenzoanthracene	0/21	0.45-9.4	NA	NA	0.90-4.70	NA
Diethylphthalate	0/21	0.45-9.4	NA	NA	0.90-4.70	NA
Di-n-butylphthalate	2/21	0.45-9.4	ND(0.45)-0.61	0.59	0.90-4.70	NA
Dioctylphthalate	0/21	0.45-9.4	NA	NA	0.90-4.70	NA
Fluoranthene	2/21	0.45-9.4	ND(0.45)-1.60	1.44	0.90-4.70	NA
Fluorene	2/21	0.45-0.87	0.26-0.37	0.37	0.90-4.70	NA
Indeno(123cd)pyrene	0/21	0.45-9.4	NA	NA	0.90-4.70	NA
Naphthalene	3/21	0.45-9.4	ND(0.45)-1.0	1.11	0.90-4.70	NA
Phenanthrene	2/21	0.45-9.4	ND(0.45)-1.50	1.43	0.90-4.70	NA
Phenol	0/21	0.45-9.4	NA	NA	0.90-4.70	NA
Pyrene	2/21	0.45-9.4	ND(0.45)-1.50	1.43	0.90-4.70	NA
VOLATILES						
1,1-Dichloroethane	0/21	0.007-0.071	NA	NA	0.013-0.035	NA
1,2-Dichloroethene	0/21	0.007-0.071	NA	NA	0.013-0.035	NA
Benzene	0/21	0.007-0.071	NA	NA	0.013-0.035	NA
Carbon disulfide	7/21	0.007-0.071	0.004-0.064	0.035	0.009-0.035	NA
Chlorobenzene	3/21	0.007-0.071	ND(0.007)-0.43	0.102	0.013-0.035	NA
Chloroethane	0/21	0.017-0.14	NA	NA	0.027-0.07	NA
Chloroform	1/21	0.007-0.071	ND(0.007)-0.01	0.01*	0.013-0.035	NA
Ethylbenzene	1/21	0.007-0.071	ND(0.007)-0.013	0.013*	0.013-0.035	NA
Toluene	4/21	0.007-0.071	0.006-0.049	0.027	0.006-0.035	NA
Trichloroethene	0/21	0.007-0.071	NA	NA	0.013-0.035	NA
Xylenes	3/21	0.007-0.071	ND(0.007)-0.97	0.106	0.013-0.035	NA
INORGANICS						
Aluminium	21/21	NA	1530-32500	18014.8	1530-10200	72000
Antimony	0/21	3.2-23.7	NA	NA	7.5-23.5	0.66
Arsenic	21/21	NA	1.2-30	13.1	1.9-6	7.2
Barium	21/21	NA	32.8-6230	486.4	45-142	580
Beryllium	15/21	0.28-2.4	ND(0.28)-3.5	2.3	0.75-2.4	0.92
Cadmium	11/21	1.3-5.9	ND(1.3)-17.1	9.8	1.6-4.7	9.1
Calcium	21/21	NA	1270-23700	19684.7	10000-23700	24000
Chromium	20/21	11.9	7.6-64.4	25.6	11.9-14.8	54
Cobalt	17/21	3-9.5	ND(3)-60.6	10.8	3-9.5	9.1
Copper	21/21	NA	3-64.8	38	15.5-21.5	25
Iron	21/21	NA	1310-137000	105995	1310-3970	26000
Lead	8/21	NA	8.3-93.7	90	NA	19
Magnesium	21/21	NA	721-3110	2547.6	721-1060	9000
Manganese	21/21	NA	83-68100	10161.6	83-104	550
Mercury	6/21	0.13-1.1	ND(0.13)-7	0.5	0.38-1.1	0.09
Nickel	19/21	11.9	6.2-31.7	21.9	7.3-11.9	19
Potassium	19/21	711-1240	500-2080	1271.5	1250-2080	15000
Selenium	12/21	0.42-16.4	ND(0.42)-5.9	4.5	2.1-7.6	0.39
Silver	6/21	0.93-9.5	0.84-12.8	5.5	3-9.5	80
Sodium	21/21	NA	82.9-771	688.5	139-296	12000
Thallium	2/21	0.29-5.1	ND(0.29)-0.45	2.3	1.4-5.1	9.4
Vanadium	21/21	NA	7.5-79.5	30.9	8.1-11.1	80
Zinc	10/21	NA	32-340	259.8	NA	60
Cyanide	2/21	0.94-12.7	ND(0.94)-3	6	3.8-12.7	NA
PESTICIDES/PCBS						
4,4'-DDE	1/21	0.027-0.053	ND(0.027)-0.038	0.039	NA	NA
4,4'-DDD	0/21	0.022-0.11	NA	NA	NA	NA
4,4'-DDT	1/21	0.022-0.11	ND(0.022)-0.074	0.054	NA	NA

ND: NOT DETECTED
NA: NOT APPLICABLE
*: MAXIMUM DETECTED VALUE
A: Source - USGS(1983)

Table 1D

SUMMARY OF SURFACE SOIL DATA

COMPOUND NAME	FREQUENCY OF DETECTION	RANGE OF SQL (ug/kg)	RANGE OF DETECTION (mg/kg)	95% UCL (mg/kg)	RANGE OF ON-SITE BACKGROUND LEVELS(mg/kg)	U.S BACKGROUND LEVELS(mg/kg) A
SEMIVOLATILE ORGANICS						
1,2-Dichlorobenzene	0/22	0.37-24	NA	NA	0.57	NA
1,4-Dichlorobenzene	0/22	0.37-24	NA	NA	0.57	NA
2,4-Methylphenol	0/22	0.37-24	NA	NA	0.57	NA
4-Methylphenol	0/22	0.37-24	NA	NA	0.57	NA
Acenaphthene	1/22	0.37-24	0.062	0.06	0.57	NA
Anthracene	2/22	0.37-24	0.048-0.13	0.13	0.57	NA
Benzoic Acid	0/22	0.37-24	NA	NA	2.8	NA
Benzo(a)anthracene	5/22	0.37-24	0.082-1.2	0.77	0.57	NA
Benzo(a)pyrene	4/22	0.37-24	0.094-1.1	0.97	0.57	NA
Benzo(b)fluoranthene	6/22	0.37-24	0.086-1.7	0.93	0.57	NA
Benzo(ghi)perylene	3/22	0.37-24	0.14-0.72	0.72	0.57	NA
Benzo(k)fluoranthene	1/22	0.37-24	0.098	0.098	0.57	NA
Bis(2ethylhexyl)phthalate	10/22	0.37-24	0.037-2.4	1.64	0.57	NA
Butylbenzylphthalate	0/22	0.37-24	NA	NA	0.57	NA
Chrysene	6/22	0.37-24	0.078-1.7	0.87	0.57	NA
Dibenzo(a,h)anthracene	0/22	0.37-24	NA	NA	0.57	NA
Diethylphthalate	1/22	0.37-24	0.043	0.04	0.57	NA
Di-n-butylphthalate	2/22	0.37-24	0.08-0.09	0.09	0.57	NA
Di-n-octylphthalate	0/22	0.37-24	NA	NA	0.57	NA
Fluoranthene	7/22	0.37-24	0.063-2.4	2.26	0.57	NA
Fluorene	1/22	0.37-24	0.046	0.05	0.57	NA
Indeno(123cd)pyrene	4/22	0.37-24	0.058-0.65	0.72	0.57	NA
Naphthalene	1/22	0.37-24	ND(0.37)-3.1	2.36	0.57	NA
Phenanthrene	5/22	0.37-24	0.077-1.9	1.16	0.57	NA
Phenol	0/22	0.37-24	NA	NA	0.57	NA
Pyrene	7/22	0.37-24	0.058-2.8	2.32	0.57	NA
INORGANICS						
Aluminum	22/22	NA	5210-33500	19316.2	5330-28700	72000
Antimony	0/22	7.5-18.6	NA	NA	11.5-18.6	0.66
Arsenic	9/22	NA	9.1-109	45.4	NA	7.2
Barium	22/22	NA	43.5-2070	191.1	43.5-155	580
Beryllium	2/22	0.68-1.7	ND(0.68)-0.84	1	1.0-1.70	0.92
Cadmium	17/22	1.1-2.8	ND(1.1)-38.6	7.6	1.7-2.8	0.5
Calcium	22/22	NA	1410-29500	11293:7	2530-8890	24000
Chromium	22/22	NA	7.7-2880	502.4	10.3-22.4	54
Cobalt	21/22	NA	5.4-29.4	18.4	4.5-12.5	9.1
Copper	11/22	NA	32.20-319	161.5	NA	25
Iron	22/22	NA	538-278000	115980	4880-32500	26000
Lead	19/22	0.29-0.35	ND(0.29)-835	581.5	0.35-123	19
Magnesium	19/22	191-335	ND(191)-14200	15127	499-2040	9000
Manganese	22/22	NA	478-1890	1732	230-1790	550
Mercury	14/22	NA	0.3-1.60	1.6	NA	0.09
Nickel	21/22	7.9	ND(7.9)-347	64.7	7.9-15.3	19
Potassium	14/22	730-1780	14.9-2320	2810.7	1100-1780	15000
Selenium	0/22	1.1-28.2	NA	NA	17.5-28.2	0.39
Sodium	16/22	182-449	ND(182)-1460	672.1	279-449	12000
Thallium	0/22	1.4-3.4	NA	NA	2.1-3.4	9.4
Vanadium	22/22	NA	16.9-51.1	31.3	36.5-51.1	80
Zinc	22/22	NA	62.6-469	183	67.8-133	60
Cyanide	0/22	1.1-2.8	NA	NA	1.7-2.8	NA
PESTICIDES/PCBs						
4,4'-DDE	2/22	0.018-1.5	ND(0.018)-0.50	0.341	0.500	NA
4,4'-DDD	0/22	0.018-1.5	NA	NA	0.280	NA
4,4'-DDT	6/22	0.018-1.5	ND(0.018)-0.62	0.491	0.540	NA

ND: NOT DETECTED
NA: NOT APPLICABLE
A: Source-USGS(1983)

Table 1E

SUMMARY OF SUBSURFACE SOIL DATA

COMPOUND NAME	FREQUENCY OF DETECTION	RANGE OF SOIL (mg/kg)	RANGE OF DETECTION (mg/kg)	95% UCL (mg/kg)	RANGE OF ON-SITE BACKGROUND LEVELS (mg/kg)	U.S. BACKGROUND LEVELS (mg/kg) A
SEMIVOLATILE ORGANICS						
1,2-Dichlorobenzene	0/11	0.370-24.0	NA	NA	NA	NA
1,4-Dichlorobenzene	1/11	0.370-24.0	0.10	0.1	NA	NA
2,4-Dimethylphenol	0/11	0.370-24.0	NA	NA	NA	NA
4-Methylphenol	1/11	0.370-24.0	0.34	0.34	NA	NA
Acenapthene	0/11	0.370-24.0	NA	NA	NA	NA
Anthracene	2/11	0.370-24.0	0.088-0.15	0.15	NA	NA
Benzoic Acid	1/11	1.8-120	0.22	0.22	NA	NA
Benzo(a)Anthracene	2/11	0.37-0.84	0.30-0.42	0.43	NA	NA
Benzo(a)Pyrene	1/11	0.37-0.84	0.24	0.24	NA	NA
Benzo(b)Fluoranthene	2/11	0.37-4.1	0.26-0.71	0.69	NA	NA
Benzo(g,h,i)perylene	0/11	0.370-24.0	NA	NA	NA	NA
Benzo(k)Fluorathene	2/11	0.37-0.77	0.27-0.36	0.391	NA	NA
Bis(2-Ethylhexyl)Phthalate	5/11	0.370-24.0	0.087-4.5	6.39	NA	NA
Butylbenzylphthalate	2/11	0.370-24.0	0.092-0.24	0.24	NA	NA
Chrysene	2/11	0.37-0.84	0.27-0.43	0.43	NA	NA
Dibenzo(a,h)anthracene	0/11	0.370-24.0	NA	NA	NA	NA
Diethylphthalate	1/11	0.370-24.0	0.11	0.11	NA	NA
Di-n-butylphthalate	0/11	0.370-24.0	NA	NA	NA	NA
Di-n-Octylphthalate	1/11	0.370-24.0	0.20	0.2	NA	NA
Fluoranthene	4/11	0.370-24.0	0.05-1.2	1.35	NA	NA
Fluorene	1/11	0.370-24.0	ND(0.37)-0.42	0.60	NA	NA
Indeno(1,2,3-cd)pyrene	0/11	0.370-24.0	NA	NA	NA	NA
Naphthalene	6/11	0.37-1.9	0.068-0.65	0.65	NA	NA
Phenanthrene	4/11	0.370-24.0	0.17-1.1	0.84	NA	NA
Phenol	0/11	0.370-24.0	NA	NA	NA	NA
Pyrene	4/11	0.370-24.0	0.073-1.1	1.21	NA	NA
VOLATILE ORGANICS						
Benzene	2/11	0.006	0.001-0.002	0.002	NA	NA
Carbon Disulfide	3/11	0.006	0.003	0.003	NA	NA
Chlorobenzene	5/11	0.006	0.001-0.009	0.007	NA	NA
Ethylbenzene	7/11	0.006	ND(0.006)-0.041	0.023	NA	NA
Toluene	8/11	0.006	0.002-0.015	0.012	NA	NA
Xylene(total)	8/11	0.006	ND(0.006)-0.310	0.422	NA	NA
INORGANICS						
Aluminium	11/11	NA	9360-16200	13255.5	NA	72000
Antimony	6/11	2.9-3.9	ND(2.9)-21	22.8	NA	0.66
Arsenic	11/11	NA	2-12.5	6.9	NA	7.2
Barium	11/11	NA	32-378	118.8	NA	580
Beryllium	11/11	NA	0.43-0.89	0.8	NA	0.92
Cadmium	4/11	0.41-0.55	ND(0.41)-1.8	0.8	NA	0.5
Calcium	11/11	NA	986-2450	1722.8	NA	24000
Chromium	11/11	NA	12.2-21.9	18.3	NA	54
Cobalt	11/11	NA	8.9-13.9	12.5	NA	9.1
Copper	11/11	NA	20.3-45.6	36.1	NA	25
Iron	11/11	NA	17400-28300	24278.1	NA	26000
Lead	11/11	NA	8.5-93.1	60.1	NA	19
Magnesium	11/11	NA	3990-6010	4954.3	NA	9000
Manganese	11/11	NA	201-1720	1250.2	NA	550
Nickel	11/11	NA	14.3-25	21.1	NA	19
Potassium	11/11	NA	738-1550	1334.6	NA	15000
Selenium	0/11	0.22-0.49	NA	0.4	NA	0.39
Sodium	6/11	NA	70.5-237	191.5	NA	12000
Vanadium	11/11	NA	12.1-22.3	16.8	NA	80
Zinc	11/11	NA	48.6-286	134.1	NA	60
Cyanide	2/11	0.5-0.75	ND(0.50)-10.4	2.4	NA	NA
PESTICIDES/PCBS						
4,4'-DDE	0/11	0.035-0.051	NA	NA	NA	NA
4,4'-DDD	0/11	0.035-0.051	NA	NA	NA	NA
4,4'-DDT	0/11	0.035-0.051	NA	NA	NA	NA

