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Pfohl Brothers Landfill

Cheektowaga, Erie County, New York
Site No. 09-15-043

RECORD OF DECISION

FEBRUARY 1992

Prepared by
New York State Department of Environmental Conservation
Division of Hazardous Waste Remediation

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

Thomas C. Jorling
Commissioner

DECLARATION STATEMENT - RECORD OF DECISION (ROD)

Pfohl Brothers Landfill
Cheektowaga, Erie County
Site No. 09-15-043

Statement of Purpose

The Record of Decision (ROD) sets forth the selected Remedial Action Plan for the Pfohl Brothers Landfill inactive hazardous waste site. This Remedial Action Plan was developed in accordance with the Comprehensive Environmental Response Compensation and Liability Act (CERCLA) of 1980, as amended by the Superfund Amendments and Reauthorization Act (SARA) of 1986, and the New York State Environmental Conservation Law (ECL). The selected remedial plan complies to the maximum extent practicable with the National Oil and Hazardous Substance Pollution Contingency Plan, 40 CFR Part 300, of 1985.

Statement of Basis

This decision is based upon the Administrative Record of the New York State Department of Environmental Conservation (NYSDEC) for the Pfohl Brothers Landfill site and upon public input to the Proposed Remedial Action Plan (PRAP) presented by the NYSDEC. A bibliography of the documents included as a part of the Administrative Record is included in Appendix D of the ROD.

Description of Selected Remedy

The selected remedial action plan will control the potential contaminant routes of exposure to human health and the environment through capping and containment of the source waste. The remedy is technically feasible and complies with the statutory requirements. Briefly, the selected remedial action plan includes the following:

1. A Slurry Wall Containment System excavated through the native alluvial materials and backfilled with a low permeability bentonite clay/soil/slurry mixture. This physical containment system will encircle the waste in areas south of Aero Lake and north of Pfohl Road and will intersect with the landfill cap system at the surface.

2. A Landfill Cap will cover the entire area of the waste and will extend beyond the slurry wall containment system. The landfill cap will comply with the substantive requirements of the 6NYCRR Part 360 regulations for Solid Waste Management Facilities. The Subpart 360 - 2.13 of this regulation pertains to cap construction materials and requirements. This

cap will eliminate the infiltration of precipitation into the landfill waste, prevent erosion of contaminated soils and will prevent the direct contact by both people and wildlife with the waste.

3. <u>Leachate Collection and Treatment</u> will be accomplished by removing water from within the cap and slurry wall containment system and treating it as necessary to meet the appropriate permit requirements for its discharge. Discharge may be to either the Cheektowaga Sewer District No. 8 or to surface water depending on the acceptance by the local municipality. In either case all permit requirements and quality standards for discharge will be met.

4. **Interim Remedial Measures (IRM)**

   The IRM will proceed the implementation of the final remedy at the landfill. Drums and phenolic tars in both the 100-year flood plain and at concentrated areas of the site will be collected for proper disposal or temporary stored in an on-site encapsulation cell. Those material temporarily stored on-site will be re-evaluated during the design of the final remedy with respect to their permanent disposal.

New York State Department of Health Acceptance

The New York State Department of Health (NYSDOH) concurs with the remedy selected for this site as being protective of human health.

Declaration

The selected Remedial Action Plan is protective of human health and the environment. The remedy selected will meet the substantive requirements of the Federal and State laws, regulations and standards that are applicable or relevant and appropriate to the remedial action. The remedy will satisfy, to the maximum extent practicable, the statutory preference for remedies that employ treatment that reduce toxicity, mobility or volume as a principal element. This statutory preference will be met by eliminating the mobility of contaminant pathways of exposure to human health and the environment through the installation of a cap and containment system for the source waste at this site.

2-11-92
DATE

Edward O. Sullivan
Edward O. Sullivan
Deputy Commissioner

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Pfohl Brothers Landfill
Cheektowaga, Erie County, New York
Site No. 09-15-043

Section

Section 1: SITE LOCATION AND DESCRIPTION

The Pfohl Brothers Landfill is a 120 acre inactive hazardous waste site (Site No. 9-15-043) located in the Town of Cheektowaga, Erie County New York approximately one mile northeast of the Buffalo International Airport. The site is bordered by wetlands and the New York State Thruway to the north. The eastern border is Transit Road. The southern border is marked by the homes along the north side of Pfohl Road and the western border is the Niagara Mohawk Power easement and the Pfohl Trucking property. Aero Drive cuts through the middle of the site before intersecting Transit Road. Figure 1.1 - 1.3 illustrate the location of the site and surrounding wetlands.

The site has been separated into three geographical areas. Area A is that portion north of Aero Creek upon which the Thruway ramp and toll booth, as well as a trucking firm are located. Area B is that portion bounded by Aero Creek to the north Aero Drive to the south and bounded by the Niagara Mohawk power lines to the west and Transit Road on the east. Area C is bounded by Aero Drive to the north Pfohl Road to the south and bounded by Pfohl Trucking to the west and Transit Road and the Conrail Railroad tracks to the southeast (see Figures 1.2 and 1.3).

Section 2: SITE HISTORY

The Pfohl Brothers Landfill was operated between 1932 and 1971 as a landfill receiving both municipal and industrial waste. Aerial photographs taken during the 1950s, 60s, and 70s, document, to some extent, the timing and location of excavation and dumping at the site. Reports indicate that, in addition to domestic and commercial waste, the site received sizable amounts of industrial waste. Among the firms whose wastes were reportedly disposed of in the landfill are steel and metal manufacturers, chemical and petroleum companies, utilities, manufacturers of optical and furnace-related materials, and other large manufacturing and processing concerns.

The landfill was operated, in general, as a cut and fill operation where drums, which were filled with substances that could be spilled out, were emptied and then salvaged. Cells were prepared by removing the topsoil and placing it in a separate storage area. A bulldozer then pushed the remaining fill and clay into a berm approximately 15 feet high, around the perimeter of the dumping area. Each excavation was approximately two feet deep and approximately 150 feet in diameter. At the end of each day, the bulldozer ran back and forth over the area to compress the material. When the area was full, fly ash and fill material were spread over it.

PREVIOUS INVESTIGATIONS: In June 1982, the United States Environmental Protection Agency (EPA) contracted with Fred C. Hart Associates to perform a hazardous ranking of the site. Ten water and four sediment samples were obtained at various seep locations, drainage ditches, and domestic wells which were analyzed for organics, inorganics, sulfide, cyanide, and ammonia. The contaminants detected in water samples obtained from a seep flowing into a drainage ditch along the south side of Aero Lake were most notably chlorobenzene, benzene and N-nitrosodiphyenylamine at concentrations of 85, 34 and 11 parts per billion (ppb), respectively.

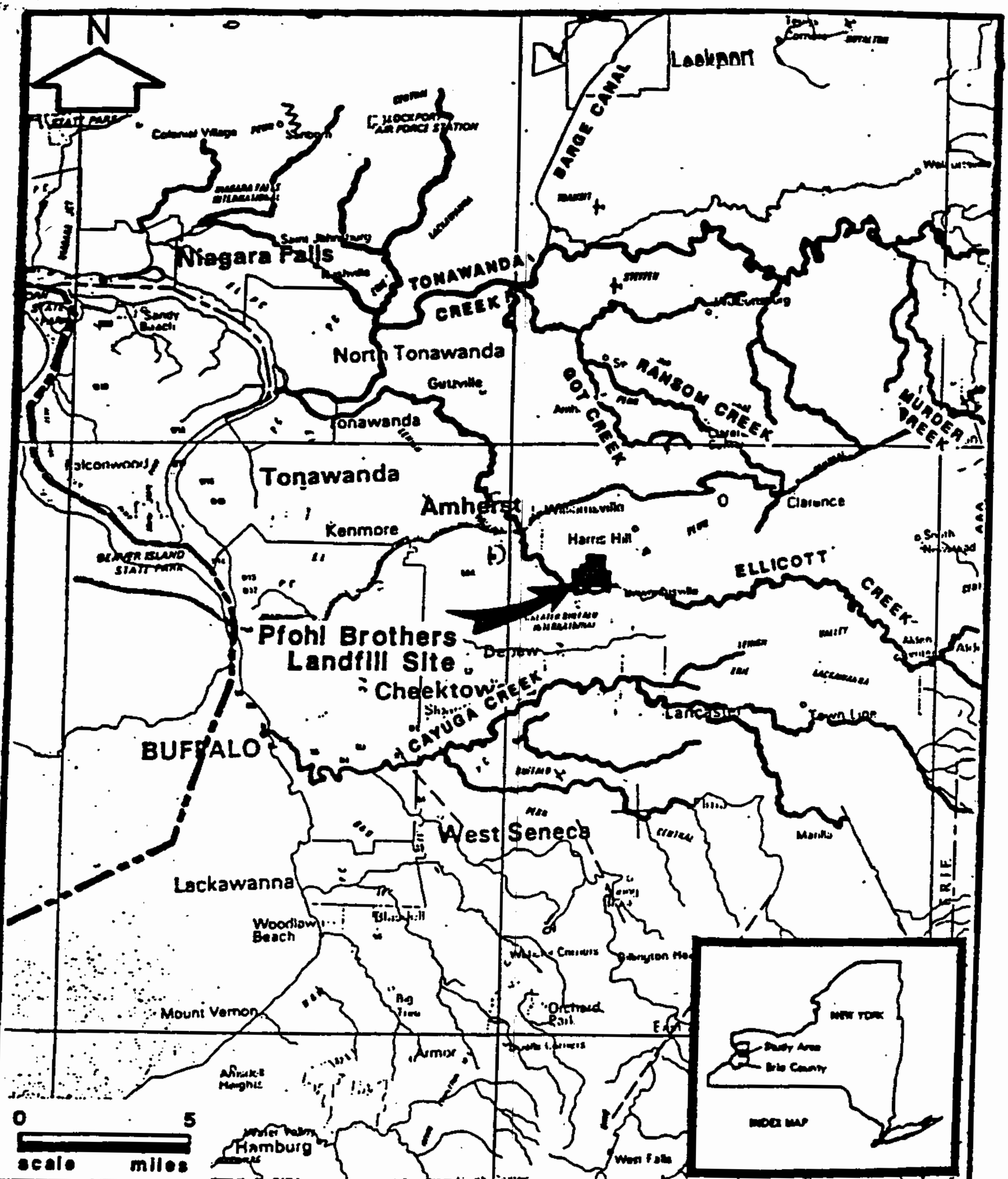

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Figure 1.1

Location Plan

Pfohl Brothers Landfill, Cheektowaga, New York

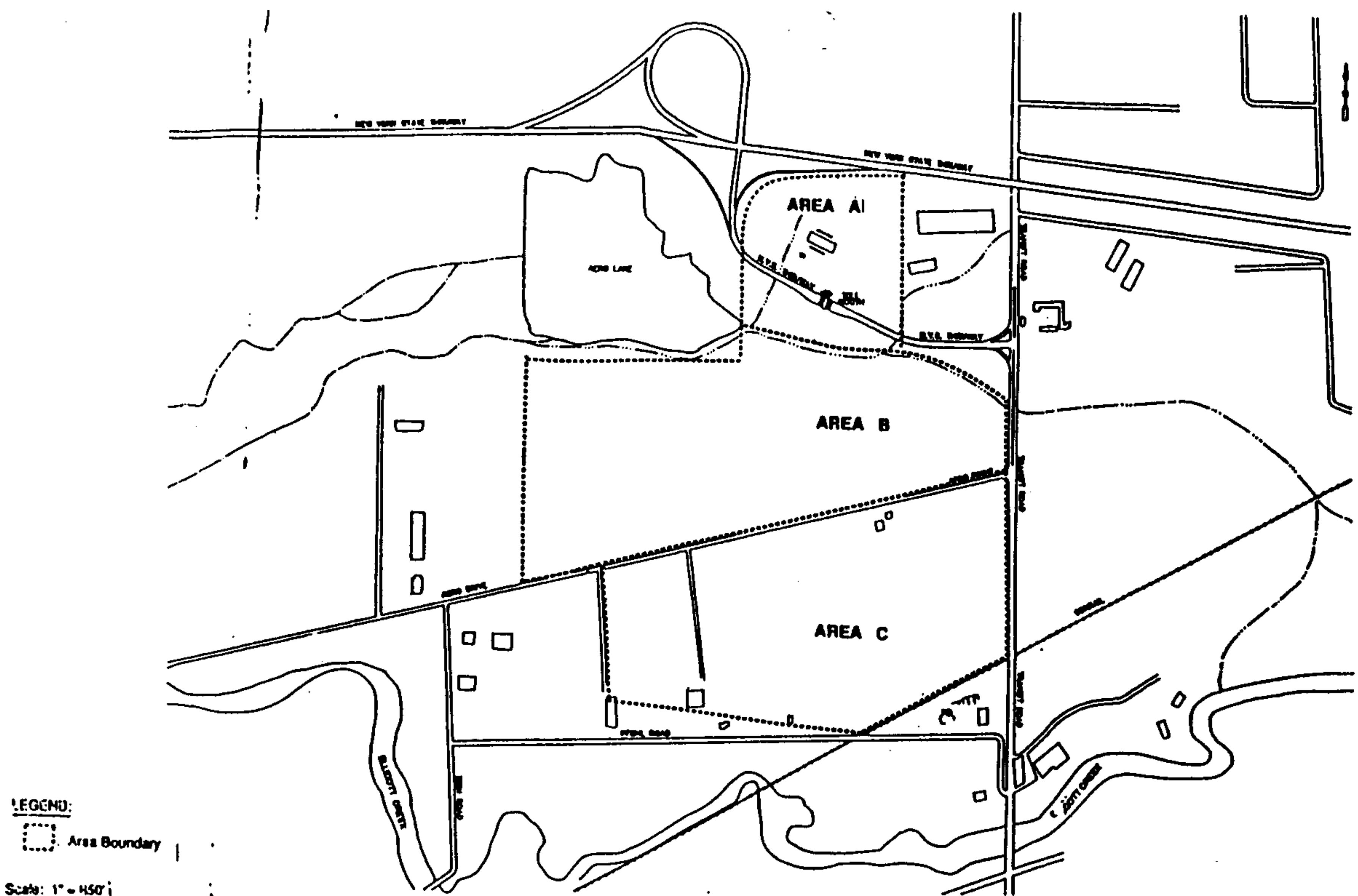

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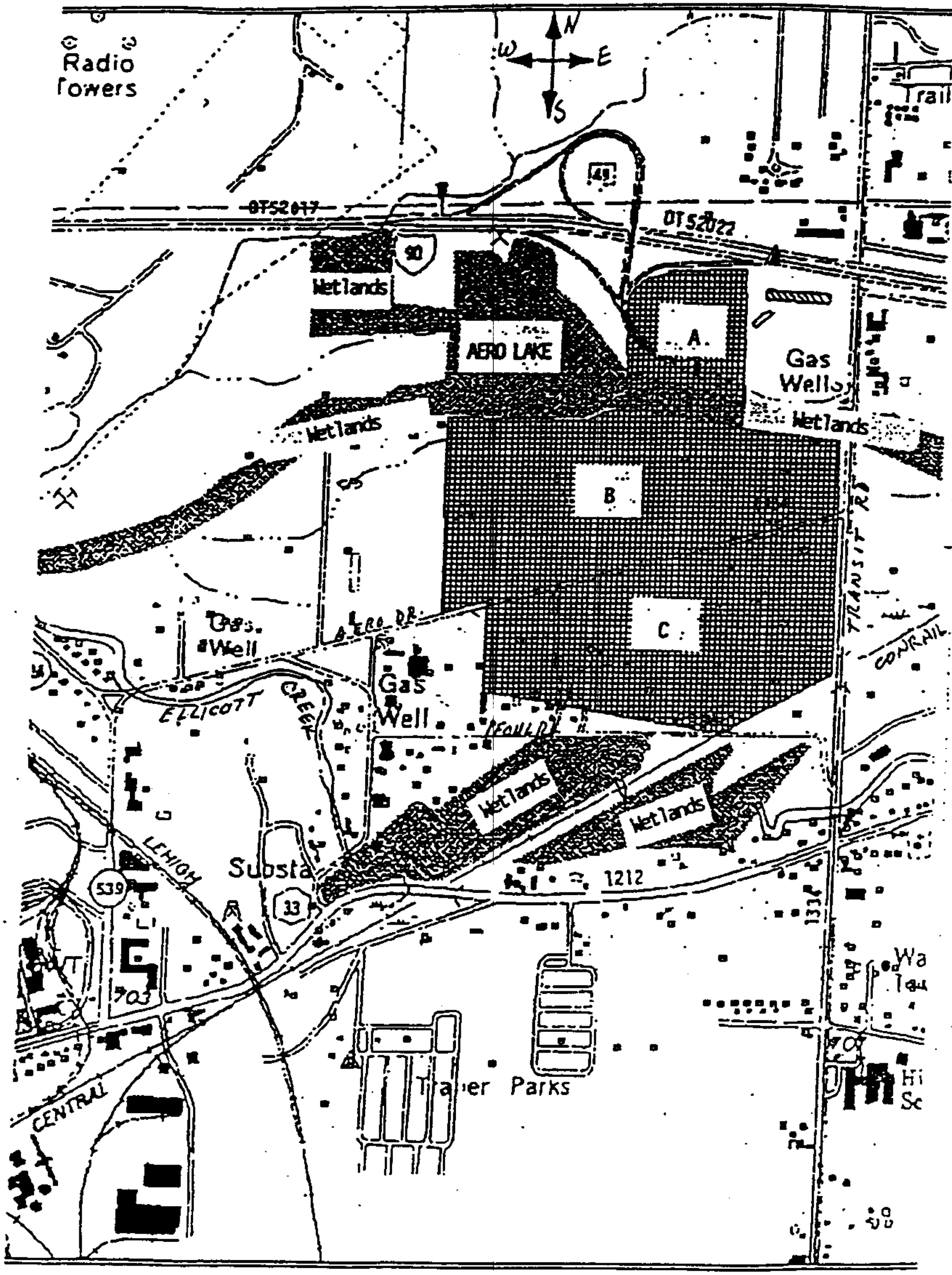
Figure 1.2-
Pfohl Brothers Landfill S

Pfohl Brothers Landfill, Cheektowaga, New Y



PFOHL BROTHERS LANDFILL
CHEEKTOWAGA, ERIE COUNTY, NEW YORK
SITE NO. 09-15-043

FIGURE 1.3

In February 1984, the property owner commissioned Ecology and Environment, Inc., to perform an additional investigation of the site. The objective of the investigation was to determine if the landfill at the time posed, or had the potential to pose, either an environmental or public health threat. As part of the investigation, groundwater, sediment, and leachate seep samples were collected and analyzed for volatile organics, semi-volatiles, inorganics, phenols, PCBs, pesticides, and oil and grease.

In the western portion of the site this study identified barium concentrations of 49,600 parts per million (ppm) in a leachate seep sample, and concentrations of chrysene, anthracene, and nickel were detected in the soil at 2.74, 2.08 and 94.1 ppm, respectively. Soil samples obtained at the northeastern part of the site had concentrations of fluoranthene and pyrene at 5.21 and 2.39 ppm, respectively. Acenaphthene was detected in the soil at the southeastern corner of the site at a concentration of 76 ppm. Phenols and oil and grease were detected, but generally at low concentrations. Metal concentrations were high in many of the monitoring wells. Elevated concentrations of barium, lead, chromium, and cadmium were detected. As a result of this work, the site was listed on the NYSDEC Registry as a Class 2 Inactive Hazardous Waste Site, in 1985.

In November 1986, samples of leachate, soil and waste from surface drums that contained a tar-like material were collected by the NYSDEC and analyzed by the New York State Department of Health (NYSDOH). The contaminants detected in the waste samples from the drums were fluorene and phenanthrene at concentrations of 5,500 and 790 ppm, respectively. Various heavy metals were also found in the soil, such as arsenic (38.9 ppm), barium (7,400 ppm), cadmium (48 ppm), chromium (60 ppm), lead (1,760 ppm), and mercury (1.4 ppm).

A Remedial Investigation/Feasibility Study (RI/FS) was initiated in 1988 by the NYSDEC consultant, Camp Dresser and McKee (CDM) under the State Superfund Program. The RI spanned the years 1988 through 1990 and consisted primarily of six major field activities. These included:

- Geophysical Survey
- Surface Water, Leachate Seep, and Sediment Sampling
- Gamma Radiation Survey - Phases I and II
- Test Pit Investigation
- Soil Boring Investigation
- Groundwater Investigation

Additionally, NYSDEC and the NYSDOH collected supplemental data on groundwater radioactivity, residential basement sump groundwater samples, residential radon testing, blood lead testing, residential water well, surface water, residential surface soil and on-site surface soil and sediment quality from April 1989 through June 1991.

A number of Interim Reports were issued during the course of the Remedial Investigation (RI) by CDM, NYSDOH and NYSDEC. All of these reports were distributed to interested citizens groups, local political officials and the local document repositories in Cheektowaga and Williamsville. A complete listing of these reports is contained in the Administrative Record (Appendix D) of this document.

A series of Citizen Forum meetings were held in Cheektowaga during 1990 and 1991 to discuss the results of the Interim Reports and other issues with interested citizens. Additionally, the NYSDOH held a separate meeting in March 1991 to discuss health studies related to the site.

The Remedial Investigation report was issued to the public in January 1991. A public meeting was held on March 7, 1991 to present the results of the investigation at this site and a Responsiveness Summary was issued on April 12, 1991 to respond to questions and comments presented to the NYSDEC regarding the investigation.

The Feasibility Study (FS), released to the public in September 1991, contains the evaluation of alternatives and the selection of the preferred remedy for this site. A Citizen Forum meeting was held on September 26, 1991 at which NYSDEC discussed the preferred remedy, remedial alternatives, remedial concepts and the selection process presented in the FS report. Future meetings will be held to discuss the selected remedy and its design.

Section 3: <u>CURRENT STATUS</u>

This project is proceeding towards completion in three parallel work efforts; (i) Interim Remedial Measures (IRM), (ii) an off-site Remedial Investigation (RI), as a separate operable unit and (iii) the Source Area (Landfill) remedy selection which is the subject of this document. Each of these efforts deal with a different aspect of the concerns related to this site.

<u>INTERIM REMEDIAL MEASURES</u>

The IRMs are intended to remediate the "hot spots" which have been discovered at the site. The "hot spots" generally consist of drums, drum remnants and identifiable concentrations of phenolic tars. These materials will be excavated, sorted and treated or disposed. If the materials cannot be treated or disposed off site in accordance with Federal and State regulations, then they will be temporarily stored on site until an applicable technology can be implemented to dispose of or treat them. The current IRM work plans also provide for further investigation to insure that the lateral extent of the "hot spots" are fully defined. This IRM effort will proceed as a separate work effort prior to implementation of the remedy proposed by this PRAP. As the IRM proceeds it will be the subject of an independent public review process.

<u>OFF-SITE REMEDIAL INVESTIGATION</u>

The off-site RI is intended to accomplish three objectives; (1) provide monitoring wells further away from the perimeter of the site to monitor for any off site migration, (2) the newly installed monitoring wells will serve as long term monitoring for the source remediation project at the landfill, and (3) additional samples will be taken from Area A of the site to provide additional data upon which a decision can be made to either delist this part of the site from further consideration or to remediate this area as part of the hazardous waste site.

SOURCE REMEDIATION

The Source Remediation, the subject of this document, consists of the remedial measures necessary to mitigate the exposures to persons or wildlife presented by contaminants in the various media at the site.

It is anticipated that the IRMs and the off-site RI will be completed in 1992. The NYSDEC will offer the Potential Responsible Parties (PRPs) the opportunity to implement the Record of Decision (ROD). The Source Remediation is currently projected for completion by 1995, however, any delays encountered in the negotiations with the PRP's will impact this schedule for completion.

3.1 REMEDIAL INVESTIGATION RESULTS - NATURE AND EXTENT OF CONTAMINATION

A RI was conducted by the NYSDEC's consultant, Camp Dresser & McKee from 1988 to 1990. The investigation included the installation of soil borings, monitoring wells, test pits and samples of surface soils, groundwater, subsurface soils, leachate seeps, phenolic tars, drum contents and radioactive materials. More detailed information on chemical composition and media at the site can be found in Appendix B of this report.

Table 3-1 illustrates those chemical compounds found in the various media that either represent a significant risk or exceed ARARs for that media.

A carcinogenic risk for a given media and pathway which were above one-in-a-million chance of cancer were considered significant to the total carcinogenic risk. If the total Hazard Index was greater than 1, those media and pathways which contributed a tenth or more to the total Hazard Index were considered significant as were incremental blood levels of 5 ug/dl or greater.

A more generalized view of the data is shown in Tables 4-16 through 4-19 taken from the RI report. These tables show the categories of organic and specific inorganics detected above baseline quality and above standards in the various media. The symbols used in the tables are intended to qualitatively illustrate the frequency of exceedences by the contaminant in the specific media. The various media can be summarized as follows:

DRUMMED WASTE

The materials found in the drums do not reflect any significant pattern in waste disposal practices or source material. No drums were observed in Area A, however, drums were observed at and below the surface of the landfill throughout areas B and C.

Analysis of the waste drummed material indicates that a wide variety of organic compounds were disposed of at the landfill. Elevated levels of volatile organics, aromatic and chlorinated aliphatic hydrocarbons were observed in the waste samples. In addition, a wide variety of semi-volatile organic compounds were detected in the drums.

The most toxic isomer of chlorinated dioxin (2,3,7,8-tetrachloro dibenzo-p-dioxin (TCDD)) was detected at concentrations ranging from 100 to 370 ppb in the drum and waste samples collected during the test pit investigation. Of the

Table 3-1

ARAR VALUES:
CHEMICALS EXCEEDING ARARs AND/OR CONTRIBUTING SIGNIFICANTLY TO RISK

Media	Exposure Pathway	Chemicals contributing to significant risk	ARAR	Chemicals exceeding ARARs (ppb)	ARAR
Surface Water (Ellicott Creek & Aero Lake)	• Ingestion of surface water and dermal contact with Aero Lake surface water while swimming • Dermal adsorption of drainage ditch surface waters and Ellicott Creek surface water			Chlorobenzene Aluminum Cadmium Iron Lead Zinc Mercury	5[a] 100[a] 1.7[a]/7[b] 300[a]/300[b] 6.3[a] 30[a] 0.2[a]/0.2[b]
Leachate Seeps	• Dermal exposure by children and workers	Bis (2-ethylhexyl)phthalate PAHs (Carc)	50[c] 0.8[d]	1,2 trans dichloroethene phenol 1,2 dichlorobenzene Aldrin Endrin 4,4 - DDD Barium Beryllium Cadmium Chromium Copper Iron Lead Magnesium Manganese Zinc	5[c] 1[c] 4.7[c] 0.05[c] 0.05[c] 0.05[c] 1,000[c] 3[c] 10[c] 50[c] 200[c] 300[c] 25[c] 35,000[c] 300[c] 300[c]

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TABLE 3-1 (cont.)

ARAR VALUES:
CHEMICALS EXCEEDING ARARs AND/OR CONTRIBUTING SIGNIFICANTLY TO RISK

Media	Exposure Pathway	Chemicals contributing to significant risk	ARAR	Chemicals exceeding ARARs (ppb)	ARAR
Drainage Ditches, Aero Creek & Ellicott Creek Sediments	• Dermal absorption • Ingestion	PAHs (carc)	1.32[f] mg/kg		
Landfill Soils	• Dermal absorption • Ingestion	PAHs (carc)	1.32[f]mg/kg	Chlorobenzene	5.5[g]
		PCBs	1[g]	BEHP	4.4[g]
		2,3,7,8 TCDD TEQ	0.001[g]	PAHs (noncarc)	114.8[g]
		Arsenic	7.5[g]	b-BHC	0.01[g]
		Lead	32.5[g]	Chlordane	0.2[g]
Groundwater (Unconsolidated Aquifer)	• Ingestion of drinking water • Dermal contact • Inhalation of airborne contaminants	Benzene	2[c]	Xylenes	5[c]
		1,4 dichlorobenzene	4.7[c]	Chromium	50[c]
		Bis(2-ethylhexyl)phthalate	50[c]	Iron	300[c]
		PCBs	0.1[c]	Magnesium	35,000[c]
		Arsenic	25[c]	Sodium	20,000[c]
		Chlorobenzene	5[c]		
		1,1,1-Trichloroethene	5[c]		
		2,4 dimethylphenol	50[c]		
		Barium	100[c]		
		Manganese	300[c]		
		1,4 dichlorobenzene	4.7[c]		

TABLE 3-1 (cont.)

ARAR VALUES:
CHEMICALS EXCEEDING ARARs AND/OR CONTRIBUTING SIGNIFICANTLY TO RISK

Media	Exposure Pathway	Chemicals contributing to significant risk	ARAR	Chemicals exceeding ARARs (ppb)	ARAR
- Bedrock Aquifer	• Ingestion of drinking water	Benzene	2[c]		
	• Dermal contact while showering	Bis(2-ethylhexyl) phthalate	50[c]		
	• Inhalation of airborne contaminants while showering	Aldrin	0.05[c]		
		Arsenic	25[e]		
		Barium	1,000[c]		
		Cadmium	10[c]		
		Nickel	100[h]		
		Vanadium	14[a]		
		Lead	25[a]		

[a] Class B Standards
[b] Class D Standards
[c] 6NYCRR Part 703.5 Class GA Standards/BA TOGS
[d] EPA 1990: Drinking Water Regs and Health Advisories
[e] NYSDOH MCL
[f] Guideline Values from Technology Section Division of Hazardous Waste
[g] Draft Soil Cleanup Guideline Values (TBC's) issued by Technology Section, Division of Hazardous Waste Remediation, NYSDEC.
[h] SDWA MCLG

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Constituent	Drums	Soil	Groundwater: Shallow	Groundwater: Bedrock	Leachate: Seeps	Leachate: Sediment	Drainage Ditch/ Intermittent Stream: Surface Water	Drainage Ditch/ Intermittent Stream: Sediment	Aero Lake: Surface Water	Aero Lake: Sediment	Ellicott Creek: Surface Water	Ellicott Creek: Sediment
Aluminum	○	[●]	[●]	[◒]	[●]	○	[◒]	[●]	○	○	[◒]	●
Antimony	[○]	○	[○]	[○]	○	○	○	◒	○	○	○	○
Arsenic	[○]	[●]	○	○	[◒]	○	○	[●]	○	○	○	○
Barium	[◒]	[●]	○	○	[●]	[●]	[◒]	[●]	●	[○]	○	◒
Beryllium	[○]	[●]	○	○	○	◒	○	◒	○	○	○	◒
Cadmium	[◒]	[○]	○	○	[●]	[●]	[◒]	[●]	○	[○]	[◒]	○
Calcium	[○]	[●]	[●]	[●]	[●]	[●]	[●]	[●]	○	○	●	○
Chromium	[◒]	[●]	[○]	[○]	[●]	[●]	○	[●]	○	○	○	◒
Cobalt	[◒]	[●]	[◒]	○	[◒]	[◒]	○	[●]	○	○	○	●
Copper	[●]	[●]	[○]	○	[●]	[●]	[●]	[◒]	○	○	◒	[○]
Iron	[○]	[●]	[●]	[●]	[◒]	[●]	[●]	[●]	○	◒	[●]	●
Lead	[◒]	[●]	[○]	○	[●]	○	◒	[◒]	○	○	○	○
Magnesium	[○]	[●]	[●]	○	●	[●]	◒	[○]	○	◒	◒	○
Manganese	[◒]	[●]	[●]	○	◒	[◒]	○	[◒]	○	○	◒	○
Mercury	[○]	[◒]	○	○	[●]	[●]	○	[◒]	[●]	○	○	●
Nickel	[◒]	[●]	[●]	[◒]	[●]	[●]	○	[◒]	○	○	◒	●
Potassium	[○]	[●]	[●]	[●]	●	◒	[●]	◒	●	○	[●]	[●]
Selenium	[○]	[○]	○	○	[○]	[◒]	○	○	○	○	○	○
Silver	[○]	[○]	○	○	[◒]	[◒]	○	○	○	○	○	○
Sodium	[◒]	[●]	[●]	[●]	○	[●]	○	[○]	○	○	○	○
Thallium	[○]	○	○	○	○	○	○	○	○	○	○	○
Vanadium	[○]	[●]	[●]	[○]	[○]	○	○	[●]	○	◒	○	○
Zinc	[◒]	[●]	[○]	○	[●]	[●]	[◒]	[◒]	○	○	[●]	○
Cyanide	[○]	[○]	○	○	○	[●]	○	[○]	○	○	○	○

○ Constituent detected in less than 1/3 of the samples above baseline

◒ Constituent detected at a frequency of 1/3 to 2/3 above baseline

● Constituent detected at a frequency greater than 2/3 above baseline

[ ] Constituent detected above twice baseline levels in one or more samples

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Table 4-16

Summary of Inorganic Constituents
Detected at the Site Above Baseline Quality

Pfohl Brothers Landfill, Cheektowaga, New York

Constituent	Drums	Soil	Groundwater: Shallow	Groundwater: Bedrock	Leachate: Surface Water	Leachate: Sediment	Drainage Ditch/ Intermittent Stream: Surface Water	Drainage Ditch/ Intermittent Stream: Sediment	Aero Lake: Surface Water	Aero Lake: Sediment	Ellicott Creek: Surface Water	Ellicott Creek: Sediment
Aromatics	□◒	□○	□○	○	□○	○	○	○	○	○	○	○
Halogenated Hydrocarbons (w/o methylene chloride)	□○	□○	□○	○	○	○	○	○	○	○	○	○
Methylene Chloride	□◒	□◒	○	○	○	●	○	◒	○	●	○	●
Ketones (w/o acetone)	○	○	○	○	○	○	○	○	○	○	○	○
Acetone	□○	◒	○	○	○	◒	○	○	○	◒	○	○
Phenols	□◒	□○	□○	○	○	○	○	○	○	○	○	○
dibenzofuran	□◒	□○	○	○	○	□○	○	○	○	○	○	○
Nitrogen compounds	○	○	○	○	○	○	○	○	○	○	○	○
phthalate esters	○	□◒	◒	●	○	○	○	○	○	○	○	○
PAHs	□○	□◒	□○	○	○	□●	○	◒	○	○	○	○
Pesticide	□○	○	○	○	○	○	○	○	○	○	○	○
PCBs	□○	○	○	○	○	□○	○	○	○	○	○	○

○ Constituent detected in less than 1/3 of the samples above baseline

◒ Constituent detected at a frequency of 1/3 to 2/3 above baseline

● Constituent detected at a frequency greater than 2/3 above baseline

□ At least one constituent in the group was found in one sample at a significant concentration as defined below:

- all groups in soil except PCBs/pesticides = 10,000 mg/kg
- PCBs and pesticides in soil = 1000 mg/kg
- all constituent groups in water = 100 mg/kg

* Methylene chloride was detected at significant concentrations at a low frequency.