ND: NOT DETECTED
NA: NOT APPLICABLE
A: Source - USGS(1983)

Table 1F

HERTEL LANDFILL REMEDIAL INVESTIGATION

COMPOUNDS DETECTED IN THE PRIVATE WELLS

FIELD SAMPLE ID	PW-01	PW-2	PW-03	PW-04	PW-05	PW-06	PW-07	PW-08	PW-09	PW-10	PW-11	PW-12
DATE SAMPLED	19-Jun-90	19-Jun-90	20-Jun-90	20-Jun-90	20-Jun-90	20-Jun-90	20-Jun-90	20-Jun-90	20-Jun-90	20-Jun-90	20-Jun-90	20-Jun-90
SAMPLE TYPE	CERRA	CAVEZZA	LACASCIO	M. LAMANNA	F. LAMANNA	JOHNSON	SNYDER	ROOSA	BISACCIO	ERICKSEN BONE	ERICKSEN APT.	DUP OF PW-8
VOLATILE ORGANICS (ug/l).												
ACETONE	10 U	5 J	10 U	10 U	10 UJ	10 UJ	10 UJ	10 UJ	10 U	10 U	10 U	10 U
BASE NEUTRAL/ACID EXTRACTABLES (ug/l)	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
PESTICIDES/PCB's (ug/l)	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
INORGANICS (ug/l)												
ARSENIC	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 UJ	3.2 J	2.0 UJ	2.0 UJ	2.0 U	2.0 U	2.0 UJ
BARIUM	6.2	16.1	5.2	5.2	10.9	17.5	49.0 J	6.0	29.2 J	34.3	14.0	9.4
CALCIUM	39200.0	27100.0	54500.0	28900.0	56500.0	45300.0	41700.0	27200.0	43500.0	46500.0	64400.0	37600.0
COPPER	15.0	4.6	3.3	18.2	3.0 U	81.2	38.5	24.6	7.5	11.7	24.8	34.7
IRON	205.0	139.0	63.1	29.2	43.2	71.5	539.0	110.0	252.0	28.6	412.0	139.0
LEAD	2.4 J	3.4 J	2.4 J	2.2 J	2.0 UJ	-- R	-- R	-- R	-- R	2.6 J	30.7 J	-- R
MAGNESIUM	2360.0	2170.0	4400.0	1790.0	7450.0	5180.0	4390.0	1950.0	5640.0	8940.0	5260.0	2740.0
MANGANESE	7.0 U	41.2	7.0 U	7.0 U	7.0 U	4.3	242.0	1.2	156.0	7.0 U	49.9	2.4
SELENIUM	3.0 U	3.0 U	3.0 U	3.0 U	3.0 U	3.0 UJ	3.0 UJ	3.0 UJ	3.0 UJ	3.0 U	3.0 U	3.0 U
SODIUM	6700.0	6560.0	12400.0	7050.0	5490.0	7670.0	11900.0	19300.0 J	4560.0	7180.0	30500.0	28200.0 J
ZINC	-- R	-- R	-- R	-- R	-- R	26.8	34.1	211.0 J	41.4 J	-- R	-- R	276.0 J
WET CHEMISTRY (mg/l)												
CHLORIDE	20	15	14	9.8	20	39.0	35.0	50.0	4.3	78.0	10.0	50.0
TKN	0.18	0.15	0.14	0.15	<0.10	0.18	0.13	0.15	<0.10	0.13	<0.10	0.25
TOTAL DISSOLVED SOLIDS	160	120	200	180	310	250	220	190	140	320	200	190
SULFATE	18	20	19	17	16	28	15	18	20	24	19	19
CARBONATE as CaCO3	VS	VS	VS	VS	VS	VS	VS	VS	VS	VS	VS	VS
BICARBONATE as CaCO3	82	55	140	62	140	61	140	76	190	120	130	75
NITRATE-NITRITE-N2	0.25	<0.050	2.9	1.6	0.10	4.8	<0.050	1.0	<0.050	2.0	1.1	1.0
AMMONIA NITROGEN	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
TOC	<1.0 J	1.49 J	<1.0	<1.0	<1.0	<1.0	1.08	<1.0	<1.0	<1.0 J	<1.0 J	<1.0
FIELD PARAMETERS												
pH (standard units)	6.8	NA	6.4	5.7	6.3	6.8	7.4	7	7.8	6.3	6.5	DUP
TEMPERATURE (°C)	18	18	16.5	20	17	17	19	NA	15.5	18	15	DUP
EH (mv)	NA	NA	140	182	147	215	50	161	187	114	111	DUP
CONDUCTIVITY (umhos/cm)	210	270	270	185	290	265	440	312	210	300	405	DUP
SALINITY (%)	0	0	0	0	0	0	0	NA	0	0	0	DUP

U = Not Detected to the Reported Detection Limit

UJ = Not Detected to an Estimated Detection Limit

J = Estimated Value

R = Data Rejected by Validation

ND = No analytes of this compound group detected

Table 2A

HERTEL LANDFILL REMEDIAL INVESTIGATION

COMPARISON OF GROUND WATER CONCENTRATIONS TO ARARS

Parameter	Maximum Concentration Observed In Ground Water (ppb)	Federal ARARs			New York ARARs	
		MCL[1] (ppb)	MCLG[2] (ppb)	Ambient Water[3] Quality Criteria (ppb)	Ground Water[4] Quality Criteria (ppb)	NYMCL[5] (ppb)
Acetone	45					50
Benzene	6	5	0	0.66	ND	5
2-Butanone	31					50
Chlorobenzene	24	100	100	488	20	5
Chloroethane	4					5
Chloroform	1	100(a)		0.19	100	
1,1-Dichloroethane	2					5
1,2-Dichloroethene	1	cis-70 trans-100	cis-70 trans-100			5
1,2-Dichloropropane	1	5	0		50	5
Ethylbenzene	64	700	700	2,400	50	5
Styrene	1	100	100		931	5
Toluene	33	1,000	1,000	15,000	50	5
Trichloroethene	1	5	0	2.8	10	5
Xylenes	240	10,000	10,000		50	
Benzoic Acid	200					50
Benzyl Alcohol	6					
Bis (2-ethylhexyl) Phthalate	21		(0)	21,000	50	
1,4-Dichlorobenzene	10	75	75	470	4.7	5
Diethylphthalate	900			434,000	50	50
2,4-Dimethylphenol	82			400	0.3	5
Di-n-octylphthalate	69				50	50
2-Methylnaphthalene	5					50
4-Methylphenol	44					
Naphthalene	39				10	50
Phenanthrene	11				50	50
Phenol	72			3,500	1	50
Aluminum (total/dissolved)	252,000/733					
Arsenic (total/dissolved)	44.1/33.8	50	(50)	0.0022	25	50
Barium (total/dissolved)	1,980/732	2,000	2,000		1000	1000
Berylium (total/dissolved)	13.4/ND	1	0			
Cadmium (total/dissolved)	9.0/ND	5	5	10	10	10
Calcium (total/dissolved)	71,000/264,000					
Chromium (total/dissolved)	538/ND	100	100	50		50
Cobalt (total/dissolved)	220/ND					
Copper (total/dissolved)-Not Primary	846/ND	See Note		1000	1000	200
Iron (total/dissolved)	893,800/116,000				300	300

Table 2A

HERTEL LANDFILL REMEDIAL INVESTIGATION

COMPARISON OF GROUND WATER CONCENTRATIONS TO ARARS

(Continued)

Parameter	Maximum Concentration Observed In Ground Water (ppb)	Federal ARARs			New York ARARs	
		MCL[1] (ppb)	MCLG[2] (ppb)	Ambient Water[3] Quality Criteria (ppb)	Ground Water[4] Quality Criteria (ppb)	NYMCL[5] (ppb)
Lead (total/dissolved)	313/5.9	See Note	0	50	25	50
Magnesium (total/dissolved)	133,000/55,500					35,000
Manganese (total/dissolved)	121,000/27,900			50	300	300
Mercury (total/dissolved)	— 0.90/0.3	2	2	10	2	2
Nickel (total/dissolved)	490/43.2	(100)	(100)	15.4		
Potassium (total/dissolved)	41,000/38,500					
Silver (total/dissolved)	266/ND	100		50	50	50
Sodium (total/dissolved)	115,000/122,000					20,000
Vanadium (total/dissolved)	319/ND					
Zinc (total/dissolved)	2,880/91.6			5,000		300
Chloride	150,000			250,000	250,000	

(a) Based on standard for total trihalomethanes of 100 ppb.

ND - Not detected.

1 MCL - Maximum Contaminant Level, National Primary Drinking Water Regulations, Final Rule Amendments to SDWA, U.S. EPA, 1/30/91, 40 CFR 141 - (Proposed MCL)

2 MCLG - Maximum Contaminant Level Goals, based on health considerations only, amendments to SDWA, U.S. EPA, 1/30/91; Cites 50 FR 46936, 11/13/85 - Proposed MCLG).

3 Derived from published EPA Ambient Water Quality Criteria (drinking water only) 45 FR 79318-79379, 11/28/90. (August 8, 1988 draft - recent update is being sent to SDWA).

4 NYSDEC 6NYCRR Part 703, Regulations for ground water (1/9/89).

5 NYSDOH 10NYCRR Part 5, Regulations for drinking water supplies (1/9/89) and NYSDOH 10NYCRR Part 170, Regulations for source of drinking water.

June 7th - Final Rule on Lead and Copper Treatment technique action levels have been identified in lieu of MCL levels: Lead 15 ppb; Copper 1,300 ppb. Testing would be done at the consumer's tap water and any time 10% of the samples exceed these limits, then action would be required.

Table 2B

HERTEL LANDFILL REMEDIAL INVESTIGATION

COMPARISON OF SURFACE WATER CONCENTRATIONS TO (ARARS)

Parameter	Maximum Concentration in Surface Water (ppb)	Maximum Concentration in Leachate Seep (ppb)	Federal ARARs			New York ARARs		
			MCL[1] (ppb)	MCLG[2] (ppb)	Ambient Water[3] Quality Criteria (ppb)	Drinking Water Supply[4] (ppb)	Fishing and Fish Propagation[4] (ppb)	Fishing and Fish Survival[4] (ppb)
Acetone	110	17						
Carbon Disulfide	2	8						
Chlorobenzene		8	100	100	488	20	5	50
Chloroethane		5						
1,1-Dichloroethane		3				50[5]		
Ethylbenzene		4	700	700	2,400	50[5]		
Methylene Chloride	10					50[5]		
Toluene	4	1	1,000	1,000	15,000	50[5]		
Trichloroethene			5	0	2.8			
Xylenes		7	10,000	10,000		50[5]		
Benzoic Acid	9							
Benzyl Alcohol	10							
Bis (2-ethylhexyl) Phthalate	3	5		(0)	21,000	4[5]	0.6	
Di-n-Butylphthalate		3				50[5]		
Fluoranthene		2				50[5]		
4-Methylphenol	7	110						
Naphthalene		4				10		
Phenanthrene		2				50[5]		
Phenol		21				1	1	1
Pyrene		2				50[5]		
Aluminum	4,280	20,400					100[5]	
Arsenic	12.1		50	(50)	0.0022	50[5]	190[6]	360[6]
Barium	509	3,580	2,000	2,000		1,000		
Cadmium	37.1	178	5	5	10	10		
Calcium	61,700	317,000						
Chromium		316	100	100	50	50		
Copper - Not Primary	39.2	370	See Note		1000	200		
Iron	190,000	526,000				300	300	300
Lead	54.9	454	See Note	0	50	50		
Magnesium	37,300	836,000				35,000		
Manganese	11,800	25,300			50	300		

Table 2B

HERTEL LANDFILL REMEDIAL INVESTIGATION

COMPARISON OF SURFACE WATER CONCENTRATIONS TO (ARARS)

(Continued)

Parameter	Maximum Concentration in Surface Water (ppb)	Maximum Concentration in Leachate Seep (ppb)	Federal ARARs			New York ARARs		
			MCL[1] (ppb)	MCLG[2] (ppb)	Ambient Water[3] Quality Criteria (ppb)	Drinking Water Supply[4] (ppb)	Fishing and Fish Propagation[4] (ppb)	Fishing and Fish Survival[4] (ppb)
Mercury	1.0	4.1	2	2	10	2	0.2[5]	0.2[5]
Nickel	19.0	116	(100)	(100)	15.4			
Potassium	7,700	28,300						
Sodium	29,600	79,800						
Vanadium	11.8	54.6					14	190
Zinc	347	11,200				300	30	
Cyanide		85.3				100	5.2[7]	22[7]

1 MCL - Maximum Contaminant Level, National Primary Drinking Water Regulations, Final Rule Amendments to SDWA, U.S. EPA, 1/30/91, 40 CFR 141 - (Proposed MCL)

2 MCLG - Maximum Contaminant Level Goals, based on health considerations only, amendments to SDWA, U.S. EPA, 1/30/91; Cites 50 FR 46936, 11/13/85 - (Proposed MCLG).

3 Derived from published EPA Ambient Water Quality Criteria (drinking water only) 45 FR 79318-79379, 11/28/90. (August 8, 1988 draft - recent update is being sent to SDWA).

4 New York State Ambient Water Quality Standards and Guidance Values, NYSDEC 6NYCRR Part 701 and 702, Regulations for Surface Water.

5 Guidance value.

6 Dissolved concentrations.

7 Standard for free cyanide.

June 7th - Final Rule on Lead and Copper Treatment technique action levels have been identified in lieu of MCL levels: Lead 15 ppb; Copper 1,300 ppb. Testing would be done at the consumer's tap water and any time 10% of the samples exceed these limits, then action would be required.

Table 2C

HERTEL LANDFILL REMEDIAL INVESTIGATION

COMPARISON OF SEDIMENT CONCENTRATIONS TO ARARS

Parameter	Maximum Concentration Detected In Sediment (ppb)	New York ARARs	
		Aquatic Toxicity Basis[1] (ug/gOC)	Human Health Basis[1] (ug/gOC)
2-Butanone	86		
Carbon Disulfide	64		
Chlorobenzene	430	700	
Chloroform	19		
Ethylbenzene	13		
Methylene Chloride	860		
Toluene	49		
Xylenes	970		
Acenaphthene	160	146,000	
Acenaphthylene	280		
Benzo(A)Anthracene	1,500		
Benzo(B)Fluoranthene	770		
Benzo(K)Fluoranthene	1,200		
Benzo(A)Pyrene	870		260
Benzoic Acid	5,600		
Bis(2 ethylhexyl)phthalate	2,900	23,940	
Chrysene	1,700		
Dibenzo(A,H)Anthracene	960		
1,2-Dichlorobenzene	120		
Di-n-butylphthalate	610		
Fluorene	370		
Fluoranthene	3,100		
Indeno(1,2,3-CD)Pyrene	390		
2-Methylnaphthalene	300		
4-Methylphenol	59		
Naphthalene	1,000		
Phenanthrene	2,500		
Pyrene	2,900		
Aluminum	32,500,000		
Arsenic	30,000		(5,000 ppb)
Barium	6,230,000		
Cadmium	17,400		(800 ppb)
Calcium	23,700		

Table 2C

HERTEL LANDFILL REMEDIAL INVESTIGATION

COMPARISON OF SEDIMENT CONCENTRATIONS TO ARARS

(Continued)

Parameter	Maximum Concentration Detected In Sediment (ppb)	New York ARARs	
		Aquatic Toxicity Basis[1] (ug/gOC)	Human Health Basis[1] (ug/gOC)
Chromium	64,400		(26,000 ppb)
Cobalt	60,600		
Copper	67,800		(19,000 ppb)
Iron	137,000,000		(27,000 ppb)
Lead	93,700		(24,000 ppb)
Magnesium	5,950,000		
Manganese	68,100,000		(428,000 ppb)
Mercury	700		(110 ppb)
Nickel	29,000		(22,000 ppb)
Potassium	1,620,000		
Selenium	400		
Silver	5,600		
Vanadium	78,300		
Zinc	340		(85,000 ppb)
Cyanide	6,700		

All New York ARARs values were based on a representative site organic carbon value of 20% by weight.

[1] NYSDEC 1987; Sediment Criteria, Bureau of Environmental Protection, Division of Fish and Wildlife.

2C

Table 2D

HERTEL LANDFILL REMEDIAL INVESTIGATION

COMPARISON OF SURFACE SOIL CONCENTRATIONS TO RCRA FACILITY INVESTIGATION GUIDANCE VALUES

Parameter	Maximum Concentration In Surface Soil (ppb)	RCRA* (ppm)
Total Volatile Organics (with Benzene <1 ppm)	353	
Benzene	2	
Total Carcinogenic PAHs		
Total PAHs (if total carcinogenic (PAHs <10 ppm)		
Total Base Neutrals		
Anthracene	130	
Benzo(A)Anthracene	1,200	
Benzo(B)Fluoranthene	1,700	
Benzo(K)Fluoranthene	100	
Benzo(G,H,I)Perylene	720	
Benzo(A)Pyrene	1,100	
Bis(2-Ethylhexyl)Phthalate	2,400	2,000
Chrysene	1,700	
Diethylphthalate	43	60,000
Di-n-butylphthalate	90	
Fluoranthene	2,400	
Fluorene	46	
Indeno(1,2,3-CD)Pyrene	650	
Naphthalene	3,100	
Phenanthrene	1,900	
Pyrene	2,800	
4,4'-DDE	500	
4,4'-DDT	620	40
Aluminum	33,500	
Arsenic	109*/	
Barium	4,490	4,000
Cadmium	113	
Calcium	29,500	

* RCRA Facility Investigation (RFI) guidance, Office of Solid Waste, Volume I, Section 8, Table 8-7.

Table 2D

HERTEL LANDFILL REMEDIAL INVESTIGATION

COMPARISON OF SURFACE SOIL CONCENTRATIONS TO RCRA FACILITY INVESTIGATION GUIDANCE VALUES
(CONTINUATION)

Parameter	Maximum Concentration In Surface Soil (ppb)	RCRA* (ppm)
Chromium	2,880	80,000[1]
Cobalt	34.7	
Copper	319	
Iron	278,000	
Lead	1,170	
Magnesium	14,200	
Manganese	6,040	
Mercury	1.6	
Nickel	347	2,000
Potassium	2,320	
Sodium	1,460	
Vanadium	51.1	
Zinc	615	

1 This is the value for Cr^{3+}, value for Cr^{6+} is 400 ppm.

Table 3

CHEMICALS OF POTENTIAL CONCERN IN ALL MEDIA SAMPLED

	RANGE OF SURFACE SOIL SAMPLES (mg/kg)	RANGE OF TEST PIT SAMPLES (mg/kg)	RANGE OF SEDIMENT SAMPLES (mg/kg)	RANGE OF SURFACE WATER SAMPLES(mg/l)	RANGE OF GROUND WATER SAMPLES(mg/l) ROUND I	RANGE OF GROUND WATER SAMPLES(mg/l) ROUND II
SEMIVOLATILE ORGANICS						
‡‡ 1,2-Dichlorobenzene	NA	NA	0.120	NA	NA	NA
‡‡‡ 1,4-Dichlorobenzene	NA	0.10	NA	NA	0.002	NA
‡‡ 2,4-Dimethylphenol	NA	NA	NA	NA	0.003-0.005	ND(0.01)-0.032
‡‡‡ p-Cresol	NA	0.34	ND(0.45)-0.59	0.007-0.11	0.031-0.044	ND(0.01)-0.079
‡‡ Acenaphthene	0.062	NA	0.28	NA	NA	NA
‡ Anthracene	0.048-0.13	0.088-0.15	NA	NA	NA	NA
‡‡ Benzoic acid	NA	0.22	NA	0.009	0.014-0.2	NA
‡ Benzo(a)anthracene	0.082-1.2	0.30-0.42	ND(0.45)-1.0	NA	NA	NA
‡ Benzo(a)pyrene	0.094-1.1	0.24	NA	NA	NA	NA
‡ Benzo(b)fluoranthene	0.086-1.7	0.26-0.71	ND(0.45)-0.77	NA	NA	NA
Benzo(ghi)perylene	0.14-0.72	NA	NA	NA	NA	NA
‡ Benzo(k)fluoranthene	0.098	0.27-0.36	NA	NA	NA	NA
Benzyl alcohol	NA	NA	NA	0.01	NA	NA
‡ Bis(2ethylhexyl)phthalate	0.037-2.4	0.087-4.5	0.10-2.90	0.002-0.005	0.003	ND(0.01)-0.021
‡‡‡ Butylbenzylphthalate	NA	0.092-0.24	NA	NA	NA	NA
‡ Chrysene	0.078-1.7	0.27-0.43	0.28-0.93	NA	NA	NA
‡‡ Dibenzo(a,h)anthracene	NA	NA	NA	NA	NA	NA
‡ Diethylphthalate	0.043	0.11	NA	NA	0.01	ND(0.01)-0.900
‡ Di-n-butylphthalate	0.08-0.09	NA	ND(0.45)-0.61	0.003	NA	NA
‡‡ Di-n-octylphthalate	NA	0.20	NA	0.003	0.069	NA
‡ Fluoranthene	0.063-2.4	0.05-1.2	ND(0.45)-1.60	0.002	NA	NA
‡ Fluorene	0.046	ND(0.37)-0.42	0.26-0.37	NA	NA	NA
‡ Indeno(123cd)pyrene	0.058-0.65	NA	NA	NA	NA	NA
‡ Naphthalene	ND(0.37)-3.1	0.068-0.65	ND(0.45)-1.0	0.004	0.004-0.039	ND(0.01)-0.036
‡ Phenanthrene	0.077-1.9	0.17-1.1	ND(0.45)-1.50	0.001-0.002	NA	NA
‡‡‡ Phenol	NA	NA	NA	ND(0.01)-0.021	0.018-0.072	ND(0.01)-0.018
‡ Pyrene	0.058-2.8	0.073-1.1	ND(0.45)-1.50	0.002	NA	NA
INORGANICS						
‡ Aluminium	5210-33500	9360-16200	1530-32500	ND(0.02)-20.4	0.649-252	ND(0.029)-0.193
‡‡ Antimony	NA	ND(2.9)-21	NA	ND(0.01)-0.015	0.029-0.041	NA
‡ Arsenic	9.1-109	2-12.5	1.2-30	ND(0.001)-0.012	0.001-0.041	0.002-0.0334
‡ Barium	43.5-2070	32-378	32.8-6230	0.008-3.58	0.034-1.98	0.0048-0.564
‡ Beryllium	ND(0.68)-0.84	0.43-0.89	ND(0.28)-3.5	NA	0.0013-0.015	0.0012-0.0071
‡ Cadmium	ND(1.1)-38.6	ND(0.41)-1.8	ND(1.3)-17.1	11.7-317	ND(0.002)-0.006	0.002-0.003
Calcium	1410-29500	986-2450	1270-23700	0.002-0.178	181-1460	5.41-257
‡ Chromium	7.7-2880	12.2-21.9	7.6-64.4	ND(0.003)-0.316	0.0036-0.538	NA
‡ Cobalt	5.4-29.4	8.9-13.9	ND(3)-60.6	ND(0.004)-0.016	0.007-0.22	ND(0.004)-0.014
‡ Copper	32.20-319	20.3-45.6	3-64.8	ND(0.002)-0.370	0.0047-0.846	NA
Iron	538-278000	17400-28300	1310-137000	0.013-836	2.29-482	ND(0.012)-88.3
‡ Lead	ND(0.29)-835	8.5-93.1	8.3-93.7	ND(0.001)-0.454	0.0047-0.288	ND(0.002)-0.004
Magnesium	ND(191)-14200	3990-6010	721-3110	0.853-18.6	2.27-133	0.569-55.5
‡ Manganese	478-1890	201-1720	83-68100	0.033-25.3	0.159-212	ND(0.007)-16.4
‡ Mercury	0.3-1.60	NA	ND(0.13)-7	ND(0.0002)-0.004	0.0002-0.002	NA
‡ Nickel	ND(7.9)-347	14.3-25	6.2-31.7	ND(0.005)-0.116	0.0154-0.49	ND(0.005)-0.029
Potassium	14.9-2320	738-1550	500-2080	ND(0.445)-28.3	0.851-41.7	ND(0.780)-38.5
‡‡ Selenium	NA	NA	ND(0.42)-5.9	ND(0.002)-0.0028	ND(0.0011)-0.002	NA
Silver	NA	NA	0.84-12.8	NA	NA	NA
Sodium	ND(182)-1460	70.5-237	82.9-771	1.730-79.8	2.18-112	2.48-119
‡‡ Thallium	NA	NA	ND(0.29)-0.45	NA	ND(0.001)-0.003	NA
‡ Vanadium	16.9-51.1	12.1-22.3	7.5-79.5	ND(0.003)-0.055	0.0037-0.319	ND(0.003)-0.004
‡ Zinc	62.6-469	48.6-286	32-340	0.0022-11.2	0.0234-2.88	ND(0.002)-0.092
‡ Cyanide	NA	ND(0.50)-10.4	ND(0.94)-3	ND(0.010)-0.085	NA	NA
VOLATILES						
‡ 1,1-Dichloroethane	NA	NA	NA	0.003	NA	NA
1,2-Dichloroethene	NA	NA	NA	NA	NA	NA
Benzene	NA	0.001-0.002	NA	NA	NA	NA
‡ Carbon disulfide	NA	0.003	0.004-0.064	0.005-0.008	NA	NA
‡ Chlorobenzene	NA	0.001-0.009	ND(0.007)-0.43	0.001-0.008	0.001-0.024	ND(0.005)-0.027
Chloroethane	NA	NA	NA	0.005	0.004	NA
Chloroform	NA	NA	ND(0.007)-0.01	NA	0.001	NA
‡ Ethylbenzene	NA	ND(0.006)-0.041	ND(0.007)-0.01	0.001-0.004	0.001-0.064	ND(0.005)-0.063
‡ Toluene	NA	0.002-0.015	0.006-0.049	0.001-0.004	0.016-0.033	ND(0.005)-0.033
Trichloroethene	NA	NA	NA	NA	NA	NA
‡ Xylenes	NA	ND(0.006)-0.310	ND(0.007)-0.97	0.002-0.007	0.062-0.2	ND(0.005)-0.200
PESTICIDES/PCBS						
‡ 4,4'-DDE	ND(0.018)-0.50	NA	ND(0.027)-0.03	NA	NA	NA
4,4'-DDD	NA	NA	NA	NA	NA	NA
‡ 4,4'-DDT	ND(0.018)-0.62	NA	ND(0.022)-0.07	NA	NA	NA