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Table 4-17

Summary of Organic Constituents Detected at the Site Above Baseline Quality

Pfohl Brothers Landfill, Cheektowaga, New York

Organic Constituent	Media					
	Groundwater		Leachate	Drainage Ditch/ Intermittent Stream	Aero Lake	Ellicott Creek
	Shallow	Bedrock	Seeps	Surface Water	Surface Water	Surface Water
Benzene	○	○	○			
Chlorobenzene	○		○			◒
Trans 1,2-Dichloroethene		○	○			
1,1-Dichloroethene	○					
1,1-Dichloroethane	○					
1,1,1-Trichloroethane	○					
Toluene	○					
Xylenes	○					
Phenol	○	○	○			
1,4 Dichlorobenzene	○		○			
1,2 Dichlorobenzene	○		○			
Bis (2-ethylhexyl) phthalate	○		○			
Butylbenzylphthalate	○					
Di-n-octylphthalate	○					
Aldrin		○	○			
Dieldrin			○			
Endrin			○			
4-4'- DDD			○			
Arochlor - 1232	○					
Benzo (a) anthracence			○			
Chrysene			○			
Benzo (b) fluoranthene			○			
Benzo (a) pyrene			○			

○ Constituent detected in less than 1/3 of the samples above ARARs

◒ Constituent detected at a frequency greater than 2/3 above ARARs

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Table 4-18

Summary of Organic Contaminants Exceeding ARARs

Pfohl Brothers Landfill, Cheektowaga, New York

Inorganic Constituent	Media					
	Groundwater		Leachate	Drainage Ditch/ Intermittent Stream	Aero Lake	Ellicott Creek
	Shallow	Bedrock	Seeps	Surface Water	Surface Water	Surface Water
Aluminum						◒
Antimony	○	○				
Arsenic						
Barium	○		○			
Beryllium			○			
Cadmium	○		◒	◒		◒
Calcium						
Chromium	○	○	○			
Cobalt						
Copper	○		◒			
Iron	●	●	◒	●		●
Lead	○		●			◒
Magnesium	●	○	●			
Manganese	●	○	●			
Mercury	○		○	○	●	
Nickel						
Potassium						
Selenium			○			
Silver						
Sodium	●	●	●			
Thallium						
Vanadium						
Zinc			◒			●
Cyanide						

○ Constituent detected in less than 1/3 of the samples above ARARs
◒ Constituent detected at a frequency of 1/3 to 2/3 above ARARs
● Constituent detected at a frequency greater than 2/3 above ARARs

Table 4-19

CDM
environmental engineers, scientists, planners & management consultants

Summary of Inorganic Constituents Exceeding ARARs

Pfohl Brothers Landfill, Cheektowaga, New York

18 samples tested, 50 percent of the samples revealed the presence of this compound.

SOILS

The detection of low concentrations of a few organic compounds throughout Area A suggests that Area A is not a major source of organic contamination. The off-site RI will further characterize Area A of this site. However, many of the same organic compounds detected in the drums were also present in the soil samples in Areas B and C. In some cases, the organic compounds present in the drums were detected at higher concentrations in the soil samples. Most of the inorganics detected in the soil samples from Areas B and C exceeded background in one or more samples. As with the organics, several of the inorganics were detected at higher concentrations in the soil samples as opposed to the drum samples.

UNCONSOLIDATED GROUNDWATER AQUIFER

Most of the organic compounds detected in the drums and soil samples were also detected in the unconsolidated groundwater aquifer on-site landfill and many inorganic constituents were detected in the unconsolidated aquifer within the site boundary above background. Many of these are common landfill leachate inorganic parameters and were found to be elevated above background concentrations and at concentrations above New York State groundwater quality standards. Additionally the organics benzene and toluene as well as some inorganics were detected in the perimeter monitoring wells to the west and southwest of the site.

BEDROCK AQUIFER

Generally, concentrations of compounds present in the bedrock aquifer were lower than the overlying unconsolidated aquifer. The bedrock aquifer revealed the presence of the organic contaminants benzene and phenol in the perimeter bedrock wells at low concentrations.

Inorganics were detected at levels above background concentration baseline, in approximately 50 percent of the bedrock wells but only a few inorganics exceeded groundwater standards.

LEACHATE SEEPAGE AND SEDIMENTS

The leachate seep samples revealed organic contaminants similar to those found in the drums, soil, and shallow groundwater samples. Several pesticides found in one or more of the other media were also detected in the leachate seep samples. Most of the pesticides detected in the leachate seep samples were not detected in the corresponding sediment samples and many of the inorganic constituents analyzed were detected significantly above background levels.

Organic and inorganics were detected at levels in the seep water which exceeded groundwater standards.

The locations of the samples where the highest concentration of specific inorganic constituents were detected are in very different sections of the site, indicating widespread and varied contamination by inorganics.

SURFACE WATERS

Low levels of volatiles and one semi-volatile compounds were detected in a limited number of drainage ditch/intermittent stream surface water samples. None of the organics were detected at concentrations exceeding surface water standards and only a few inorganics exceeded the surface water standards.

No organics exceeded standards and only one inorganic exceeds standards in Aero Lake.

Ellicott Creek surface water analytical results from locations both upstream and downstream of the Pfohl Landfill site drainage were similar and showed no significant levels of contamination attributable to the Pfohl Landfill.

3.2 SIGNIFICANT THREAT

The hazardous waste, as defined in 6NYCRR Part 371, disposed of at this site has resulted in environmental damage at a level demonstrated by the following:

a) Contravention of ambient surface water standards set forth in 6NYCRR Part 701 and 702.

b) Contravention of ambient groundwater standards set forth in 6NYCRR Part 703.

c) Contents of some drummed waste determined to be flammable.

d) The location of this site is near private residences, business, freshwater wetlands and recreational fishing areas and there is foreseeable possibility of direct human exposure at this site.

A reasonable anticipation of environmental damage is also present due to the presence of radioactive materials and phenolic tars contaminated with dioxins, which are spread throughout the areas of waste deposition and at the surface of the site. Also of concern is that although the general nature and extent of the waste disposed at the site has been characterized, due to the large area of the site and the wide variety of materials disposed, a specific and full characterization of all the waste present has not been completed, therefore, the potential exists that undiscovered contaminants and concentrations are present at this site.

The setting of the site adjacent to freshwater wetlands, fishing areas and creeks, as well as the uncovered and exposed waste at the site presents a high potential for terrestrial and aquatic wild life exposure, with resultant degradation of these critical environmental areas.

The material currently contained or isolated at the site will continue to be acted on by infiltration of rainwater and corrosion of containers. The potential for future release of this material into the environment over time is high since no mechanism for containing migration of the waste currently exists.

3.3 FISH STUDY

Tables 2-27 and 2-28 of Appendix B present an abbreviated summary of concentrations of PCBs and organochlorine pesticides detected in fish and other locations in New York State. Table 2-27 presents concentrations detected in various fish species in lakes located outside of Erie County to the east and south of the site. Although these lakes are not located in Erie County, they are located in areas similar to Cheektowaga and provide a level of comparison. Table 2-28 presents concentrations detected in various fish species in rivers located within Erie County. These data were obtained by NYSDEC Division of Fish and Wildlife (NYSDEC 1987) through the Statewide Toxic Substances Monitoring Program (SWTSMP).

The SWTSMP, as well as other state programs were established in response to the fact that PCBs and pesticides are ubiquitous and persistent in the environment. For example, the detected concentration of DDT in sediment samples can range from 5 to 500 ug/kg DDT (Lowe 1986) and it is recognized that DDT has been globally transported by volatilization (Conway 1982). Rivers and sediments often act as transient reservoirs for pesticides and PCBs. Most of these compounds have low solubilities in water, high specific gravities, and high affinity for solids. This results in concentrations in sediments that are many times higher than those found in the overlying water. The overall objectives of the state sampling programs were as follows:

- To determine the degree to which aquatic and terrestrial organisms are contaminated.
- To determine how the concentrations within these organisms vary with geography.
- To assess the suitability of fish caught in the state for human consumption.

As can be seen through a comparison of Tables 2-27 and 2-28 to Tables 2-25a through 2-25 and Table 2-26 the concentrations of PCBs and pesticides detected in the fish collected from Aero Lake and Ellicott Creek are typically lower than those found in other locations within the state. Therefore, it was determined that the concentrations detected in the fish from Aero Lake and Ellicott Creek-Amherst are not significantly higher than those found elsewhere within the state with similar urban characteristics and are not necessarily indicative of wide-spread contamination from the landfill. Based on a report entitled Contaminant Concentrations in Fish from the Waters Associated with the Pfohl Brothers Landfill prepared by the State the following was concluded:

a) Based on samples collected in this study, fish in the vicinity of the Pfohl Brothers Landfill do not contain concentrations of PCB, mercury and organochlorine pesticides which exceed tolerance or action levels established by the U.S. Food and Drug Administration.

b) Dioxin and dibenzofuran concentrations in fish are well below guidelines established by the New York State Department of Health (NYSDOH). However, the NYSDOH's general advisory to eat no more than one meal (one-half pound) per week of fish taken from the State's freshwater applies to these waters.

c) With respect to fish eating wildlife, at least one species of fish from all four location samples, including the control station, contained PCB levels which exceeded the recommendation of 0.11 ppm PCB for the protection of those species. However, PCB concentrations did not exceed the lowest concentration documented (0.6 ppm) that caused an impact in a fish eating species (i.e., reproductive impairment in mink).

d) Mercury, organochlorine pesticides, dioxins and dibenzofuran were not present in quantities which would impair sensitive wildlife consumers of fish.

e) No significant differences could be determined in the spatial distribution of PCB and other compounds analyzed. The average PCB levels in fish from Aero Lake and Tributary IIb of Ellicott Creek were slightly higher than the levels in fish from Ellicott Creek near Bownmansville. The differences, however, were not statistically significant. The power of the statistical test to detail such differences was affected by the small number of samples.

3.4 RADIOACTIVITY

A two-phased approach was employed to characterize the nature and extent of radiation contamination at the site. It consists of a "walk-over" gamma survey along and parallel to the existing transits and in suspicious areas off the transit lines to obtain a better understanding of the radiation levels throughout the site. A subsurface radiation investigation included observations during the installation of test pits, the collection of gamma readings, and the identification of materials and objects causing above-background readings. The results of the radioactive investigation were provided in two CDM Interim Reports (CDM 1989; 1990). The results of the radiation investigation were addressed by the NYSDEC and the NYSDOH in two separate reports (NYSDEC 1990).

The NYSDOH and the NYSDEC conclusions from the radiation investigation as presented in these two reports were as follows:

a) All water sample analyses were below the drinking water standards of 0.015 pCi for gross alpha or 1.0 pCi for gross beta.

b) There is little impact of naturally occurring radioactive materials (NORM) on groundwater at the site since they are predominately alpha emitters and no elevated alpha readings were found in the water.

c) Based on the groundwater monitoring results obtained to date, there is no migration of radioactive contamination in the groundwater to off-site locations.

d) The site does not represent an immediate radiological health hazard.

e) The radioactive waste material is stabilized on the surface and subsurface of the landfill and does not present an airborne environmental hazard.

f) Direct contact with the radioactive materials should be discouraged.

g) Radon exposure is expected to occur at normal levels.

h) Since the major routes of access to the site have been fenced and posted with "Hazardous Waste" signs, the potential for direct exposure of the public from on-site contamination will be extremely remote. Therefore, remediation of the radioactive wastes is not required at this time (i.e., prior to general site remediation).

i) Should remediation of hazardous waste occur at this site, the impact of radioactive wastes on the remedy must be taken into account in both the technology and the worker health and safety aspects.

3.5 NEW YORK STATE DEPARTMENT OF HEALTH ACCEPTANCE

The NYSDOH believes the remedial concepts discussed in the RI and FS will protect the general public from exposure to contamination associated with the Pfohl Brothers Landfill.

Section 4: ENFORCEMENT STATUS

A chronological review of the enforcement status follows:

LANDFILL OPERATION

1980 Erie County Health Department - tested 10 neighboring wells.

1982 Fred C. Hart Associates - tested 10 water and 4 sediment samples.

1983 Ecology and Environment Inc. - perimeter sampling of ground water, leachate seeps and sediments.

1985 Listed as a Class 2 site in the NYS Registry of Inactive Hazardous Waste Disposal Sites.

1985 NYSDEC enters into negotiation with Potential Responsible Parties (PRPs) Steering Committee regarding the performance of a Remedial Investigation and Feasibility Study.

1986 NYS Department of Health - analyzed samples of leachate, soils and surface drum contents.

1987 Negotiation with PRPs do not prove fruitful and NYSDEC proceeds with Remedial Investigation and Feasibility Study.

1989 Site property owners and PRPs are offered the opportunity to erect a fence around the site. They refuse and NYSDEC proceeds to erect the fence.

1991 The PRPs and site property owners were offered the opportunity to perform an IRM at the site.

Section 5: GOALS FOR THE REMEDIAL ACTIONS

The legal basis for the remedial program is contained in Article 27, Title 13 of the Environmental Conservation Law and Public Law 96-510, entitled, "Comprehensive Environmental Response, Compensation, and Liability Act of 1980" (CERCLA) as amended by Public Law 99-499, entitled, "Superfund Amendments and Reauthorization Act of 1986".

Section 121(d) of CERCLA requires that remedial actions comply with applicable or relevant and appropriate requirements (ARARs). Applicable requirements are those cleanup standards, standards of control, and other substantive environmental protection requirements, criteria, or limitations promulgated under Federal or State law that specifically address a hazardous substance, pollutant, containment, remedial action, location or circumstance at an inactive hazardous waste site. Relevant and appropriate requirements are those cleanup standards, standards of control and other substantive environmental protection requirements, criteria or limitations promulgated under Federal or State law, that while not "applicable" to a hazardous substance, pollutant or containment, remedial action, location or other circumstance at an inactive hazardous waste site address problems or situations sufficiently similar to those encountered at the inactive hazardous waste site that their use is well suited to that particular site.

Remedial action objectives (RAOs) consist of media-specific goals for protecting human health and the environment and focus on the contaminants of concern, exposure routes and receptors, and an acceptable contaminant level or range of levels for each exposure route. Because RAOs are established to preserve or restore a resource, the environmental objectives are expressed in terms of the medium of interest and target cleanup levels, whenever possible. Chemicals exceeding ARARs and/or contributing significantly to risk for the Pfohl Brothers Landfill site are presented in table 3.1 of the Feasibility Study and contained in Appendix C. The compounds listed on this table are those exceeding a media-specific ARAR. Contaminants of concern (COCs) are those chemical constituents that have been identified in the Baseline (Human Health) Risk Assessment as contributing significantly to risk and which do not have corresponding ARARs for the specific media.

In order to meet the overall objective of protecting human health and the environment, RAOs have been developed for COCs for surface water, leachate seeps, sediments, landfill solids and groundwater media. RAOs specify the COCs, the exposure scenario(s), and acceptable contaminants level or range of levels for each exposure scenario. Target cleanup levels are defined in this section as the chemical-specific ARAR per guidance of NYSDEC.

COCs were identified in two ways, based on risk and based on exceedence of ARARs. Risk based COCs were determined using the exposure pathways and compounds which contributed significantly to the total risk. As a result, a subset of those COCs evaluated in the Risk Assessment were chosen as COCs for remedial actions. ARAR based COCs were identified by comparison with chemical specific ARARs.

The current policy of the NYSDEC is to clean up to levels consistent with chemical-specific ARARs. This goal may be achieved by limiting exposure to COCs (e.g., institutional/use controls, source control) or by treatment of media to levels which are protective for all potential site uses.

Section 6: <u>REMEDIAL ACTION OBJECTIVES</u>:

The general remedial action objective for all inactive hazardous waste sites is to remediate the site to be protective of human health and the environment by treatment of media to protective levels and/or by limiting exposure to COCs. Specific RAO's for the Pfohl Brothers Landfill are:

- Reduce organic and inorganic contaminant loads to the surface water streams from leachate seeps and groundwater to assist in meeting Class B and D stream standards.

- Reduce carcinogenic and non-carcinogenic risks caused by dermal exposure to leachate seeps.

- Reduce carcinogenic risks caused by dermal absorption and ingestion of sediments.

- Prevent migration of contaminants from sediments that could result in surface water exceedence of Class B or D stream standards.

- Reduce carcinogenic and non-carcinogenic risks caused by ingestion and dermal contact of landfill soils.

- Reduce risk or exposure to groundwater via ingestion and dermal contact.

- Minimize migration of contaminants into uncontaminated groundwater.

Location specific ARARs set restrictions on activities based on the characteristics of the site or immediate environs. Location specific ARARs may restrict the conduct of activities solely because they occur in special locations. Two potential location specific ARARs for this site were identified and they pertain to the wetlands and flood plains present on or adjacent to the site. Wetlands are located along the western and northern sides of the Pfohl Brother Landfill site. All alternatives will achieve compliance with the wetland requirements by maintaining the wetland area to the extent possible and by creation of new wetland areas to replace where necessary. Overall the remedial alternatives are protective of the wetland, because they serve to eliminate the potential migration of contaminants to this control environmental areas.

Portions of the Pfohl Brothers Landfill site are located in the 100 year flood plain. Actions taken with respect to this site may encroach further into

Portions of the Pfohl Brothers Landfill site are located in the 100 year flood plain. Actions taken with respect to this site may encroach further into the flood plain but are not anticipated to impact the floodway. In designing the cap for the site attempts will be made to minimize any encroachment on the floodplain and the cap will be contoured to place it above the 100 year flood plain elevation where possible or berms will be provided to prevent flooding of the landfill area. Rip rap or other erosion control techniques will be employed as needed to maintain the integrity of the cap or berms where encroachment into the flood plain cannot be avoided.

The NYCRR Part 360 landfill closure requirements are relevant and appropriate to the cap. These requirements will be achieved through proper design of the cap which provides for minimization of liquid migration, controlled surface runoff, minimization of erosion, and prevention of run-on.

Section 7: SUMMARY OF EVALUATION OF ALTERNATIVES

The NYSDEC Division of Hazardous Waste Remediation's Technology Section provided a list of technologies to be considered at the Pfohl site. Section 4 of the Feasibility Study evaluated these alternatives and this evaluation is contained in Appendix A of this report. After review of the preliminary evaluation of technologies performed by the NYSDEC consultant, Camp Dresser & McKee, the following conclusion was reached by NYSDEC:

> "Due primarily to the size of the site and the presence of metal, organic, tar, radioactive, and dioxin contaminants, the only reasonable treatment technologies are containment and pumping and treating of the contaminated groundwater."

At this point in the evaluation of alternatives the technologies under consideration were reduced to consideration of cap and containment options that would achieve the general response actions. The principle general response actions at the Pfohl Brothers Landfill site are:

- solids/soils media containment
- aqueous (groundwater and leachate) media containment
- aqueous media collection/treatment/disposal

Using the yes/no matrix, presented in Table 2 it was determined that a total of eight possible combinations exist for the three general response actions. The combinations represent a range of possible actions that can be taken to remediate the site. The eight combinations listed on Table 2 became the basis for ten remedial action alternatives. The number of the alternative(s) associated with each combination of general response actions are given in the last line of the table.

The following Tables ES-1 and ES-2 are a summary comparison of the Remedial Alternatives. The first and seventh general response action combinations, (no solids containment but aqueous containment and collection/treatment/disposal) have been presented as two remedial alternatives. The two additional remedial alternatives (alternatives 2 and 8) include as key components two other general response actions - institutional

TABLE 2

CONCEPTUAL DEVELOPMENT OF REMEDIAL ALTERNATIVES

Key General Response Action[b]	Possible Combinations of General Response Actions[a]							
Solids Media Containment	No	Yes	Yes	No	Yes	No	No	Yes
Ground water & leachate containment	No	No	No	No	Yes	Yes	Yes	Yes
Ground water & leachate Collection, Treatment and Disposal	No	Yes	No	Yes	No	No	Yes	Yes
Remedial Alternative Number[c]	1,2	3	4	5	6	7	8,9	10

NOTES:

(a) The yes/no designations indicate if the general response action is part of the alternative.
(b) The general response actions listed are those which can attain the remedial action objectives for one or more media, as presented on Table 5.1-1.
(c) The numbers assigned to the remedial alternatives are discussed in Section 5.2.

TABLE 3

PFOHL BROTHERS LANDFILL FEASIBILITY STUDY
DESCRIPTION OF REMEDIAL ACTION ALTERNATIVES

Alternative No. 1 - No Action
- Groundwater Monitoring
- Maintenance of existing fencing

Alternative No. 2 - Institutional Controls
- On-site well prohibition, off-site well monitoring
- Zoning and deed regulations, fencing and warning signs, and public education for landfill

Alternative No. 3 - Capping, Ground Water Collection, Treatment, and Disposal, and Institutional Controls
- On-site well prohibition, off-site well monitoring
- Single Barrier Cap with off-site wetland replacement
- Select Solids/Soils Excavation with On-Site Disposal (for shallow and peripheral contamination)
- Ground Water collection, on-site metals and organics treatment, and off-site disposal
- Zoning and deed regulations, fencing and warning signs, and public education for landfill

Alternative No. 4 - Capping with Institutional Controls
- On-site well prohibition, off-site well monitoring
- Single Barrier Cap with off-site wetland replacement
- Select solids/soils excavation with on-site disposal (for shallow and peripheral contamination)
- Zoning and deed regulations, fencing and warning signs, and public education for landfill

Alternative No. 5 - Ground Water Collection, Treatment, and Disposal, and Institutional Controls
- On-site well prohibition, off-site well monitoring
- Zoning and deed regulations, fencing and warning signs, and public education for landfill
- Ground water collection, on-site metals and organics treatment, and off-site disposal

Alternative No. 6 - Capping, Ground Water Containment, and Institutional Controls
- On-site well prohibition, off-site well monitoring
- Slurry wall containment
- Single Barrier Cap with off-site wetland replacement
- Select landfill solids/soils excavation and on-site disposal (for shallow and peripheral contamination)
- Zoning and deed regulations, fencing and warning signs, and public education for landfill
- Surface Runoff collection, channelization and off-site disposal

TABLE 3 - (cont'd)

PFOHL BROTHERS LANDFILL FEASIBILITY STUDY
DESCRIPTION OF REMEDIAL ACTION ALTERNATIVES

Alternative No. 7 - Ground Water Containment and Institutional Controls

- On-site well prohibition, off-site well monitoring
- Slurry wall containment
- Zoning and deed regulations, fencing and warning signs, and public education for landfill

Alternative No. 8 - Ground Water Containment, Leachate Seep Collection, Treatment and Disposal and Institutional Controls

- Slurry wall containment
- Leachate seep collection, treatment and off-site disposal
- On-site well prohibition, off-site well monitoring
- Zoning and deed regulations, fencing and warning signs, and public education for landfill

Alternative No. 9 - Ground Water Containment, Collection, Treatment and Disposal and Institutional Controls

- Slurry wall containment
- Ground Water collection, on-site metals and organics treatment and off-site disposal
- Off-site groundwater well monitoring
- Zoning and deed regulations, fencing and warning signs, and public education for landfill

Alternative No. 10 - Capping, Ground Water Containment Collection, Treatment and Disposal and Institutional Controls

- Slurry wall containment
- Ground Water extraction, collection on-site metals and organics treatment, abd off-site disposal
- Single Barrier Cap with on-site wetland replacement
- Select landfill solids/soils excavation and on-site disposal (for shallow and peripheral contamination)
- Zoning and deed regulations, fencing and warning signs, and public education for landfill

TABLE ES-1

SUMMARY COMPARISON OF REMEDIAL ALTERNATIVES

	Alternative 1	Alternative 2	Alternative 3	Alternative 4	Alternative 5
Assessment Factors	• No Action • Long-term ground water monitoring • Maintenance of existing fence	• On-site well prohibition • Long-term ground water monitoring • Zoning and deed restrictions, fencing and warning signs, public education	• Capping (single barrier) • Passive ground water collection. On-site treatment and discharge to POTW or surface waters • On-site well prohibition • Long-term ground water monitoring • Off-site wetland replacement • Zoning and deed restrictions, fencin and warning signs, public education • Select soil excavation in peripheral areas	• Capping (single barrier) • On-site well prohibition • Long-term ground water monitoring • Off-site wetland replacement • Zoning and deed restrictions, fencing and warning signs, public education • Select soil excavation in peripheral areas	• Passive ground water collection on-site treatme and discharge to POTW surface waters • On-site well prohibition • Long-term ground water monitoring • Zoning and deed restrictions, fencing and warning signs, public education
Attainment of Remedial Action Objectives	No	No	No	No	No
Short- and Long-Term Effectiveness	LOW Not effective in protecting human health and the environment.	LOW-MEDIUM Institutional controls will not reduce or eliminate the source and subsequent spread of contamination. Offers little effectiveness in eliminating possible exposure pathways.	MEDIUM Very effective in protecting human health and environment from landfill soils and moderately effective in reducing risks from all other possible exposure pathways.	MEDIUM Very effective in protecting human health and environment from landfill soils, but only moderately effective in preventing the migration of contaminated ground water and surface water/sediments.	MEDIUM Moderately effective in protecting human health & exposure to landfill soils ground water but is not effective for other possibl exposure pathways.
Implementability	HIGH Easily implemented - requires long-term ground water monitoring and periodic maintenance of existing fences	HIGH Easily implemented - as with all alternatives considered, (with exception of Alt 1) difficulties may be encountered in implementing institutional controls.	HIGH Easily implemented since required approvals for the cap are expected to be easily obtained.	HIGH Easily implemented since approvals for the cap and both the ground water and landfill access institutional controls are expected to be easily obtained.	HIGH Easily implemented since approvals for ground wat restriction institutional co and leachate collection sy are expected to be easily obtained.

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TABLE ES-1 (cont.)

SUMMARY COMPARISON OF REMEDIAL ALTERNATIVES

	Alternative 6	Alternative 7	Alternative 8	Alternative 9	Alternative 10
Assessment Factors	• Capping(single barrier) • Ground water containment slurry wall • Select soil excavation in peripheral areas • Surface water collection and discharge to POTW or surface water • On-site well prohibition • Long-term ground water monitoring • Zoning and deed restrictions, fencing and warning signs, public education • Off-site wetland replacement	• Ground water containment - slurry wall • On-site well prohibition • Long-term ground water monitoring • Zoning and deed restrictions, fencing and warning signs, pubic education	• Ground water containment-slurry wall • Ground water and leachate collection, on-site treatment and discharge to POTW or surface water • On-site well prohibition • Long-term ground water monitoring • Zoning and deed restrictions, fencing and warning signs, public education	• Ground water containment - slurry wall and extraction wells, on -site treatment and discharge to POTW or surface water • Long-term ground water monitoring • Zoning and deed restrictions, fencing and warning signs, public education	• Capping - (single barrier) • Ground water containment - slurry wall and extraction wells, on-site treatment and discharge to POTW or surface water • Off-site wetland replacement • Select soil excavation in peripheral areas • Zoning and deed restrictions, fencing and warning signs, public education
Full Attainment of Remedial Action Objectives	YES	NO	NO	NO	YES
Short- and Long-Term Effectiveness	MEDIUM-HIGH Very effective in protecting human health and environment from landfill soils and effective in minimizing the migration of contaminated groundwater and leachate contamination of surface water.	MEDIUM Not effective in protecting human health and environment from landfill soils. Moderately effective in reducing risks from contaminated ground water and surface water sediments.	MEDIUM Moderately protective of human health and environment from ground water and leachate but not protective of continued risk from exposure to landfill soils.	MEDIUM Relatively high degree of effectiveness in protecting human health and environment from contaminated ground water. Not effective in protecting human health and environment from exposure to landfill soils.	HIGH Highly effective in minimizing risks from all exposure pathways.
Implementability	MODERATE-HIGH Construction of slurry wall may encounter potential difficulties w/underground piping and high water table. Approvals for slurry wall and ground water are expected to be obtained relatively easily.	MODERATE-HIGH Construction of slurry wall may encounter potential difficulties w/underground piping and high water table. Approvals for slurry wall are expected to be obtained relatively easily.	MODERATE-HIGH See comments under Alternative 7.	MODERATE-HIGH See comments under Alternative 7.	MODERATE-HIGH See comment under Alternative 6.

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Table ES-2

COMPARISON OF SELECTED REMEDIAL ALTERNATIVES

Assessment Factor	Remedial Alternatives Which Underwent Detailed Evaluation		
	Alternative 1	Alternative 6	Alternative 10
	• Long term ground water monitoring • Maintenance of existing fence	• Capping • Groundwater containment • Select soils excavation • Surface runoff collection and off-site disposal • On-site institutional controls • Off-site wetland replacement	• Capping • Groundwater containment • Surface runoff collection and off-site disposal • Select soils excavation • Extraction wells, on site treatment and discharge to POTW or surface water • Off-site wetland replacement • On-site institutional controls
1. Compliance with ARARs	Does not meet chemical-specific ARARs. Action and location-specific ARARs do not apply.	Meets chemical-specific ARARs for all media except potable water. Health-based risks from landfill soils and sediments are acceptable. Location-specific ARARs for wetlands and floodplains are met. Action-specific ARARs will be met.	Meets all chemical-specific ARARs for all media. Health based risks from landfill soils and sediments are acceptable. Location- and action-specific ARARs are met, as in Alternative 6.
2. Protection of Human Health and the Environment	No reduction in risks to human health and the environment.	Greatly reduces risk from all exposure pathways. The magnitude of residual risk at the site is moderate since contamination is still present and failure of the cap or slurry wall could result in exposure to contamination.	Same as Alternative 6.
3. Short-term effectiveness.	Only minimal risk to workers and the community during ground water sampling.	Potential risks are associated with airborne contaminants during construction but mitigation measures would minimize risks. Contaminated sediments entering surface waters, temporary loss of wetland habitats and possible contamination of aquifer during installation of slurry walls may be anticipated. Most impacts could be mitigated. Requires approximately 6 months to design and 2.5 years to implement.	Same as Alternative 6. Requires approximately 6 months to design and 3.5 years to implement.
4. Long-term effectiveness and permanence.	High residual risk. Risk control through groundwater sampling is minimal.	Risk from landfill soils would remain low since design life of cap is 30 years. Risks associated with the migration of contaminated groundwater are marginally adequate because the integrity of slurry wall and bottom barrier is unknown. Long-term monitoring offers minimal risk control.	Risk from landfill soils would remain low since design life of cap is 30 years. Control of the migration of contaminated groundwater would be adequate due to groundwater extraction technologies. If cap or slurry walls failed, pumping rates could be increased to compensate for increased ground water recharge.
5. Reduction in Toxicity, Mobility and Volume	There is no treatment process involved and subsequently no reduction in toxicity, mobility and volume of contaminated media.	Does not reduce toxicity of the contamination; contaminant mobility is reduced by the cap and slurry wall; volume of contaminants is unaffected.	Reduces toxicity of the contamination through groundwater treatment. Maximum reduction in contaminant mobility; considerable reduction in the volume of contaminated ground water.
6. Implementability	Necessary equipment and labor force readily available. Coordination and approvals from regulatory agencies should not be difficult to obtain.	Necessary equipment and labor force are readily available. Success in implementation of slurry wall relies on presence of clay/silt layers at the site. Specialized equipment will be required due to hummocky nature of landfill. Once in place, the cap, slurry wall and groundwater monitoring offer reliable technologies.	Same as Alternative 6. In addition, installation of well points, piping collection and treatment systems would be reasonably easy.
7. Cost	$560,000	$45,194,000	$53,789,000

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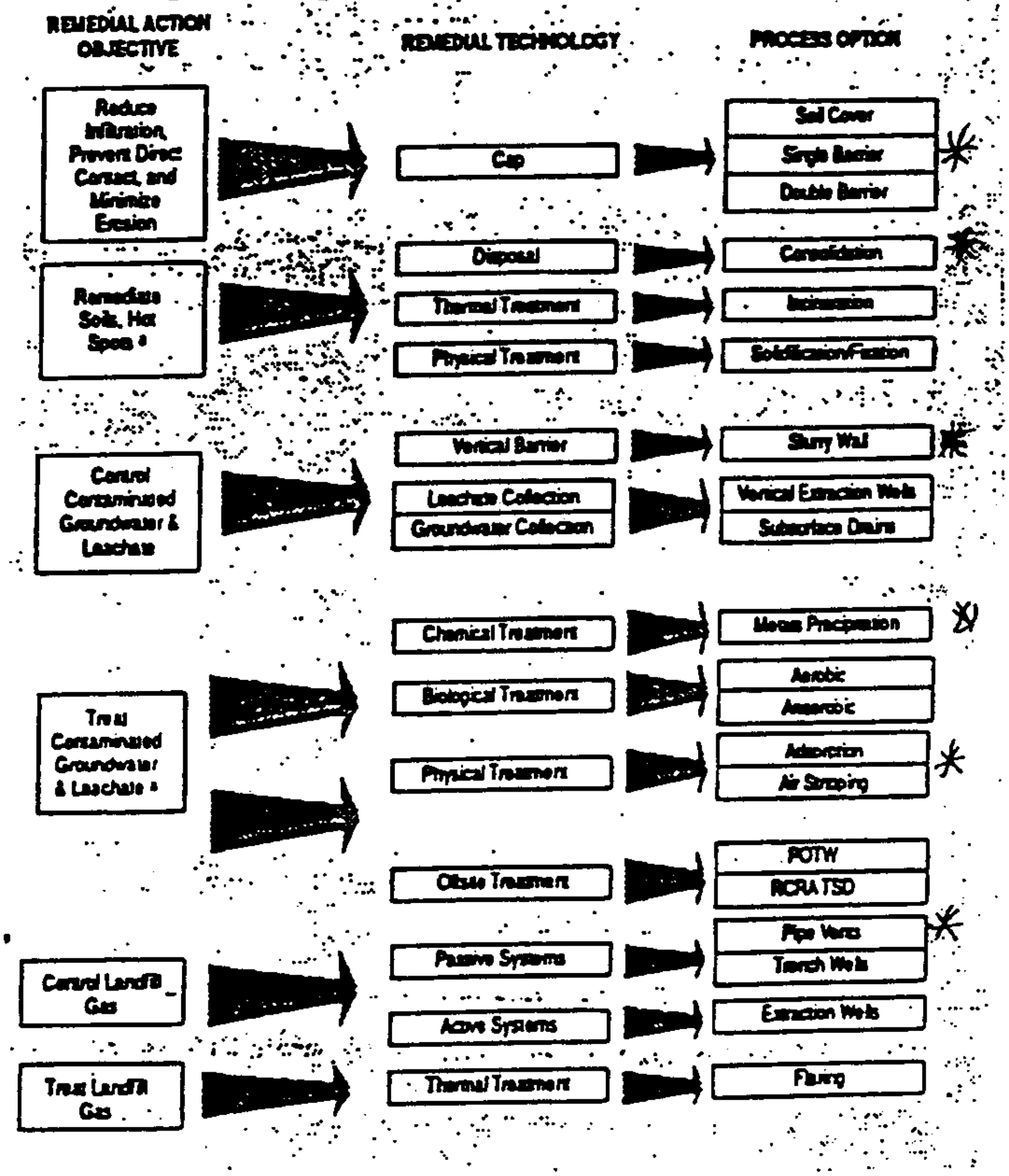
Technologies Frequently Implemented for Remedial Action at CERCLA Municipal Landfills



a Other treatment technologies may be appropriate

* - Indicates Selected Process Option

controls and leachate seep collection/treatment/disposal, respectively. These additional alternatives were added because the evaluation indicated these response actions have some benefit toward achieving remedial action objectives, even though they could not, by themselves, adequately satisfy the RAOs.