ND: NOT DETECTED
NA: NOT APPLICABLE
‡ : USED IN QUANTITATIVE ANALYSIS
‡‡ : USED IN QUALITATIVE ANALYSIS
‡‡‡ : USED IN BOTH QUANTITATIVE AND QUALITATIVE ANALYSIS

Table 4

SUMMARY OF EXPOSURE PATHWAYS

Potentially Exposed Population	Exposure Route, Medium and Exposure Point	Pathway Selected for Evaluation?	Reason for Selection or Inclusion
Current Land Use			
Residents	Ingestion of ground water from local wells down gradient of the site	No	No impacts found
Residents	Ingestion of soils on site	Yes	Access to site unrestricted
Residents	Ingestion of sediments on site	No	Ingestion of soils characterizes equal or greater risk
Residents	Ingestion of surface water on site	Yes	Access to site unrestricted
Residents	Dermal contact with soils	Yes	Access to site unrestricted
Residents	Dermal contact with sediments	No	Dermal contact with soils characterizes equal or greater risk
Residents	Inhalation of fugitive dusts	No	Site heavily vegetated
Residents	Dermal contact with surface water	Yes	Access to site unrestricted
Future Land Use			
Residents	Ingestion of ground water from local wells on the site	Yes	Potential residential use of site
Residents	Ingestion of soils on site	Yes	Potential residential use of site
Residents	Ingestion of sediments on site	No	Ingestion of soils characterizes equal or greater risk
Residents	Ingestion of surface water on site	No	Contact route unlikely; ground water available for ingestion
Residents	Dermal contact with soils	Yes	Potential residential use of site
Residents	Dermal contact with sediments	No	Dermal contact with soils characterizes equal or greater risk
Residents	Inhalation of fugitive dusts	Yes	Potential residential use of site may produce areas devoid of cover
Residents	Inhalation of chemicals volatilized from ground water during home use	Yes	Potential residential use of site; volatile organics in ground water
Construction Workers	Ingestion of ground water from local wells	No	Wells not developed during construction
Construction Workers	Ingestion of soils on site	Yes	Incidental ingestion expected
Construction Workers	Ingestion of sediments on site	No	Contact route unlikely; ingestion of soils characterizes equal or greater risk
Construction Workers	Ingestion of surface water on site	No	Contact route unlikely
Construction Workers	Dermal contact with soils	Yes	Contact with soils expected during construction
Construction Workers	Dermal contact with sediments	No	Contact route unlikely
Construction Workers	Inhalation of fugitive dusts	Yes	Generation of fugitive dust expected during construction

Table 5

SUMMARY OF PARAMETER VALUES USED TO ESTIMATE EXPOSURE

PARAMETER	VALUE OR RANGE	VALUE USED	RATIONAL	REFERENCE
Scenario 1-3: Global variables				
Body Weight (kg)				
- Child (scenario 1)	36-61.2	49	Value based on average of males and females between 9-10 yrs	EPA 1990
- Child (scenario 3)	11.6-17.4	16	Value based on average of males and females between 0-6 yrs	EPA 1989
- Adult	67.2-74.5	70	Value based on average of males and females between 18-65 yrs	EPA 1989
Exposure Duration (years)				
(scenario 1)			Based upon the age range of children likely to enter the site	
Child	1-18	9	Based upon the age range for adults and national upper-bound	
Adult	1-70	30	(90th percentile) residence at one location.	
(scenario 2)	1-70	1	Amount of time spent building new homes.	
(scenario 3)				
Child	1 - 6	6	Number of years in this age group.	
Adult	1-70	30	National upper-bound (90th percentile) at one residence.	
Averaging Time				
Cancer-risks (days)	NA	25,550	Value based upon 70 year life expectancy.	
Noncancer-risks (days) (scenario 1)				
Child	365-25,550	3,285	Value based upon exposure duration.	
Adult	365-25,550	10,950	Value based upon exposure duration.	
Noncancer-risks (days) (scenario 2)	180	180	Value based upon exposure duration.	
Noncancer-risks (days) (scenario 3)				
Child	365-2,190	2,190	Value based upon exposure duration.	
Adult	365-25,550	10,950	Value based upon exposure duration.	
Absorption Factor				
organic compounds	0-1	0.1		Brown (1984)
arsenic	0-1	0.1		ATSDR (1989)
inorganic compounds	0-1	0.01		EPA (1984;1982;1986)
Permeability Constant - Dermal contact in Water (cm/hr)		0.4E-04	Based upon the penetration rate of water	
Adherence Factor (mg/cm2)	0-2.77	1.45	Based upon commercial potting soil	
Fraction Ingestion From Contaminated Source	0-1	1	Assuming 100% of the soil ingestion occurs while on site	
Scenario 1-3 Chemical Concentration Justification				
Surface Soils; Subsurface soils; Surface Water; Ground Water			95th percentile values used in exposure estimate were calculated using the methods described in section 6.3.	

Table 5

(continued)

SUMMARY OF PARAMETER VALUES USED TO ESTIMATE EXPOSURE

Scenario 1 - Recreational Exposure: Current Use				
Exposure Frequency (days/year)				
Child	1-365	90	Based upon trespassing 1/2 of non-school days/year	
Adult	1-365	5	Based on a high estimate of the number of contacts with surface water during a total of 60 trips/year	
Dermal Contact With Chemicals in Water				
Skin Surface Area (cm2)				
Child	0-1440	6,800	Based upon immersion of legs, arms, hands. Swimming is unlikely. Average for 9-18 years age group.	
Adult	0-18,150	5,500	Based upon total lower body exposure to water.	
Exposure Time (hrs/day)				
Child	1-24	4	Clothing stays wet after initial exposure.	
Adult	1-24	4	Clothing stays wet after initial exposure.	
Ingestion Of Chemicals In Surface Water				
Contact Rate (L/hr)				
Child		0.05	Based upon water ingestion rate for swimming.	EPA 1989
Exposure Time (hrs/day)				
Child	1-24	1		
Dermal Contact With Chemicals In Soils				
Skin Surface Area (cm2)				
Child	0-14,400	6,800	Based upon exposed arms, hands, and legs.	
Adult	0-18,150	3,100	Based upon exposed arms and hands.	
Ingestion Of Chemicals In Soils				
Ingestion Rate (mg/day)				
Child	0-200	100	Soil ingestion rate for those over 6 years of age.	EPA 1989
Adult		100	Soil ingestion rate for those over 6 years of age.	EPA 1989
Scenario 2 - Construction Exposure: Future Use				
Exposure Frequency (days/year)	1-365	180	Based on an estimate of the number of days building homes.	
Dermal Contact with Chemicals In Soils				
Skin Surface Area (cm2)	0-18,150	6,300	Includes hands, arms, head, neck and a portion of the trunk.	
Ingestion Of Chemicals In Soils				
Ingestion Rate (mg/day)		100	Soil ingestion rate for those over 6 years of age.	EPA 1989
Inhalation Of Airborne Chemicals Absorbed to Dust				
Ambient Dust Concentration (kg/m3)		3.2E-09	Wind erosion, loading and dumping model found in AP-42.	EPA 1985
Inhalation Rate (m3/hr)		2	Adults during moderate exertion	
Exposure Time (hrs/day)	1-24	8	Based upon an eight hour work day.	
Scenario 3 - Residential Scenario: Future Use				
Exposure Frequency (days/yr)	1-365	365	No time spent away from home.	
Dermal Contact With Chemicals In Water				
Skin Surface Area (cm2)				
Child	0-7200	7200	Average child 2-6 years old; total body exposure	
Adult	0-18,150	18,150	Adult total body exposure.	
Exposure Time (hrs/day)	1-24	0.2	Bathing or showering time.	
Dermal Contact With Chemicals In Soil				
Skin Surface Area (cm2)				
Child	0-7200	3,146	Exposure of an child's arms, hands, and legs.	
Adult	0-18,150	9,440	Exposure of an adult's arms, hands, and legs.	
Ingestion Of Chemicals In Soils and House Dust				
Ingestion Rate (mg/day)				
Child	0-200	200	Children, 1-6 years old; EPA 1989	
Adult	0-100	100	Age groups greater than 6 years old; EPA 1989.	
Ingestion Of Chemicals In Drinking Water				
Ingestion Rate (L/day)				
Child		0.756	Children, 0-6 years old; EPA 1990	
Adult		2	Adult, 90th percentile; EPA 1989.	
Inhalation Of Airborne (Vapor Phase) Chemicals				
Inhalation Rate (m3/hr)		0.83	Adults and children, light activity assumed.	
Exposure Time (hrs/day)	0-24	0.1 hr	Based upon the duration of a shower.	
Inhalation Of Airborne Chemicals Absorbed to Dust				
Ambient Dust Concentration		1.04E-09	Wind erosion, loading and dumping model found in AP-42	EPA 1985
Inhalation Rate (m3/hr)		0.83	Adults and children, light activity assumed.	
Exposure Time (hrs/day)	1-24	4	The amount of time spent outdoors.	

Table 6A

SUMMARY OF TOXICITY VALUES ASSOCIATED WITH NONCARCINOGENIC-CHRONIC EFFECTS: ORAL

CHEMICAL	CHRONIC RFD (ORAL) (mg/kg/day)	CONFIDENCE LEVEL	CRITICAL EFFECT	ORAL RFD BASIS/ SOURCE	UNCERTAINTY AND MODIFYING FACTORS
INORGANICS					
Aluminum	DI			HEAST	
Antimony	4E-04	Low	Longevity,blood glucose and cholesterol	Water/IRIS	UF=1000;MF=1
Arsenic	1E-03	NA	Keratosis and hyperpigmentation	NA/HEAST	UF=1
Barium	7E-02	Medium	Increased blood pressure	Water/IRIS	UF=3;MF=1
Beryllium	5E-03	Low	None observed	Water/IRIS	UF=100;MF=1
Cadmium	1E-03	High	Proteinuria	Water/IRIS	UF=10;MF=1
Chromium III	1E+00	Low	No effects reported	Diet/IRIS	UF=100;MF=10
Chromium VI	5E-03	Low	No effects reported	Water/IRIS	UF=500;MF=1
Cobalt	NF			IRIS,HEAST	
Copper	4E-02	NA	Local GI irritation	NA/HEAST	UF=NA
Lead	ND	NA	Neurobehavioral effects	NA/IRIS	NA
Manganese	1E-01	Medium	CNS effects	Diet/IRIS	UF=1;MF=1
Mercury	3E-04	NA	Kidney effects	NA/HEAST	UF=1000
Nickel	2E-02	Medium	Decreased body and organ weight	Diet/IRIS	UF=100;MF=3
Selenium	NF			IRIS,HEAST	
Vanadium	7E-03	NA	None observed	Water/HEAST	UF=100
Zinc	2E-01	NA	Anemia	NA/HEAST	UF=10
Cyanide	2E-02	Medium	Weight loss, thyroid effects, myelin degeneration	Oral/IRIS	UF=100;M=5
VOLATILES					
Carbon Disulfide	1E-01	Medium	Fetal toxicity, malformation	Inhalation/IRIS	UF=100;MF=1
Chlorobenzene	2E-02	Medium	Histopathological changes in the liver	Oral/IRIS	UF=1000;MF=1
Ethylbenzene	1E-01	Low	Liver and kidney toxicity	Oral/IRIS	UF=1000;MF=1
Toluene	2E-01	Medium	Changes in liver and kidney	Gavage/IRIS	UF=1000;MF=1
Xylenes	2E+00	Medium	Hyperactivity,decreased body weight	Gavage/IRIS	UF=100;MF=1
SEMIVOLATILES					
Bis(2ethylhexyl)phthalate	2E-02	Medium	Increased relative liver weight	Diet/IRIS	UF=1000;MF=1
Butylbenzylphthalate	2E-01	Low	Effects on body weight gain, testes, liver, kidney	Diet/IRIS	UF=1000,MF=1
Benzo(a)anthracene	NF			IRIS,HEAST	
Benzo(a)pyrene	NF			IRIS,HEAST	
Chrysene	DI			HEAST	
Benzo(b)fluoranthene	NF			IRIS,HEAST	
Benzo(k)fluoranthene	NF			IRIS,HEAST	
Dibenzo(a,h)anthracene	NF			IRIS,HEAST	
Indeno(1,2,3-c,d)pyrene	NF			IRIS,HEAST	
1,4-Dichlorobenzene	ND	NA		NA/HEAST	
Diethylphthalate	8E-01	Low	Decreased growth rate, food consumption rate and altered organ weights	Diet/IRIS	UF=1000;MF=1
Di-n-butylphthalate	1E-01	Low	Increased mortality	Diet/IRIS	UF=1000;MF=1
Di-n-octylphthalate	2E-02	NA	Elevated kidney and liver weights,increased SGOT and SGPT	Diet/HEAST	UF=1000
Acenaphthene	6E-02	Low	Hepatotoxicity	Oral/IRIS	UF=3000,MF=1
Anthracene	3E-01	Low	No observed effects	Gavage/IRIS	UF=3000;MF=1
Benzo(g,h,i)perylene	NF			IRIS,HEAST	
Fluoranthene	4E-02	Low	Nephropathy, liver weight changes hematological alterations and clinical effects	Gavage/IRIS	UF=3000;MF=1
Fluorene	4E-02	Low	Decreased RBC, packed cell volume and hemoglobin	Gavage/IRIS	UF=3000;MF=1
p-Cresol	5E-02	Medium	Decreased body weight gain, neurotoxicity	IRIS	UF=1000;MF=1
Naphthalene	4E-03	NA	Decreased body weight gain	Gavage/HEAST	UF=10,000
Pyrene	3E-02	Low	Kidney effects	Gavage/IRIS	UF=3000;MF=1
Phenanthrene	DI			HEAST	
Phenol	6.0E-01	Low	Reduced fetal body weight	Gavage/IRIS	UF=100;MF=1
PESTICIDES/PCBS					
4,4'-DDD	NF			IRIS,HEAST	
4,4'-DDE	NF			IRIS,HEAST	
4,4'-DDT	5E-04	Medium	Liver lesions	Diet/IRIS	UF=100;MF=1

SUMMARY OF TOXICITY VALUES ASSOCIATED WITH NONCARCINOGENIC-CHRONIC EFFECTS: INHALATION

CHEMICAL	CHRONIC RFD (INHALATION) (mg/kg/day)	CONFIDENCE LEVEL	CRITICAL EFFECT	INHALATION RFD BASIS/ SOURCE	UNCERTAINTY AND MODIFYING FACTORS
INORGANICS					
Aluminum	DI			HEAST	
Antimony	4E-04 a				
Arsenic	1E-03 a				
Barium	7E-02 a				
Beryllium	5E-03 a				
Cadmium	5E-4 a				
Chromium III	6E-07		Nasal mucosa atrophy	HEAST	UF=300
Chromium VI	6E-07		Nasal mucosa atrophy	HEAST	UF=300
Cobalt	NF			IRIS,HEAST	
Copper	ND	NA		NA/HEAST	NA
Lead	ND	NA	CNS effects	NA/HEAST	NA
Manganese	1E-04	Medium	Increased prevalance of respiratory symptoms and psycho-motor disturbances	IRIS HEAST	UF=300;MF=3 UF=900
Mercury	1E-04	NA	Neurotoxicity	NA/HEAST	UF=30
Nickel	2E-02 a				
Selenium	NF			IRIS,HEAST	
Vanadium	7E-03 a				
Zinc	2E-01 a				
Cyanide	2E-02 a		myelin degeneration		
VOLATILES					
Carbon Disulfide	1E-01 a				
Chlorobenzene	5E-03	NA	Liver and kidney effects	HEAST	UF=10,000
Ethylbenzene	1E-01 a				
Toluene	6E-01	NA	CNS effects, eyes and nose irritation	HEAST	UF=100
Xylenes	9E-02	NA	CNS effects, eyes and nose irritation	HEAST	UF=100
SEMIVOLATILES					
Bis(2ethylhexyl)phthalate	2E-02 a				
Butylbenzylphthalate	2E-01 a				
Benzo(a)anthracene	NF			IRIS,HEAST	
Benzo(a)pyrene	NF			IRIS,HEAST	
Chrysene	DI			HEAST	
Benzo(b)fluoranthene	NF			IRIS,HEAST	
Benzo(k)fluoranthene	NF			IRIS,HEAST	
Dibenzo(a,h)anthracene	NF			IRIS,HEAST	
Indeno(1,2,3-c,d)pyrene	NF			IRIS,HEAST	
1,4-Dichlorobenzene	2E-01	NA	Liver and kidney effects	HEAST	UF=100
Diethylphthalate	8E-01 a				
Di-n-butylphthalate	1E-01 a				
Di-n-octylphthalate	2E-02 a				
Acenaphthene	6E-02 a				
Anthracene	3E-01 a				
Benzo(g,h,i)perylene	NF			IRIS,HEAST	
Fluoranthene	4E-02 a				
Fluorene	4E-02 a				
p-Cresol	5E-02 a				
Naphthalene	4E-03 a				
Pyrene	3E-02 a				
Phenanthrene	DI			HEAST	
Phenol	DI			IRIS	
PESTICIDES/PCBS					
4,4'-DDD	NF			IRIS,HEAST	
4,4'-DDE	NF			IRIS,HEAST	
4,4'-DDT	5E-04 a				

Table 6C

SUMMARY OF TOXICITY VALUES ASSOCIATED WITH NONCARCINOGENIC-SUBCHRONIC EFFECTS: ORAL

CHEMICAL	SUBCHRONIC RFD (ORAL) (mg/kg/day)	CONFIDENCE LEVEL	CRITICAL EFFECT	ORAL RFD BASIS/ SOURCE	UNCERTAINTY AND MODIFYING FACTORS
INORGANICS					
Aluminum	DI			HEAST	
Antimony	4E-04 c	Low	Decreased longevity,blood glucose and cholesterol	Water/IRIS	UF=1000;MF=1
Arsenic	1E-03	NA	Keratosis and hyperpigmentation	NA/HEAST	UF=1
Barium	5E-02		Fetotoxic, increased blood pressure	Water/HEAST	UF=100
Beryllium	5E-03 c	Low	None observed	Water/IRIS	UF=100;MF=1
Cadmium	1E-03				
Chromium III	1E+01		Hepatotoxicity	Diet/HEAST	UF=100
Chromium VI	2E-02		Not defined	Water/HEAST	UF=100
Cobalt	NF			IRIS,HEAST	
Copper	1.3mg/l (0.04)	NA	Local GI irritation	NA/HEAST	UF=NA
Lead	ND		NA	NA/HEAST	UF=NA
Manganese	1E-01 c	Medium	CNS effects, respiratory symptoms	Diet/IRIS	UF=1;MF=1
Mercury	3E-04	NA	Kidney effects, neurotoxicity	NA/HEAST	UF=1000
Nickel	2E-02 c	Medium	Decreased body and organ weight	Diet/IRIS	UF=100;MF=3
Selenium	NF			IRIS,HEAST	
Vanadium	7E-03	NA	None observed	Water/HEAST	UF=100
Zinc	2E-01	NA	Anemia	NA/HEAST	UF=10
Cyanide	2E-02 c	Medium	Weight loss, thyroid effects, myelin degeneration	Oral/IRIS	UF=100;M=5
VOLATILES					
Carbon Disulfide	1E-01 c	Medium	Fetal toxicity, malformation	Inhalation/IRIS	UF=100;MF=1
Chlorobenzene	2E-01		Liver and kidney effects	HEAST	UF=100
Ethylbenzene	1E+00		Hepatotoxicty, nephrotoxicity	Oral/HEAST	UF=100
Toluene	2E+00		Changes in liver and kidney weight, CNS	HEAST	UF=100
Xylenes	4E+00		CNS effects	Gavage/HEAST	UF=100
SEMIVOLATILES					
Bis(2ethylhexyl)phthalate	2E-02 c	Medium	Increased relative liver weight	Diet/IRIS	UF=1000;MF=1
Butylbenzylphthalate	2E+00		Effects on body weight gain, testes, liver, kidney	Diet/HEAST	UF=100
Benzo(a)anthracene	NF			IRIS,HEAST	
Benzo(a)pyrene	NF			IRIS,HEAST	
Chrysene	DI			HEAST	
Benzo(b)fluoranthene	NF			IRIS,HEAST	
Benzo(k)fluoranthene	NF			IRIS,HEAST	
Dibenzo(a,h)anthracene	NF			IRIS,HEAST	
Indeno(1,2,3-c,d)pyrene	NF			IRIS,HEAST	
1,4-Dichlorobenzene	ND	NA		NA/HEAST	
Diethylphthalate	8E+00		NA	HEAST	UF=100
Di-n-butylphthalate	1E+00		Mortality	Diet/HEAST	UF=100
Di-n-octylphthalate	2E-02	NA	Elevated kidney and liver weights,increased SGOT and SGPT	Diet/HEAST	UF=1000
Acenaphthene	6E-01		Hepatotoxicity	Gavage/HEAST	UF=300
Anthracene	3E+00		No observed effects	Gavage/HEAST	UF=300
Benzo(g,h,i)perylene	NF			IRIS,HEAST	
Fluoranthene	4E-01		Nephropathy, liver weight changes hematological alterations and clinical effects	Gavage/HEAST	UF=300
Fluorene	4E-01		Hematological changes	Gavage/HEAST	UF=300
p-Cresol	5E-01		Decreased body weight gain, neurotoxicity	HEAST	UF=100
Naphthalene	4E-02		Decreased body weight gain	Gavage/HEAST	UF=1000
Pyrene	3E-01		Renal effects	Gavage/HEAST	UF=300
Phenanthrene	DI			HEAST	
Phenol	6.0E-01	Low	Reduced fetal body weight	HEAST	UF=100
PESTICIDES/PCBS					
4,4'-DDD	NF			IRIS,HEAST	
4,4'-DDE	NF			IRIS,HEAST	
4,4'-DDT	5E-04		Liver lesions	IRIS,HEAST	UF=100

DI:Data inadequate for quantitative risk assessment
NA:Not available ative risk assessment
NF:Not found
ND:Not determined
a:Oral value has been placed where no inhalation value exists.
c:Subchronic RFD/RFC values taken from HEAST tables