From the eight combinations of general response actions, ten remedial alternatives have been developed. The main components of the ten remedial alternative are listed in tabular form on Table 3.

Alternatives 2, 3, 4 and 5 were rejected because they do not provide for groundwater and leachate seep protection. Alternatives 7, 8 and 9 were rejected because they do not provide for solid media containment. Alternatives 6 and 10 were carried forward to a more detailed evaluation along with the No Action alternative. The only difference between alternatives 6 and 10 is the collection, treatment and disposal of groundwater in alternative 10 as opposed to simple containment of groundwater proposed by 6. Ultimately, Alternative 10 was selected as the preferred remedy due to the necessity of providing an upward groundwater gradient in the contained landfill area, to control contaminant migration from the source area into the environment.

The following chart, taken from a USEPA guidance titled "Conducting Remedial Investigation/Feasibility Studies for CERCLA Municipal Landfill Sites", further illustrates accepted closure procedures for major landfills.

The Remedial Action Objectives detailed on this chart are the same as those outlined in Section 6 for the Pfohl Brothers Landfill. The RAO's are achieved at the Pfohl Brothers Landfill in the following manner:

- A cap was selected to reduce infiltration and prevent direct contract with the waste and soils. Consistent with 6NYCRR Part 360 regulations, a single barrier cap was selected.

- The remediation of hot spots has been separated into an IRM and steps are currently being taken to implement this action.

- The control of contaminated groundwater and leachate is by a vertical barrier, in this case a slurry wall.

- The pumping and treatment of contaminated groundwater is intended to provide an inward flow of clean water into the landfill area. Both chemical treatment for metals precipitation and physical treatment for adsorption of organics will be provided as necessary to meet discharge requirements.

- Initially the landfill gas venting system will be a passive system of pipe vents. Should monitoring of these vents indicate a potential health or nuisance problem the system can be readily upgraded to an active system where vent gasses are collected and treated before release to the atmosphere.

Section 8: SUMMARY OF THE STATES PREFERRED ALTERNATIVE - CONCEPTUAL DESIGN

The remedy for this site has three major components, a low permeability slurry wall, single barrier cap and leachate collection and treatment.

<u>Slurry Wall Containment System</u>: A slurry wall is simply a trench excavated through the native alluvial materials, which will be backfilled with a low permeability bentonite clay/soil/slurry mixture. The trench will be excavated into the low permeability clay and till deposits underlying the site. To prevent lateral migration of contaminants in the groundwater the slurry wall, a physical containment system, would encircle areas B and C of the landfill and intersect with the landfill cap system at the surface. Should it be possible to consolidate the waste at this site into a smaller area, the slurry wall would surround this smaller area.

Special conditions and procedures arising from the physical location of the slurry wall will need to be incorporated into its construction. The crossing of underground pipelines; work in the high voltage transmission line right of way; as well as installation below the water table, near and across major highways, and adjacent to Aero Lake and other wetlands will require special attention during the design phase. Lateral migration prevention measures other than the slurry wall may be necessitated by the physical location of the waste boundary in certain of these areas and equivalent measures may be substituted at the approval of the NYSDEC. These alternative barriers could include grouted sheet piling, concrete walls, or barrier drains, all of which would provide a level of containment consistent with a slurry wall.

Select excavation of soils and landfill material will occur at the periphery of the landfill where practical. The objective of this excavation will be to consolidate landfill waste such that the most cost effective remedy can be implemented, while maintaining a balance with community acceptance and health and safety considerations. Special consideration will be given to moving waste away from those residences and properties adjoining the landfill as well as the adjacent wetlands, in order to minimize impacts on both areas. Future beneficial use of the site (i.e., parklands or other public access) will also be taken into account when a determination is made on the final contouring of the site surface. Consideration will be given to consolidating sediments from adjacent areas into the landfill if they exceed the Division of Fish and Wildlife Sediment Criteria and it is deemed necessary by the Division of Fish and Wildlife to protect the environment.

It is recognized, that in consolidating the waste into a smaller area, a lower cost remedy may be achieved. The slope contours could be created with the waste and steeper slopes could be constructed. The reduced surface area of the cap and reduced perimeter length would reduce both the cap and slurry wall costs. However, the trade-offs with community acceptance, visual impact, future beneficial uses of the site and the implementability of dust controls and other issues related to worker and community health and safety in the vicinity of homes and major roadways need to be balanced against these potential cost reduction measures.

Any drums, drum remnants, radioactive materials or phenolic tars encountered during construction will be consolidated, segregated and disposed or stored in accordance with the procedures implemented during the Interim Remedial Measures (IRM) at this site. Additionally, any material temporarily stored at the site will be further evaluated with respect to permanent treatment or disposal. This includes material stored during the IRM as well as any consolidated material resulting from the remedial construction activities for the landfill.

LANDFILL CAP

The landfill cap system detailed below was chosen to (1) eliminate the infiltration of precipitation into the landfilled waste materials, (2) prevent erosion of contaminated soils and (3) to prevent the direct contact by both people and wildlife with the waste.

The landfill cap will comply with the substantive requirements of the 6NYCRR Part 360 regulations for Solid Waste Management Facilities. The Subpart 360-2.13 of this regulation pertains to cap construction materials and requirements.

The landfill cap will cover the entire area of waste deposition, extending beyond the slurry wall containment system. Surface run-off and water from the drainage layer of the cap will be channeled to the north in Area B of the site and to the southeast in Area C of the site with discharge ultimately to Aero Lake and Ellicott Creek. The contouring of the landscape and placement of structures at the surface will be designed, to the extent possible, to be compatible with any future beneficial uses of the site which may be identified by local government and which will not adversely impact the landfill containment system. A barrier/buffer zone between the landfill cap and adjacent properties will be created. The limits of the cap will be determined by the area of waste consolidation possible at the site with a preference given to removing waste from areas adjacent to current residences and wetlands areas.

The components of the landfill cap will be, as required by 6NYCRR Part 360-2.13, and are presented here, in order, starting from the existing landfill surface to the surface of the cap. (also see Figure 2):

a. A minimum 12 inch compacted layer. This layer may be constructed utilizing some or all of the following: consolidated waste soils, "clean fill" brought to the site or C&D material brought to the site. This material will be used to create appropriate landfill slopes and contours and may range from a minimum of 12 inches to several feet in thickness. It is likely that a combination of all of the above sources of fill will be utilized in contouring the landfill.

b. A gas venting layer consisting of 12 inches of graded stone (or an equivalent geotextile gas venting material) combined with piping to vent the gas to the atmosphere.

c. The low permeability barrier layer. This will consist either of an 18 inch low permeability soil layer (clay) constructed to minimize precipitation into the landfill. The clay must have a maximum remolded coefficient of permeability of 1×10^{-7} cm/second. This material must be placed on a slope of no less than four percent to promote positive drainage and at a maximum slope of 33 percent to minimize erosion.

A geomembrane, typically a high density polyethylene material (HDPE), may be used as an alternative to the low permeability soil layer. It must have a maximum coefficient of permeability of 1×10^{-12} centimeters per second, chemical and physical resistance to materials it may come in contact with and accommodate the expected forces and stresses caused by installation, settlement and weather. The minimum thickness of the geomembrane will be 40 mils. It is anticipated that for this landfill cap a geomembrane system will be utilized due to the large quantity of clay otherwise required.

d. A drainage layer which will have a minimum hydraulic conductivity of 2×10^{-2} cm/sec and a final bottom slope of two percent after settlement and subsidence will be used to drain precipitation which percolates into the soil of the cap. Water removed by this layer will be transmitted to a perimeter drain system and then discharged to surface water.

   This drainage layer will consist of either a six inch layer of crushed stone and conveyance piping or a geosynthetic drainage membrane designed to perform the equivalent function of the 6 inch stone drainage layer.

e. A minimum 24 inch barrier protection layer of soil must be installed above the low permeability cover. Material specifications, installation methods and compaction specifications must be adequate to protect the geomembrane barrier layer from frost and thaw damage, root penetration, to resist erosion and to be stable on the final cover design slopes. Consideration should also be given to the prevention of burrowing by animals down to the geomembrane.

f. A minimum 6 inch topsoil layer must be designed and constructed to maintain vegetative growth over the landfill. A thicker layer of topsoil may be required if the post-closure site use warrants a thicker layer.

The landfill cap construction will have to take into account the important features in the neighboring physical setting. Water will have to be channeled away from adjacent residences and streets. The eastern border of the site will have to conform to the New York State Department of Transportation Transit Road improvement project. New power lines and towers are to be erected west of Area B and the cap and slurry wall need to be tailored to minimize interference with this project. The impact of the cap on the neighboring wetlands has to be minimized and should wetland area need to be reduced, they will have to be reestablished on adjacent property. Any wetland encroachment will comply with the US Army Corps of Engineers determination as to any wetlands modification, elimination or replacement.

A consideration in constructing the cap is the use of "construction and demolition debris" (C&D) for fill to create the elevations and contours required at the site for cap construction. The intent in substituting this material to replace clean soil for contouring the landfill is to reduce the cost of the cap and minimize the commitment of this natural resource. Normally a fee is charged for receiving construction and demolition debris and any fee collection could be used to offset the cost of remediation.

The technical challenge in utilizing this material will be to create stable, compact, and non-degradable slopes and elevations from the widely varying material. The desired results may be achieved by limiting some of the types of materials typically contained in construction and demolition debris.

Some materials such as debris with high percentages of vegetative material may degrade over time and cause sagging of the cap elevation or slope. Some settling of any capping system is anticipated in the design. The use of C&D will be taken into account when designing the cap and placement of the material will be limited, as necessary, to avoid any unacceptable settlements. In addition some materials, such as large amounts of vegetation or drywall, can over time emit nuisance odors. Because of potential construction, maintenance, and public health problems, use of these types of materials will be held to a minimum. Although the use of construction and demolition debris may present some technical problems, its use can be managed and implemented at a substantial benefit. Since this is the case, we consider the use of controlled volumes and compositions of construction and demolition debris to be a probable component in the contouring fill used at this site.

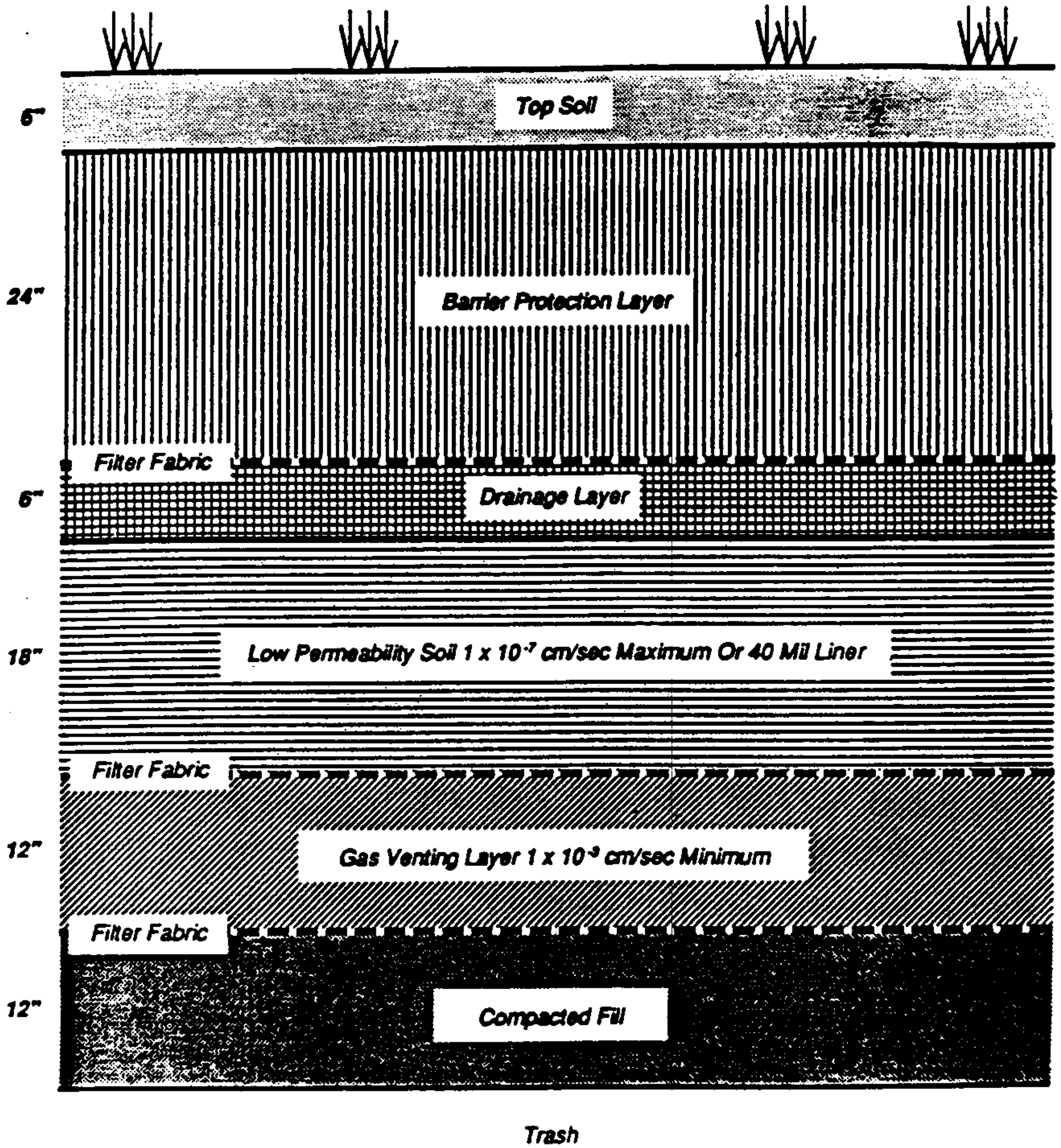
LEACHATE COLLECTION, TREATMENT AND DISPOSAL

Groundwater, now considered leachate, present within the site area contained by the slurry wall will be collected by a series of extraction wells or equivalent means. Due to the relatively low saturated thickness and lack of recharge available to the contained area, the extraction rates will be low. Extracting leachate from within the contained landfill area will induce groundwater flow toward the extraction wells, eliminating the outward migration of contaminants into either the bedrock or adjacent portions of the alluvial aquifer.

The extraction wells or equivalent system will be located throughout the site in order to collect the leachate uniformly across the site. The leachate will be collected from the wells to a central location and treated as necessary to meet the appropriate permit requirements for its discharge. The treatment may include a precipitation/settling/filtration process for metals removal followed by a physical/chemical process for removal of organic constituents. Other types of appropriate technologies may be considered in order to meet discharge requirements. Two options exist for discharge of the treated leachate. The treated water will be discharged either to the local Public Owned Treatment Works (POTW) or nearby surface waters. The preferred method is discharge to the Cheektowaga sewer system for conveyance to the treatment facilities of the Erie County Sewer Authority, following any necessary pretreatment on site.

INSTITUTIONAL CONTROL

Access restrictions at landfill sites are intended to prevent or reduce exposure to on-site contamination. They include actions such as fencing, signage, and property deed covenants to prevent development of the site or use



NOTE:
Thickness of layers shown reflects the minimum thickness allowed by NYSDEC.

Not To Scale

CDM

environmental engineers, scientists planners & management consultants

Figure 2

Design Schematic For Composite Barrier

Draft Feasibility Study
Pfohl Brothers Landfill, Cheektowaga, New York

of groundwater below the site. Access restrictions may also be used to protect the integrity of the landfill cap system.

At the Pfohl Brothers Landfill site the objective will be to limit subsurface excavation, prevent vehicular traffic (including off-road vehicles and dirt bikes), and groundwater use. Although fencing of the entire site will not be required, it may be necessary, if areas cannot be restricted by plantings of tree barriers or use of berms. The tree barriers will be designed to limit vehicular traffic access with gates necessary to allow maintenance access to the site.

The NYCRR Part 360 landfill closure process will provide adequate protection to isolate the radioactive materials located at this site from the environment. It meets the U.S. Nuclear Regulatory Commission (USNRC) regulations for on site disposal of these materials. However, deed restrictions on subsequent land use are recommended should the landfill remedy change in the future. The NYSDEC will pursue enactment of these restrictions with the appropriate authority.

Signs will be posted on the site to advise people that intrusive activities into the soils are not allowed. This warning will serve to prevent potential damage to the buried geomembrane or filter fabric.

OPERATION AND MAINTENANCE

As a part of the long term monitoring program at this site, water level measurements as well as analyses of groundwater samples will be used to determine if the remedial action is achieving its intended goals. These measurements and groundwater samples will be taken from existing monitoring wells in the vicinity of the site. If additional monitoring wells are determined to be necessary, they will be added during the remedial design phase. The Remedial Design will include provisions for the regular Operation and Maintenance (O&M) of the components of the remedial action once it is in place. This will include regular inspections (and repair when necessary) of the soil cap to monitor for erosion and/or settling. These inspections may be incorporated into the regular maintenance of the landfill. In addition, the remedial design will include provisions for the O&M of the groundwater pumping and treatment system.

FIVE YEAR REVIEW

A periodic review, at least every five years, at sites where the remedial action leaves hazardous wastes, pollutants or contaminants is required. At this site substances remain on site above levels that allow for unrestricted use and unlimited exposure for human and environmental receptors. If the periodic review shows that the remedy is no longer protective of human health and the environment, additional action will be evaluated and taken to mitigate the threat.

APPENDIX A

4.0 DEVELOPMENT OF TECHNOLOGY TYPES AND PROCESS OPTIONS

4.1 GENERAL RESPONSE ACTIONS

General Response Actions are categories of activities which are applied toward remediation of contaminated sites. The remedial action objectives developed for a site dictate which general response actions should be undertaken. Within each general response action (other than No Action) are several technology types and process options.

The general response actions identified for the Pfohl Brothers Landfill site which will meet the remedial action objectives for the site or will provide a baseline against which actions may be compared consist of the following:

No Action - This response is always identified for the purpose of establishing a baseline with which to compare other general response actions. There are no preventative or corrective actions taken as a result of this general response action, however, monitoring of the contamination may be prescribed.

Institutional Controls - These utilize actions which control contact with the contamination rather than remediating the contamination itself. These actions may be physical, such as fences or barriers, or legal such as deed restrictions, zoning changes or security restricted access.

Containment - As a general response action, containment prevents risk to human health and the environment by restricting contact to or migration of the contaminants via the soil, water or air pathways. A number of technologies and different materials are available for use in establishing migration barriers.

Removal/Collection - This response action physically removes or collects the existing contaminated media from the site. Other response actions are usually necessary in order to achieve remedial action goals and objectives for the removed or collected media. Collection and removal of solids/soils media is often associated with source control activities and eventually reduces contaminant concentrations in the surrounding surface water, ground water, biota and air media. Collection or removal actions in water and air media do not prevent continued migration of contaminants in those media, but do typically intercept the most contaminated portions of those media. Collection actions which completely intercept their respective media would be considered containment general response actions.

Treatment - These actions involve removal of the contaminant from the contaminated media or alteration of the contaminant. The result is a reduction in mobility, volume or toxicity of the contaminant. This general response action is usually preferred unless site or contaminant-specific characteristics make it unrealistic.

Disposal/Discharge - This general response action involves the transfer of contaminated media, concentrated contaminants, related or treated materials to a site reserved for long term storage of such materials or to an appropriate location. Disposal sites are strictly regulated in operation and the types of materials that they may accept.

The general response actions presented above provide the basis for identifying technology types and process options specific for the site, which are subsequently screened for technical feasibility.

4.2 DETERMINATION OF THE VOLUMES AND AREAS OF CONTAMINATED MEDIA

In order to apply the general response actions, an initial assessment of the quantity of contaminated media is necessary. This section describes the methods used to estimate quantities of soil/solids/sediments and groundwater/leachate/surface water.

4.2.1 LANDFILL SOILS/SOLIDS/SEDIMENTS

Based on information presented in the RI Report, it appears that contaminated soils and solids are located throughout the landfill. Thus, in calculating the volume of contaminated landfill soils and solids, it was assumed that all of the fill material is contaminated.

Sheet No. 1 in the RI report shows an AutoCAD-generated contour map depicting the depth of fill in the landfill based on soil boring data collected during the installation of the monitoring wells and excavation of test pits. This map was used in developing fill volumes and areas; the AutoCAD software package was used to calculate areas. Then based on the area and average depth, volumes of fill material were determined within each contour interval and then totaled. Total area for each geographical subdivision, average thickness of fill material, and total volumes of fill material, are presented in Table 4.1-1.

TABLE 4.1-1

ESTIMATED VOLUME OF CONTAMINATED LANDFILL SOLIDS AND SOILS

	Area (acres)	Ave Thickness (ft)	Volume (cy)
Area B	75	11.7	1,410,110
Area C	47	12.4	937,460
Total	122		2,347,570

Volumes of contaminated sediments from Aero Creek and the drainage ditches are expected to be a fraction of the contaminated soils and are estimated at an additional 200 cubic yards. This volume estimate is based on assuming that sediments are contaminated to a depth of 0.5 feet and three feet wide over a combined creek and ditch length of 3,600 feet.

4.2.2 GROUND WATER/LEACHATE/SURFACE WATER

Based on ground water sampling results collected to date, no significant/concentrated ground water plumes have been identified in the area. Data collected under the proposed Phase II Remedial Investigation will allow for a determination to be made on the volume of contaminated ground water. It is currently estimated that the volume of water within the site is 15,000,000 cubic feet.

4.3 CRITERIA FOR SCREENING OF GENERAL RESPONSE TECHNOLOGIES AND PROCESS OPTIONS

For each of the general response actions identified in Section 4.1, there exists a number of potentially effective technologies applicable to each medium of interest. These remedial technologies and associated process options are identified in the following sections and are initially screened on the basis of technical feasibility.

The evaluation of the technical feasibility of a technology or process option is based primarily upon the site conditions and the characteristics of the waste on the site. A technology/process option that cannot be implemented based on these criteria is eliminated from further evaluation.

4.3.1 LANDFILL SOLIDS/SOILS AND SEDIMENTS

Table 4.3-1 summarizes the general response technologies and process options identified for the landfill solids/soils and sediments media, provides a brief description of each technology/process option, and lists the results of the technical feasibility screening.

4.3.2 GROUND WATER AND LEACHATE

Table 4.3-2 summarizes the general response technologies and process options identified for the ground water and leachate media, provides a brief description of each technology/process option, and lists the results of the technical feasibility screening.

4.4 IDENTIFICATION AND INITIAL SCREENING OF REMEDIAL TECHNOLOGIES AND PROCESS OPTIONS

In Section 4.3, the technical feasibility of the general response technologies were determined. In this section, the process options associated with these technically feasible technologies are evaluated relative to each other and screened in terms of their ability to meet medium-specific remedial action objectives, their short- and long-term effectiveness, and their implementability. Each of the evaluation criterion is described below:

Ability to meet remedial action objectives - Specific process options that have been identified should be evaluated on their ability to meet remedial action objectives relative to other process options within the same technology type.

TABLE 4.3-1
PFOHL BROTHERS LANDFILL FEASIBILITY STUDY

IDENTIFICATION AND SCREENING OF REMEDIAL TECHNOLOGIES
LANDFILL SOLIDS/SOIL AND SEDIMENTS

RESPONSE ACTION • Remedial Technology - Process Option	Description	Screening Status	Comments
NO ACTION	No remediation of hazards present on site. Monitoring may occur.	Technically Implementable	This option required by the NCP and is retained for comparison with other alternatives.
INSTITUTIONAL CONTROLS			
• Land Use Controls			
- Deed Restrictions	Restrictive covenants on deeds to the landfill property. Includes limitations on excavation and basements in contaminated solids/soils areas.	Technically Implementable	May be difficult to administer for this site.
- Zoning Change	Zoning change, administrative consent order, or judicial order prohibiting certain land uses.	Technically Implementable	
• Fencing	Restrict general public from on-site hazards	Technically Implementable	Already in place around most of landfill.
• Written Warnings	Place warning signs in area to warn local citizens of landfill hazards	Technically Implementable	Already in place around most of landfill.
CONTAINMENT ACTIONS			
• Capping			
- Native Soil Cap	Reduce exposure to, and migration of contaminated materials through use of a native soil cap.	Technically Implementable	Allows most of the existing infiltration to reach the landfill solids. Surface runoff likely to contain high sediment content, which would require detention basins prior to final discharge.
- Single Barrier Cap	Utilizes a single layer of media for the barrier; such as clay, flexible membrane liner, asphalt or concrete-based material.	Technically Implementable	Allows for some infiltration. Meets NYSDEC capping criteria.
- Composite Barrier Cap	Utilizes multiple layers of media for the barrier, such as soil, synthetics, and concrete.	Technically Implementable	Minimizes infiltration of existing precipitation. Creates relatively high volume of clean runoff. Meets NYSDEC capping criteria.

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TABLE 4.3-1 (cont.)
PFOHL BROTHERS LANDFILL FEASIBILITY STUDY

IDENTIFICATION AND SCREENING OF REMEDIAL TECHNOLOGIES
LANDFILL SOLIDS/SOIL AND SEDIMENTS

RESPONSE ACTION • Remedial Technology - Process Option	Description	Screening Status	Comments
• Surface Controls			
- Grading	Modifies topography to manage surface water infiltration, run-on and runoff.	Technically Implementable	
- Revegetation	Stabilizes soil surface of landfill and promotes evapotranspiration.	Technically Implementable	
REMOVAL ACTIONS			
• Excavation	Physical removal of materials via backhoe or other suitable equipment.	Technically Implementable	Appropriate for isolated areas such as "hot spots" and areas where thickness of landfill deposits is low.
TREATMENT ACTIONS			
• Biological Treatment			
- Aerobic	Degradation of organics using acclimated microorganisms in an aerobic environment.	Technically Unimplementable	Although degradation of PAHs has been demonstrated and proven, degradation of PCBs may be difficult and has not been tried on a full scale. Inorganics would be unaffected by the process.
- Anaerobic	Degradation of organics using microorganisms in an anaerobic environment.	Technically Unimplementable	Not applicable to inorganic and some organic contaminants.
• Stabilization/Fixation	Contaminated soil mixed with a variety of stabilizing agents (cement-based, pozzolanic- or silicate-based, thermoplastic-based, or inorganic polymer-based) to reduce the mobility of hazardous constituents.	Technically Implementable	Bench scale testing would be required to develop the effective stabilizing mixture. Non-uniform composition of landfill solids makes the process difficult to implement as sorting of waste materials prior to treatment may be necessary. Treatment of homogeneous areas may be more implementable.

TABLE 4.3-1 (cont.)
PFOHL BROTHERS LANDFILL FEASIBILITY STUDY

IDENTIFICATION AND SCREENING OF REMEDIAL TECHNOLOGIES
LANDFILL SOLIDS/SOIL AND SEDIMENTS

RESPONSE ACTION • Remedial Technology - Process Option	Description	Screening Status	Comments
• Thermal Treatment			
- Rotary Kiln	Thermal treatment of contaminated soils by combustion on horizontally rotating cylinder designed for uniform heat transfer.	Technically Implementable	Non-uniform composition of landfill solids makes the process difficult to implement as sorting of waste materials prior to treatment may be necessary. Treatment of homogeneous areas may be more implementable.
- Circulating Fluidized Bed	Waste injected into hot bed of sand where combustion occurs.	Technically Implementable	Non-uniform composition of landfill solids makes the process difficult to implement as sorting of waste materials prior to treatment may be necessary. Treatment of homogeneous areas may be more implementable.
- Multiple Hearth	Waste injected into a vertical cylinder containing a series of solid, flat hearths.	Technically Implementable	Non-uniform composition of landfill solids makes the process difficult to implement as sorting of waste materials prior to treatment may be necessary. Treatment of homogeneous areas may be more implementable. Requires high level of maintenance.
- Pyrolysis	Thermal conversion of organic material into solid, liquid, and gaseous components in an oxygen deficient atmosphere.	Technically Unimplementable	Not applicable; wastes must contain pure organics. Some dioxin destruction achievable.
- Infrared Thermal Treatment	Uses silicon carbine elements to generate thermal radiation beyond the end of the visible spectrum for thermal destruction.	Technically Implementable	Applicable only for organic compounds. Non-uniform composition of landfill solids makes the process difficult to implement as sorting of waste materials prior to treatment may be necessary. Treatment of homogeneous areas may be more implementable.

TABLE 4.3-1 (cont.)
PFOHL BROTHERS LANDFILL FEASIBILITY STUDY

IDENTIFICATION AND SCREENING OF REMEDIAL TECHNOLOGIES
LANDFILL SOLIDS/SOIL AND SEDIMENTS

RESPONSE ACTION • Remedial Technology - Process Option	Description	Screening Status	Comments
- Supercritical Water Oxidation	Breaks down suspended and dissolved oxidizable inorganic and organic materials by oxidation in a high-temperature, high pressure, aqueous environment.	Technically Unimplementable	Waste must be pumpable.
- Low Temperature Thermal Desorption	Involves the volatilization of organics from soil without achieving soil combustion temperatures. Volatiles can be destroyed in an afterburner.	Technically Implementable	The technology has been developed for treating soils containing PCBs and PAHs. Non-volatile compounds are not removed. Must be used in combination with a vapor collection system.
• Physical/Chemical Treatment			
- Air Stripping/ Mechanical Aeration	Mechanical aeration of soils to remove volatile organics	Technically Unimplementable	Non applicable to inorganics and non volatiles, which are the primary contaminants of concern on the site.
- Soil Washing	Organic solvents are mixed with soils to extract organic contaminants. Liquid waste is produced.	Technically Implementable	Can remove PCBs and PAHs, however low concentrations in the soil may result in low removal efficiencies. Non-uniform composition of landfill solids makes the process difficult to implement as sorting of waste materials prior to treatment may be necessary. Treatment of homogeneous areas may be more implementable.
- Dechlorination	Use of potassium polyethylene glycolate (KPEG) and dimethyl sulfoxide to dechlorinate halogenated organic compounds, creating large numbers of nontoxic products.	Technically Unimplementable	Will not detoxify PAHs or inorganics.