SUMMARY OF TOXICITY VALUES ASSOCIATED WITH NONCARCINOGENIC-SUBCHRONIC EFFECTS: INHALATION

CHEMICAL	SUBCHRONIC RFC (INHALATION) (mg/kg/day)	CONFIDENCE LEVEL	CRITICAL EFFECT	INHALATION RFD BASIS/ SOURCE	UNCERTAINTY AND MODIFYING FACTORS
INORGANICS					
Aluminum	DI			HEAST	
Antimony	4E-04 a				
Arsenic	1E-03 a				
Barium	1E-03		Fetotoxicity; increased blood pressure	HEAST	
Beryllium	5E-03 a				
Cadmium	1E-03 a				
Chromium III	6E-06		Nasal mucosa atrophy	HEAST	UF=30
Chromium VI	6E-06		Nasal mucosa atrophy	HEAST	UF=30
Cobalt	NF			IRIS,HEAST	
Copper	ND	NA		NA/HEAST	NA
Lead	ND		NA	NA/HEAST	NA
Manganese	4E-4	Medium	Increased prevalance of respiratory symptoms and psycho-motor disturbances	IRIS	UF=300;MF=3
Mercury	1E-04	NA	Neurotoxicity	NA/HEAST	UF=30
Nickel	2E-02 a				
Selenium	NF			IRIS,HEAST	
Vanadium	7E-03 a				
Zinc	2E-01 a				
Cyanide	2E-02 a		myelin degeneration		
VOLATILES					
Carbon Disulfide	1E-01 a				
Chlorobenzene	5E-02		Liver and kidney effects	HEAST	UF=1000
Ethylbenzene	1E+00 a				
Toluene	2E+00	NA	CNS effects, eyes and nose irritation	HEAST	UF=100
Xylenes	3E-01	NA	CNS effects, eyes and nose irritation	HEAST	UF=100
SEMIVOLATILES					
Bis(2ethylhexyl)phthalate	2E-02 a				
Butylbenzylphthalate	2E+00 a				
Benzo(a)anthracene	NF			IRIS,HEAST	
Benzo(a)pyrene	NF			IRIS,HEAST	
Chrysene	DI			HEAST	
Benzo(b)fluoranthene	NF			IRIS,HEAST	
Benzo(k)fluoranthene	NF			IRIS,HEAST	
Dibenzo(a,h)anthracene	NF			IRIS,HEAST	
Indeno(1,2,3-c,d)pyrene	NF			IRIS,HEAST	
1,4-Dichlorobenzene	2E-01	NA	Liver and kidney effects	HEAST	UF=100
Diethylphthalate	8E+00 a				
Di-n-butylphthalate	1E+00 a				
Di-n-octylphthalate	2E-02 a				
Acenaphthene	6E-01 a				
Anthracene	3E+00 a				
Benzo(g,h,i)perylene	NF			IRIS,HEAST	
Fluoranthene	4E-01 a				
Fluorene	4E-01 a				
p-Cresol	5E-01 a				
Naphthalene	4E-02 a				
Pyrene	3E-01 a				
Phenanthrene	DI			HEAST	
Phenol	DI			HEAST	
PESTICIDES/PCBS					
4,4'-DDD	NF			IRIS,HEAST	
4,4'-DDE	NF			IRIS,HEAST	
4,4'-DDT	5E-04 a		Liver lesions	HEAST	

Table 7A

TABLE A-1

SUMMARY OF TOXICITY VALUES ASSOCIATED WITH CARCINOGENIC EFFECTS: ORAL

CHEMICAL	SLOPE FACTOR (SF) ORAL (mg/kg/day)-1	WEIGHT-OF-EVIDENCE CLASSIFICATION	TYPE OF CANCER	SF BASIS/ SOURCE
INORGANICS				
Aluminum	NF	D		NA/IRIS,HEAST
Antimony	NF	D		NA/IRIS,HEAST
Arsenic	1.75	A	Skin	Water/IRIS
Barium	NF	D		Water/IRIS
Beryllium	4.3	B2	Skin	Water/IRIS
Cadmium	ND	ND		NA/HEAST
Chromium VI	ND	ND		NF/IRIS
Cobalt	NF	D		NA/IRIS,HEAST
Copper	NF	D		NA/IRIS
Lead	NA	B2	Renal	Oral/IRIS
Manganese	NF	D		NA/IRIS
Mercury	NF	D		NA/IRIS
Nickel	ND	ND		NA/IRIS
Selenium	NF	D		NA/IRIS,HEAST
Vanadium	NF	D		NA/IRIS,HEAST
Zinc	NF	D		NA/IRIS,HEAST
Cyanide	NF	D		NA/IRIS
VOLATILES				
Carbon Disulfide	NF	D		NA/IRIS,HEAST
Chlorobenzene	NF	D		NA/IRIS
Ethylbenzene	NF	D		NA/IRIS
Toluene	NF	D		NA/IRIS
Xylenes	NF	D		NA/IRIS
SEMIVOLATILES				
Bis(2ethylhexyl)phthalate	1.4E-02	B2	Liver	Diet/IRIS
Butylbenzylphthalate	ND	C		NF/IRIS
Benzo(a)anthracene	11.5	B2		NA/IRIS
Benzo(a)pyrene	11.5	B2	Stomach	Diet/IRIS
Chrysene	11.5	B2		NA/IRIS
Benzo(b)fluoranthene	11.5	B2		NA/IRIS
Benzo(k)fluoranthene	11.5	B2		NA/IRIS
Dibenzo(a,h)anthracene	11.5	B2		NA/IRIS
Indeno(123cd)pyrene	11.5	B2		NA/IRIS
1,4-Dichlorobenzene	2.4E-02	B2	Liver	Gavage/HEAST
Diethylphthalate	NF	D		NA/IRIS,HEAST
Di-n-butylphthalate	NF	D		NA/IRIS,HEAST
Di-n-octylphthalate	NF	D		NA/IRIS
Acenaphthene	NF	D		NA/IRIS,HEAST
Anthracene	NF	D		NA/IRIS
Benzo(g,h,i)perylene	NF	D		NA/IRIS
Fluoranthene	NF	D		NA/IRIS,HEAST
Fluorene	NF	D		NA/IRIS
p-Cresol	ND	C		IRIS
Naphthalene	NF	D		NA/IRIS
Pyrene	NF	D		NA/IRIS
Phenanthrene	NF	D		NA/IRIS
Phenol	NF	D		NA/IRIS
PESTICIDES/PCBS				
4,4'-DDD	2.4E-01	B2	Lung, liver, thyroid	Diet/IRIS
4,4'-DDE	3.4E-01	B2	Liver, thyroid	Diet/IRIS
4,4'-DDT	3.4E-01	B2	Liver	Diet/IRIS

Table 7B

TABLE 5-12

SUMMARY OF TOXICITY VALUES ASSOCIATED WITH CARCINOGENIC EFFECTS: INHALATION

CHEMICAL	SLOPE FACTOR (SF) INHALATION (mg/kg/day)-1	WEIGHT-OF-EVIDENCE CLASSIFICATION	TYPE OF CANCER	SF BASIS/ SOURCE
INORGANICS				
Aluminum	NA	D		NA/IRIS,HEAST
Antimony	NA	D		NA/IRIS,HEAST
Arsenic	5E+01	A	Lung	Air/HEAST
Barium	NA	D		NA/IRIS,HEAST
Beryllium	8.4E+00 a			
Cadmium	6.1E+00	B1		OCCUPATIONAL/HEAST
Chromium VI	4.1e+1	A	Lung	OCCUPATIONAL/HEAST
Cobalt	NA	D		NA/IRIS,HEAST
Copper	NA	D		NA/IRIS,HEAST
Lead	NA	B2		NA/IRIS,HEAST
Manganese	NA	D		NA/IRIS,HEAST
Mercury	NA	D		NA/IRIS,HEAST
Nickel	8.4E-1	A	Respitory Tract	OCCUPATIONAL/HEAST
Selenium	NA	D		NA/IRIS,HEAST
Vanadium	NA	D		NA/IRIS,HEAST
Zinc	NA	D		NA/IRIS,HEAST
Cyanide	NA	D		NA/IRIS,HEAST
VOLATILES				
Carbon Disulfide	NA	D		NA/IRIS,HEAST
Chlorobenzene	NA	D		NA/IRIS,HEAST
Ethylbenzene	NA	D		NA/IRIS,HEAST
Toluene	NA	D		NA/IRIS,HEAST
Xylenes	NA	D		NA/IRIS,HEAST
SEMIVOLATILES				
Bis(2ethylheryl)phthalate	1.4E-02 a			
Butylbenzylphthalate	NA	C		NF/IRIS, NA/HEAST
Benzo(a)anthracene	6.1 b	B2		NA/IRIS,HEAST
Benzo(a)pyrene	6.1 b	B2	Respitory Tract	INHALATION/HEAST
Chrysene	6.1 b	B2		NA/IRIS,HEAST
Benzo(b)fluoranthene	6.1 b	B2		NA/IRIS,HEAST
Benzo(k)fluoranthene	6.1 b	B2		NA/IRIS,HEAST
Dibenzo(a,h)anthracene	6.1 b	B2		NA/IRIS,HEAST
Indeno(123cd)pyrene	6.1 b	B2		NA/IRIS,HEAST
1,4-Dichlorobenzene	2.4E-02 a			
Diethylphthalate	NA	D		NA/IRIS,HEAST
Di-n-butylphthalate	NA	D		NA/IRIS,HEAST
Di-n-octylphthalate	NA	D		NA/IRIS,HEAST
Acenaphthene	NA	D		NA/IRIS,HEAST
Anthracene	NA	D		NA/IRIS,HEAST
Benzo(g,h,i)perylene	NA	D		NA/IRIS,HEAST
Fluoranthene	NA	D		NA/IRIS,HEAST
Fluorene	NA	D		NA/IRIS,HEAST
p-Cresol	NA	C		IRIS
Naphthalene	NA	D		NA/IRIS,HEAST
Pyrene	NA	D		NA/IRIS,HEAST
Phenanthrene	NA	D		NA/IRIS,HEAST
Phenol	NA	D		NA/IRIS,HEAST
PESTICIDES/PCBS				
4,4'-DDD	2.4E-01	B2		NA/IRIS,HEAST
4,4'-DDE	3.4E-01	B2		NA/IRIS,HEAST
4,4'-DDT	3.4E-01	B2	Liver	NA/IRIS,HEAST

Table 8A

SUMMARY OF CANCER RISK ESTIMATES - SCENARIO 1: CHILDREN

CHEMICAL	CHRONIC DAILY INTAKE(CDI) (mg/kg/day)	CDI ADJUSTED FOR ABSORPTION	SF (mg/kg/day)-1	WEIGHT OF EVIDENCE	TYPE OF CANCER	SF BASIS/ SOURCE	CHEMICAL SPECIFIC RISK	TOTAL PATHWAY RISK	TOTAL EXPOSURE RISK
EXPOSURE PATHWAY: DERMAL CONTACT								5E-04	5E-04
INORGANICS									
Arsenic	2.9E-05	0.10	1.75	A	Bladder, Liver, Lung		5E-04		

Table 8B

SUMMARY OF CANCER RISK ESTIMATES - SENARIO 1: ADULTS

CHEMICAL	CHRONIC DAILY INTAKE(CDI) (mg/kg/day)	CDI ADJUSTED FOR ABSORPTION	SF (mg/kg/day)-1	WEIGHT OF EVIDENCE	TYPE OF CANCER	SF BASIS/ SOURCE	CHEMICAL SPECIFIC RISK	TOTAL PATHWAY RISK	TOTAL EXPOSURE RISK
EXPOSURE PATHWAY: DERMAL CONTACT WITH SURFACE WATER - ADULTS								1.3E-07	3.7E-04
INORGANICS									
Arsenic	7.4E-09	0.10	1.75	A	Bladder, Liver, Lung	Water/IRIS	1.3E-07		
EXPOSURE PATHWAY: DERMAL CONTACT WITH SOILS - ADULT								3.6E-04	
INORGANICS									
Arsenic	2.1E-05	0.10	1.75	A	Bladder, Liver, Lung	Water/IRIS	3.6E-04		

Table 8C

SUMMARY OF CHRONIC HAZARD INDEX ESTIMATES - SCENARIO 1: CHILDREN

CHEMICAL	CHRONIC DAILY INTAKE(CDI) (mg/kg/day)	CDI ADJUSTED FOR ABSORPTION	RFD (mg/kg/day)	CONFIDENCE LEVEL	CRITICAL EFFECT	RFD SOURCE/ BASIS	RFD UNCERTAINTY ADJUSTMENTS	MODIFYING FACTORS	HAZARD QUOTIENT	PATHWAY HAZARD INDEX (HI)	TOTAL EXPOSURE HI
EXPOSURE PATHWAY: DERMAL CONTACT WITH SOIL - CHILDREN										2E+00	3E+00
INORGANICS											
Arsenic	2.3E-04	0.10	1E-03	NA	Keratosis and Hyperpigmentation	NA/HEAST			2E+00		