TABLE 4.3-1 (cont.)
PFOHL BROTHERS LANDFILL FEASIBILITY STUDY

IDENTIFICATION AND SCREENING OF REMEDIAL TECHNOLOGIES
LANDFILL SOLIDS/SOIL AND SEDIMENTS

RESPONSE ACTION • Remedial Technology - Process Option	Description	Screening Status	Comments
INSITU TREATMENT			
• Physical/Chemical			
- Vapor Extraction/and Thermally Enhanced Vapor Extraction	Vertical or horizontal vents used to extract contaminated soil gas and volatilize contaminant residuals from soils. Steam/hot gas can be used to enhance volatilization.	Technically Unimplementable	Not amenable to non-volatile organics and inorganic contaminants or to contaminants mixed with trash/debris.
- Radio Frequency (RF)/ Microwave Heating	Electrodes are placed in contaminated soils. RF energy field heats soils and volatilizes contaminants which are collected in vents or at the surface.	Technically Unimplementable	Although system would vaporize volatile and semi-volatile contaminants, non-volatile and inorganic constituents would not be addressed. Applicability to contaminants mixed with trash/debris is limited and unproven.
- Vitrification	Electrodes are placed in soil and current is passed through soil to create resistive heating. Soil eventually melts, organics are volatilized or destroyed and inorganics are dissolved within vitrified mass.	Technically Unimplementable	Contaminants mixed in with trash and other demolition debris could limit the effectiveness of this process. Technology effectiveness in landfill media is unproven. Requires uniform composition of soil.
- Soil Flushing	Surfactant solution is percolated through contaminated soils and elutriate is brought to the surface for removal, recirculation or on-site treatment and reinjection. Amenable for removal of some organics.	Technically Unimplementable	Limited applicability to wastes mixed with trash/demolition debris due to inability to distribute solution to contaminated areas. Also requires effective collection system to prevent contaminant migration; fractured bedrock does not provide for effective recovery. Because of the variety of contaminants present, no one type of surfactant would remove all contaminants of concern. Lack of hydraulic control may create problems. Possible contamination due to surfactants used.

TABLE 4.3-1 (cont.)
PFOHL BROTHERS LANDFILL FEASIBILITY STUDY

IDENTIFICATION AND SCREENING OF REMEDIAL TECHNOLOGIES
LANDFILL SOLIDS/SOIL AND SEDIMENTS

RESPONSE ACTION • Remedial Technology - Process Option	Description	Screening Status	Comments
- Photolysis/UV	Photochemical reactions requiring the absorption of light energy, generally from sunlight in natural conditions. Because light does not penetrate very far into soils, photodegradation of contaminated soils is limited to soil surfaces.	Technically Unimplementable	Only applicable for surface soil contamination. Non-uniform composition of landfill solids makes the process difficult to implement as sorting of waste materials prior to treatment may be necessary. Treatment of homogeneous areas may be more implementable.
• Biological Treatment			
- Aerobic	Nutrients and cosubstrates, such as methane, are injected into soils to stimulate biological destruction of contaminants.	Technically Unimplementable	Proven in aqueous laboratory reactors, but unproven for soils application. Will not degrade chlorinated organics.
- Anaerobic	Cosubstrate such as acetate is added to subsurface. Anaerobic bacteria are stimulated to degrade chlorinated organics.	Technically Unimplementable	Will degrade chlorinated organics, but incomplete degradation forms vinyl chloride. Difficult to maintain anaerobic conditions insitu.
DISPOSAL ACTIONS			
• Offsite			
- RCRA Subtitle C	Disposal of contaminated soil at offsite RCRA "C" Landfill.	Technically Implementable	Soil may require treatment prior to disposal due to Land Ban restrictions. Radioactive and/or dioxin contaminated soils may require separate handling and disposal.
- RCRA Subtitle D	Disposal of treated solids/soils at an RCRA "D" landfill.	Technically Implementable	Requires treatment prior to disposal. Radioactive and/or dioxin contaminated soils may also require separate handling and disposal due to Land Ban Restrictions.
• Onsite	Involves the construction of an onsite containment vessel (RCRA landfill) or a Subtitle D vessel for the disposal of contaminated materials.	Technically Implementable	Contaminated material would be required to be excavated. Existing site structures may need to be removed. Would be difficult to implement in areas with a high water table or location within 100-year flood plain.

TABLE 4.3-2
PFOHL BROTHERS LANDFILL FEASIBILITY STUDY

IDENTIFICATION AND SCREENING OF REMEDIAL TECHNOLOGIES
GROUND WATER AND LEACHATE

RESPONSE ACTION • Remedial Technology - Process Option	Description	*Screening Status*	Comments
NO ACTION	No removal or reduction of risks from ground water or leachate. Continue monitoring of ground water and leachate.	Technically Implementable	This option has been retained for comparison with other alternatives, as required by NCP.
INSTITUTIONAL ACTIONS			
• Water Use Controls			
- Well Permit Regulation	Regulate drilling of new wells in contaminated shallow aquifer.	Technically Implementable	Applicable and feasible in this area since alternate water sources exist.
- Inspect and Seal Existing Wells	Voluntary abandonment of existing shallow wells in contaminated areas. Properly seal bedrock wells to prevent downward contaminant migration.	Technically Implementable	Could affect several private wells located off-site. Potentially important in protecting bedrock aquifer.
- Point of Use Treatment	Provide individual water treatment systems to all potentially affected well water systems.	Technically Implementable	Must be used with other institutional actions to prevent human contact with ground water.
• Public Education	Increase public awareness of site conditions and remedies through meetings, written notices, and news releases.	Technically Implementable	Provide forum for open discussion and may prevent unintended exposures.

TABLE 4.3-2 (cont.)
PFOHL BROTHERS LANDFILL FEASIBILITY STUDY

IDENTIFICATION AND SCREENING OF REMEDIAL TECHNOLOGIES
GROUND WATER AND LEACHATE

RESPONSE ACTION • Remedial Technology - Process Option	Description	Screening Status	Comments
CONTAINMENT ACTIONS			
• Hydraulic Controls			
- Passive Drainfields	Use of an interceptor trench containing perforated pipe and gravel for collection of ground water or leachate which is pumped to the surface. Trench is located downgradient of site.	Technically Implementable	Collected water must be treated prior to discharge. Existing underground utilities could pose problems. May not be technically feasible to install system deep enough within aquifer. Worker health and safety may be a concern during construction.
- Extraction Wells	Capture ground water in the shallow aquifer using a series of pumping wells which pump at high enough rates to reverse existing hydraulic gradient.	Technically Implementable	Collected water must be treated prior to discharge. Requires on-site studies to determine well capture zones. Requires constant monitoring to maintain system effectiveness.
• Physical Controls			
- Slurry Walls	Bentonite-filled trench. Reduces permeability and restricts ground water flow.	Technically Implementable	Provides consistent barrier to lateral flow. Does not address vertical migration of contaminants.
- Grout Curtain	Inject grout into soil to harden soils and form an impermeable wall.	Technically Implementable	Difficult to completely seal a large area. Does not address vertical migration of contamination.
- Sheet Piling	Metal sheets are driven into bedrock to form an impermeable wall.	Technically Implementable	Difficult to install in rocky soils or at depths greater than 30 feet.

TABLE 4.3-2 (cont.)
PFOHL BROTHERS LANDFILL FEASIBILITY STUDY

IDENTIFICATION AND SCREENING OF REMEDIAL TECHNOLOGIES
GROUND WATER AND LEACHATE

RESPONSE ACTION • Remedial Technology - Process Option	Description	Screening Status	Comments
- Bottom Sealing	Prevent vertical migration of contaminants using a horizontal layer of impermeable material injected beneath contaminated area.	Technically Implementable	To be implemented in areas where natural clay underlying landfill is absent. May be difficult to implement at the site since the areas are unknown and difficult to identify.
- Capping	Install a properly designed cap over the site. Cap could be asphalt/concrete, clay, synthetic or multi-layered.	Technically Implementable	Would minimize infiltration into landfill materials, thereby reducing leachate seep discharge and decrease downward hydraulic gradient between alluvial and bedrock aquifers.
COLLECTION ACTIONS			
• Hydraulic Collection			
- Passive Drainfields	Water is collected in a trench containing perforated pipe and gravel, and is pumped to the surface.	Technically Implementable	Construction difficulty increases with depth below water table surface. Worker health and safety may be a concern during construction in waste material.
- Extraction Wells	An array of wells is used to pump out ground water.	Technically Implementable	Can collect water over a large area. Pumping rates on individual wells can be varied to focus collection efforts in desired areas.

TABLE 4.3-2 (cont.)
PFOHL BROTHERS LANDFILL FEASIBILITY STUDY

IDENTIFICATION AND SCREENING OF REMEDIAL TECHNOLOGIES
GROUND WATER AND LEACHATE

RESPONSE ACTION • Remedial Technology - Process Option	Description	Screening Status	Comments
TREATMENT ACTIONS			
• Biological			
- Activated Sludge	Treat ground water/leachate using bacteria and other microbes in an aerated tank with biomass recirculation.	Technically Unimplementable	Organic compound concentrations are too weak to support a viable microbial population. Does not completely address inorganic removal.
- Activated Sludge and Powdered Activated Carbon	Treat ground water/leachate with microbes and powdered activated carbon in the same reactor.	Technically Unimplementable	Potentially applicable for treating organic contaminants. Does not completely address treatment of inorganic constituents.
- Aeration Tank	Biological treatment by microbes in an aerated tank with no recirculation.	Technically Unimplementable	Extremely difficult to sustain sufficient microbial population.
- Aerobic Fixed Film	Microbes attached to an inert media provide organic contaminant removal under aerobic conditions.	Technically Implementable	Possible application even for low strength waters. Incidental metals removal.
- Anaerobic Fixed Film	Microbes attached to an inert media provide organic contaminant removal under anaerobic conditions.	Technically Implementable	Generally not used for removal of low level organic compound concentrations.
- Aerobic/Anaerobic Fixed Film	Microbes attached to an inert media provide organic contaminant removal under spatially segregated aerobic and anaerobic zones.	Technically Unimplementable	Not applicable for waters with low organic compound concentrations.

TABLE 4.3-2 (cont.)
PFOHL BROTHERS LANDFILL FEASIBILITY STUDY

IDENTIFICATION AND SCREENING OF REMEDIAL TECHNOLOGIES
GROUND WATER AND LEACHATE

RESPONSE ACTION • Remedial Technology - Process Option	Description	Screening Status	Comments
- Anaerobic Digester/Tank	Organic contaminants are removed in an anaerobic digester.	Technically Unimplementable	Applicable for sludge; not applicable for ground water or leachate.
- Combined Biological	Both aerobic and anaerobic microbes are used for treatment.	Technically Unimplementable	Ground water/leachate organic compound concentrations too low to sustain a viable population.
- Fluidized Bed Reactor	Microbes attached to a fluidized bed of inert media provide organic contaminant removal.	Technically Implementable	Potentially applicable for ground water/leachate treatment. Does not address inorganic constituents.
- In-situ Biodegradation	Microbes present in the soil are used for biodegradation.	Technically Unimplementable	Not applicable for low concentration waters encountered at this site. Difficult to controll environment in the fill material/soil found at this site.
- Land Treatment	Ground water/leachate is applied to land. Microbes present in soil provide treatment.	Technically Unimplementable	Potential for creating additional contamination. Potential RCRA Land-ban restrictions. Must be used in combination with a vapor collection system.
- Rock Reed Filters	Contaminants are absorbed in wetlands environment (natural or artificial).	Technically Implementable	Potentially applicable as a polishing stage when treated ground water/leachate is discharged to surface waters.
- Sequencing Batch Reactors	Ground water/leachate is treated under aerobic conditions in a sequencing batch reactor configuration.	Technically Unimplementable	Ground water and leachate concentrations are too weak to support a viable microbial populations. Does not completely address inorganic removal.

TABLE 4.3-2 (cont.)
PFOHL BROTHERS LANDFILL FEASIBILITY STUDY

IDENTIFICATION AND SCREENING OF REMEDIAL TECHNOLOGIES
GROUND WATER AND LEACHATE

RESPONSE ACTION • Remedial Technology - Process Option	Description	Screening Status	Comments
- Trickling Filters	Similar to a fixed film aerobic process.	Technically Implementable	Possible application for removing some of the organics. Not applicable for inorganics.
• Physical/Chemical			
- Activated Carbon	Granular activated carbon is used to adsorb organic contaminants. Spent carbon is regenerated and concentrated. Contaminants are destroyed or treated.	Technically Implementable	Proven technology for removal of most organics. Methylene chloride is poorly adsorbed. Metals removal is incidental.
- Air Stripping/Steam Stripping	Air or steam is used to strip volatile organic compounds from ground water/leachate. Vapor phase streams are treated for concentrated contaminant removal or destruction.	Technically Implementable	Proven technologies for removal of certain organic compounds, especially volatile organics.
- Alkaline Destruction	Remove inorganic constituents by raising pH to high values.	Technically Unimplementable	Not a proven technology and is not applicable for all inorganic constituents.
- Centrifugation	Remove inorganic constituents by raising pH to high values.	Technically Unimplementable	Not applicable for ground water/leachate with low solids contents. Can be used for sludge dewatering but minimal sludge processing is anticipated at this site.
- Chelation	Chelating agents are used for heavy metal removal.	Technically Unimplementable	Technology is not proven for such applications. Only some inorganics are treated.

TABLE 4.3-2 (cont.)
PFOHL BROTHERS LANDFILL FEASIBILITY STUDY

IDENTIFICATION AND SCREENING OF REMEDIAL TECHNOLOGIES
GROUND WATER AND LEACHATE

RESPONSE ACTION • Remedial Technology - Process Option	Description	Screening Status	Comments
- Coagulation/flocculation	Coagulating agents and flocculants are used for collecting precipitated metals to facilitate separation from waters.	Technically Implementable	Applicable and proven technology for assisting in removal of some inorganic constituents.
- Dechlorination/ Dehalogenation	Organic compounds are dechlorinated or dehalogenated using chemical addition.	Technically Unimplementable	Not effective in media with a wide range of organic constituents. No metals removals.
- Distillation	Organic constituents are removed from ground water/leachate	Technically Unimplementable	Not applicable to ground water with several contaminants and low concentrations of organics. No metals removal.
- Electrodialysis	Ion separation is achieved using electrodialysis techniques.	Technically Unimplementable	Only applicable for ion separation. Does not remove precipitates and most organics.
- Electrochemical	Electrochemical properties exhibited by heavy metals are used for separating them from waters.	Technically Implementable	Has been proven in pilot scale testing. Potentially applicable for metals removal. No organics removal.
- Evaporation	Dissolved solids are separated from water using evaporation. Volatile constituents are also removed.	Technically Unimplementable	Not applicable for treatment of dilute waters in the cool, humid conditions at the site.
- Filtration	Precipitated solids containing metals are filtered out.	Technically Implementable	Potential application as a secondary process during metals removal.
- Freeze Crystallization	Various organic constituents are separated from water by freezing.	Technically Unimplementable	Not proven for such large volumes and dilute concentrations. Metals removal incidental.
- Hydrolysis	Contaminants are hydrolyzed and destroyed.	Technically Unimplementable	Not a proven technology.

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TABLE 4.3-2 (cont.)
PFOHL BROTHERS LANDFILL FEASIBILITY STUDY

IDENTIFICATION AND SCREENING OF REMEDIAL TECHNOLOGIES
GROUND WATER AND LEACHATE

RESPONSE ACTION • Remedial Technology - Process Option	Description	Screening Status	Comments
- Ion Exchange	Heavy metals are exchanged with sodium or hydrogen ions and removed from water as pass through an ion exchange column.	Technically Implementable	Potentially applicable and proven technology for heavy metals removal.
- Low Temperature Stripping	Volatile organic contaminants are removed from water through addition of heat and air.	Technically Implementable	Possible application for volatile organics removal.
- Magnetic Separation	Magnetic forces are used for removal of suspended metals which are magnetic.	Technically Unimplementable	Not applicable to non-magnetic nor dissolved ground water/leachate contaminants at the site. No organics removal.
- Mechanical Aeration	Organics are volatilized through aeration provided by mechanical mixers.	Technically Unimplementable	Very limited applicability to ground water/leachate at this site due to low concentrations.
- Neutralization	pH adjustment is made for treating waters outside the range of normal pH.	Technically Unimplementable	pH for ground water/leachate at this site is normal (within the range 6-9)
- Oil/Water Separation	Free floating oil or other phases are separated from water.	Technically Unimplementable	Applicable only when free product is found. No such products exist at this site.
- Oxidation/Reduction	Oxidation/reduction reactions are used to remove metals.	Technically Unimplementable	Limited application for selective metals only. No organics removal.
- Phases Separation	Immiscible phases are separated physically.	Technically Unimplementable	Multiple phases are not present at this site

TABLE 4.3-2 (cont.)
PFOHL BROTHERS LANDFILL FEASIBILITY STUDY

IDENTIFICATION AND SCREENING OF REMEDIAL TECHNOLOGIES
GROUND WATER AND LEACHATE

RESPONSE ACTION • Remedial Technology - Process Option	Description	Screening Status	Comments
- Photolysis (UV)	UV energy is used to degrade organic contaminants.	Technically Unimplementable	Not applicable to the organic contaminants found at this site. Incomplete destruction of certain volatile organics.
- Precipitation	Heavy metals are precipitated out using chemical addition.	Technically Implementable	Proven and applicable technology used in metals removal process.
- Reverse Osmosis	Selective membranes utilize osmotic pressures for separation of organic and inorganic constituents.	Technically Implementable	Possible application as a polishing step depending on the treatment limits to be met. Only practical for achieving very low effluent dissolved solids.
- RF/Microwave In-situ	Microwave energy is used for destruction of contaminants.	Technically Unimplementable	Not applicable for ground water/leachate.
- Sedimentation	Settleable solids are separated from water in tanks.	Technically Implementable	Retained only as a technology in the metals removal process.
- Solvent Extraction	Solvents are used for removal of contaminants from water.	Technically Unimplementable	Concentration of various organics are too low to make this a viable technology.
- Supercritical Fluid Extraction	Solvents are used under supercritical conditions for contaminant removal.	Technically Unimplementable	Concentration of various organics are too low to make this a viable technology.
- UV/Hydrogen Peroxide/ Ozone Reactors	Contaminants are oxidized and dechlorinated using oxidizers in the presence of UV light.	Technically Implementable	Innovative technology. Effective for removal of some organic compounds.
- Ultrafiltration	Contaminants are removed from water using ultrafiltration membranes or columns.	Technically Implementable	May be applicable as a polishing step depending on the level of treatment required.

TABLE 4.3-2 (cont.)
PFOHL BROTHERS LANDFILL FEASIBILITY STUDY

IDENTIFICATION AND SCREENING OF REMEDIAL TECHNOLOGIES
GROUND WATER AND LEACHATE

RESPONSE ACTION • Remedial Technology - Process Option	Description	Screening Status	Comments
- Vacuum/Vapor Extraction	Vacuum or vapors are used for extracting contaminants from water.	Technically Unimplementable	Concentration of various organics are too low to make this a viable technology.
- Wet Air Oxidation	Thermal energy is used for destruction of contaminants.	Technically Unimplementable	Technology is too energy intensive. Not applicable for waters with insufficient organics and thermal values.
• Thermal Treatment Technologies	Heat energy is used to destroy organic and inorganic contaminants.	Technically Unimplementable	Not efficient and applicable for dilute ground water/leachate.
• In-Situ Treatment Technologies	Ground water/leachate is treated in place using biological or physical/chemical processes.	Technically Unimplementable	Not proven on a large scale, nor with the suite of compounds present at the site. Certain compounds resistant to degradation.
DISPOSAL TECHNOLOGIES			
• On-Site			
- Ground Water Reinjection	Inject treated ground water back into aquifer using injection wells.	Technically Implementable	Useful in flushing out additional contamination and in dilution. Potential plugging problems.
- Infiltration Trenches	Recharge treated ground water/leachate into the aquifer through gravel filled trenches.	Technically Implementable	Less plugging problems than with reinjection wells. Needs permeable soils. Underground utilities may limit locations; verification of locations required.
- Discharge to Surface Waters	Discharge to Elliott Creek after treatment.	Technically Implementable	Treatment standards are dictated by Class B surface water criteria. Permits needed.

TABLE 4.3-2 (cont.)
PFOHL BROTHERS LANDFILL FEASIBILITY STUDY

IDENTIFICATION AND SCREENING OF REMEDIAL TECHNOLOGIES
GROUND WATER AND LEACHATE

RESPONSE ACTION • Remedial Technology - Process Option	Description	Screening Status	Comments
	Discharge to Aero Lake after treatment.	Technically Implementable	Treatment standards are dictated by Class D surface water criteria. Permits needed.
• Off-Site			
- Ground Water Reinjection	Inject treated ground water back into aquifer using injection wells.	Technically Implementable	Useful in flushing out additional contamination and in dilution. Potential plugging problems.
- Infiltration Trenches	Recharge treated ground water/leachate into the aquifer through gravel filled trenches.	Technically Implementable	Less plugging problems than with reinjection wells. Needs permeable soils. Underground utilities may limit locations.
- Discharge to Surface Waters	Discharge to off-site surface water.	Technically Implementable	Appropriate permits needed. Treatment standards dictated by appropriate surface water criteria.
- Discharge to Sewers	Discharge to Buffalo Sewer Authority sanitary sewer system.	Technically Implementable	Pretreatment criteria established by the authority must be met. Requires local permits.

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Long-term effectiveness - This evaluation focuses on:

1) The performance of the remediation;
2) The magnitude of the remaining risk;
3) The adequacy of the controls implemented to manage waste left on the site; and
4) The long-term reliability of the controls left on site.

Short-term effectiveness - This evaluation focuses on:

1) The protection of the community during the remedial action;
2) The environmental impacts from the implementation of the remedial action;
3) The time until remedial action objectives are achieved; and
4) The protection of workers during remedial actions.

Implementability - The implementability criteria encompasses both the technical and institutional feasibility of implementing a technology process.

Screening of the process options using these criteria was conducted to select one process option that is representative of each remedial technology. More than one process option may be selected for a remedial technology if the processes are sufficiently different in their performance.

The screening process is presented in Tables 4.4-1 for the Landfill Solids/Soils and Sediment, and Table 4.4-2 for Ground Water and Leachate. The remedial technologies and process option that were evaluated in Section 4.3 as being technically feasible are presented. Each process options was evaluated against the four criteria and, when compared to the other process options within their technology type as presented on the tables, were given a relative High, Moderate, or Low rating based on their performance in meeting each criteria. It is important to note that the ratings are only indicative of each process option's performance relative to the other process options within each technology type that were retained in the screening tables.

The process option within each technology type receiving the highest performance ratings for the four evaluation criteria was retained for possible incorporation into one or more remedial action alternatives, and the other process options within the technology type are eliminated, unless noted otherwise in the tables. It should be noted that any of the process options contained in Tables 4.4-1 and 4.4-2 could be

TABLE 4.4-1
PFOHL BROTHERS LANDFILL FEASIBILITY STUDY

REMEDIAL ACTION PROCESS OPTIONS EVALUATION
LANDFILL SOLIDS/SOIL AND SEDIMENTS

Response Action	Remedial Technology	Process Option	Achieve Remedial Action Objectives[a]	Long-Term Effectiveness[a]	Short-Term Effectiveness[a]	Implementation[a]	Evaluation Result
No Action	Monitoring	Monitoring	Low	N/A[b]	N/A[b]	N/A[b]	Retain
Institutional Controls	Land Use Restrictions	Deed Restrictions	Low	Low	Moderate	Low	Retain, because sufficiently different
		Zoning Change	Low	Moderate	Low	Moderate	Retain, because sufficiently different
		Fencing	Moderate	Moderate	Moderate	Moderate	Retain because sufficiently different
	Public Education	Written Warnings	Low	Low	Low	High	Retain
Containment	Capping	Native Soil Cap	Low	Low	High	High	Not retained
		Single Barrier	High	Moderate	High	Moderate	Retained
		Composite Barrier Cap	High	High	Low	Low	Not Retained
	Surface Controls	Grading	Low	Low	Moderate	Moderate	Not retained
		Revegetation	Low	Low	Low	High	Retain
Removal	Excavation	--	High	High	Moderate	Low	Retain for isolated regions
Treatment	Stabilization/ Fixation	--	N/A[b]	N/A[b]	N/A[b]	N/A[b]	Reject since hot spots being remediated separately
	Thermal Treatment	Rotary Kiln	High	High	High	High	Reject since hot spots being remediated separately
		Circulating Fluidized Bed	Moderate	Moderate	Moderate	Moderate	Not retained
		Multiple Hearth	Moderate	Moderate	Moderate	Low	Not retained
		Infrared Thermal Treatment	Moderate	Low	Low	Low	Not retained
		Low Temperature Thermal Desorption	Low	Low	Low	Low	Not retained
	Physical/Chemical Treatment	Soil Washing	Low	N/A[b]	N/A[b]	N/A[b]	Reject since hot spots being remediated separately

TABLE 4-1 (cont.)
PFOHL BROTHERS LANDFILL FEASIBILITY STUDY

REMEDIAL ACTION PROCESS OPTIONS EVALUATION
LANDFILL SOLIDS/SOIL AND SEDIMENTS

Response Action	Remedial Technology	Process Option	Achieve Remedial Action Objectives[a]	Long-Term Effectiveness[a]	Short-Term Effectiveness[a]	Implementation[a]	Evaluation Result
Disposal	Off-Site	RCRA Subtitle "C"	High	High	Low	Low	Retain for material requiring RCRA "C" disposal
		RCRA Subtitle "D"	Moderate	Moderate	Moderate	Moderate	Retain for material meeting RCRA "D" disposal requirements
	On-Site	—	Low	N/A[b]	N/A[b]	N/A[b]	Retain

[a] Process options were evaluated relative to only other process options within the same remedial technology according to the following:

Ability to achieve remedial action objectives.
Long Term Effectiveness:
1) Performance of the remediation
2) Magnitude of the remaining risk
3) Adequacy of controls
4) Reliability of controls
Short Term Effectiveness:
1) Protection of the community during remedial actions
2) Environmental impacts
3) Time until remedial objectives are achieved
4) Protection of workers during remedial actions
Implementability:
1) Technical feasibility
2) Administrative feasibility

[b] N/A = Evaluative ranking not applicable either because only one option exists for the technology or because the options were not comparable. See text for details.

Note that all of the above process options may be incorporated into alternatives during detailed design.

TABLE 4.4-2
PFOHL BROTHERS LANDFILL FEASIBILITY STUDY
REMEDIAL ACTION PROCESS OPTIONS EVALUATION
GROUND WATER AND LEACHATE

Response Action	Remedial Technology	Process Option	Achieve Remedial Action Objectives[a]	Long-Term Effectiveness[a]	Short-Term Effectiveness[a]	Implementation[a]	Evaluation Result
No Action	Monitoring	Monitoring	Low	N/A	N/A	N/A	Retain
Institutional Controls	Water Use Controls	Well Permit Regulation	Low	Moderate	Low	Moderate	Retain because sufficientl different
		Inspect/Seal Existing Wells	Low	Moderate	High	Moderate	Retain because sufficientl different
		Point of Use Treatment	Moderate	Moderate	High	High	Retain because sufficientl different
	Public Education	Written Warnings	Low	Low	Low	High	Retain
Containment	Hydraulic Controls	Drainfields	High	High	Moderate	Moderate	Retain
		Extraction Wells	Moderate	Moderate	High	Moderate	Not retained
	Physical Controls	Slurry Walls	High	Moderate	High	Moderate	Retain
		Grout Curtain	Moderate	Low	Moderate	Moderate	Not retained
		Sheet Piling	Moderate	Low	Moderate	Moderate	Not retained
		Bottom Sealing	Moderate	Low	Moderate	Low	Not retained
		Capping	High	Moderate	Moderate	Moderate	Retain because sufficient different
Collection	Hydraulic Collection	Passive Drainfields	High	High	Moderate	High	Retain for near surface collection
		Extraction Wells	High	Moderate	High	Moderate	Retain
Treatment	Biological	Aerobic Fixed Film	High	Low	Moderate	Moderate	Not Retained
		Anaerobic Fixed Film	Moderate	Low	Low	Low	Not retained
		Fluidized Bed Reactor	Moderate	Low	Low	Low	Not retained
		Rock Reed Filters	Low	Moderate	Low	Low	Not retained
		Trickling Filters	Low	Low	Moderate	Low	Not retained

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TABLE -.4-2 (cont.)
PFOHL BROTHERS LANDFILL FEASIBILITY STUDY

REMEDIAL ACTION PROCESS OPTIONS EVALUATION
GROUND WATER AND LEACHATE

Response Action	Remedial Technology	Process Option	Achieve Remedial Action Objective[a]	Long-Term Effectiveness[a]	Short-Term Effectiveness[a]	Implementation[a]	Evaluation Result
	Physical/Chemical	Activated Carbon	High	High	High	High	Retain - for organics
		Air Stripping/Steam Stripping	Moderate	Moderate	Moderate	Moderate	Not retained
		Coagulation/Flocculation	High	Moderate	High	High	Retain - for inorganics
		Electrochemical	Moderate	Moderate	Moderate	Moderate	Not retained
		Filtration	Moderate	Moderate	Moderate	Moderate	Retain - for inorganics (use after coagulation/-flocculation)
		Ion Exchange	Moderate	Moderate	Moderate	Low	Retain - for inorganics
		Low Temperature Stripping	Moderate	Moderate	Moderate	Moderate	Not retained
		Precipitation	High	Moderate	Moderate	Moderate	Retain - for inorganics
		Reverse Osmosis	Moderate	Moderate	Moderate	Low	Not retained
		Sedimentation	Moderate	Moderate	Moderate	High	Retain - for inorganics
		UV/Hydrogen Peroxide/ Ozone Reactors	Moderate	Moderate	Moderate	Moderate	Retain - if polishing needed
		Ultra Filtration	Moderate	Moderate	Moderate	Low	Not retained
Disposal	On-Site	Ground Water Reinjection	Low	Low	Moderate	Moderate	Not retained
		Infiltration Trenches	Low	Moderate	Moderate	Moderate	Not retained
		Discharge to Surface Waters	Moderate	Moderate	Moderate	High	Retain
	Off-Site	Ground Water Reinjection	Low	Low	Moderate	Moderate	Not retained
		Infiltration Trenches	Low	Moderate	Moderate	Moderate	Not retained

TABLE 4.4-2 (cont.)
PFOHL BROTHERS LANDFILL FEASIBILITY STUDY

REMEDIAL ACTION PROCESS OPTIONS EVALUATION
GROUND WATER AND LEACHATE

Response Action	Remedial Technology	Process Option	Achieve Remedial Action Objectives[a]	Long-Term Effectiveness[a]	Short-Term Effectiveness[a]	Implementation[a]	Evaluation Result
		Discharge to Surface Waters	Moderate	Moderate	Moderate	High	Retain for uncontaminated and treated water
		Discharge to Sewers	High	High	High	High	Retain

[a] Process options were evaluated relative to only other process options within the same remedial technology according to the following:
Ability to achieve remedial action objectives.
Long Term Effectiveness:
1) Performance of the remediation
2) Magnitude of the remaining risk
3) Adequacy of controls
4) Reliability of controls
Short Term Effectiveness:
1) Protection of the community during remedial actions
2) Environmental impacts
3) Time until remedial objectives are achieved
4) Protection of workers during remedial actions
Implementability:
1) Technical feasibility
2) Administrative feasibility

[b] N/A = Evaluative ranking not applicable either because only one option exists for the technology or because the options were not comparable. See text for details.

Note that all of the above process options may be incorporated into alternatives during detailed design.

included as part of the remedial action at the site for those technology types which are part of the selected alternative.

4.4.1 TECHNOLOGY/PROCESS OPTIONS FOR LANDFILL SOLIDS/SOILS AND SEDIMENTS

General descriptions of the technologies, appropriate comments and their technical implementability are provided in Table 4.3-1. This section provides a brief summary of these options and provides justification for eliminating certain technologies.

4.4.1.1 No Action

The "no action" response allows for conditions to remain status quo, that is, no remedial actions are taken at the site. This option typically includes long-term monitoring and is maintained as a potential response action throughout the screening process.

4.4.1.2 Institutional Control Actions

Institutional controls represent general response actions that are intended to limit exposure to contaminated landfill solids, soils, and sediments. These actions include land use controls such as deed restrictions and removal of physical structures, and public education such as written warnings. Many of these actions have already been taken at the site and are also technically implementable.

Limited response actions, such as fencing, constitute a second category of remedial technologies and may be used alone for general site restrictions or as part of other remedial measures to reduce risks to public exposure. The Pfohl Brothers Landfill is currently fenced and this technology is technically implementable for future remediation also.

4.4.1.3 Containment Actions

Containment actions are intended to reduce dispersion and leaching of a hazardous substance to otherwise uncontaminated areas. Containment actions include placement of a constructed cap over the surface of the landfill, which minimizes exposure and reduces infiltration, and surface controls which alter surface runoff and evaporation at a site. As indicated in Table 4.3-1, all of the technologies under this category are technically implementable at the Pfohl Brothers landfill site.

The three capping technology process options present a large range in their ability to meet the criteria of achieving remedial action objectives, long-term effectiveness and short-term effectiveness. The native soil cap is the easiest to construct, so it ranks the highest in implementability and short-term effectiveness among the cap technologies in Table 4.4-1. The native soil cap, however, would also allow most of the water which currently infiltrates into the landfill to continue to do so. The production of contaminated landfill leachate and associated contamination of the alluvial aquifer would be expected to continue after this process option has been implemented. Although the amount of surface runoff is expected to be lower from the native soil cap than from the barrier caps, due to its higher infiltration characteristics, runoff from the native soil cap is likely to contain a large amount of sediment. The sediment would need to be removed before the surface runoff can be discharged to off-site streams, thus requiring construction of sediment detention basins.

The single and composite barrier caps would reduce infiltration through the landfill and sedimentation associated with surface runoff. Both barrier caps meet state capping regulations (6NYCRR, Part 360). The composite barrier cap is more difficult to construct and therefore receives a low rating for short-term effectiveness and implementation. The single barrier cap was selected as the preferred and representative process option for containment general response action capping technology.

The surface control technology process options are fairly easy to implement. Due to the large area the site covers and high annual rainfall, neither the revegetation nor grading process options would be effective in reducing infiltration. Neither process option would reduce exposure to contaminated landfill solids, so remedial action objectives would not be met. Revegetation is easier to implement than grading, so it has been retained as the representative and preferred process option for this technology type.

4.4.1.4 Removal Actions

The removal general response action consists of the technology type of excavation. Excavation is not implementable for the entire volume of landfill solids due to the thickness and depth of fill materials and shallow depth to water. Excavation has been retained, however, as an appropriate general response action for peripheral portions of the landfill where the fill materials are less thick. It is assumed that removal of localized landfill solids and soils containing high contaminant concentrations ("hot spots") is being undertaken separately, and therefore, will not be addressed in this evaluation.

4.4.1.5 Treatment Actions

This set of technology types consists of the collection, by excavation, of landfill solids and soils, as well as sediments, and subsequent treatment either at a facility located on-site or off-site. The remedial action categories of onsite and offsite treatment include biological (aerobic and anaerobic), stabilization/fixation, physical/chemical treatment and thermal treatment.

Due to the large quantity and heterogenous nature of the material in the Pfohl Brothers Landfill, source removal would require extensive excavation, handling and processing. Offsite treatment would also require handling and transport of the contaminated material, thereby creating a risk of exposure to the workers and general public. This technology type is, however, technically feasible. Therefore, the option of excavating the landfill and treating the soils and solids on or off site will be retained for further evaluation. Treatment of localized "hot spots" is being undertaken separately, and will therefore not be addressed in this evaluation.

Biological treatment, commonly referred to as bioremediation, is a process which uses soil microorganisms to chemically degrade organic constituents. Biodegradation can occur in the presence of oxygen (aerobic) or in the absence of oxygen (anaerobic). Available data suggest that halogenated aliphatic compounds, non-halogenated organic compounds, and nitrated compounds are treated successfully using this technology. However, this technology type has no record of demonstrated effectiveness in treating PCBs, dioxins or furans. In addition, bioremediation processes are not suitable for the treatment of wastes with high levels of metals, such as those found at the PBL site and were, therefore, not retained for further evaluation.

Stabilization/fixation is a physical/chemical process in which a stabilizing material is added to a liquid or semi-liquid waste to produce a solid. In general, this technology has been successful in immobilizing volatile metals and non-volatile metals in full-scale systems. Significant reductions in mobility of the leachate have not been demonstrated for many organic compounds. Stabilization has been most successfully demonstrated on PAHs, where 99% reduction in mobility has been achieved. This technology type is therefore considered technically implementable for metals and some organics at the site, and has been retained for further consideration.

Thermal treatment is a very effective technology type for treating organic and inorganic contaminants through the application of heat. With the exception of polar aromatic compounds (i.e., chlorinated phenols and methoxychlor) this process generally achieves a removal efficiency of greater than 98%. Thermal treatment does not destroy volatile metals, such as lead and mercury, or non-volatile metals, such as iron and chromium. Several process options such as rotary kiln, multiple hearth, circulating fluidized bed, pyrolysis, infrared thermal treatment, supercritical water oxidation, vitrification and low temperature thermal desorption options are included in this category. Among these, pyrolysis and super critical water oxidation technologies are considered to be technically unimplementable for this site.

Physical and chemical treatment technologies, such as air stripping, soil washing and dechlorination represent another technology type which is potentially applicable to contaminants at the site. Air stripping is a process used to transfer volatile contaminants in water or soil to the gaseous phase. It is less effective in removing the heavier, less volatile compounds, such as PAHs, in the soils and is, therefore, not technically implementable on this site.

Soil washing as described in Table 4.3-1 is considered to be technically implementable at this site. Dechlorination is a destruction process which uses a chemical reaction to remove chlorine atoms in chlorinated molecules, thus converting more toxic compounds to less toxic, more soluble products. Transformation of these chemicals in the soil facilitates their removal and subsequent treatment. This process option is not expected to treat volatile and non-volatile metals. To date, no full-scale soil treatment programs have been undertaken using dechlorination, especially for mixed debris encountered at landfills. Because of the clayey nature of the soils at the PBL site and the type of contaminants present, this technology would not be technically implementable and is eliminated from further evaluation.

Insitu treatment is a subset of the treatment general response action which contains a large number of technology type/process options, so has been presented separately for discussion purposes. This includes physical/chemical or biological treatment technologies that are used to treat contaminants in soils, solids and sediments without having to excavate these materials. The category of physical/chemical treatment includes physical and chemical vapor extraction, microwave heating, vitrification, soil flushing, and photolysis. These technologies are not appropriate for conditions at the Pfohl Brothers site primarily because of the heterogenous mixture of the waste material and lack of proven effectiveness in landfill media. Soil flushing technology would be impractical because the mixture of waste material would require the application of a variety of surfactants to remove all the contaminants. Effective removal could not be accomplished because the presence of trash and demolition debris would preclude an even distribution of the solution. For these reasons, all physical/chemical insitu treatment technologies are considered to be technically unimplementable at this site and are not considered further.

Insitu biological treatment includes aerobic and anaerobic treatment technologies. Because of the limited application and lack of demonstrated performance for these technologies for mixed debris at this landfill, biological processes are technically unimplementable and are also eliminated from further evaluation.

4.4.1.6 Disposal Actions

The disposal general response action includes transport offsite to either a RCRA subtitle C or RCRA subtitle D facility, or construction of an onsite containment facility. Onsite disposal may include excavation of portions of the landfilled material. The radioactive and/or dioxin-contaminated landfill solids and soils may have to be separated prior to offsite disposal and disposed of separately. Dioxin contaminated soils may not be able to be disposed of offsite due to EPA Land Ban restrictions. All are considered technically implementable and are retained for further evaluation.

4.4.2 TECHNOLOGY/PROCESS OPTIONS FOR GROUND WATER AND LEACHATE

Several general response actions were identified for ground water and leachate remediation, as discussed in Section 4.1. A set of technology types and process options was evaluated based on the general remedial actions. These actions ranged from "no action" to collection and treatment. General descriptions of technologies, types, and process options, appropriate comments, and initial screening based on their technical implementability are provided in Table 4.3-2. This section provides a brief summary of the technology types and process options for each general response action and provides justification for additional screening.

4.2.2.1 No Action

The "no action" general response action allows for current conditions to remain as no remedial actions are taken at the site. This response action typically includes the technology type/process option of long-term monitoring, and is maintained as a potential response action throughout the screening process to provide a baseline condition upon which all of the other response actions are compared.

4.4.2.2 Institutional Control Actions

Institutional controls are implemented to control the exposure to contaminated or potentially contaminated ground water for drinking and domestic uses. Included are well permit regulation for new wells, inspection and sealing of existing wells in areas at risk of ground water contamination, point of use treatment and public education in the form of written warnings. All four institutional control options have been retained since they are sufficiently different and because each of these should be undertaken as part of this general response action.

4.4.2.3 Containment Actions

Containment general response actions are intended to reduce off-site migration of contaminated ground water. Technology types for containment of horizontal migration of contaminated ground water include hydraulic and physical containment. Hydraulic containment consists of the reversal of ground water gradients via pumping or passive drainfields. In aquifers with low hydraulic conductivity, drainfields are more effective than wells in intercepting groundwater. However, installation of drainfields through waste materials may pose considerable difficulties and would require extreme health and safety precautions during installation. In addition, in order to completely intercept alluvial ground water leaving the site, the drainfields would need to be installed near the base of the alluvial aquifer. The shallow depth to water creates additional construction difficulties. Physical containment consists of barriers such as a slurry wall, grout curtain, or sheet piling. The physical containment technologies considered for use at the site each extend from the ground surface to the base of the alluvial aquifer. Their continuous nature provides physical containment of contaminants migrating laterally in both the aqueous and gaseous phases. Lateral containment of gaseous phase contaminants, if present at the site, provides an extra degree of protection to offsite uncontaminated areas that does not exist with the hydraulic containment technology process options. The grout curtain, sheet piling, bottom sealing and extraction well process options of containment are more difficult to implement and less effective than other options, and so these have not been carried forward.

4.4.2.4 Collection Actions

The collection general response action for ground water and leachate consists of two hydraulic collection technology process options. These process options, passive drainfields and extraction wells, are similar to the process options described for the ground water/leachate hydraulic containment technology. Unlike the hydraulic containment process options, the hydraulic collection technology process options do not need to completely intercept the water that flows in the vicinity of the collection system. Hydraulic collection technologies are most appropriate for maintaining water levels below a specified elevation, such as in dewatering systems, or for collecting separate-phase contaminants that may be present at the top or bottom of an aquifer.

The drainfields are most effective in collecting floating contaminants and in uniformly decreasing the water table surface at the location of the drainfield. The groundwater extraction wells would be easier to install through the landfill solids, and are more effective than the drainfields in decreasing the water table surface over a larger geographical area. Both options are retained, as the drainfields could be used for near surface collection.

4.4.2.5 Treatment Actions

This general response action includes technology types that collect the ground water and subsequently treat it at an on-site facility. Technology type categories include biological (aerobic and anaerobic) and physical/chemical. On-site treatment involves construction of an on-site facility or use of a mobile treatment unit.

Biological treatment has been discussed in Section 4.4.1.5 Compounds which can be treated by this technology type are the halogenated aliphatic compounds, the nonhalogenated organic compounds, and the nitrated compounds. PCBs, dioxins, and furans have proven recalcitrant to biotreatment. Thus, biological treatment technologies were not retained for further evaluation.

Physical/chemical treatment process options physically separate contaminants from the aqueous waste stream by precipitation, absorption, ion exchange, filtration, or vapor extraction. In general, different process options are required for removal of organics and inorganics. Treatment options for removal of inorganics include coagulation/flocculation followed by filtration, ion exchange, precipitation, and/or sedimentation. Physical/chemical process options for removal of organics include activated carbon followed by a polishing step using UV/Hydrogen Peroxide/Ozone reactors. These process options were retained for further analysis.

A variety of physical/chemical treatment process options were not retained. Air stripping and low temperature stripping do not effectively remove the less volatile compounds, such as PAHs. Electrochemical separation of metals from aqueous waste streams has not been tested on a full-scale basis. Reverse osmosis for removal of both organic and inorganic contaminants has potential problems with clogging of the membrane, large wastewater sidestreams and high maintenance requirements.

4.4.2.6 Disposal/Discharge Actions

Treated and untreated water that is collected at the site can be disposed of via reinjection or recharge to ground water, discharge to on- or off-site surface water bodies, or discharge to the municipal Publicly Owned Treatment Works (POTW) sewer system. Recharge and reinjection process options are usually more effective when the source of contamination has been removed or isolated, the depth to ground water is great and the aquifer media receiving the recharge water has a relatively high hydraulic conductivity. Since removal of source materials will not be undertaken, the depth to water is so shallow, and the alluvial materials contain many low permeability deposits, reinjection or recharge to ground water is not practical, either on or off site. Due to the proximity of surface water bodies (Ellicott Creek, Aero Creek, and Aero Lake) and POTW lines to the site, the option of discharging to surface water bodies and/or to the Buffalo POTW system has been retained.

4.5 SUMMARY OF SCREENING PROCESS

Table 4.5-1 summarizes the technologies and process options that are retained for remedial action alternative development. These technologies/process options were evaluated as technically implementable in Section 4.3 and in Section 4.4 were rated the highest, relative to other process options within each technology type, when evaluated against the four evaluation criteria: ability to meet remedial action objectives; short-term effectiveness; long-term effectiveness; and implementability.

Table 4.5-1

PFOHL BROTHERS LANDFILL FEASIBILITY STUDY
SUMMARY OF REPRESENTATIVE PROCESS OPTIONS
RETAINED FOR ALTERNATIVES DEVELOPMENT

Landfill Solids/Soil and Sediment

No Action

Monitoring

Institutional Monitoring Controls

Deed and Land Use Zoning Restrictions
Fencing, Written Warnings

Containment

Single Barrier Cap
Revegetation Surface Control, Grading

Removal

Excavation

Disposal

RCRA Subtitle D Off-Site Disposal
RCRA Subtitle C Off-Site Disposal
On-Site Disposal

Ground Water and Leachate

No Action

Monitoring

Institutional Control

Well Permit Regulation, Well Inspections/Sealing
Point of Use Treatment

Table 4.5-1 (continued)

PFOHL BROTHERS LANDFILL FEASIBILITY STUDY
SUMMARY OF REPRESENTATIVE PROCESS OPTIONS
RETAINED FOR ALTERNATIVES DEVELOPMENT

Containment

Drainfield Hydraulic Control
Slurry Wall, and Capping Physical Control

Collection

Passive Drainfield Hydraulic Collection
Extraction Well Hydraulic Collection

Treatment

Activated Carbon Physical/Chemical Treatment for Organics
Coagulation/Flocculation Physical/Chemical Treatment for Inorganics
Filtration Physical/Chemical Treatment for Inorganics
Ion Exchange Physical/Chemical Treatment for Inorganics
Precipitation Physical/Chemical Treatment for Inorganics
Sedimentation Physical/Chemical Treatment for Inorganics
UV/Hydrogen Peroxide/Ozone Reactors Physical/Chemical Treatment for Polishing

Disposal

On- and Off-Site Discharge to Surface Water
Off-Site Discharge to POTW

APPENDIX B

APPENDIX B

LIST OF TABLES

LIST OF TABLES (Cont'd)

TABLE 2-1

SAMPLING AND ANALYSIS DATA SUMMARY
PFOHL BROTHERS LANDFILL, CHEEKTOWAGA, NEW YORK

MEDIUM	PHASE I SAMPLING DATA 4/89 - 12/89					SUPPLEMENTAL SAMPLING DATA 6/90 - 12/90				
DATA EVALUATED IN QUANTITATIVE RISK ASSESSMENT	VOCs	SVOCs	Pests/PCBs	Metals	Dioxins/Furans	VOCs	SVOCs	Pests/PCBs	Metals	Dioxins/Furans
Surface Soils										
Area B								5	5	5 (2,3,7,8-TCDD and TCDF)
Residential								14	14	14 (isomer-specific)
On-site Truck Repair										1 (isomer-specific)
Sediments										
Leachate Seep Sediments	19	19	19	19	18 (2,3,7,8-TCDD)					
Aero Lake Sediments	3	3	3	3	3 (2,3,7,8-TCDD)					
Aero Creek Sediments						17	17	17	2	8 (isomer-specific) 17 (2,3,7,8-TCDD and TCDF)
Drainage Ditch Sediments	12	12	11-17	11	10 (2,3,7,8-TCDD)					
Area C Marsh					1 (2,3,7,8-TCDD)	5	5	5		5 (isomer-specific)
Ellicott Creek Sediments	3	3		3	3 (2,3,7,8-TCDD)	5	5	5	5	4 (2,3,7,8-TCDD and TCDF)

TABLE 2-1 (Cont'd)

SAMPLING AND ANALYSIS DATA SUMMARY
PFOHL BROTHERS LANDFILL, CHEEKTOWAGA, NEW YORK

MEDIUM	PHASE I SAMPLING DATA 4/89 - 12/89					SUPPLEMENTAL SAMPLING DATA 6/90 - 12/90				
DATA EVALUATED IN QUANTITATIVE RISK ASSESSMENT	VOCs	SVOCs	Pests/PCBs	Metals	Dioxins/Furans	VOCs	SVOCs	Pests/PCBs	Metals	Dioxins/Furans
Surface Water										
Leachate Seeps	19-38	19	19	19						
Aero Lake	3	3	2	3	3 (2,3,7,8-TCDD)					
Ellicott Creek	1	1		1	3	7	7	7	7	
Drainage Ditch	11	11	11	10	10 ((2,3,7,8-TCDD)					
Groundwater										
Unconsolidated	25-90	11-26	21	26	17 (2,3,7,8-TCDD)	5				
Bedrock	12	10	10	11	7 (2,3,7,8-TCDD)					

TABLE 2-1 (Cont'd)

SAMPLING AND ANALYSIS DATA SUMMARY
PFOHL BROTHERS LANDFILL, CHEEKTOWAGA, NEW YORK

MEDIUM	PHASE I SAMPLING DATA 4/89 - 12/89					SUPPLEMENTAL SAMPLING DATA 6/90 - 12/90				
DATA EVALUATED IN QUALITATIVE RISK ASSESSMENT	VOCs	SVOCs	Pests/PCBs	Metals	Dioxins/Furans	VOCs	SVOCs	Pests/PCBs	Metals	Dioxins/Furans
Surface Soil										
Aero Path								8	8	8 (isomer-specific)
Fish[(a)]										
Ellicott Creek										
Amherst			13							
Bowmansville			9					3	1(Hg)	
Airport								6	1(Hg)	
Tributary 11B								4	1(Hg)	
Aero Lake			13					5	1(Hg)	
Other										
Residential Sump						6	6	6	6	
Basement Floor								3	3	

TABLE 2-1 (Cont'd)

SAMPLING AND ANALYSIS DATA SUMMARY
PFOHL BROTHERS LANDFILL, CHEEKTOWAGA, NEW YORK

MEDIUM	PHASE I SAMPLING DATA 4/89 - 12/89					SUPPLEMENTAL SAMPLING DATA 6/90 - 12/90				
DATA EVALUATED IN SUPPORT OF RISK ASSESSMENT(b)	VOCs	SVOCs	Pests/PCBs	Metals	Dioxins/Furans	VOCs	SVOCs	Pests/PCBs	Metals	Dioxins/Furans
Subsurface Soils										
Area A	2	6	6	6						
Area B										
(on-site)	21	21	21	23						
(off-site)	6	6	-	6						
Area C										
(on-site)	15	15	15	15						
(off-site)	1	1	1	1						
Drums										
Ruptured Drums	6	6	6	6						
Exposed Drums	3	3	-	3						
Buried Drums	3	3	-	3						
Test Pits										
Area B	6	5	5	5						
Area C	1	1	1	1						

(a) Phase I Fish Data collected 7/87-8/87.

(b) These data were not evaluated in qualitative or quantitative risk assessment as exposure to subsurface soils, drums and test pit materials is believed to be unlikely.

TABLE 2-2 (Cont'd)

CHEMICALS DETECTED IN ALL MEDIA

PFOHL BROTHERS LANDFILL, CHEEKTOWAGA, NEW YORK

CHEMICALS	SOILS: LAND-FILL SOILS	SOILS: RESI-DENTIAL SOILS	SOILS: AERO PATH SOILS	SEDIMENTS: AERO LAKE	SEDIMENTS: ELLICOTT CREEK	SEDIMENTS: DRAINAGE DITCHES	SURFACE WATER: AERO LAKE	SURFACE WATER: ELLICOTT CREEK	SURFACE WATER: DRAINAGE DITCHES	SURFACE WATER: LEA-CHATE SEEPS	GROUNDWATER: UNCON-SOLIDATED AQUIFER	GROUNDWATER: BEDROCK AQUIFER	FISH	RESI-DENTIAL SUMP	BASE-MENT FLOORS
Bis-(2-Ethylhexyl)-phthalate	X			X	X	X	X	X		X	X	X			
Dimethyl phthalate						X									
Di-n-octyl phthalate						X			X	X	X				
Di-n-butyl phthalate	X					X		X			X				
Diethyl phthalate	X				X	X									
Butyl benzyl phthalate	X					X					X				
N-Nitrosodiphenylamine						X				X					
PAHs (carcinogenic)	X				X	X				X					
PAHs (non-carcinogenic)	X				X	X				X					
PESTICIDES/PCBs															
Aldrin	X									X		X			
Beta-BHC	X					X									
Chlordane	X					X							X		
Dieldrin	X									X			X		
DDD	X									X			X		
DDT						X							X		
DDE													X		
Endrin										X			X		
Endosulfan II										X	X				
Heptachlor epoxide													X		
Hexachlorobenzene													X		
Mirex													X		
Transnonachlor													X		
Aroclor-1016													X		
Aroclor-1221	X												X		
Aroclor-1232											X				
Aroclor-1248	X														
Aroclor-1254	X												X		
Aroclor-1242						X									
Aroclor-1260													X		

TABLE 2-2

CHEMICALS DETECTED IN ALL MEDIA
PFOHL BROTHERS LANDFILL, CHEEKTOWAGA, NEW YORK

CHEMICALS	SOILS			SEDIMENTS			SURFACE WATER				GROUNDWATER				
	LAND-FILL SOILS	RESI-DENTIAL SOILS	AERO PATH SOILS	AERO LAKE	ELLICOTT CREEK	DRAINAGE DITCHES	AERO LAKE	ELLICOTT CREEK	DRAINAGE DITCHES	LEA-CHATE SEEPS	UNCON-SOLIDATED AQUIFER	BEDROCK AQUIFER	FISH	RESI-DENTIAL SUMP	BASE-MENT FLOORS
VOLATILES															
Acetone	X			X	X	X			X						
Benzene						X				X	X	X			
2-Butanone				X											
Chlorobenzene	X				X	X			X	X	X				
Chlorethane										X	X	X			
4-Chloro-3-methylphenol						X									
1,2-Dichlorobenzene	X					X			X	X	X				
1,3-Dichlorobenzene	X									X	X				
1,4-Dichlorobenzene	X					X				X	X				
1,1-Dichloroethane										X	X	X			
1,1-Dichloroethene											X				
1,2-Trans-dichloroethane									X	X		X			
Ethylbenzene										X					
Methylene Chloride	X			X		X									
1,1,1-Trichloroethane											X				
Trichloroethene	X				X					X				X	
Toluene											X	X			
Xylenes											X				
SEMIVOLATIES															
Benzoic Acid	X									X	X	X			
2-Chlorophenol											X				
2,4-Dimethylphenol									X	X	X				
2-Methylphenol											X				
4-Methylphenol											X				
Phenol						X			X	X	X	X			
Dibenzofuran	X					X				X	X				

TABLE 2-2 (Cont'd)

CHEMICALS DETECTED IN ALL MEDIA

PFOHL BROTHERS LANDFILL, CHEEKTOWAGA, NEW YORK

CHEMICALS	SOILS			SEDIMENTS			SURFACE WATER				GROUNDWATER				
	LAND-FILL SOILS	RESI-DENTIAL SOILS	AERO PATH SOILS	AERO LAKE	ELLICOTT CREEK	DRAINAGE DITCHES	AERO LAKE	ELLICOTT CREEK	DRAINAGE DITCHES	LEA-CHATE SEEPS	UNCON-SOLIDATED AQUIFER	BEDROCK AQUIFER	FISH	RESI-DENTIAL SUMP	BASE-MENT FLOORS
INORGANICS															
Aluminum	X			X	X	X	X	X	X	X	X	X		X	X
Antimony					X	X					X	X			
Arsenic	X	X	X	X	X	X			X	X	X	X			
Barium	X	X	X	X	X	X	X	X	X	X	X	X		X	X
Beryllium	X			X	X	X			X	X	X				
Cadmium	X	X	X	X	X	X	X	X	X	X	X	X			
Calcium	X			X	X	X	X	X	X	X	X	X		X	X
Chromium	X	X	X	X	X	X				X	X	X			
Cobalt	X			X	X	X			X	X	X	X			
Copper	X	X	X	X	X	X	X	X	X	X	X	X		X	X
Iron	X			X	X	X	X		X	X	X	X		X	X
Lead	X	X	X	X	X	X	X	X	X	X	X	X			X
Magnesium	X			X	X	X	X	X	X	X	X	X		X	X
Manganese	X	X	X	X	X	X	X	X	X	X	X	X		X	X
Mercury	X	X	X		X	X	X			X	X	X	X		
Nickel	X			X	X	X			X	X	X	X		X	X
Potassium	X			X		X	X	X	X	X				X	X
Selenium	X	X				X				X	X	X			
Silver	X									X	X	X	X		
Sodium	X			X	X	X	X	X	X	X	X	X		X	X
Thallium	X														
Vanadium	X			X	X	X			X	X	X	X			X
Zinc	X	X	X	X	X	X	X	X	X	X	X	X		X	X
Cyanide	X					X				X	X			X	X
Dioxins/Furans	X	X	X		X	X									

TABLE 2-3

CHEMICALS DETECTED IN SOIL BORINGS FROM AREA A
PFOHL BROTHERS LANDFILL, CHEEKTOWAGA, NEW YORK

CHEMICALS	FREQUENCY OF DETECTION (a)	RANGE OF DETECTED CONCENTRATIONS (b)
VOLATILES		
Acetone	2/2	5 - 18
Methylene Chloride	2/2	25 - 35
SEMIVOLATILES		
Bis(2-ethylhexyl)-phthalate	1/5	3,008
Acenaphthene	1/6	75
Anthracene	2/6	72 - 320
Benzo(a)anthracene	2/6	99 - 940
Benzo(b)fluoranthene	2/6	170 - 610
Benzo(k)fluoranthene	1/6	400
Benzo(g,h,i)perylene	2/6	68 - 230
Benzo(a)pyrene	2/6	92 - 390
Chrysene	2/6	150 - 600
Dibenz(a,h)anthracene	1/6	31
Fluoranthene	3/6	160 - 910
Indeno(1,2,3-cd)pyrene	2/6	65 - 270
Naphthalene	1/6	120
Phenanthrene	3/6	230 - 350
Pyrene	3/6	110 - 940
PESTICIDES/PCBs	0/6	--
INORGANICS		
Aluminum	6/6	4,620 - 11,600
Antimony	2/6	13.4 - 20.3
Arsenic	6/6	2.2 - 3.8
Barium	6/6	35.4 - 93.5
Beryllium	2/6	0.39 - 0.44
Cadmium	0/6	-
Calcium	6/6	43,200 - 121,000
Chromium	6/6	6.5 - 16.0
Cobalt	6/6	3.1 - 8.0
Copper	6/6	13.9 - 21.3
Iron	6/6	7,920 - 18,700
Lead	6/6	10 - 49.1
Magnesium	6/6	13,400 - 60,000
Manganese	6/6	339 - 667
Mercury	2/6	0.31 - 0.71
Nickel	6/6	4.5 - 17.4
Potassium	6/6	769 - 2,190
Selenium	0/6	-
Silver	0/6	-
Sodium	6/6	161 - 263
Thallium	0/6	-
Vanadium	6/6	10.6 - 21.6
Zinc	6/6	50.1 - 97.2
Cyanide	0/6	-

a. The frequency of detection is the number of times the chemical was detected over the number of samples analyzed for that parameter (this does not include the data that were rejected).

b. Organics are in ug/kg and inorganics and in mg/kg.

TABLE 2-4

CHEMICALS DETECTED IN SOIL BORINGS IN AREA B
PFOHL BROTHERS LANDFILL, CHEEKTOWAGA, NEW YORK

CHEMICALS	FREQUENCY OF DETECTION (a)	RANGE OF DETECTED CONCENTRATIONS (b)
VOLATILES		
Acetone	12/21	21 - 950
Benzene	2/21	52 - 3,700
Chlorobenzene	4/21	18 - 2,200
Chloroethane	1/21	75
1,1-Dichloroethane	2/21	110 - 2,100,000
1,1-Dichloroethene	1/21	910,000
1,2-Dichlorethene	1/21	4,600
Ethylbenzene	6/21	590 - 89,000
Methylene Chloride	3/21	12 - 690
Tetrachloroethene	1/21	31,000
Toluene	3/21	12 - 15,000
1,1,1-Trichloroethane	3/21	620 - 83,000,000
1,1,2-Trichloroethane	1/21	28,000
Trichloroethene	2/21	31 - 30,000
Xylenes	8/21	7 - 350,000
SEMIVOLATILES		
Benzoic Acid	1/18	1,800
2,4-Dimethylphenol	2/18	65,000 - 110,000
2-Methylphenol	1/18	4,400
4-Methylphenol	1/18	36,000
Phenol	2/18	1,800 - 150,000
Dibenzofuran	5/21	150 - 1,900,000
bis(2-Ethylhexyl)-phthalate	7/21	120 - 100,000
Butyl benzyl phthalate	4/7	140 - 31,000
Diethylphthalate	1/21	150
Acenaphthene	1/7	210
Antracene	3/7	150 - 1,900
Benzo(a)anthracene	4/21	550 - 24,000
Benzo(b)fluoranthene	4/21	480 - 32,000
Benzo(g,h,i)perylene	1/21	300
Benzo(a)pyrene	2/21	510 - 21,000
Chrysene	3/21	460 - 25,000
Fluoranthene	8/21	140 - 67,000
Fluorene	1/21	160
Indeno(1,2,3-cd)pyrene	1/21	390
Naphthalene	3/21	340 - 7,500
Phenanthrene	8/21	5 - 32,000
Pyrene	8/21	150 - 49,000
2-Methylnaphthalene	1/21	9,900
PESTICIDES/PCBs		
Aldrin	1/21	6.9

TABLE 2-4
(continued)

CHEMICALS DETECTED IN SOIL BORINGS IN AREA B
PFOHL BROTHERS LANDFILL, CHEEKTOWAGA, NEW YORK

CHEMICALS	FREQUENCY OF DETECTION (a)	RANGE OF DETECTED CONCENTRATIONS (b)
g-Chlordane	1/21	4.8
DDE	1/21	560
DDT	3/20	30 - 320
Dieldrin	1/21	210
Endrin	1/20	220
Aroclor 1242	1/21	3,700
INORGANICS		
Aluminum	22/23	1,700 - 16,500
Antimony	0/23	-
Arsenic	22/22	0.77 - 29.7
Barium	23/23	12.6 - 5,080
Beryllium	14/23	0.06 - 1.4
Cadmium	3/23	1.5 - 5.5
Calcium	21/21	3,190 - 74,700
Chromium	23/23	4.7 - 82.8
Cobalt	23/23	0.99 - 44.6
Copper	23/23	11.5 - 573
Iron	23/23	5,400 - 104,000
Lead	23/23	10 - 633
Magnesium	23/23	1,070 - 27,300
Manganese	23/23	146 - 728
Mercury	10/23	0.14 - 1.3
Nickel	22/23	5.6 - 193
Potassium	23/23	189 - 3,560
Selenium	4/23	0.62 - 2.0
Silver	6/23	1.7 - 11.2
Sodium	23/23	174 - 837
Thallium	5/23	0.24 - 0.34
Vanadium	21/23	6.1 - 31.0
Zinc	22/22	63.2 - 1,000
Cyanide	3/19	0.74 - 1.3

a. The frequency of detection is the number of times the chemical was detected over the number of samples analyzed for that parameter (this does not include data that were rejected).

b. Organics are in ug/kg and inorganics are in mg/kg.

File: PRASBB

TABLE 2-5

CHEMICALS DETECTED IN SOIL BORINGS OFFSITE - AREA B
PFOHL BROTHERS LANDFILL, CHEEKTOWAGA, NEW YORK

CHEMICALS	FREQUENCY OF DETECTION (a)	RANGE OF DETECTED CONCENTRATIONS (b)
Volatiles		
Acetone	5/6	55- 220
2-Butanone	1/6	25
Methylene Chloride	4/6	6 - 19
4-Methyl-2-Pentanone	1/6	4
Toluene	2/6	1 - 3
Semivolatiles		
Bis(2-ethylhexyl)-phthalate	5/6	140 - 1,500
Inorganics		
Aluminum	6/6	4240 - 13100
Antimony	4/6	4.6 - 8.6
Arsenic	6/6	1.6 - 4.9
Barium	6/6	38.8 - 94.7
Beryllium	6/6	0.17 - 0.59
Cadmium	0/6	-
Calcium	6/6	65400 - 78300
Chromium	6/6	4.5 - 16.3
Cobalt	6/6	4.3 - 11.1
Copper	4/4	13.9 - 17.6
Iron	6/6	7470 - 21400
Lead	6/6	11.9 - 20.8
Magnesium	6/6	23400 - 31900
Manganese	6/6	323 - 520
Mercury	2/6	0.17 - 0.22
Nickel	6/6	10.3 - 22.3
Potassium	6/6	801 - 3010
Selenium	0/6	-
Silver	0/3	-
Sodium	6/6	155 - 239
Thallium	0/6	-
Vanadium	6/6	11.2 - 25.2
Zinc	6/6	64 - 92.6
Cyanide	0/6	-

a. The frequency of detection is the number of times a chemical was detected over the number of samples analyzed for that parameter (this does not include data that were rejected).

b. Organics are in ug/kg and inorganics and in mg/kg.

File: PRASBBOS (10-14-90)

TABLE 2-6

CHEMICALS DETECTED IN SOIL BORINGS IN AREA C
PFOHL BROTHERS LANDFILL, CHEEKTOWAGA, NEW YORK

CHEMICALS	FREQUENCY OF DETECTION (a)	RANGE OF DETECTED CONCENTRATIONS (b)
VOLATILES		
Acetone	11/15	39 - 930
Carbon Disulfide	1/15	420
Methylene Chloride	11/13	7 - 200
Toluene	1/15	1
1,1,1-Trichloroethane	2/15	6 - 7
SEMIVOLATILES		
Phenol	3/15	310 - 3,300
Dibenzofuran	2/15	140 - 170
Bis(2-ethylhexyl)-phthalate	8/15	61 - 4,700
Benzo(a)anthracene	1/15	280
Benzo(b)fluoranthene	1/15	240
Benzo(a)pyrene	1/15	170
Chrysene	1/15	210
Fluoranthene	2/15	290 - 340
Indeno(1,2,3-cd)pyrene	1/15	95
Pyrene	2/15	310 - 340
PESTICDES/PCBs	0/15	--
INORGANICS		
Aluminum	15/15	2,570 - 14,900
Antimony	0/15	-
Arsenic	15/15	1.7 - 15.8
Barium	15/15	12.6 - 2,240
Beryllium	12/15	0.23 - 1.4
Cadmium	1/15	5.9
Calcium	15/15	7,150 - 71,400
Chromium	15/15	4.2 - 21.6
Cobalt	15/15	2.3 - 13.5
Copper	15/15	9.8 - 337
Iron	15/15	6,250 - 33,100
Lead	15/15	11.7 - 882
Magnesium	15/15	1,300 - 28,500
Manganese	15/15	202 - 508
Mercury	6/15	0.11 - 1.2
Nickel	15/15	7.4 - 34.8
Potassium	15/15	563 - 3,130
Selenium	2/15	0.59 - 2.0
Silver	1/15	2.40
Sodium	15/15	143 - 345
Thallium	1/15	0.45
Vanadium	15/15	8 - 36.6
Zinc	15/15	61.1 - 1,150
Cyanide	0/7	-

a. The frequency of detection is the number of times the chemical was detected over then number of smaples analyzed for that parameter (this does not include data that were rejected).

b. Organics are in ug/kg and inorganics and in mg/kg.