Table 8D

SUMMARY OF CHRONIC HAZARD INDEX ESTIMATES - SENARIO 1: ADULTS

CHEMICAL	CHRONIC DAILY INTAKE(CDI) (mg/kg/day)	CDI ADJUSTED FOR ABSORPTION	RFD (mg/kg/day)	CONFIDENCE LEVEL	CRITICAL EFFECT	RFD SOURCE/ BASIS	RFD UNCERTAINTY ADJUSTMENTS	MODIFYING FACTORS	HAZARD QUOTIENT	PATHWAY HAZARD INDEX (HI)	TOTAL EXPOSURE HI
EXPOSURE PATHWAY: DERMAL CONTACT WITH CHEMICALS IN SOIL - ADULTS										4.9E-01	5.4E-01
INORGANICS											
Arsenic	4.8E-05	0.1	1E-03	NA	Keratosis and hyperpigmentation	NA/HEAST	1		4.8E-01		

Table 8E

SUMMARY OF CANCER RISK ESTIMATES - SCENARIO 3: CHILDREN

CHEMICAL	CHRONIC DAILY INTAKE(CDI) (mg/kg/day)	CDI ADJUSTED FOR ABSORPTION	SF (mg/kg/day)-1	WEIGHT OF EVIDENCE	TYPE OF CANCER	SF BASIS/ SOURCE	CHEMICAL SPECIFIC RISK	TOTAL PATHWAY RISK	TOTAL EXPOSURE RISK
EXPOSURE PATHWAY: INGESTION OF CHEMICALS IN DRINKING WATER								2E-04	2E-03
INORGANICS									
Arsenic	9.8E-05	No	1.75E+00	A	Skin	Water/IRIS	2E-04		
EXPOSURE PATHWAY: DERMAL CONTACT WITH CHEMICALS IN SOIL -								2E-03	
INORGANICS									
Arsenic	1.1E-04	0.10	1.75E+00	A	Skin	Water/IRIS	2E-03		

Table 8F

SUMMARY OF CANCER RISK ESTIMATES - SCENARIO 3: ADULT

CHEMICAL	CHRONIC DAILY INTAKE(CDI) (mg/kg/day)	CDI ADJUSTED FOR ABSORPTION	SF (mg/kg/day)-1	WEIGHT OF EVIDENCE	TYPE OF CANCER	SF BASIS/ SOURCE	CHEMICAL SPECIFIC RISK	TOTAL PATHWAY RISK	TOTAL EXPOSURE RISK
EXPOSURE PATHWAY: INGESTION OF CHEMICALS IN DRINKING WATER								5E-04	7E-03
INORGANICS									
Arsenic	3.0E-04	No	1.75E+00	A	Skin	Water/IRIS	5E-04		
EXPOSURE PATHWAY: DERMAL CONTACT WITH CHEMICALS IN SOIL -								7E-03	
INORGANICS									
Arsenic	3.8E-04	0.10	1.75E+00	A	Skin	Water/IRIS	7E-03		

Table 8G

SUMMARY OF CHRONIC HAZARD INDEX ESTIMATES - SCENARIO 3: CHILDREN

CHEMICAL	CHRONIC DAILY INTAKE(CDI) (mg/kg/day)	CDI ADJUSTED FOR ABSORPTION	RFD (mg/kg/day)	CONFIDENCE LEVEL	CRITICAL EFFECT	RFD SOURCE/ BASIS	RFD UNCERTAINTY ADJUSTMENTS	MODIFYING FACTORS	HAZARD QUOTIENT	PATHWAY HAZARD INDEX (HI)	TOTAL EXPOSURE HI
EXPOSURE PATHWAY: INGESTION OF CHEMICALS IN DRINKING WATER - CHILDREN										84	100
INORGANICS											
Arsenic	1.1E-03	No	1E-03	NA					1E+00		
Chromium VI	1.6E-02	No	5E-03	Low	No effect reported	Water/IRIS	500	1	3E+00		
Manganese	7.6E+00	No	1E-01	Medium	CNS effects	Diet/HEAST	1	1	8E+01		
EXPOSURE PATHWAY: DERMAL CONTACT WITH CHEMICALS IN SOIL - CHILDREN										13	
INORGANICS											
Arsenic	1.3E-03	0.10	1E-03	NA	Keratosis and hyperpigmentation	NA/HEAST	1		13		
EXPOSURE PATHWAY: INGESTION OF CHEMICALS IN SOIL AND HOUSE DUST - CHILDREN										3	
INORGANICS											
Chromium VI	6.3E-03	No	5E-03	Low	No effect reported	Water/IRIS	500	1	1E+00		

Table 8H

SUMMARY OF CHRONIC HAZARD INDEX ESTIMATES - SCENARIO 3: ADULT

CHEMICAL	CHRONIC DAILY INTAKE(CDI) (mg/kg/day)	CDI ADJUSTED FOR ABSORPTION	RFD (mg/kg/day)	CONFIDENCE LEVEL	CRITICAL EFFECT	RFD SOURCE/ BASIS	RFD UNCERTAINTY ADJUSTMENTS	MODIFYING FACTORS	HAZARD QUOTIENT	PATHWAY HAZARD INDEX (HI)	TOTAL EXPOSURE HI
EXPOSURE PATHWAY: INGESTION OF CHEMICALS IN DRINKING WATER - ADULT										51	60
INORGANICS											
Chromium VI	9.6E-03	No	5E-03	Low	No effect reported	Water/IRIS	500	1	2E+00		
Manganese	4.6E+00	No	1E-01	Medium	CNS effects	Diet/HEAST	1	1	5E+01		
EXPOSURE PATHWAY: DERMAL CONTACT WITH CHEMICALS IN SOIL - ADULT										9	
INORGANICS					Keratosis						
Arsenic	8.9E-04	0.10	1E-03	NA	and hyperpigmentation	NA/HEAST	1		9		

Table 8I

SUMMARY OF CANCER RISK ESTIMATES - SCENARIO 2 : CONSTRUCTION WORKERS

CHEMICAL	CHRONIC DAILY INTAKE(CDI) (mg/kg/day)	CDI ADJUSTED FOR ABSORPTION	SF (mg/kg/day)-1	WEIGHT OF EVIDENCE	TYPE OF CANCER	SF BASIS/ SOURCE	CHEMICAL SPECIFIC RISK	TOTAL PATHWAY RISK	TOTAL EXPOSURE RISK
EXPOSURE PATHWAY: DERMAL CONTACT WITH CHEMICALS IN SOIL								1E-05	1E-05
INORGANICS									
Arsenic	6.34E-07	0.10	1.75	A	Skin	Water/IRIS	1E-05		

Table 8J

SUMMARY OF CHRONIC HAZARD INDEX ESTIMATES - SCENARIO 2 : CONSTRUCTION WORKERS

CHEMICAL	SUBCHRONIC DAILY INTAKE (mg/kg/day)	CDI ADJUSTED FOR ABSORPTION	RFD (mg/kg/day)	CONFIDENCE LEVEL	CRITICAL EFFECT	RFD SOURCE/ BASIS	RFD UNCERTAINTY ADJUSTMENTS	MODIFYING FACTORS	HAZARD QUOTIENT	PATHWAY HAZARD INDEX (HI)	TOTAL EXPOSURE HI
EXPOSURE PATHWAY: DERMAL CONTACT WITH CHEMICALS IN SOIL										9E-01	1E+00
INORGANICS					Keratosis						
Arsenic	9.0E-05	0.10	1E-03	NA	and hyperpigmentation	NA/HEAST	1		9E-01		

Table 9 - Detailed Costs

Alternative 4A:
Site Use Restrictions, Multi-Layer Cap,
Ground Water Extraction, On-Site Innovative Treatment and Discharge to Surface Water

Item	Quantity	Units	Unit Price	Basis year	Reference	Escalation	1991 Unit costs	1991 Costs	Years (O&M)	(1) Present Value (O&M)
CAPITAL COSTS - DIRECT										
Monitoring Well Installation										
(4 60-ft. bedrock wells - 2" diam., 2 30-ft. deep overburden wells - 2 ")										
-Well Construction & Matls. (Tubex)	300	ft	$125.00	1991	1	1.00	$125.00	$37,500.00		
-Health & Safety (17%)					8			$6,375.00		
-Mobilization	1	time	$8,000.00	1991	1	1.00	$8,000.00	$8,000.00		
Total Monitoring Well Cost										$51,875.00
Security										
-Perm. Chain Link Fence	6,250	linear ft	$11.65	1991	5	1.00	$11.65	$72,812.50		
-Warning Signs	20	signs	$42.00	1991	5	1.00	$42.00	$840.00		
Total Security Cost										$73,652.50
Site Preparation										
Clearing	12.2	acres	$3,675.00	1991	5	1.00	$3,675.00	$44,835.00		
Grading	80,000	cu.yd.	$3.53	1987	6	1.083	$3.82	$305,839.20		
Fill Material	80,000	cu.yd.	$11.03	1991	5	1.00	$11.03	$882,400.00		
Access Road Reconstruction	7,200	sq.ft.	$15.20	1991	5	1.00	$15.20	$109,440.00		
Total Site Preparation										$1,342,514.20

(1) - Calculated based on an assumed 5% interest rate.

Table 9 - Detailed Costs

Alternative 4A:
Site Use Restrictions, Multi-Layer Cap,
Ground Water Extraction, On-Site Innovative Treatment and Discharge to Surface Water
(continued)

Item	Quantity	Units	Unit Price	Basis year	Reference	Escalation	1991 Unit costs	1991 Costs	Years (O&M)	Present Value (O&M) (1)
Run-on/Run-off Controls										
-Ditching	2100	l.ft.	$1.70	1988	7	1.055	$1.79	$3,766.35		
-Sedimentation Basin	1	each	$10,000.00	1988	7	1.055	$10,550.00	$10,550.00		
Total Run-On/Run-Off Controls										$14,316.35
Multi-Layer Cap Construction										
-12" Gas Vent Layer	20,000	cu.yd.	$17.25	1991	13	1.00	$17.25	$345,000.00		
-40-mil HDPE Liner	530,000	sq.ft.	$0.80	1991	13	1.00	$0.80	$424,000.00		
-Filter Fabric (2 layers)	1,060,000	sq.ft.	$0.17	1991	13	1.00	$0.17	$180,200.00		
-24" Barrier Protection Layer	40,000	cu.yd.	$2.50	1988	7	1.055	$2.64	$105,600.00		
-6" Topsoil Layer	530	msf	$400.00	1991	5	1.00	$400.00	$212,000.00		
-Seed, Fertilizer, Mulch	530	msf	$43.00	1991	5	1.00	$43.00	$22,790.00		
-Vertical Gas Vent Pipes	15	each	$500.00	1988	7	1.055	$527.50	$7,912.50		
-Lateral Gas Vent Pipe	6,500	ft	$6.00	1988	7	1.055	$6.33	$41,145.00		
-Health and Safety(17%)					8			$220,558.43		
Total Cap Construction Costs										$1,559,105.93
Ground Water Extraction										
(22 30-ft. deep overburden wells - 6")										
-Well Construction and Materials (Tubex)	660	ft	$124.00	1991	1	1.00	$124.00	$81,840.00		
-Health and Safety(17%)					8			$13,912.80		
-Ejector Pumps	22	pumps	$4,264.00	1991	24	1.00	$4,264.00	$93,808.00		
Total Extraction Cost										$189,560.80
Piping To and From Treatment System										
-(2" diam. PVC in Trench)	2450	ft	$5.81	1991	5	1.00	$5.81	$14,234.50		$14,234.50

(1) - Calculated based on an assumed 5% interest rate.

Table 9 - Detailed Costs

Alternative 4A:
Site Use Restrictions, Multi-Layer Cap,
Ground Water Extraction, On-Site Innovative Treatment and Discharge to Surface Water
(continued)

Item	Quantity	Units	Unit Price	Basis year	Reference	Escalation	1991 Unit costs	1991 Costs	Years (O&M)	Present Value (O&M) (1)
Ground Water Treatment System										
-Membrane Microfiltration Unit	1	each	$50,000.00	1991	25	1.00	$50,000.00	$50,000.00		
-Filter Aid System	1	each	$20,000.00	1991	25	1.00	$20,000.00	$20,000.00		
-UV Oxidation Unit	1	each	$59,950.00	1991	10	1.00	$59,950.00	$59,950.00		
-UV Oxidation Service Connection	1	time	$5,000.00	1991	10	1.00	$5,000.00	$5,000.00		
-Piping	500	l.ft.	$2.60	1988	7	1.055	$2.74	$1,371.50		
-Equalization Tank	1	each	$12,500.00	1988	7	1.055	$13,187.50	$13,187.50		
Total Ground Water Treatment System Costs										$149,509.00
Equipment Decontamination										
-Rental of steam cleaner	4	months	$390.00	1991	5	1.00	$390.00	$1,560.00		
-Construct Decon Pit										
Excavate Pit	100	cu.yd.	$27.00	1991	5	1.00	$27.00	$2,700.00		
Polyethylene Tarpaulin	1200	sq.ft.	$0.31	1991	5	1.00	$0.31	$372.00		
-Tanker rental	1	each	$800.00	1989	9	1.036	$828.80	$828.80		
-Disposal	1	each	$1,100.00	1989	9	1.036	$1,139.60	$1,139.60		
Total Equipment Decon Costs										$6,600.40
Engineering Mgmt. Mob/Demob (1 Trailer)	6	months	$430.00	1991	5	1.00	$430.00	$2,580.00		$2,580.00
Dust Control										
- Water Tank Sprayer	800	hours	$7.10	1991	5	1.00	$7.10	$5,680.00		$5,680.00
Direct Capital Cost Subtotal										$3,409,628.68

(1) - Calculated based on an assumed 5% interest rate.