File: PRASBC (10-12-90)

TABLE 2-7

CHEMICALS DETECTED IN SOIL BORINGS OFFSITE - AREA C
PFOHL BROTHERS LANDFILL, CHEEKTOWAGA, NEW YORK

CHEMICALS	FREQUENCY OF DETECTION (a)	RANGE OF DETECTED CONCENTRATIONS (b)
VOLATILES		
Methylene Chloride	1/1	7
SEMIVOLATILES		
Bis(2-ethylhexyl)-phthalate	1/1	150
Fluoranthene	1/1	190
PESTICIDES/PCBs		
DDT	1/1	35
INORGANICS		
Aluminum	1/1	4,200
Antimony	0/1	-
Arsenic	1/1	3.7
Barium	1/1	29.3
Beryllium	1/1	0.24
Cadmium	0/1	-
Calcium	1/1	55,400
Chromium	1/1	7.3
Cobalt	1/1	3.9
Copper	1/1	7.8
Iron	1/1	7,770
Lead	1/1	18.5
Magnesium	1/1	21,800
Manganese	1/1	321
Mercury	1/1	0.37
Nickel	1/1	6.1
Potassium	1/1	1,270
Selenium	0/1	-
Silver	0/1	-
Sodium	1/1	169
Thallium	0/1	-
Vanadium	1/1	11.6
Zinc	1/1	78.1
Cyanide	0/1	-

a. The frequency of detection is the number of times the chemical was detected over the number of samples analyzed for that parameter (this does not include data that was rejected).

b. Organics are in ug/kg and inorganics and in mg/kg.

File: PRASCBOS (10-14-90)

TABLE 2-8

CHEMICALS DETECTED IN RUPTURED DRUMS
PFOHL BROTHERS LANDFILL, CHEEKTOWAGA, NEW YORK

CHEMICALS	FREQUENCY OF DETECTION (a)	RANGE OF DETECTED CONCENTRATIONS (b)
VOLATILES		
Acetone	2/6	11,000 - 79,600
Bromodichloromethane	1/6	1350
2-Butanone	4/6	159,000 - 169,000
Chlorobenzene	3/6	920 - 6940
Chloroform	1/6	1160
1,2-Dichlorobenzene	2/6	12,100 - 16,300
1,4-Dichlorobenzene	2/6	12,100 - 16,300
Methylene Chloride	1/6	2570
Toluene	4/6	1,450 - 9,300
Xylenes	2/6	18,000 - 25,000
SEMIVOLATILES		
Benzoic Acid	1/6	143,000
2-Methylphenol	3/6	498,000 - 1,100,000
4-Methylphenol	2/6	69,200 - 165,000
Phenol	5/6	22,000 - 27,000,000
Dibenzofuran	4/6	56,000 - 97,000
Bis(2-Ethylhexyl)-phthalate	1/6	69,200
Butyl benzyl phthalate	1/6	63,800
Di-n-butyl phthalate	3/6	3310 - 35,000
Di-n-octyl phthalate	1/6	18,600
N-Nitrosodiphenylamine	1/6	143,000
Anthracene	4/6	8,100 - 25,400
Fluoranthene	1/6	240 - 3,440
Naphthalene	1/6	1,300
Phenanthrene	6/6	85 - 27,500
Pyrene	1/6	3710
PESTICIDES/PCBs		
alpha-BHC	1/6	4,700
DIOXINS/FURANS	(e)	(e)
INORGANICS		
Aluminum (c)	5/5	70 - 2,010
Antimony	1/6	39.2
Arsenic	5/6	0.56 - 15.3
Barium	3/6	14 - 2,820
Beryllium	1/6	0.17
Cadmium	2/6	2.5 - 3.1
Calcium (c)	5/5	110 - 2,280
Chromium	6/6	13 - 39.3
Cobalt (d)	2/2	15.1 - 22.7
Copper	2/6	171 - 343
Iron	6/6	3,300 - 56,500
Lead	4/6	11 - 3,180

TABLE 2-8
(continued)

CHEMICALS DETECTED IN RUPTURED DRUMS
PFOHL BROTHERS LANDFILL, CHEEKTOWAGA, NEW YORK

CHEMICALS	FREQUENCY OF DETECTION (a)	RANGE OF DETECTED CONCENTRATIONS (b)
Magnesium	4/6	48 - 541
Manganese	6/6	16 - 243
Mercury (d)	2/2	0.53 - 0.65
Nickel	3/6	4.2 - 59.8
Potassium (d)	2/2	205 - 402
Selenium (d)	1/2	0.72
Silver	4/6	1.0 - 2.1
Sodium	6/6	30 - 14,900
Vanadium	2/2	2.5 - 4.3
Zinc	2/6	30 - 2,030
Cyanide	2/6	1.2 - 2.8

a. The frequency of detection is the number of times the chemical was detected over the number of samples analyzed for that parameter (this does not include data that were rejected).

b. Organics are in ug/kg and inorganics and in mg/kg.

c. This compound was rejected in one sample.

d. Based on the data provided, it is assumed that four of these samples were not analyzed for these inorganics.

e. See Draft Remedial Investigation Report for dioxin/furan data.

TABLE 2-9

CHEMICALS DETECTED IN THE EXPOSED DRUMS
PFOHL BROTHERS LANDFILL, CHEEKTOWAGA, NEW YORK

CHEMICALS	FREQUENCY OF DETECTION (a)	RANGE OF DETECTED CONCENTRATIONS (b)
VOLATILES		
Acetone	1/3	420,000
Methylene Chloride	1/2	12,000
Xylenes	1/3	6200
SEMIVOLATILES		
Phenol	1/3	2,600,000
Dibenzofuran	1/3	1,800,000
Diethylphthalate	1/3	129
Acenaphthene	1/3	130
Anthracene	2/3	590 - 84,000
Benzo(a)anthracene	2/3	1,300 - 140,000
Benzo(b)fluoranthene	2/3	2,100 - 190,000
Benzo(g,h,i)perylene	1/3	410
Benzo(a)pyrene	2/3	1,400 - 120,000
Cyrsene	2/3	1,400 - 170,000
Dibenz(a,h)anthracene	1/3	200
Fluoranthene	2/3	3,400 - 390,000
Fluorene	2/3	130 - 140,000
Indeno(1,2,3-cd)pyrene	1/3	570
Phenanthrene	2/3	1,600 - 350,000
Pyrene	2/3	2,100 - 270,000
DIOXINS/FURANS	(c)	(c)
INORGANICS		
Aluminum	3/3	9 - 2,120
Antimony	0/3	- -
Arsenic	2/3	0.65 - 1.2
Barium	3/3	1.1 - 51.9
Beryllium	0/3	- -
Cadmium	1/3	1.9
Calcium	3/3	42.4 - 12,000
Chromium	3/3	1.7 - 14.8
Cobalt	2/3	1.7 - 1.8
Copper	3/3	2.6 - 131
Iron	3/3	162 - 22,900
Lead	3/3	3 - 79
Magnesium	2/3	303 - 1,020
Manganese	2/3	51.4 - 134
Mercury	1/3	0.77
Nickel	2/3	11.1 - 14.4
Potassium	2/3	97.5 - 424
Selenium	1/3	0.52
Silver	1/3	1.9
Sodium	3/3	47.6 - 2,970
Vanadium	0/3	- -
Zinc	1/3	2.7
Cyanide	3/3	7.1 - 174

a. The frequency of detection is the number of times the chemical was detected over the number of samples analyzed for that parameter (this does not include data that were rejected).

b. Organics are in ug/kg and inorganics are in mg/kg.

c. See Draft Remedial Investigation Report for dioxin/furan data.

TABLE 2-10

CHEMICALS DETECTED IN BURIED DRUMS, WASTE AND STAINED SOIL
PFOHL BROTHERS LANDFILL, CHEEKTOWAGA, NEW YORK

CHEMICALS	FREQUENCY OF DETECTION (a)	RANGE OF DETECTED CONCENTRATIONS (b)
VOLATILES		
Acetone	11/38	150 - 11,000
Benzene	1/38	13
2-Butanone	3/38	26 -360
Carbon disulfide	1/38	63
Chlorobenzene	6/38	30 - 16,000
1,2-Dichlorobenzene	3/38	190 - 310
1,4-Dichlorobenzene	1/38	300
1,1-Dichloroethane	1/38	290
1,2-Dichlorethene	2/38	5 - 41,000
Ethylbenzene	11/38	38 - 310,000
Methylene chloride	19/38	19 - 140,000
Methyl-2-pentanone	1/38	240,000
Tetrachloroethene	2/38	47 - 22,000
Toluene	10/38	8 - 4,200,000
1,1,1-Trichloroethane	3/38	7 - 4900
Trichloroethene	1/38	150
Xylene	18/38	25 - 1,300,000
SEMIVOLATILES		
Benzyl alcohol	1/38	1000
2,4-Dimethylphenol	4/38	160 - 25,000
2-Methylphenol	2/38	190 - 120,000
4-Methylphenol	4/38	680 - 68,000
Pentachlorophenol	2/38	560 - 29,000
Phenol	16/38	8,500 - 4,000,000
Dibenzofuran	13/38	18 - 49,000,000
Bis(2-ethylhexyl)phthalate	12/38	4 - 28,000
Butyl benzyl phthalate	1/38	49,000
Di-n-butyl phthalate	1/38	170,000
Diethylphthalate	1/38	6,500
N-Nitrosodiphenylamine	1/38	5,900
2-Methylnaphthalene	8/38	12 - 230,000
Acenaphthene	2/38	2,500 - 36,000
Anthracene	2/38	4,000 - 17,000
Benzo(a)anthracene	4/38	1,900 - 11,000
Benzo(a)fluoranthene	4/38	3,000 - 12,000
Benzo(g,h,i)perylene	3/38	750 - 4,500
Benzo(a)pyrene	3/38	1,700 - 7,100
Chrysene	4/38	1,700 - 10,000
Fluoranthene	4/38	2,000 - 39,000
Fluorene	4/38	180 - 29,000
Indeno(1,2,3-cd)pynene	4/38	820 - 5,200
Naphthalene	12/38	3 - 150,000
Phenanthrene	3/38	150 - 86,000
Pyrene	4/38	2,000 - 11,000

TABLE 2-10
(continued)

CHEMICALS DETECTED IN BURIED DRUMS, WASTE AND STAINED SOIL
PFOHL BROTHERS LANDFILL, CHEEKTOWAGA, NEW YORK

CHEMICALS	FREQUENCY OF DETECTION (a)	RANGE OF DETECTED CONCENTRATIONS (b)
DIOXINS/FURANS	(c)	(c)
PESTICIDES/PCBs		
Aldrin	1/38	4,700
alpha-BHC	2/38	680 - 430,000
gamma-BHC	3/38	1,700 - 69,000
Dieldrin	1/38	1,700
Endrin	1/38	710
Heptachlor	1/38	1,900
Heptachlor epoxide	1/38	1,200
Methoxychlor	1/38	14,000
Aroclor-1242	2/38	7,500 - 13,000
Aroclor-1248	1/38	9,600,000
Aroclor-1254	2/38	8,700 - 420,000
Aroclor-1260	1/38	31,000
INORGANICS		
Aluminum	33/37	43.3-108,000
Antimony	0/37	- -
Arsenic	25/37	0.72-575
Barium	37/37	0.53-8,860
Beryllium	13/37	0.28-2.2
Cadmium	25/37	0.99-39.4
Calcium	31/37	48.5-216,000
Chromium	36/37	1.0-18,100
Cobalt	25/37	2.4-378
Copper	37/37	1.9-29,400
Iron	36/37	155-465,000
Lead	35/37	2.8-36,000
Magnesium	37/37	11.3-28,900
Manganese	36/37	6.1-445
Mercury	13/37	0.14-4.4
Nickel	27/37	4.1 - 445
Potassium	20/37	75.1 - 33,000
Selenium	8/37	0.5 - 39.2
Silver	12/37	0.92 - 11.9
Sodium	37/37	29.7 - 19,500
Thallium	3/37	0.33 - 1.9
Vanadium	20/37	1.7 - 106
Zinc	37/37	13.1 - 35,300
Cyanide	10/37	0.53 - 33.4

a. The frequency of detection is the number of times the chemical was detected over the number of samples analyzed for that parameter (this does not include data that were rejected).

b. Organics are in ug/kg and inorganics and in mg/kg.

c. See Draft Remedial Investigation Report for dioxin/furan data.

TABLE 2-11

CHEMICALS DETECTED IN TEST PITS IN AREA B
PFOHL BROTHERS LANDFILL, CHEEKTOWAGA, NEW YORK

CHEMICALS	FREQUENCY OF DETECTION (a)	RANGE OF DETECTED CONCENTRATIONS (b)
VOLATILES		
Acetone	1/6	640
2-Butanone	1/5	150
Chlorobenzene	1/6	52
1,4-Dichlorobenzene	1/5	3,200
Ethylbenzene	1/6	4,200
Methylene Chloride	2/6	40 - 46
Toluene	3/6	9 - 2,100
Xylenes (total)	4/6	6,700 - 17,000
SEMIVOLATILES		
2,4-Dimethylphenol	2/5	330 - 7,300
2-Methylphenol	1/5	14,000
Phenol	1/5	12,000
Dibenzofuran	3/5	800 - 18,000
4-Chloroaniline	1/5	1,800
Bis(2-ethylhexyl) phthalate	2/5	2,700 - 3,400
Acenaphthene	1/5	910
Benzo(a)anthracene	2/5	1,300 - 1,400
Benzo(b)fluoranthene	2/5	890 - 1,500
Benzo(a)pyrene	1/5	410
Chrysene	1/5	1,100
Fluoranthene	2/5	2,700 - 6,800
Fluorene	1/5	1,400
Naphthalene	2/5	1,600 - 5,200
Phenanthrene	2/5	2,100 - 9,400
Pyrene	2/5	1,900 - 4,200
2-Methylnaphthalene	2/5	1,600 - 4,000
PESTICIDES/PCBs		
Aldrin	1/5	89
gamma-BHC	1/5	38
DDD	1/5	240
DDT	1/5	190
Dieldrin	1/5	180
Endrin	1/5	230
Heptachlor	1/5	47
INORGANICS		
Aluminum	5/5	13.1 - 5,720
Antimony	0/5	-
Arsenic	4/5	0.44 - 15.9
Barium	5/5	0.66 - 452
Beryllium	2/5	0.51 - 0.57
Cadmium	2/5	5.9 - 8.1

TABLE 2-11
(continued)

CHEMICALS DETECTED IN TEST PITS IN AREA B
PFOHL BROTHERS LANDFILL, CHEEKTOWAGA, NEW YORK

CHEMICALS	FREQUENCY OF DETECTION (a)	RANGE OF DETECTED CONCENTRATIONS (b)
Calcium	1/1	396
Chromium	5/5	1.6 - 63.9
Cobalt	2/5	6.6 - 8.9
Copper	5/5	2.3 - 222
Iron	5/5	2,970 - 102,000
Lead	5/5	3.5 - 2,340
Magnesium	4/5	13.9 - 2,170
Manganese	5/5	3.9 - 618
Mercury	1/5	0.55
Nickel	2/5	21.2 - 42.8
Potassium	2/5	658 - 918
Selenium	1/5	120
Silver	1/5	4.4
Sodium	5/5	22.1 - 493
Thallium	0/5	-
Vanadium	1/5	10.4
Zinc	5/5	13.6 - 5,850
Cyanide	2/4	3.1 - 5.9

a. The frequency of detection is the number of times the chemica was detected over the number of samples analyzed for that parameter (this does not include data that were rejected).

b. Organics are in ug/kg and inorganics are in mg/kg.

File: TPH6-20 (11-01-90)

TABLE 2-12

CHEMICALS DETECTED IN TEST PITS IN AREA C
PFOHL BROTHERS LANDFILL, CHEEKTOWAGA, NEW YORK

CHEMICALS	FREQUENCY OF DETECTION (a)	RANGE OF DETECTED CONCENTRATIONS (b)
VOLATILES		
Acetone	1/1	30
SEMIVOLATILES	0/1	-
PESTICIDES/PCBs		
delta-BHC	1/1	1.8
Methoxychlor	1/1	4.0
INORGANICS		
Aluminum	1/1	7,250
Antimony	0/1	-
Arsenic	1/1	15.3
Barium	1/1	301
Beryllium	1/1	0.98
Cadmium	1/1	3.0
Calcium	1/1	10,300
Chromium	1/1	25.9
Cobalt	1/1	7.3
Copper	1/1	124
Iron	1/1	18,400
Lead	1/1	485
Magnesium	1/1	2,270
Manganese	1/1	223
Mercury	1/1	1.10
Nickel	1/1	22.3
Potassium	1/1	680
Selenium	1/1	2.00
Silver	1/1	0.68
Sodium	1/1	260
Thallium	0/1	-
Vanadium	1/1	26.2
Zinc	1/1	422
Cyanide	1/1	1.20

a. The frequency of detection is the number of times the chemical was detected over the number of samples analyzed for that parameter (this does not include data that was rejected).

b. Organic concentrations are in ug/kg and inorganics are in mg/kg.

File: TPH6-21 (11-01-90)

TABLE 6-13

CHEMICALS DETECTED IN LANDFILL SOILS[a]
PFOHL BROTHERS LANDFILL, CHEEKTOWAGA, NEW YORK

Chemical	Frequency of Detection (b)	Range of Sample Quantitation Limits (c)	Range of Detected Concentrations (c)	Background Levels (c)(d)
VOLATILES				
Acetone	7/24	14	15-770	11
Chlorobenzene	2/24	7-41	10-23	ND
Methylene Chloride	12/24	11-32	9-150	4
Trichloroethylene	2/24	7-41	8-9	NA
SEMIVOLATILES				
Benzoic Acid	1/24	2,600-55,000	740	NA
bis(2-Ethylhexyl)phthalate	5/24	530-11,000	1,500-3,000	NA
Butylbenzyl phthalate	2/24	530-11,000	38-43	NA
Dibenzofuran	3/24	530-11,000	430-13,000	ND
Diethyl phthalate	4/24	530-11,000	18-990	23
1,3-Dichlorobenzene	1/24	530-11,000	14	NA
1,4-Dichlorobenzene	1/24	530-11,000	19	NA
1,2-Dichlorobenzene	1/24	530-11,000	33	NA
Di-n-butyl phthalate	2/24	530-11,000	75-250	40
Acenapthene	2/24	530-11,000	17-720	ND
Anthracene	7/24	530-11,000	11-2,500	ND
Benzo(a)anthracene	19/24	540-8,500	26-6,000	ND
Benzo(b)fluoranthene	15/24	530-7,900	20-9,200	24
Benzo(a)pyrene	10/24	530-8,500	21-6,000	34
Benzo(g,h,i)perylene	7/24	530-11,000	50-2,500	19
Chrysene	20/24	540-7,900	16-7,500	69
Dibenzo(a,h)anthracene	2/24	530-11,000	190-480	NA
Fluoranthene	23/24	7,900	35-13,000	66
Fluorene	2/24	530-11,000	23-880	NA
Indeno(1,2,3-cd)pyrene	4/24	530-11,000	30-2,000	ND
2-Methylnaphthalene	1/24	530-11,000	120	NA
Naphthalene	2/24	530-11,000	44-620	NA
Phenanthrene	12/24	540-11,000	17-10,000	ND
Pyrene	23/24	7,900	11-15,000	57
PESTICIDES/PCBs				
Aldrin	1/23	11-270	32	ND
beta-BHC	2/23	11-270	22-75	ND
gamma-Chlordane	5/19	110-2,100	6.3-92	ND
DDD	1/22	21-530	14	ND
Dieldrin	1/23	21-530	16	ND
Aroclor-1221	1/28	110-2,700	560	ND
Aroclor-1248	5/28	110-2,700	290-7,700	ND
Aroclor-1254	6/28	210-5,300	270-19,000	ND

TABLE 2-13 (Cont'd)

CHEMICALS DETECTED IN LANDFILL SOILS[a]
PFOHL BROTHERS LANDFILL, CHEEKTOWAGA, NEW YORK

Chemical	Frequency of Detection (b)	Range of Sample Quantitation Limits (c)	Range of Detected Concentrations (c)	Background Levels (c)(d)
TCDF AND TCDD[e] (GENERAL LANDFILL)				
HxCDFs (total)	2/5	0.0059-0.015	0.11-0.5	0.011
HpCDFs (total)	3/5	0.017-0.022	0.02-0.7	0.015
1,2,3,4,6,7,8-HpCDF	3/5	0.017-0.022	0.02-0.29	0.0059
OCDF	2/5	0.034-0.079	0.32-1	0.014
PeCDDs (total)	1/5	0.011-0.014	0.13	0.0057
HxCDDs (total)	2/5	0.011-0.024	0.23-0.42	0.016
HpCDDs (total)	4/5	0.037	0.02-1.8	0.043
1,2,3,4,6,7,8-HpCDD	4/5	0.037	0.02-1.2	0.024
OCDD	5/5	NA	0.13-4	0.12
TCDF and TCDD (Truck Repair Service)				
TCDF (total)	1/1	NA	17,000	0.0078
2,3,7,8-TCDF	1/1	NA	1,000	0.00086
HxCDFs (total)	1/1	NA	3,200	0.011
1,2,3,4,7,8-HxCDF	1/1	NA	1,000	<0.002
1,2,3,6,7,8-HxCDF	1/1	NA	490	<0.00071
1,2,3,7,8,9-HxCDF	1/1	NA	76	<0.00067
2,3,4,6,7,8-HxCDF	1/1	NA	6	<0.0016
HpCDFs (total)	1/1	NA	3,400	0.015
1,2,3,4,6,7,8-PeCDD	1/1	NA	3,100	0.0059
1,2,3,4,7,8,9-HpCDF	1/1	NA	100	<0.00045
PeCDFs (total)	1/1	NA	6,600	0.0068
1,2,3,7,8-PeCDF	1/1	NA	690	<0.00063
2,3,4,7,8-PeCDF	1/1	NA	130	<0.0011
PeCDDs (total)	1/1	NA	55,000	0.0057
1,2,3,7,8-PeCDD	1/1	NA	930	—
HxCDD (total)	1/1	NA	26,000	0.016
1,2,3,4,7,8-HxCDD	1/1	NA	1,500	<0.00042
1,2,3,6,7,8-HxCDD	1/1	NA	3,700	<0.0018
2,3,4,6,7,8-HxCDD	1/1	NA	2,400	—
HpCDDs (total)	1/1	NA	23,000	0.043
1,2,3,4,6,7,8-HpCDD	1/1	NA	13,000	0.024
OCDD	1/1	Na	30,000	0.120
TCDD (total)	1/1	NA	20,000	0.0049
2,3,7,8-TCDD	1/1	NA	110	0.00046
INORGANICS				
Aluminum	18/18	-	1,260-11,000	12,000
Arsenic	22/23	NA	3-29.9	12.2
Barium	20/20	-	95.9-2,220	47.9
Beryllium	15/18	0.19-0.4	0.23-0.63	0.38

CHEMICALS DETECTED IN LANDFILL SOILS[a]
PFOHL BROTHERS LANDFILL, CHEEKTOWAGA, NEW YORK

Chemical	Frequency of Detection (b)	Range of Sample Quantitation Limits (c)	Range of Detected Concentrations (c)	Background Levels (c)(d)
Cadmium	23/23	-	2.2-27.6	0.77
Calcium	18/18	-	7,900-222,000	2,980
Chromium	23/23	-	4.8-84.0	12.7
Cobalt	16/18	1.6-1.7	2.4-17.8	5.5
Copper	23/23	-	14.8-1,057	15.4
Iron	18/18	-	14,000-317,000	17,900
Lead	23/23	-	24.2-985	741
Magnesium	18/18	-	2,150-19,400	2,380
Manganese	20/20	-	132-1,770	228
Mercury	22/23	0.17	0.1-6.2	<0.08
Nickel	18/18	-	10-125	14.1
Potassium	18/18	-	351-2,420	994
Selenium	9/18	0.65-5.6	0.67-5.3	0.46
Silver	9/23	0.84-3.1	1.8-4.8	<0.55
Sodium	18/18	-	125-4,490	173
Thallium	1/18	0.47-1.7	0.59	0.28
Vanadium	17/18	1.3	3.8-26.4	21.7
Zinc	20/20	-	69.1-2,770	75.2
Cyanide	13/14	1.4	1.5-7.3	<0.67

(a) Landfill soils represent surface samples from leachate seep sediments, Area C Marsh sediments, and Area B surface soil.

(b) The frequency of detection is the number of times the chemical was detected over the number of samples analyzed for that parameter (this does not include data that was rejected).

(c) Organic chemical concentrations and dioxin/furan concentrations are in µg/kg; inorganics are in mg/kg.

(d) Sample SUSL-4 collected by Dvirka and Bartilucci was used as a background sample for the landfill soils as directed by NYDEC. ND appears when the chemical was not detected in the background sample. It is not known what the detection limits were for every chemical in the sample. To provide an additional level of comparison, landfill soils were also compared to the background sediment samples SE-1 and SE-14. The lower concentration of lead and arsenic in these sediment samples were used for comparison because the concentrations in the Dvirka and Bartilucci were higher than normal.

(e) TCDF and TCDD data were collected from the following locations: five isomer-specific samples and one 2,3,7,8-TCDD sample from Area C Marsh; five 2,3,7,8-TCDD/TCDF samples from Area B; eighteen 2,3,7,8-TCDD samples from leachate seep sediments.

NOTE: Area C (Marsh) sediment samples were collected by NYSDEC and analyzed for volatiles, semivolatiles, pesticides, PCBs, and TCDFs/TCDDs.

TABLE 2-14

CHEMICALS DETECTED IN RESIDENTIAL SURFACE SOILS
PFOHL BROTHERS LANDFILL, CHEEKTOWAGA, NEW YORK

Chemical	Frequency of Detection (a)	Range of Sample Quantitation Limit (b)	Range of Detected Concentration (b)	Background Concentrations (b)
DIOXINS/FURANS				
TCDFs (total)	10/10	NA	0.0053-0.052	0.0078
2,3,7,8-TCDF	12/13	0.00068	0.00058-0.0051	0.00086
PeCDFs (total)	10/10	NA	0.0027-0.055	0.0068
1,2,3,7,8-PeCDF	7/10	0.00071-0.002	0.00037-0.0047	<0.00063
2,3,4,7,8-PeCDF	7/10	0.001-0.0013	0.00054-0.0085	<0.0011
HxCDFs (total)	10/10	NA	0.0081-0.22	0.011
1,2,3,4,7,8-HxCDF	6/10	0.00055-0.0029	0.0012-0.0074	<0.002
1,2,3,6,7,8-HxCDF	5/10	0.00041-0.00097	0.00042-0.0033	<0.00071
2,3,4,6,7,8-HxCDF	5/10	0.00076-0.0015	0.0013-0.0059	<0.0016
1,2,3,7,8,9-HxCDF	5/10	0.0003-0.0074	0.0003-0.029	<0.00067
HpCDFs (total)	10/10	NA	0.01-0.85	0.015
1,2,3,4,6,7,8-HpCDF	9/10	2.2	0.0034-0.19	0.0059
1,2,3,4,7,8,9-HpCDF	5/10	0.00066-0.004	0.00067-0.0022	<0.00045
OCDF	10/10	NA	0.011-0.49	0.014
TCDDs (total)	9/10	0.00021	0.00047-0.0093	0.0049
2,3,7,8-TCDD	7/13	0.0003-0.0009	0.00031-0.00058	0.00046
PeCDDs (total)	10/10	NA	0.00086-0.019	0.0057
1,2,3,7,8-PeCDD	5/10	0.00071-0.0028	0.00033-0.0015	<0.00075
HxCDDs (total)	10/10	NA	0.009-0.59	0.016
1,2,3,4,7,8-HxCDD	5/10	0.00034-0.0025	0.00054-0.0024	<0.00042
1,2,3,6,7,8-HxCDD	6/10	0.00069-0.0019	0.0011-0.06	<0.0018
1,2,3,7,8,9-HxCDD	6/10	0.00057-0.0019	0.0011-0.054	<0.0023
HpCDDs (total)	10/10	NA	0.04-3.5	0.043
1,2,3,4,6,7,8-HpCDD	10/10	NA	0.015-0.77	0.024
OCDD	10/10	NA	0.090-21	0.120
INORGANICS				
Arsenic	12/13	1.4	2.5-21.0	3.0
Barium	13/13	NA	67.2-801	<29
Cadmium	9/13	0.6-5	1.9-6.2	3.3
Chromium	12/13	10	1.6-14.9	2.3
Copper	13/13	NA	5.4-93.8	<25
Lead	13/13	NA	5.0-339	14.5
Manganese	13/13	NA	88.9-525	52.0
Mercury	10/13	0.1	0.1-0.9	<0.1
Silver	1/13	1.2-10	1.4	<1.4
Zinc	13/13	NA	47.1-969	49.6

(a) The frequency of detection is the number of times the chemical was detected over the number of samples analyzed for that parameter (this does not include data that were rejected).

(b) Inorganics are in mg/kg; dioxins/furans are in µg/kg (ppb).

(c) Background data from sample SSS-55.

NOTE: Data were collected by NYSDEC and were analyzed for inorganics, PCBs and dioxins/furans.

TABLE 2-15

CHEMICALS DETECTED IN AERO LAKE PATH SURFACE SOILS
PFOHL BROTHERS LANDFILL, CHEEKTOWAGA, NEW YORK

Chemical	Frequency of Detection (a)	Range of Sample Quantitation Limit (b)	Range of Detected Concentration (b)	Background Concentrations (b)
DIOXINS/FURANS				
TCDFs (total)	8/8	NA	0.00055-0.016	0.0078
2,3,7,8-TCDF	5/8	0.36-0.69	0.00062-0.018	0.00086
PeCDFs (total)	7/8	0.22	0.0014-0.013	0.068
2,3,4,7,8-PeCDF	1/8	0.22-1.2	0.00041	<0.0011
HxCDFs (total)	8/8	NA	0.0032-0.014	0.011
HpCDFs (total)	8/8	NA	0.0032-0.019	0.015
1,2,3,4,6,7,8-HpCDF	6/8	0.52-1.2	0.002-0.0099	0.0059
OCDF	8/8	NA	0.006-0.017	0.014
TCDDs (total)	8/8	NA	0.00026-0.0068	0.0049
2,3,7,8-TCDD	2/8	0.27-0.37	0.00026-0.00052	0.00046
PeCDDs (total)	3/8	0.17-1.3	0.0014-0.0065	0.0057
HxCDDs (total)	8/8	NA	0.0022-0.014	<0.016
1,2,3,6,7,8-HxCDD	2/8	0.78-1.7	0.00076-0.0014	<0.0018
1,2,3,7,8,9-HxCDD	1/8	0.84-1.8	0.002	<0.0023
HpCDDs (total)	8/8	NA	0.026-0.057	0.043
1,2,3,4,6,7,8-HpCDD	7/8	12	0.014-0.028	0.024
OCDD	8/8	NA	0.046-0.130	0.120
INORGANICS				
Arsenic	8/8	NA	1.0-10.1	3.0
Barium	7/8	25	103-323	<29
Cadmium	4/8	0.57-0.72	1.9-3.0	3.3
Chromium	7/8	1.2	4.6-7.9	2.3
Copper	8/8	NA	6.6-12.0	<25
Lead	8/8	NA	1.6-58.0	14.5
Manganese	8/8	NA	59.2-313.0	52.0
Mercury	7/8	0.1	0.1-0.2	<0.1
Zinc	8/8	NA	35.7-110.0	49.6

(a) The frequency of detection is the number of times the chemical was detected over the number of samples analyzed for that parameter (this does not include data that were rejected).

(b) Inorganics are in mg/kg; dioxins/furans are in ug/kg (ppb).

(c) Background data from sample SSS-55.

NOTE: Data were collected by NYSDEC and were analyzed for inorganics, PCBs and dioxins/furans.

TABLE 2-16

CHEMICALS DETECTED IN THE DRAINAGE DITCH SEDIMENTS AND AERO CREEK SEDIMENTS[c]
PFOHL BROTHERS LANDFILL, CHEEKTOWAGA, NEW YORK

Chemical	Frequency of Detection (a)(c)	Range of Sample Quantitation Limit (b)(e)	Range of Detected Concentration (b)	Background Concentrations (b)(d)
VOLATILES				
Acetone	3/29	13-290	15-240	20
Benzene	1/29	6-45	15	<30
Chlorobenzene	3/29	6-45	5.5-87	<30
Methylene Chloride	6/29	22-140	7-120	<26
1,2-Dichlorobenzene	3/17	370-11,000	10-95	<2,000
1,4-Dichlorobenzene	6/29	370-11,000	17-70	<2,000
SEMIVOLATILES				
Acenaphthene	10/21	370-11,000	14-220	<2,000
Acenaphthylene	15/29	370-1,500	29-680	<2,000
Anthracene	20/29	440-11,000	18-3,100	440
Benzo(a)anthracene	21/29	370-3,100	47-1,200	1,500
Benzo(b/k)fuoranthene	22/28	370-11,000	340-5,700	2,900
Benzo(a)pyrene	20/29	370-11,000	59-1,300	1,300
Benzo(g,h,i)perylene	20/29	370-11,000	57-3,800	580
Benzoic Acid	5/29	1800-53,000	79-770	9,600
bis(2-Ethylhexyl)phthalate	18/29	370-1,500	190-4,200	780
Butylbenzylphthalate	3/29	370-11,000	23-53	<2,000
4-Chloro-3-methylphenol	1/29	370-11,000	11	<2,000
Chrysene	20/29	370-1,500	55-2,900	1,300
Dibenzo(a,h)anthracene	15/29	370-11,000	60-2,300	<2,000
Dibenzofuran	8/29	370-11,000	15-2,500	<2,000
Diethylphthalate	18/29	430-11,000	15-8,200	<2,000
Dimethylphthalate	2/29	370-11,000	26-140	<2,000
Di-n-butylphthalate	15/29	370-11,000	33-160	<2,000
Di-n-octylphthalate	1/17	370-11,000	32	<2,000
Fluoranthene	25/29	370-1,500	81-5,800	3,100
Fluorene	14/29	370-11,000	16-320	<2,000
Indeno(1,2,3-cd)pyrene	17/29	370-11,000	150-3,700	730
Naphthalene	1/29	370-11,000	180	<2,000
N-Nitrosodiphenylamine	4/29	370-11,000	45-1,900	<2,000
Phenanthrene	23/29	370-1,500	34-2,900	1,800
Pyrene	25/29	370-1,500	96-5,400	2,700
Phenol	2/29	370-11,000	74-76	<2,000

TABLE 2-16 (Cont'd)

CHEMICALS DETECTED IN THE DRAINAGE DITCH SEDIMENTS AND AERO CREEK SEDIMENTS[c]
PFOHL BROTHERS LANDFILL, CHEEKTOWAGA, NEW YORK

Chemical	Frequency of Detection (a)(c)	Range of Sample Quantitation Limit (b)(e)	Range of Detected Concentration (b)	Background Concentrations (b)(d)
PESTICIDES/PCBs				
Aroclor 1242	1/29	99-670	7	<96
Beta-BHC	3/11	10-67	19-62	13
DDT	1/9	20-130	520	<19
Gamma-Chlordane	1/12	99-670	5.3	<96
INORGANICS				
Aluminum	11/11	-	5,580-12,200	7,030
Antimony	5/11	9.3-18.2	9-15	8.7
Arsenic	13/13	-	2.8-29	3.5
Barium	13/13	-	46.9-280	54.8
Beryllium	11/11	-	0.36-0.89	0.46
Cadmium	12/13	0.9	1.7-6.2	2.3
Calcium	11/11	-	5,230-98,300	67,400
Chromium	13/13	-	5.1-49.1	13.2
Cobalt	11/11	-	1.8-14.2	4.6
Copper	13/13	-	11.4-107	27.8
Iron	11/11	-	10,200-37,200	10,800
Lead	13/13	-	11.5-1,180	131
Magnesium	11/11	-	1,470-27,500	14,900
Manganese	13/13	-	111-1,100	313
Mercury	9/13	0.13-0.21	0.2-0.6	<0.13
Nickel	11/11	-	5.7-117	12.8
Potassium	10/10	-	368-2,830	1,060
Selenium	2/11	0.61-4	0.85-0.93	<0.6
Sodium	11/11	-	201-3,770	545
Vanadium	11/11	-	10.9-33.4	14.6
Zinc	13/13	-	48.4-910	165
Cyanide	3/11	1.3-2.2	1.1-10	<1.3
DIOXINS/FURANS				
TCDFs (total)	8/8	-	0.0032-0.077	0.0078
2,3,7,8-TCDF	12/17	0.19-0.57	0.00053-0.0042	0.00086
PeCDFs (total)	8/8	-	0.00071-0.047	0.0068
1,2,3,7,8-PeCDF	5/8	0.62-1.0	0.00014-0.0022	<0.00063
2,3,4,7,8-PeCDF	8/8	-	0.00027-0.0039	<0.0011
HxCDFs (total)	8/8	-	0.0018-0.049	0.011
1,2,3,4,7,8-HxCDF	8/8	-	0.00027-0.0068	<0.002
1,2,3,6,7,8-HxCDF	4/8	087-1.1	0.00044-0.0025	<0.00071

TABLE 2-16 (Cont'd)

CHEMICALS DETECTED IN THE DRAINAGE DITCH SEDIMENTS AND AERO CREEK SEDIMENTS[c]
PFOHL BROTHERS LANDFILL, CHEEKTOWAGA, NEW YORK

Chemical	Frequency of Detection (a)(c)	Range of Sample Quantitation Limit (b)(e)	Range of Detected Concentration (b)	Background Concentrations (b)(d)
2,3,4,6,7,8-HxCDF	5/8	0.19-2.6	0.00057-0.0038	<0.0016
1,2,3,7,8,9-HxCDF	4/8	0.18-0.94	0.0013-0.0058	<0.00067
HpCDFs (total)	8/8	-	0.0017-0.055	0.015
1,2,3,4,6,7,8-HpCDF	8/8	-	0.00038-0.020	0.0059
1,2,3,4,7,8,9-HpCDF	4/8	0.17-1.6	0.00083-0.018	<0.00045
OCDF	8/8	-	0.0019-0.091	0.014
TCDD (total)	7/8	0.21	0.0037-0.020	0.0049
2,3,7,8-TCDD	6/27	0.21-0.77	0.00045-0.0018	0.00046
PeCDDs (total)	8/8	-	0.00025-0.028	0.0057
1,2,3,7,8-PeCDD	5/8	0.55-0.68	0.00025-0.0017	<0.00075
HxCDDs (total)	8/8	-	0.0021-0.046	0.016
1,2,3,4,7,8-HxCDD	4/8	0.26-0.73	0.00047-0.0015	<0.00042
1,2,3,6,7,8-HxCDD	6/8	0.26-1.1	0.0014-0.004	<0.0018
1,2,3,7,8,9-HxCDD	6/8	0.41-2.6	0.00054-0.0044	<0.0023
HpCDDs (total)	8/8	-	0.008-0.130	0.043
1,2,3,4,6,7,8-HpCDD	8/8	-	0.0043-0.066	0.034
OCDD	8/8	-	0.035-0.460	0.120

NA - Not available. This data was collected by NYSDEC, detection limits were not provided.

(a) The frequency of detection is the number of times the chemical was detected over the number of samples analyzed for that parameter (this does not include data that was rejected).

(b) Organic chemical concentrations and dioxin/furan concentrations are in µg/kg; inorganic chemical concentrations are in mg/kg.

(c) Seventeen samples were collected from Aero Creek. All samples were analyzed for volatiles, semivolatiles, pesticides and PCBs. Only two samples were analyzed for inorganics, 8 samples were analyzed for dibenzofurans (TCDF) and dioxins (TCDD) (several isomers) and 9 samples were analyzed only for the 2,3,7,8 isomer of TCDF and TCDD.

(d) Background data were collected from sediment sample SE-1, west of Transit Road; sediment sample SE-14, an intermittent stream east of Aero Lake; and residential soil sample SSS-55 for dioxins/furans.

(e) Detection limits for Aero Creek sediment samples not available.

TABLE 2-17

CHEMICALS DETECTED IN AERO LAKE SEDIMENTS
PFOHL BROTHERS LANDFILL, CHEEKTOWAGA, NEW YORK

Chemical	Frequency of Detection (a)	Range of Sample Quantitation Limit (b)	Range of Detected Concentration (b)	Background Concentrations (b)(c)
VOLATILES				
Acetone	2/3	12	62-360	20
2-Butanone	1/3	12-16	54	<60
Methylene chloride	3/3	--	13-54	<26
INORGANICS				
Aluminum	3/3	--	4,670-11,200	7,030
Arsenic	3/3	--	1.8-5.9	3.5
Barium	3/3	--	43.3-117	54.8
Beryllium	3/3	--	0.24-0.44	0.46
Cadmium	2/3	1.3	1.3-4.7	2.3
Calcium	3/3	--	4,850-66,000	67,400
Chromium	3/3	--	8.3-18.6	13.2
Cobalt	3/3	--	4.4-7	4.6
Copper	3/3	--	10.7-26.1	27.8
Iron	3/3	--	8,870-19,800	10,800
Lead	3/3	--	10.2-73.6	131
Magnesium	3/3	--	2,190-16,500	14,900
Manganese	3/3	--	129-438	313
Nickel	3/3	--	9.3-20.3	12.8
Potassium	3/3	--	409-1,810	1,060
Silver	2/3	0.79	1.2-1.7	<0.78
Sodium	3/3	--	177-585	545
Vanadium	3/3	--	10.6-22.8	14.6
Zinc	3/3	--	55.2-145	165

(a) The frequency of detection is the number of times the chemical was detected over the number of samples analyzed for that parameter (this does not include data that was rejected).

(b) Organics are in ug/kg and inorganics are in mg/kg.

(c) Background data from 2 stream sediment samples (SE-1 and SE-14) north of Area B.

TABLE 2-18

CHEMICALS DETECTED IN ELLICOTT CREEK SEDIMENTS
PFOHL BROTHERS LANDFILL, CHEEKTOWAGA, NEW YORK

Chemical	Frequency of Detection (a)	Range of Sample Quantitation Limit (b)	Range of Detected Concentration (b)	Background Concentrations (b)
VOLATILES				
Acetone	2/5	13	24-50	240
Chlorobenzene	3/5	5	13-20	<26
Trichloroethylene	2/5	-	8-9	9
SEMIVOLATILES				
Acenaphthylene	1/5	400-1,000	63	<1,500
Fluorene	1/5	400-1,000	16	33
Diethylphthalate	2/5	400-1,000	21-28	35
Phenanthrene	2/5	400-1,000	42-200	230
Anthracene	2/5	400-1,000	14-89	93
Fluoranthene	3/5	870-1,000	81-420	340
Pyrene	3/5	870-1,000	91-290	200
Chrysene	2/5	400-1,000	61-170	170
Benzo(a)anthracene	2/5	400-1,000	54-130	120
bis(2-Ethylhexyl)phthalate	2/5	400-1,000	800-950	1,600
Benzo(b,k)fluoranthene	3/5	870-1,000	28-73	370
Benzo(a)pyrene	2/5	400-1,000	53-94	140
Indeno(1,2,3-cd)pyrene	2/5	400-1,000	41-170	273
Dibenz(a,h)anthracene	1/5	400-1,000	17	257
Benzo(g,h,i)perylene	2/5	400-1,000	63-220	190
DIOXINS/FURANS				
2,3,7,8-TCDF	1/5	-	0.56-1.4	-
INORGANICS				
Aluminum	3/3	-	5,120-9,010	7,030 (d)
Arsenic	5/5	-	2.2-7.4	9.5 (c)
Barium	5/5	-	21.9-301	271 (c)
Beryllium	3/3	-	0.33-0.57	0.46 (d)
Cadmium	4/5	0.3	0.33-3.7	3.1 (c)
Calcium	3/3	-	6,480-14,000	67,400 (d)
Chromium	5/5	-	4.9-14	35.6 (c)
Cobalt	3/3	-	4.7-5.7	4.6 (d)
Copper	5/5	-	13.4-2,160	68.9 (c)
Iron	3/3	-	12,600-14,500	10,800 (d)
Lead	5/5	-	14.8-51	462 (c)

TABLE 2-18 (Cont'd)

CHEMICALS DETECTED IN ELLICOTT CREEK SEDIMENTS
PFOHL BROTHERS LANDFILL, CHEEKTOWAGA, NEW YORK

Chemical	Frequency of Detection (a)	Range of Sample Quantitation Limit (b)	Range of Detected Concentration (b)	Background Concentrations (b)
Magnesium	3/3	-	2,820-5,690	14,900 (d)
Manganese	5/5	-	130-311	284 (c)
Mercury	5/5	-	0.10-0.25	0.57 (c)
Nickel	3/3	-	14.2-18.7	12.8 (d)
Potassium	3/3	-	456-1,210	1,060 (d)
Sodium	3/3	-	130-144	545 (d)
Vanadium	3/3	-	13.1-16	14.6 (d)
Zinc	5/5	-	61.2-144	315 (c)

(a) The frequency of detection is the number of times the chemical was detected over the number of samples analyzed for that parameter (this does not include data that was rejected).

(b) Organic chemical concentrations are in µg/kg; inorganic chemical concentrations are in mg/kg; and dioxins/furans are in ng/kg (ppt).

(c) Background data from 3 upgradient Ellicott Creek samples collected by CDM 12/90 and NYSDOH 6/90 (SE17-001, STR-19 and STR-20). See text for discussion.

(d) Background data from 2 stream sediment samples (SE-1 and SE-14) north of Area B collected by CDM 1987. See text for discussion.

TABLE 2-19

CHEMICALS DETECTED IN DRAINAGE DITCH SURFACE WATERS
PFOHL BROTHERS LANDFILL, CHEEKTOWAGA, NEW YORK

Chemical	Frequency of Detection (a)	Range of Sample Quantitation Limit (b)	Range of Detected Concentration (b)	Background Concentrations (b)(c)
VOLATILES				
Acetone	1/11	10-17	18	<10
Chlorobenzene	1/11	5-10	10	<5
1,2-Dichlorobenzene	1/11	10	4	<10
1,2-Dichloroethylene	3/11	5	3-6	<5
SEMIVOLATILES				
2,4-Dimethylphenol	1/11	10	4	<10
Di-n-octyl phthalate	1/11	10	14	<10
INORGANICS				
Aluminum	10/10	—	33.7-1,090	77
Arsenic	3/10	2.2	3.1-3.7	<2.2
Barium	10/10	—	18.8-393	77
Beryllium	1/10	0.4	0.46	<0.4
Cadmium	5/10	3.5	5-13.8	<3.5
Calcium	10/10	—	56,800-233,000	99,000
Cobalt	1/10	2.8	3	<2.8
Copper	10/10	—	5.4-26.8	6.8
Iron	10/10	—	294-4,000	507
Lead	9/10	2.1	2.1-20.1	10.6
Magnesium	10/10	—	15,000-43,000	25,300
Manganese	10/10	—	54.3-427	244
Mercury	3/10	0.2	0.25-0.3	<0.2
Nickel	1/10	12.8	13.8	<12.8
Potassium	10/10	—	1,680-24,200	2.740
Sodium	10/10	—	19,000-269,000	308,000
Vanadium	2/10	2.4	3-3.6	<2.4
Zinc	10/10	—	17-98.6	33.3

(a) The frequency of detection is the number of times the chemical was detected over the number of samples analyzed for that parameter (this does not include data that was rejected).

(b) Organics are in ug/l and inorganics are in ug/l.

(c) Background data from surface water samples SW-1 and SW-14 were collected from the western side of Transit Road ditch and an intermittent stream east of Aero Lake (same locations as SE-1 and SE-14).

TABLE 2-20

CHEMICALS DETECTED IN AERO LAKE SURFACE WATERS
PFOHL BROTHERS LANDFILL, CHEEKTOWAGA, NEW YORK

Chemical	Frequency of Detection (a)	Range of Sample Quantitation Limit (b)	Range of Detected Concentration (b)	Background Concentrations (b)(c)
SEMIVOLATILES				
bis(2-Ethylhexyl) phthalate	1/3	50-55	22	<10
INORGANICS				
Aluminum	3/3	—	58.2-62.2	77
Barium	3/3	—	93.6-96.4	77
Cadmium	1/3	3.5	6	<3.5
Calcium	3/3	—	57,100-59,300	115,000
Copper	3/3	—	3.7-6.7	6.8
Iron	2/2	—	148-187	507
Lead	2/3	2.6	2.5-3.9	10.6
Magnesium	3/3	—	14,300-14,900	25,300
Manganese	3/3	—	18.1-19.9	244
Mercury	3/3	—	0.25-0.48	<0.2
Potassium	3/3	—	3,540-4,090	2,740
Sodium	3/3	—	132,000-138,000	308,000
Zinc	3/3	—	11-18.3	33.3

(a) The frequency of detection is the number of times the chemical was detected over the number of samples analyzed for that parameter (this does not include data that was rejected).

(b) Organics are in ug/l and inorganics are in ug/l.

(c) Background data from surface water samples SW-1 and SW-14 were collected from the western side of Transit Road and an intermittent stream east of Aero Lake (same locations as SE-1 and SE-14).

TABLE 2-21

CHEMICALS DETECTED IN LEACHATE SEEPS
PFOHL BROTHERS LANDFILL, CHEEKTOWAGA, NEW YORK

Chemical	Frequency of Detection (a)	Range of Sample Quantitation Limit (b)	Range of Detected Concentration (b)	Background Concentrations (b)(c)
VOLATILES				
Benzene	5/19	2	3-8	<2
Chlorobenzene	9/38	3.7-10	2-110	<3.7
Chloroethane	2/19	5.9	11-31	<5.9
1,2-Dichlorobenzene	4/38	10-40	17-18	<5
1,3-Dichlorobenzene	3/38	10-40	4-89	<5
1,4-Dichlorobenzene	3/19	10-40	2-6	<5
1,1-Dichloroethylene	3/19	1.1	2.3-4.9	<1.1
1,2-trans-Dichloroethylene	2/19	1.6	64-85	<1.6
Ethylbenzene	1/19	3	6	<3
Trichloroethylene	1/19	1.4	2.2	<1.4
SEMIVOLATILES				
Benzoic Acid	1/19	50-100	22	<50
2,4-Dimethylphenol	2/19	10-40	30	<10
Phenol	2/19	10-40	7-10	<10
Dibenzofuran	2/19	10-40	20-63	<10
bis(2-Ethylhexyl) phthalate	5/19	6-20	9/60	25
Di-n-octyl phthalate	2/19	10-40	9-11	<10
Benzo(b)fluoranthene	1/19	10-40	7	<10
Benzo(a)anthracene	1/19	10-40	5	<10
Benzo(b)pyrene	1/19	10-40	5	<10
Chrysene	1/19	10-40	5	<10
Fluoranthene	3/19	10	3-9	<10
Fluorene	1/19	10-40	2	<10
Phenanthrene	2/19	10-40	2-5	<10
Pyrene	3/19	10	3-11	<10
PESTICIDES/PCBs				
Aldrin	2/19	0.005-0.05	0.0074-0.0081	<0.05
Dieldrin	4/19	0.01-0.1	0.0032-0.02	<0.1
DDD	1/19	0.01-0.1	0.011	<0.1
Endrin	1/19	0.02-0.1	0.028	<0.1
Endosulfan II	3/19	0.01-0.1	0.032-0.054	<0.1

TABLE 2-71 (Cont'd)

CHEMICALS DETECTED IN LEACHATE SEEPS
PFOHL BROTHERS LANDFILL, CHEEKTOWAGA, NEW YORK

Chemical	Frequency of Detection (a)	Range of Sample Quantitation Limit (b)	Range of Detected Concentration (b)	Background Concentrations (b)(c)
INORGANICS				
Aluminum	19/19	--	39.8-303,000	227
Arsenic	12/19	2.2	3.5-16.7	<2.1
Barium	19/19	--	80.3-10,000	35.5
Beryllium	4/19	0.4	0.46-14.8	<0.1
Cadmium	16/19	3.5	3.7-122	4
Calcium	19/19	--	145,000-603,000	116,000
Chromium	15/19	3.4	3.5-426	<3
Cobalt	10/19	2.8	3.4-157	<4.2
Copper	19/19	--	13.9-784	14.8
Iron	10/10	--	44,000-494,000	2,140
Lead	19/19	--	6.7-1,640	5.9
Magnesium	19/19	--	26,500-165,000	35,600
Manganese	19/19	--	123-16,100	1,670
Mercury	18/19	0.2	0.75-4.7	<0.2
Nickel	14/19	12.8	20.4-521	20.00
Potassium	19/19	--	5,500-54,200	3,350
Selenium	2/19	2.4-24	12-12.8	<2.3
Silver	9/19	3.1	3.4-16.6	<2.8
Sodium	19/19	--	16,600-209,000	130,000
Vanadium	6/19	2.4	33-471	<3.2
Zinc	18/18	--	66-8,270	9.9
Cyanide	3/10	10	18-31	<10

(a) The frequency of detection is the number of times the chemical was detected over the number of samples analyzed, including duplication, analyzed for that parameter (this does not include the data that were rejected). For chlorobenzene and the dichlorobenzenes, the denomenator is equal to the number of samples times the number of analysis performed.

(b) Organics are in ug/l and inorganics are in ug/l.

(c) Background data derived from upgradient well MW-6S.

TABLE 2-22

CHEMICALS DETECTED IN ELLICOTT CREEK SURFACE WATERS
PFOHL BROTHERS LANDFILL, CHEEKTOWAGA, NEW YORK

Chemical	Frequency of Detection (a)	Range of Sample Quantitation Limit (b)	Range of Detected Concentration (b)	Background Concentrations (b)
SEMIVOLATILES				
Di-n-butylphthalate	2/3	10	1	6(c)
Bis(2-ethylhexyl)phthalate	2/3	10	11-17	13(c)
INORGANICS				
Aluminum	1/1	-	190	77(d)
Barium	3/3	-	38.5-870	670(c)
Cadmium	2/3	5	8.6-9	8(c)
Calcium	1/1	-	133,000	115,000(d)
Copper	1/3	25	6.7	<25(c)
Iron	1/1	-	462	507(d)
Lead	1/3	5	4.8	<5(c)
Magnesium	1/1	-	16,600	25,300(d)
Manganese	3/3	-	37-46	37(c)
Potassium	1/1	-	2,840	2,740(d)
Sodium	1/1	-	33,600	308,000(d)
Zinc	1/3	20	48	59(c)

(a) The frequency of detection is the number of times the chemical was detected over the number of samples analyzed for that parameter (this does not include data that was rejected).

(b) Organic and inorganic chemical concentrations are in µg/l.

(c) Background data from 5 upgradient Ellicott Creek samples (SW-17-001, SW-18-001, SW-19-001, SWT-45 and SWT-46). See text for discussion.

(d) Background data from 2 stream samples (SW-1 and SW-14) north of Area B. See text for discussion.

TABLE 2-23

CHEMICALS DETECTED IN THE BEDROCK AQUIFER
PFOHL BROTHERS LANDFILL, CHEEKTOWAGA, NEW YORK

Chemical	Frequency of Detection (a)	Range of Sample Quantitation Limit (b)	Range of Detected Concentration (b)	Background Concentrations (b)(c)
VOLATILES				
Benzene	1/15	2.0	23	<2
Chloroethane	1/15	5.9	3.7	<5.9
1,1-Dichloroethane	1/15	1.1	4.1	<1.1
1,2-trans-Dichloroethylene	1/14	1.6	9.2	<1.6
Toluene	1/13	3.0	3	<3
SEMIVOLATILES				
Benzoic Acid	1/10	50	8	<50
Phenol	1/10	10	16	<10
bis(2-Ethylhexyl) phthalate	9/12	16-24	3-42	<3
PESTICIDES/PCBs				
Aldrin	1/11	0.05-0.25	0.05	<0.05
INORGANICS				
Aluminum	11/11	-	56.1-1,630	326
Antimony	1/11	24-53.1	35.1	<53.1
Arsenic	5/11	1.9-2	2.4-4.7	<2
Barium	11/11	-	24.9-240	60
Cadmium	6/11	1-3.6	1.1-4.2	4
Calcium	11/11	-	30,300-244,000	118,000
Chromium	10/11	1	2.4-728	191
Cobalt	1/11	2-4.2	7.1	<4.2
Copper	8/11	1-2.6	3.7-28.4	13
Iron	11/11	-	161-5,270	1,200
Lead	5/9	2	2.3-6.8	<2
Magnesium	11/11	-	156-44,400	26,700
Manganese	7/8	0.5	5.9-428	17.3
Mercury	1/8	0.2	0.48	<0.2
Nickel	7/11	10.7-20	17.4-198	33
Potassium	11/11	-	2,670-23,300	5,110
Silver	1/11	2-2.8	2	<2.8
Sodium	11/11	-	34,300-354,000	127,000
Vanadium	4/11	1-3.2	1.4-35.3	<3.2
Zinc	8/8	-	1.1-4.4	"R"

(a) The frequency of detection is the number of times the chemical was detected over the number of samples analyzed for that parameter (this does not include data that was rejected).

(b) Organics are in ug/l and inorganics are in ug/l.

(c) Background data from MW-6D located offsite of Area A east of Transit Road.

TABLE 2-24

CHEMICALS DETECTED IN THE UNCONSOLIDATED AQUIFER
PFOHL BROTHERS LANDFILL, CHEEKTOWAGA, NEW YORK

Chemical	Frequency of Detection (a)	Range of Sample Quantitation Limit (b)	Range of Detected Concentration (b)	Background Concentrations (b)(c)
VOLATILES				
Benzene	4/31	2.0	2.7-290	<2
Chlorobenzene	2/58	3.0-3.7	1,200-11,000	<3
Chloroethane	1/31	5.9	900	<5.9
1,3-Dichlorobenzene	1/56	5.0-100	82	<5
1,4-Dichlorobenzene	3/56	5.0-100	2-240	<5
1,2-Dichlorobenzene	1/50	5.0-100	4	<5
1,1-Dichloroethane	2/21	1.1	5.6-4,900	<1.1
1,1-Dichloroethene	1/31	1.8	240	<1.8
1,1,1-Trichloroethane	2/31	1.3	26-15,000	<1.3
Toluene	3/31	3.0	4.1-43	<3
Xylenes (m-, p-)	1/31	3.0-6.0	400	<3
SEMIVOLATILES				
Benzoic Acid	1/12	50-500	3	<50
2-Chlorophenol	1/11	10-100	13	<10
2,4-Dimethylphenol	2/11	10-50	630-940	<10
2-Methylphenol	1/11	10-50	72	<10
4-Methylphenol	1/11	10-50	75	<10
Phenol	2/11	10-50	6-4,000	<10
Dibenzofuran	2/27	10-100	15-20	<10
Bis(2-ethylhexyl) phthalate	11/26	10-100	3-840	25
Di-n-octyl phthalate	3/27	10-100	30-73	<10
Di-n-butyl phthalate	1/27	10-100	2	<10
Butyl benzyl phthalate	1/27	10-100	150	<10
PESTICIDES/PCBs				
Endosulfan II	1/24	0.05-0.1	0.69	<0.05
Aroclor-1232	2/21	0.5	110	<0.5
INORGANICS				
Aluminum	26/26	-	59,5-74,000	227
Antimony	2/26	24-53.1	24.4-33	<53.1
Arsenic	19/26	1.9-2	2.3-22.3	<2.1
Barium	26/26	-	52.2-1,530	35.5
Beryllium	3/26	0.1-1	1.5-1.7	<1.0
Cadmium	10/26	1-4	1.3-12	4

TABLE 2-24 (Cont'd)

CHEMICALS DETECTED IN THE UNCONSOLIDATED AQUIFER
PFOHL BROTHERS LANDFILL, CHEEKTOWAGA, NEW YORK

Chemical	Frequency of Detection (a)	Range of Sample Quantitation Limit (b)	Range of Detected Concentration (b)	Background Concentrations (b)(c)
Calcium	26/26	-	28,200-593,000	116,000
Chromium	22/26	1-3	2-196	<3
Cobalt	7/26	2-5	2-46.9	<4.2
Copper	26/26	-	2.7-3,070	14.8
Iron	26/26	-	160-176,000	2,140
Lead	20/21	2	2.8-369	5.9
Magnesium	26/26	-	20,300-203,000	35,600
Manganese	26/26	-	62.1-3,450	1,670
Mercury	6/26	0.2	0.23-3.3	<0.2
Nickel	16/26	10.7-23	11.8-141	13.1
Potassium	26/26	-	761-83,500	3,350
Silver	7/26	2-3	2.1-23.7	<2.8
Sodium	26/26	-	12,700-287,000	130,000
Vanadium	18/26	1-4	1.4-124	<3.2
Zinc	17/17	-	7.5-1,490	9.9
Cyanide	1/25	10-20	30	<10

(a) The frequency of detection is the number of times the chemical was detected over the number of samples analyzed for that parameter (this does not include data that was rejected). For chlorobenzene and the dichlorobenzenes, the denomenator is equal to the number of samples times the number of analyses performed.

(b) Background data derived from MW-6S.

TABLE 2-25a

PCBs/PESTICIDES AND MERCURY DETECTED IN FISH
COLLECTED FROM ELLICOTT CREEK - AMHERST
PFOHL BROTHERS LANDFILL, CHEEKTOWAGA, NEW YORK

Location/Compound	Frequency of Detection (a)	Range (ug/g)	Arithmetic Mean (ug/g)
ELLICOTT CREEK - AMHERST			
Aroclor - 1016	12/13	0.01-0.02	0.0096
Aroclor - 1254	13/13	0.05-0.33	0.12
Aroclor - 1260	13/13	0.03-0.29	0.85
DDT	13/13	0.0005-0.0091	0.0036
DDE	13/13	0.0062-0.0622	0.0034
DDD	13/13	0.0031-0.0349	0.015
Alpha - Chlordane	13/13	0.001-0.0101	0.004
Gamma - Chlordane	11/13	0.001-0.0045	0.0019
Oxychlordane	13/13	0.001-0.005	0.0018
Transnonachlor	13/13	0.0022-0.0195	0.0086
Heptachlor epoxide	11/13	0.001-0.0038	0.0015
Mirex	1/13	0.001	0.007
Endrin	6/13	0.001	0.0074
Dieldrin	13/13	0.001-0.0140	0.0046
Hexachlorobenzene	3/13	0.001	0.0006

a) The frequency of detection is equal to the number of times the chemical was detected over the number of samples analyzed for that parameter.

TABLE 2-23b

PCBs/PESTICIDES AND MERCURY DETECTED IN FISH
COLLECTED FROM ELLICOTT CREEK - AIRPORT
PFOHL BROTHERS LANDFILL, CHEEKTOWAGA, NEW YORK

Location/Compound	Frequency of Detection (a)	Range (µg/g)	Arithmetic Mean (µg/g)
ELLICOTT CREEK - AIRPORT			
Aroclor - 1254/1260	4/6	0.026-0.232	0.095
Alpha - BHC	NA	NA	NA
Beta - BHC	NA	NA	NA
Gamma - BHC (lindane)	NA	NA	NA
Delta - BHC	NA	NA	NA
DDT	4/6	0.004-0.008	0.0047
DDE	6/6	0.01-0.056	0.0335
DDD	4/6	0.002-0.015	0.0067
Alpha - Chlordane	1/6	0.006	0.0031
Gamma - Chlordane	0/6	<0.005	-
Oxychlordane	0/6	<0.005	-
Transnonachlor	4/6	0.008-0.013	0.008
Heptachlor epoxide	NA	NA	NA
Mirex	0/6	<0.002	-
Endrin	NA	NA	NA
Dieldrin	0/6	<0.005	-
Hexachlorobenzene	0/6	<0.002	-
Mercury	3/6	0.133-0.177	0.0903

a) The frequency of detection is equal to the number of times the chemical was detected over the number of samples analyzed for that parameter.

b) NA indicates samples from this location were not analyzed for this chemical.

TABLE 2-25c

PCBs/PESTICIDES AND MERCURY DETECTED IN FISH
COLLECTED FROM ELLICOTT CREEK - BOWMANSVILLE
PFOHL BROTHERS LANDFILL, CHEEKTOWAGA, NEW YORK

Location/Compound	Frequency of Detection (a)	Range (µg/g)	Arithmetic Mean (µg/g)
ELLICOTT CREEK - BOWMANSVILLE			
Aroclor - 1016	8/9	0.01	0.01
Aroclor - 1254	9/9	0.04-0.10	0.07
Aroclor - 1260	9/9	0.04-0.08	0.051
Aroclor - 1054/1260	2/3	0.041-0.124	0.0583
DDT	12/12	0.001-0.008	0.0025
DDE	12/12	0.001-0.0242	0.0109
DDD	9/12	0.0017-0.0070	0.0028
Alpha - Chlordane	9/12	0.001-0.0025	0.0019
Gamma - Chlordane	9/12	0.001-0.0019	0.0015
Transnonachlor	10/12	0.0017-0.009	0.0026
Heptachlor epoxide	5/9	0.001	0.00078
Endrin	5/9	0.001	0.00078
Dieldrin	9/12	0.0012-0.0024	0.0019
Mercury	3/3	0.088-0.357	0.191

a) The frequency of detection is equal to the number of times the chemical was detected over the number of samples analyzed for that parameter.

TABLE 2-25d

PCBs/PESTICIDES AND MERCURY DETECTED IN FISH COLLECTED FROM TRIBUTARY 11B TO ELLICOTT CREEK PFOHL BROTHERS LANDFILL, CHEEKTOWAGA, NEW YORK

Location/Compound	Frequency of Detection (a)	Range (ug/g)	Arithmetic Mean (ug/g)
TRIBUTARY 11B TO ELLICOTT CREEK			
Aroclor - 1016/1248	1/4	0.121	0.0378
Aroclor - 1254/1260	4/4	0.0028-0.165	0.098
Alpha - BHC	NA(b)	NA	NA
Beta - BHC	NA	NA	NA
Gamma - BHC (lindane)	NA	NA	NA
Delta - BHC	NA	NA	NA
DDT	1/4	0.002	0.0013
DDE	4/4	0.003-0.021	0.011
DDD	3/4	0.002-0.006	0.0035
Heptachlor epoxide	NA	NA	NA
Endrin	NA	NA	NA
Mercury	1/4	0.055	0.0325

a) The frequency of detection is equal to the number of times the chemical was detected over the number of samples analyzed for that parameter.

b) NA indicates samples from this location were not analyzed for this chemical.

TABLE 2-26

PCBs/PESTICIDES AND MERCURY DETECTED IN FISH
COLLECTED FROM AERO LAKE
PFOHL BROTHERS LANDFILL, CHEEKTOWAGA, NEW YORK

Location/Compound	Frequency of Detection (a)	Range (ug/g)	Arithmetic Mean (ug/g)
AERO LAKE			
Aroclor - 1016	8/13	0.01-0.05	0.0119
Aroclor - 1254	13/13	0.02-0.17	0.07
Aroclor - 1260	13/13	0.04-0.033	0.13
Aroclor - 1254/1260(b)	5/5	0.097-0.393	0.22
Alpha - BHC	2/13	0.0013-0.0021	0.00069
DDT	11/18	0.001-0.0033	0.00126
DDE	18/18	0.0036-0.046	0.019
DDD	18/18	0.0027-0.0369	0.009
Alpha - Chlordane	10/18	0.001-0.0019	0.00142
Gamma - Chlordane	4/18	0.001-0.0023	0.00148
Oxychlordane	4/18	0.001-0.0018	0.00122
Transnonachlor	13/13	0.001-0.0029	0.0019
Heptachlor epoxide	4/13	0.001-0.0062	0.00125
Mirex	3/18	0.001	0.00128
Dieldrin	7/18	0.001-0.0017	0.00133
Hexachlorobenzene	2/18	0.001-0.0036	0.00084
Mercury	1/5	0.176	0.0552

(a) The frequency of detection is equal to the number of times the chemical was detected over the number of samples analyzed for that parameter.