Table 9 - Detailed Costs

Alternative 4A:
Site Use Restrictions, Multi-Layer Cap,
Ground Water Extraction, On-Site Innovative Treatment and Discharge to Surface Water
(continued)

Item	Quantity	Units	Unit Price	Basis year	Reference	Escalation	1991 Unit costs	1991 Costs	Years (O&M)	(1) Present Value (O&M)
CAPITAL COSTS - INDIRECT										
Engineering and Design(13%)					2					$443,261.73
Legal and Administrative(3%)					2					$102,288.86
TOTAL CAPITAL COSTS										$3,955,169.26
OPERATION AND MAINTENANCE COSTS										
-Ground Water Monitoring										
Annual Sampling (15 Wells)	15	samples	$200.00	1991	13	1.00	$200.00	$3,000.00	17	$33,822.00
Quarterly Sampling (12 Wells)	48	samples	$200.00	1991	13	1.00	$200.00	$9,600.00	17	$108,230.40
TCL Analysis	63	samples	$1,800.00	1988	4	1.055	$1,899.00	$119,637.00	17	$1,348,787.54
-Cap Maintenance										
Annual Inspection	1	each	$5,000.00	1988	7	1.055	$5,275.00	$5,275.00	30	$81,087.30
Mowing/Revegetation	530,000	sq.ft.	$0.04	1991	5	1.00	$0.04	$21,200.00	30	$325,886.40
Erosion Control	12.2	acres	$200.00	1982	12	1.247	$249.40	$3,042.68	30	$46,772.08
Repairs(total for 1 year)	1	each	$1,000.00	1988	7	1.055	$1,055.00	$1,055.00	30	$16,217.46
-Membrane Microfiltration O&M	5,256	1000 gal	$4.00	1991	26	1.00	$4.00	$21,024.00	12	$186,335.71
-UV Oxidation O&M Cost	12	months	$4,796.00	1991	18	1.00	$4,796.00	$57,552.00	12	$510,083.38
-Filter Cake Transportation & Disposal	4	tons	$1,300.00	1991	22	1.00	$1,300.00	$5,200.00	12	$46,087.60
-Discharge to Surface Water Sampling And Analysis	24	samples	$850.00	1991	13	1.00	$850.00	$20,400.00	12	$180,805.20
TOTAL NET PRESENT VALUE OF O & M								$266,985.68		$2,884,115.06

(1) - Calculated based on an assumed 5% interest rate.

Table 9 - Detailed Costs

Alternative 4A:
Site Use Restrictions, Multi-Layer Cap,
Ground Water Extraction, On-Site Innovative Treatment and Discharge to Surface Water
(continued)

Item	Quantity	Units	Unit Price	Basis year	Reference	Escalation	1991 Unit costs	1991 Costs	Years (O&M)	(1) Present Value (O&M)
SUBTOTAL										$6,839,284.33
CONTINGENCY(20%)										$1,367,856.87
TOTAL PRESENT VALUE COST FOR ALTERNATIVE 4A										$8,207,141.19

(1) - Calculated based on an assumed 5% interest rate.

APPENDIX III

ADMINISTRATIVE RECORD INDEX

Document Number: HTL-001-1904 To 1904 Date: / /

Title: (Notice of the availability of the Hertel Landfill site data, Chain of Custody Forms, and Quality Assurance/Quality Control information)

Type: CORRESPONDENCE
Author: Kaplan, Richard: US EPA
Recipient: none: none

Document Number: HTL-001-0189 To 0214 Date: 06/06/83

Title: (Hazardous Ranking System Package for the Hertel Landfill site)

Type: DATA
Author: none: US EPA
Recipient: none: none

Document Number: HTL-001-0173 To 0188 Date: 06/07/83

Title: Potential Hazardous Waste Site, Site Inspection Report (Hertel Landfill site)

Type: REPORT
Author: Baumer, J. Charles Jr.: Ecological Analysts
Recipient: none: US EPA

Document Number: HTL-001-0001 To 0172 Date: 11/01/83

Title: Preliminary Investigation of the Hertel Property, Town of Plattekill, Ulster County, New York, Phase I, Summary Report

Type: PLAN
Author: none: Ecological Analysts
Recipient: none: NY Dept of Environmental Conservation

Document Number: HTL-001-1671 To 1678 Parent: HTL-001-1670 Date: 06/30/89

Title: Preliminary Health Assessment for Hertel Landfill, Inc., CERCLIS No. NYD980780779, Ulster County, Plattekill, NY

Type: PLAN
Author: none: Agency for Toxic Substances & Disease Registry (ATSDR)
Recipient: none: US EPA

Document Number: HTL-001-1670 To 1670 Date: 07/12/87

Title: (Memorandum forwarding the enclosed Preliminary Health Assessment for the Hertel Landfill site)

Type: CORRESPONDENCE
Author: Nelson, William Q.: Agency for Toxic Substances & Disease Registry (ATSDR)
Recipient: Cam, Vinh: US EPA
Attached: HTL-001-1671

Document Number: HTL-001-0441 To 0545 Date: 09/01/89

Title: Final RI/FS Work Plan for Hertel Landfill Site - Plattekill, New York

Type: PLAN
Author: none: TAMS Consultants
Recipient: none: US EPA

Document Number: HTL-001-0215 To 0440 Date: 10/01/89

Title: Final RI/FS Field Operations Plan for Hertel Landfill Site - Plattekill, New York

Type: PLAN
Author: none: TAMS Consultants
Recipient: none: US EPA

Document Number: HTL-001-1682 To 1733 Date: 11/01/89

Title: Final Community Relations Plan for Hertel Landfill Site - Plattekill, New York

Type: PLAN
Author: none: TAMS Consultants
Recipient: none: US EPA

Document Number: HTL-001-1905 To 1926 Date: 04/01/90

Title: Site Analysis, Hertel Landfill, Clintondale, New York

Type: PLAN
Author: McDonald, Bruce D.: Bionetics Corporation
Recipient: Osberg, Thomas R.: Environmental Photographic Interpretation Center (US EPA)

Document Number: HTL-001-1927 To 1934 Date: 01/29/91

Title: (Transmittal cover sheet forwarding attached proposed applicable or relevant and appropriate requirements for the Hertel Landfill site)

Type: CORRESPONDENCE
Condition: DRAFT
Author: Penn, Bill: TRC Environmental Consultants, Inc.
Recipient: Kaplan, Richard: US EPA

Document Number: HTL-001-0546 To 0755 Date: 07/01/91

Title: Remedial Investigation Report for Hertel Landfill Site, Plattekill, New York, Volume 1

Type: REPORT
Author: none: TAMS Consultants
Recipient: none: US EPA

Document Number: HTL-001-0756 To 0890 Date: 07/01/91

Title: Remedial Investigation Report for Hertel Landfill Site, Plattekill, New York, Volume 2

Type: REPORT
Author: none: TAMS Consultants
Recipient: none: US EPA

Document Number: HTL-001-0891 To 1290 Date: 07/01/91

Title: Remedial Investigation Report for Hertel Landfill Site, Plattekill, New York, Volume 3

Type: REPORT
Author: none: TAMS Consultants
Recipient: none: US EPA

Document Number: HTL-001-1291 To 1588 Date: 07/01/91

Title: Feasibility Study Report for Hertel Landfill Site, Plattekill, New York, Volume 1

Type: REPORT
Author: none: TAMS Consultants
Recipient: none: US EPA

Document Number: HTL-001-1589 To 1600 Date: 07/01/91

Title: Superfund Proposed Plan (Revised) Hertel Landfill Site

Type: PLAN
Author: none: US EPA
Recipient: none: none

Document Number: HTL-001-1601 To 1601 Date: 07/25/91

Title: (Letter offering concurrence with the selected remedy for the Hertel Landfill site)

Type: CORRESPONDENCE
Author: O'Toole, Michael J. Jr.: NY Dept of Environmental Conservation
Recipient: Callahan, Kathleen C.: US EPA

Document Number: HTL-001-1734 To 1736 Date: 07/31/91

Title: (Press Release:) EPA to Hold Meeting on Proposed Clean Up of the Hertel Landfill Superfund Site in Plattekill, New York

Type: CORRESPONDENCE
Author: none: US EPA
Recipient: none: none

Document Number: HTL-001-1602 To 1616 Date: 08/14/91

Title: General Notice of Potential Liability and Request for Information under 42 U.S.C. Sections 9604 and 9607 Concerning the Hertel Landfill Site, Plattekill, New York

Type: CORRESPONDENCE
Author: Callahan, Kathleen C.: US EPA
Recipient: none: various PRPs

Document Number: HTL-001-1617 To 1628 Date: 08/14/91

Title: General Notice of Potential Liability and Request for Information under 42 U.S.C. Sections 9604 and 9607 Concerning the Hertel Landfill Site, Plattekill, New York (Version sent to generators)

Type: CORRESPONDENCE
Author: Callahan, Kathleen C.: US EPA
Recipient: none: various PRPs

Document Number: HTL-001-1629 To 1643 Date: 08/14/91

Title: General Notice of Potential Liability and Request for Information under 42 U.S.C. Sections 9604 and 9607 Concerning the Hertel Landfill Site, Plattekill, New York (Version sent to corporations)

Type: CORRESPONDENCE
Author: Callahan, Kathleen C.: US EPA
Recipient: none: various PRPs

Document Number: HTL-001-1644 To 1654 Date: 08/14/91

Title: Request for Information under 42 U.S.C. Section 9604, Concerning the Hertel Landfill Site, Plattekill, New York

Type: CORRESPONDENCE
Author: Callahan, Kathleen C.: US EPA
Recipient: none: various parties associated with the site

Document Number: HTL-001-1655 To 1665 Date: 08/14/91

Title: Request for Information under 42 U.S.C. Section 9604, Concerning the Hertel Landfill Site, Plattekill, New York (Version sent to transporters)

Type: CORRESPONDENCE
Author: Callahan, Kathleen C.: US EPA
Recipient: none: various parties associated with the site

Document Number: HTL-001-1666 To 1669 Date: 08/14/91

Title: Hertel Landfill Addresses (for 107(a) and 104(e) letters sent August 14, 1991)

Type: CORRESPONDENCE
Author: none: US EPA
Recipient: none: none

Document Number: HTL-001-1737 To 1903 Date: 08/14/91

Title: (Public Hearing Transcript: Town of Plattekill Town Court, August 14, 1991, concerning the Hertel Landfill site)

Type: LEGAL DOCUMENT
Author: D'Lorenzo, Katherine: shorthand reporter
Recipient: none: none

Document Number: HTL-001-1679 To 1681 Date: 08/27/91

Title: (Letter on behalf of Western Publishing Company ("Western") requesting that EPA extend the public comment period for the Superfund Proposed Plan (Revised) for the Hertel Landfill site - fax transmittal slip attached)

Type: CORRESPONDENCE
Author: Ephron, Susan H.: Beveridge & Diamond
Recipient: Capon, Virginia: US EPA

ADDENDUM TO ADMINISTRATIVE RECORD INDEX--HERTEL LANDFILL SUPERFUND SITE

1. September 24, 1991--Comments on behalf of Western Publishing Company on the Proposed Plan for the Hertel Landfill Site, Plattekill, New York, submitted by Beveridge & Diamond, P.C.

APPENDIX IV

NYSDEC LETTER OF CONCURRENCE

New York State Department of Environmental Conservati
50 Wolf Road, Albany, New York 12233 7010

Thomas C. Jorling
Commissioner

SEP 2 0 1991

Mr. Constantine Sidamon-Eristoff
Regional Administrator
U.S. Environmental Protection Agency
Region II
26 Federal Plaza
New York, NY 10278

Dear Mr. Sidamon-Eristoff:

Re: Record of Decision
Hertel Landfill Site (ID No. 356006)

The New York State Department of Environmental Conservation has reviewed the Draft Record of Decision for the Hertel Landfill site located in the Town of Plattekill, Ulster County, New York and finds it to be acceptable with the condition that appropriate remedial action will be incorporated into the selected Remedial Action Plan if sampling of the residential wells shows contaminant levels of concern.

Please contact Mr. James Lister at (518) 457-3976 if you should have any questions regarding this matter.

Sincerely,

Edward O. Sullivan
Deputy Commissioner

FAX MEMO
PAGES 1 DATE 9/20 FAX #
TO Doug Gorman/EPA
FROM Jim Lister
CO. DEC
PH #518 457-3976 FAX #518 457 1088