(b) PCB data collected 7/87 - 8/87 were reported as Aroclor 1016/1248 and Aroclor 1254/1260.

TABLE 2-27

PCBs/PESTICIDES DETECTED IN
FISH COLLECTED FROM NEW YORK STATE LAKES (a)

Lake and Date	Fish		Avg. PCB	PCB Range	Avg. DDT	DDT Range	Avg. Dieldrin	Dieldrin Range	Avg. Endrin	Endrin Range	Avg. HCB	HCB Range
CANADICE LAKE												
1980	LT	4	4.44	1.37-9.18	0.17	0.08-0.34	0.03	<.01-0.12	<0.01	-	<0.01	-
1985	BT	9	2.71	0.24-4.14	0.22	0.02-0.3	0.01	<0.01-0.01	0.01	<0.01-0.01	<0.01	-
1985	RT	2	1.44	0.60-2.20	0.12	0.05-0.2	0.01	<0.01-0.01	0.01	<0.01-0.01	<0.01	-
CANANDAIGUA LAKE												
1980	RT	1	0.067	-	0.29	-	<0.01	-	<0.01	<0.01	<0.01	<0.01
1980	LT	3	1.43	1.2-2.91	0.97	0.79-2.46	0.01	0.01-0.02	<0.01	<0.01	<0.01	<0.01
1980	LT	43	1.45	0.31-5.07	1.02	0.18-3.43	0.02	<0.01-0.07	-	-	<0.01	-
1985	LT	20	0.49	0.07-1.69	0.36	0.08-1.72	0.01	<0.01-0.01	<0.01	-	<0.01	-
CHAUTAUQUA LAKE												
1982	LMB	1	0.15	-	0.14	-	<0.01	-	<0.01	-	<0.01	-
1982	WE	2	0.14	0.12-0.17	0.09	0.08-0.1	<0.01	-	<0.01	-	<0.01	-
1982	BB	1	0.13	-	0.05	-	<0.01	-	<0.01	-	<0.01	-
KEUKA												
1980	RT	1	0.12	-	2.5	-	0.02	-	<0.01	-	<0.01	-
1980	LT	3	0.44	0.08-1.97	6.28	2.04-19.75	0.04	0.01-0.08	<0.01	-	<0.01	-
1983	LT-M	5	0.34	0.19-0.42	3.63	1.41-6.91	0.03	0.01-0.04	-	-	<0.01	-
1983	LT-F	4	0.49	0.22-0.87	6.25	2.16-14.17	0.04	0.02-0.06	-	-	<0.01	-
DEC. 1983	LT-M	23	0.35	0.05-0.89	4.08	0.42-14.18	0.02	<0.01-0.04	-	-	<0.01	-
DEC. 1983	LT-F	9	0.41	0.18-0.74	4.47	1.7-16.54	0.02	0.01-0.03	-	-	<0.01	-
1985	LT	27	0.17	0.04-0.52	2.54	0.7-0.09	0.01	<0.01-0.01	0.01	<0.01-0.02	<0.01	-
OCT. 1985	BT	10	0.19	0.11-0.31	2.20	0.54-3.83	0.01	<0.01-0.02	<0.01	-	<0.08	-
SENECA LAKE												
1980	RT	2	0.13	0.12-0.14	0.19	0.18-0.2	0.02	0.01-0.02	<0.01	-	<0.01	-
1980	LT	8	0.44	0.15-2.17	1.10	0.27-2.07	0.04	0.01-0.08	<0.01	-	<0.01	-
1983	LT-M	9	0.59	0.20-1.12	0.36	0.17-0.54	0.02	<0.01-0.03	-	-	<0.01	-
1983	LT-F	10	0.60	0.20-1.20	0.40	0.20-0.61	0.02	<0.01-0.03	-	-	<0.01	-
1985	LT	27	0.40	0.08-1.05	0.21	0.04-0.76	0.01	<0.01-0.04	0.01	<0.01-0.03	0.01	<0.01-0.01
CAYUGA LAKE												
1980	LT	4	0.44	0.23-0.60	0.35	0.14-0.43	0.01	0.01-0.02	<0.01	-	<0.01	-
1985	LT	27	0.7	0.13-1.86	0.28	0.04-0.83	0.01	<0.01-0.01	<0.01	-	<0.01	-

(a) NYSDEC 1987 : Concentrations are in ug/gram (ppm)
LT = Lake Trout
RT = Rainbow Trout
LMB = Large Mouth Bass
BT = Brook Trout
WE = Walleye
LT-F = Lake Trout - Female
LT-M = Lake Trout - Male

TABLE 2-27 (continued)

PCBs/PESTICIDES DETECTED IN
FISH COLLECTED FROM NEW YORK STATE LAKES (a)

Lake and Date	Fish		Avg Lindane	Lindane Range	Avg. Mirex	Mirex Range	Avg. Hg	Hg Range	Avg Chlordane	Chlordane Range
CANADICE LAKE										
1980	LT	4	<0.01	-	<0.01	-	0.27	0.18-0.36	0.05	0.03-0.08
1985	BT	9	-	-	-	-	-	-	0.07	0.01-0.1
1985	RT	2	-	-	-	-	-	-	0.04	0.02-0.06
CANANDIAGUA LAKE										
1980	RT	1	<0.01	<0.01	<0.01	-	0.25	-	0.02	-
1980	LT	3	<0.01	<0.01	<0.01	-	0.31	0.28-0.54	0.08	0.05-0.16
1983	LT	43	-	-	-	-	-	-	-	
1985	LT	28	-	-	-	-	-	-	0.09	0.02-0.26
CHAUTAUGUA LAKE										
1982	LMB	1	<0.01	-	<0.01	-	0.3	-	0.03	-
1982	WE	2	<0.01	-	<0.01	-	0.45	0.42-0.48	0.02	0.02-0.02
1982	BB	1	<0.01	-	<0.01	-	0.13	-	0.02	-
KEUKA										
1980	RT	1	<0.01	-	<0.01	-	0.22	-	0.03	-
1980	LT	3	<0.01	-	<0.01	-	0.37	0.23-0.57	0.08	0.03-0.32
1983	LT-M	5	-	-	-	-	-	-	-	-
1983	LT-F	4	-	-	-	-	-	-	-	-
DEC. 1983	LT-M	23	-	-	-	-	-	-	-	-
DEC. 1983	LT-F	9	-	-	-	-	-	-	-	
1985	LT	27	-	-	-	-	-	-	0.11	0.04-0.24
OCT. 1985	BT	10	-	-	-	-	-	-	0.12	0.04-0.14
SENECA LAKE										
1980	RT	2	<0.01	-	<0.01	-	0.16	0.16-0.16	0.02	0.02-0.02
1980	LT	8	<0.01	-	<0.01	-	0.45	0.10-0.66	0.11	0.03-0.18
1983	LT-M	9	-	-	-	-	-	-	-	-
1983	LT-F	10	-	-	-	-	-	-	-	-
1985	LT	27	-	-	-	-	-	-	0.06	0.01-0.15
CAYUGA LAKE										
1980	LT	4	<0.01	-	<0.01	-	0.34	0.26-0.48	0.07	0.04-0.09
1985	LT	27	-	-	-	-	-	-	0.09	0.03-0.28

(a) NYSDEC 1987: Concentrations are in ug/gram (ppm)

LT = Lake Trout
RT = Rainbow Trout
LMB = Large Mouth Bass
BT = Brook Trout
WE = Walleye
LT-F = Lake Trout - Female
LT-M = Lake Trout - Male

TABLE 2-28

PCBs/PESTICIDES DETECTED IN FISH
COLLECTED FROM NEW YORK STATE RIVERS (a)

River and Date	Fish		Avg. PCB	PCB Range	Avg. DDT	DDT Range	Avg. Dieldrin	Dieldrin Range	Avg. Endrin	Endrin Range	Avg. HCB	HCB Range
NIAGARA RIVER BELOW BUFFALO												
1981	SMB	2	1.01	0.59-1.29	0.14	0.06-0.19	0.02	0.01-0.02	<0.01	<0.01	<0.01	<0.01
1981	CARP	2	2.91	2.01-3.45	0.21	0.14-0.26	0.03	0.01-0.05	0.01	<0.01-0.02	0.01	<0.01-0.01
Below Lewiston												
1981	SMB	2	0.9	0.82-1.07	0.1	0.09-0.14	0.01	0.01-0.01	<0.01	-	<0.01	-
1981	CARP	1	4.44	-	0.96	-	0.02	-	0.02	-	0.02	-
BUFFALO RIVER												
1980	CARP	2	0.75	0.69-0.82	0.3	0.29-0.3	<0.01	<0.01	<0.01	-	<0.01	-
1983	PS	2	0.4	0.38-0.41	0.04	0.03-0.04	<0.01	<0.01	<0.01	-	<0.01	-
1983	CARP	2	4.72	3.63-14.5	0.5	0.46-0.80	0.01	0.01-0.02	<0.01	-	<0.01	-
1984	CARP	1	6.67		1.63		0.04	-	<0.01	-	<0.01	-
1984	BB	1	0.87		0.3		0.01	-	<0.01	-	<0.01	-
NIAGARA RIVER LEWISTON												
1984	SMB	2	3.16	2.08-4.25	0.38	0.22-0.55	0.02	0.01-0.02	<0.01	-	<0.01	-
1984	BB	1	1.25	-	0.12	-	<0.01	-	<0.01	-	<0.01	-
TONAWANDA CREEK ABOVE WCP												
1985	BB	2	0.27	0.26-0.28	0.02	0.01-0.02	<0.01	-	<0.01	-	<0.01	-
1985	BB	2	0.92	0.84-1.00	0.08	0.07-0.10	<0.01	-	<0.01	-	<0.01	-
Below WCP												
1985	BB	2	0.3	0.29-0.32	0.01	0.01-0.01	<0.01		<0.01		<0.01	
1985	BB	2	0.75	0.64-0.86	0.06	0.05-0.06	<0.01		<0.01		<0.01	

(a) NYSDEC 1987 : Concentrations are in ug/gram (ppm).

SMB = Small mouth bass
PS = Pumpkinseed
BB = Brown bullhead
RB = Rock Bass
Carp = Carp

PH-RVFIS

TABLE 2-28 (continued)

PCBs/PESTICIDES DETECTED IN FISH
COLLECTED FROM NEW YORK STATE RIVERS (a)

River and Date	Fish		Avg Lindane	Lindane Range	Avg. Mirex	Mirex Range	Avg. Hg	Hg Range	Avg Chlordane	Chlordane Range
NIAGRA RIVER BELOW BUFFALO										
198[illegible]	SMB	2	<0.01	<0.01	<0.01		0.34	0.24-0.4	0.03	0.02-0.03
198[illegible]	CARP	2	0.01	<0.01-0.01	<0.01		0.28	0.12-0.38	0.04	0.04-0.04
Below Lewiston										
198[illegible]	SMB	2	<0.01	-	0.02	0.02-0.02	0.32	0.24-0.48	0.04	0.04-0.04
198[illegible]	CARP	1	0.01	-	0.04	-	0.36	-	0.1	-
BUFFALO RIVER										
1980	CARP	2	<0.01	-	<0.01	-	0.15	0.14-0.16	0.05	0.05-0.06
1980	PS	2	<0.01	-	<0.01	-	0.16	0.14-0.17	0.01	0.01-0.01
1980	CARP	2	<0.01	-	<0.01	-	0.10	0.1-0.12	0.12	0.11-0.12
1984	CARP	1	<0.01	-	<0.01	-	NA	NA	0.53	-
1984	BB	1	<0.01	-	<0.01	-	NA	NA	0.10	-
NIAGRA RIVER LEWISTON										
1984	SMB	2	0.01	-	0.07	0.03-0.11	NA	NA	0.09	0.06-0.12
1984	BB	1	<0.01	-	0.03	-	NA	NA	0.03	-
TONAWANDA CREEK ABOVE WCP										
1985	RB	2	<0.01	-	<0.01	-	NA	NA	<0.01	-
1985	BB	2	<0.01	-	<0.01	-	NA	NA	0.04	0.03-0.04
Below WCP										
1985	RB	2	<0.01		<0.01		NA	NA	<0.01	-
1985	BB	2	<0.01		<0.01		NA	NA	0.04	0.02-0.03

(a) NYSDEC 1987 : Concentrations are in ug/gram (ppm)

SMB = Small mouth bass
PS = Pumpkinseed
BB = Brown bullhead
RB = Rock Bass
Carp = Carp

PH-RVFIS

TABLE 2-29

PHYSICAL - CHEMICAL PROPERTIES OF CHEMICALS DETECTED IN SURFACE SAMPLES

	Molecular Weight (gl/mol)	Water Solubility (mg/l)	Vapor Pressure (mm Hg)	Henry's Law Constant (atm-m3/mol)	KOC (ml/g)	LOG (KOW)	BCF (l/kg)
CHLORINATED ALIPHATICS							
Choroethane (a)	64.52	5.74 E+3	1.00 E+3	2.0 E-3	15	1.43	—
1,1-Dichloroethane	98.97	5.5 E+3	1.82 E+2	4.31 E-3	30	1.79	—
1,2-Dichloroethene	96.94	6.3 E+3	3.24 E+2	6.56 E-3	59	0.48	1.6
Methylene chloride	84.93	2.0 E+4	3.62 E+2	2.03 E-3	8.8	1.3	5
1,1,1-Trichloroethane	133.41	1.5 E+3	1.23 E+2	1.44 E-2	152	2.5	5.6
Trichloroethene	131.29	1.50 E+3	5.79 E+1	9.1 E-3	126	2.42	10.6
SIMPLE AROMATIC COMPOUNDS							
Benzene	78.12	1.75 E+3	9.52 E+1	5.59 E-3	83	2.12	5.2
Ehylbenzene	106.17	1.52 E+2	7.0 E+0	6.43 E-3	1100	3.15	37.5
Toluene	92.15	5.35 E+2	2.81 E+1	6.34 E-3	300	2.73	10.7
Xylene (total)	106.17	1.98 E+2	1.0 E+1	7.04 E-3	240	3.26	--
CHLORINATED AROMATICS							
Chlorobenzene	112.56	4.66 E+2	1.17 E+1	3.72 E-3	330	2.84	10
1,2-Dichlorobenzene	147	1.0 E+2	1.0 E+0	1.93 E-3	1700	3.6	56
1,3-Dichlorobenzene	147	1.23 E+2	2.28 E+0	3.59 E-3	1700	3.6	56
1,4-Dichlorobenzene	147	7.9 E+1	1.18 E+0	2.89 E-3	1700	3.6	56
KETONES							
Acetone	58	1.0 E+6	2.7 E+2	3.67 E-5	2.2	-0.24	--
2-Butanone	72.12	2.68 E+5	7.75 E+1	5.14 E-5	4.51	0.26	0
PHENOLIC COMPOUNDS							
Phenol	94	9.3 E+4	3.41 E-1	4.54 E-7	14.2	1.46	1.4
2-Chlorophenol							
2,4-Demethylphenol	122.16	6.47 E+3	7.5 E-2	--	10.4	2.3	150
2-Methylphenol	108	3.1 E+4	2.4 E-1	1.1 E-6	500	1.97	0
4-Methylphenol							

TABLE 2-29
(CONTINUED)

PHYSICAL - CHEMICAL PROPERTIES OF CHEMICALS
DETECTED IN SURFACE SAMPLES

	Molecular Weight (g/mol)	Water Solubility (mg/l)	Vapor Pressure (mm Hg)	Henry's Law Constant (atm-m3/mol)	KOC (ml/g)	LOG (KOW)	BCF (l/kg)
NITROGEN COMPOUNDS							
N-Nitrosodiphenylamine (b)	198.23	3.5 E+1	6.69 E-4	5.0 E-6	—	3.13	--
PHATHALATE ESTERS							
Bis(2-ethylhexyl)phthalate (a)	391	4.0 E-1	2.0 E-7	4.4 E-7	87,400	5.11	
Di-n-butylphthalate (a)	278	9.2 E+0	1.0 E-5	1.3 E-6	1,390	3.75	--
Diethylphthalate (a)	222.2	6.8 E+2	3.5 E-3	1.5 E-6	69	2.46	--
Di-n-octylphthalate (a)	391	3.4 E-1	1.4 E-4	5.5 E-6	19,000	5.22	--
Benzyl butyl phthalate	312					> 4.42	--
ORGANIC ACIDS							
Benzoic Acid (a)	122.4	2.9 E+3	7.05 E-3	3.92 E-7	54.4	1.87	--
POLYAROMATIC HYDROCARBONS (c)							
Dibenzofuran							
Acenaphthylene	154.21	Insoluble	4.47 E-3	--	4,600	5.98	--
Anthracene	178.2	4.5 E-2	1.7 E-5	8.6 E-5	14,000	4.45	
Benzo(a) anthracene	228.29	5.7 E-3	2.2 E-8	1.16 E-6	1,380,000	5.6	--
Benzo(b) fluoranthene	252.3	1.4 E-2	5.0 E-7	1.19 E-5	550,000	6.06	--
Benzo(g,h,i) perylene	276.34	7.0 E-4	1.03 E-10	1.44 E-7	1,600,000	6.51	--
Benzo(a) pyrene	252.3	1.2 E-3	5.6 E-9	4.9 E-7	5,500,000	6.06	--
Chrysene	228.3	1.8 E-3	6.3 E-9	1.05 E-6	200,000	5.61	--
Fluoranthene	202.26	2.06 E-1	5.0 E-6	6.46 E-6	38,000	4.9	1,500
Fluorene	116.2	1.69 E+0	7.1 E-4	6.42 E-5	7,300	4.2	1,300
Indeno (1,2,3-cd) pyrene	276.3	5.3 E-4	1.0 E-10	6.95 E-8	1,600,000	6.58	--
Naphthalene (a)	128.16	3.17 E+1	7.8 E-2	4.2 E-4	940	3.36	--
Phenanthrene	178.2	1.0 E+0	6.8 E-4	2.26 E-4	14,000	4.46	2,630
Pyrene	202.3	1.32 E-1	2.5 E-6	5.1 E-6	38,000	4.88	--
POLYCHLORINATED BIPHENYLS	328	3.1 E-2	7.7 E-5	1.07 E-3	530,000	6.04	100,000

TABLE 2-29
(CONTINUED)

PHYSICAL - CHEMICAL PROPERTIES OF CHEMICALS
DETECTED IN SURFACE SAMPLES

	Molecular Weight (g/mol)	Water Solubility (mg/l)	Vapor Pressure (mm Hg)	Henry's Law Constant (atm-m3/mol)	KOC (ml/g)	LOG (KOW)	BCF (l/kg)
DIOXINS/FURANS							
2,3,7,8-TCDD	322	2.0E-04	1.7E-06	3.6E-03	3,300,000	6.72	5000
CHLORINATED PESTICIDES							
Aldrin	364.93	1.8 E-1	6.0 E-6	1.6 E-5	96,000	5.3	28
Beta-BHC (d)	291	2.4 E-1	2.8 E-7	4.47 E-7	3,800	3.9	--
Chlordane	409.81	5.6 E-1	1.0 E-5	9.63 E-6	140,000	3.32	14,000
DDD	320.05	1.0 E-1	1.89 E-6	7.96 E-6	770,000	6.2	
DDT	354.49	5.0 E-3	5.5 E-6	5.13 E-4	243,000	6.19	54,000
Dieldrin	380.93	1.95 E-1	1.78 E-7	4.58 E-7	1,700	3.5	4,760
Endrin	380.93		2.0 E-7				
Endosulfan II	406.95						

Source: Except as noted, data were obtained from EPA 1986.

a. Source: Clements 1989.
b. Source: ADSTR 1987 (a)
c: Source: ATSDR 1989. Vapor pressure is in torr for temperatures ranging from 20 to 25 C.
d: Source: Clements 1988.
e. Source: Merck 1983.

FILE: PM-CHSUR

TABLE 2-30

COMPARISON OF FDA ACTION LEVELS TO THE CONCENTRATION
DETECTED IN FISH COLLECTED IN 1987 AND 1990

Compound	FDA Action Level (ppm)	Aero Lake Arithmetic Mean (ppm)	Aero Lake Maximum Conc. (ppm)	Aero Lake Minimum Conc. (ppm)	Ellicott Creek - Bowmansville Arithmetic Mean (ppm)	Ellicott Creek - Bowmansville Maximum Conc. (ppm)	Ellicott Creek - Bowmansville Minimum Conc. (ppm)	Ellicott Creek - Amherst Arithmetic Mean (ppm)	Ellicott Creek - Amherst Maximum Conc. (ppm)	Ellicott Creek - Amherst Minimum Conc. (ppm)
Total PCBs (a)	2	0.253	0.259	0.07	0.131	0.19	0.09	0.22	0.64	0.09
Alpha - BHC	NE (e)	0.00069	0.0021	0.0013	-	-	<0.001	0.007	0.001	0.001
Delta - BHC	NE	-	-	<0.001	-	-	<0.001	-	-	<0.001
Total DDT (b)	5	0.0293	0.0862	0.0063	0.0162	0.0392	0.0037	0.0532	0.101	0.0098
Chlordane (c)	0.3	0.006	0.0089	0.001	0.006	0.0134	0.0037	0.0163	0.0391	0.0052
Heptachlor epoxide	0.3	0.00125	0.0062	0.001	0.00078	0.001	0.001	0.0015	0.0038	0.001
Mirex	0.1	0.00128	0.001	0.001	-	-	<0.002	0.007	0.001	0.001
Endrin	0.3	-	-	<0.001	0.00078	0.001	0.001	0.0074	0.0011	0.001
Aldrin/Dieldrin (d)	0.3	0.00133	0.0017	0.001	0.0019	0.0024	0.0012	0.0065	0.014	0.0011
HCB	NE	0.00084	0.0036	0.001	-	-	<0.002	0.00062	0.0011	0.001
Mercury	1.0	0.0552	0.176	<0.05	0.191	0.357	0.088	NA	NA	NA

(a) Total PCBs equals the sum of the following three Aroclor: Aroclor 1016; Aroclor 1254; Aroclor 1260.
(b) Total DDT equals the sum of DDT and its metabolites (DDE and DDD).
(c) Chlordane concentrations are the sum of the detected concentrations of cis- and trans- chlordane, oxychlordane, and trans-nonachlordane.
(d) The concentrations shown equal the concentrations for dieldrin.
(e) NE = None established.
(f) Because the compound was detected only one time, a mean could not be established.

NA - Not Available

TABLE 2-30 (Cont'd)

COMPARISON OF FDA ACTION LEVELS TO THE CONCENTRATION
DETECTED IN FISH COLLECTED IN 1987 AND 1990

Compound	FDA Action Level (ppm)	Ellicott Creek - Airport			Tributary 11B to Ellicott Creek		
		Arithmetic Mean (ppm)	Maximum Conc. (ppm)	Minimum Conc. (ppm)	Arithmetic Mean (ppm)	Maximum Conc. (ppm)	Minimum Conc. (ppm)
Total PCBs (a)	2	0.095	0.232	0.026	0.1358	0.286	0.028
Alpha - BHC	NE (e)	NA	NA	NA	NA	NA	NA
Delta - BHC	NE	NA	NA	NA	NA	NA	NA
Total DDT (b)	5	0.045	0.079	0.01	0.0158	0.029	0.003
Chlordane (c)	0.3	0.011	0.019	0.014	-	-	<0.005
Heptachlor Epoxide	0.3	NA	NA	NA	NA	NA	NA
Mirex	0.1	-	-	<0.002	-	-	<0.002
Endrin	0.3	NA	NA	NA	NA	NA	NA
Aldrin/Dieldrin (d)	0.3	-	-	<0.005	-	-	<0.005
HCB	NE	-	-	<0.002	-	-	<0.002
Mercury	1.0	0.09	0.177	0.133	0.0325	0.055	0.055

(a) Total PCBs equals the sum of the following Aroclor 1016/1248 and Aroclor 1254/1260.
(b) Total DDT equals the sum of DDT and its metabolites (DDE and DDD).
(c) Chlordane concentrations are the sum of the detected concentrations of cis- and trans- chlordane, oxychlordane, and trans-nonachlordane.
(d) The concentrations shown equal the concentrations for dieldrin.
(e) NE = None established.
(f) Because the compound was detected only one time, a mean could not be established.

NA - Not Available

TABLE 2-31

SELECTED CHEMICALS OF CONCERN - SOILS
LANDFILL SOILS, RESIDENTIAL SOILS, AERO PATH SOILS
PFOHL BROTHERS LANDFILL, CHEEKTOWAGA, NEW YORK

CHEMICAL CLASS	LANDFILL SOILS	REASON FOR SELECTION (a)	RESIDENTIAL SOIL	REASON FOR SELECTION (a)
ORGANICS				
Acetone	X	F		
Chlorobenzene	X	O		
Methylene Chloride	X	F		
bis(2-Ethylhexyl)phthalate	X	F		
Dibenzofuran	X	F		
Diethyl phthalate	X	F		
Anthracene	X	F		
Benzo(a)anthracene	X	F		
Benzo(b)fluoranthene	X	F		
Benzo(g,h,i)perylene	X	F		
Benzo(a)pyrene	X	F		
Chrysene	X	F		
Dibenzofuran	X	F		
Fluoranthene	X	F		
Indeno(1,2,3-cd)pyrene	X	F		
Phenanthrene	X	F		
Pyrene	X	F		
PCBs	X	F		
PESTICIDES				
Aldrin	X	O		
beta-BHC	X	F		
gamma-Chlordane	X	F		

TABLE 2-31

SELECTED CHEMICALS OF CONCERN - SOILS
LANDFILL SOILS, RESIDENTIAL SOILS, AERO PATH SOILS
PFOHL BROTHERS LANDFILL, CHEEKTOWAGA, NEW YORK
(CONTINUED)

CHEMICAL CLASS	LANDFILL SOILS	REASON FOR SELECTION (a)	RESIDENTIAL SOIL	REASON FOR SELECTION (a)
INORGANICS				
Arsenic	X	F,B	X	F,B
Barium	X	F,B	X	F,B
Beryllium	X	F,B		
Cadmium	X	F,B		
Chromium	X	F,B	X	F,B
Lead	X	F,B	X	F,B
Manganese	X	F,B	X	F,B
Mercury	X	F,B	X	F,B
Nickel	X	F,B		
Silver	X	F,B		
Zinc	X	F,B	X	F,B
Cyanide	X	F,B		
DIOXINS/FURANS	X	B	X	B

TABLE 2-31

SELECTED CHEMICALS OF CONCERN - SEDIMENTS
DRAINAGE DITCH AND AERO CREEK SEDIMENTS
AERO LAKE SEDIMENTS AND ELLICOTT CREEK SEDIMENTS
PFOHL BROTHERS LANDFILL, CHEEKTOWAGA, NEW YORK

CHEMICAL CLASS	DRAINAGE DITCH AND AERO CREEK	REASON FOR SELECTION[a]	AERO LAKE SEDIMENTS	REASON FOR SELECTION[a]	ELLICOTT CREEK SEDIMENTS	REASON FOR SELECTION[a]
ORGANICS						
Acetone	X	F	X	F	X	F
Chlorob..zene	X	F			X	F
1,2-Dichlorobenzene	X	F				
1,4-Dichlorobenzene	X	F	X	F		
Methylene Chloride	X	F				
Trichloroethylene					X	F
Diethylphthalate	X	F			X	F
bis(2-Ethylhexyl)phthalate	X	F			X	F
Butylbenzyl phthalate	X	F				
Di-n-butylphthalate	X	F			X	F
N-Nitrosodiphenylamine	X	F				
Acenaphthene	X	F				
Acenaphthylene	X	F				
Anthracene	X	F			X	F
Benzo(a)anthracene	X	F			X	F
Benzo(b)fluoranthene	X	F			X	F
Benzo(g,h,i)perylene	X	F			X	F
Benzo(a)pyrene	X	F			X	F
Chrysene	X	F			X	F
Dibenzo(a,h)anthracene	X	F				
Dibenzofuran	X	F				
Fluoranthene	X	F			X	F
Fluorene	X	F				
Indeno(1,2,3-cd)pyrene	X	F			X	F
Naphthalene						
Phenanthrene	X	F			X	F

TABLE 2-31

SELECTED CHEMICALS OF CONCERN - SEDIMENTS
DRAINAGE DITCH AND AERO CREEK SEDIMENTS
AERO LAKE SEDIMENTS AND ELLICOTT CREEK SEDIMENTS
PFOHL BROTHERS LANDFILL, CHEEKTOWAGA, NEW YORK
(CONTINUED)

CHEMICAL CLASS	DRAINAGE DITCH AND AERO CREEK	REASON FOR SELECTION	ELLICOTT CREEK SEDIMENTS	REASON FOR SELECTION
ORGANICS (Cont'd)				
Phenol	X	O		
Pyrene	X	F	X	F
PESTICIDES				
beta-BHC	X	F		
PCBs				
INORGANICS				
Arsenic	X	F,B		
Barium	X	F,B	X	F,B
Cadmium	X	F,B	X	F,B
Chromium	X	F,B		
Copper				
Lead	X	F,B	X	F,B
Manganese	X	F,B		
Mercury	X	F,B	X	F,B
Nickel	X	F,B		
Vanadium				
Zinc	X	F,B	X	F,B
Cyanide	X	F,B		
DIOXINS/FURANS	X	B		

TABLE 2-31

SELECTED CHEMICALS OF CONCERN - SURFACE WATER
DRAINAGE DITCH, AERO LAKE, LEACHATE SEEPS, ELLICOTT CREEK
PFOHL BROTHERS LANDFILL, CHEEKTOWAGA, NEW YORK
(CONTINUED)

CHEMICAL CLASS	DRAINAGE DITCH	REASON FOR SELECTION (a)	AERO LAKE	REASON FOR SELECTION (a)	LEACHATE SEEPS	REASON FOR SELECTION (a)	ELLICOTT CREEK	REASON FOR SELECTION (a)
ORGANICS								
Benzene					X	F		
Chlorobenzene					X	F		
1,2-Dichlorobenzene	X	O			X	F		
1,3-Dichlorobenzene					X	F		
1,4-Dichlorobenzene					X	F		
1,1-Dichloroethane					X	F		
1,2-Dichloroethylene	X	O						
1,2-trans-Dichloroethane					X	F		
1,2-Dichloroethane	X	F			X	F		
Trichloroethylene					X	T		
bis(2-Ethylhexyl)phthalate			X	T	X	F	X	F
Diethyl phthalate								
Di-n-butylphthalate								
2,4-Dimethylphenol	X	O			X	F		
N-Nitrosodiphenylamine								
Phenol					X	O		
Dibenzofuran					X	F		
Fluoranthene					X	F		
Fluorene					X	F		
Pyrene					X	F		
PCBs								
PESTICIDES								
Dieldrin					X	F		
Endosulfan					X	F		

TABLE 2-31

SELECTED CHEMICALS OF CONCERN - SURFACE WATER
DRAINGE DITCH, AERO LAKE, LEACHATE SEEPS, ELLICOTT CREEK
PFOHL BROTHERS LANDFILL, CHEEKTOWAGA, NEW YORK
(CONTINUED)

CHEMICAL CLASS	DRAINAGE DITCH	REASON FOR SELECTION	AERO LAKE	REASON FOR SELECTION	LEACHATE SEEPS	REASON FOR SELECTION	ELLICOTT CREEK	REASON FOR SELECTION
INORGANICS								
Arsenic								
Barium								
Beryllium								
Cadmium			X	F,B				
Chromium								
Lead								
Manganese								
Mercury			X	F,B				
Nickel								
Vanadium								
Zinc								
Cyanide								

TABLE 2-31

SELECTED CHEMICALS OF CONCERN - GROUNDWATER
UNCONSOLIDATED AQUIFER, BEDROCK AQUIFER
PFOHL BROTHERS LANDFILL, CHEEKTOWAGA, NEW YORK
(CONTINUED)

CHEMICAL CLASS	UNCONSOLIDATED AQUIFER	REASON FOR SELECTION (a)	BEDROCK AQUIFER	REASON FOR SELECTION (a)
ORGANICS				
Benzene	X	G,O	X	G,O
Chlorobenzene	X	G,O		
1,3-Dichlorobenzene	X	G,O		
1,4-Dichlorobenzene	X	G,O		
1,1-Dichloroethane	X	G,O	X	G,O
1,1-Dichloroethylene	X	G,O	X	G,O
1,2-trans-Dichloroethylene			X	G,O
Toluene		X	G,O	
1,1,1-Trichloroethane	X	G,O		
Xylene	X	G,O		
bis-(2-Ethylhexyl)phthalate	X	G,O	X	G,O
2-Chlorophenol	X	G,O		
2,4-Dimethylphenol	X	G,O		
2-Methylphenol	X	G,O		
4-Methylphenol	X	G,O		
Phenol	X	G,O	X	G,O
PESTICIDES				
Aldrin			X	G,P
Endosulfan II	X	G,P		
PCBs	X	G,PCBs		

TABLE 2-31

SELECTED CHEMICALS OF CONCERN - GROUNDWATER
UNCONSOLIDATED AQUIFER, BEDROCK AQUIFER
PFOHL BROTHERS LANDFILL, CHEEKTOWAGA, NEW YORK
(CONTINUED)

CHEMICAL CLASS	UNCONSOLIDATED AQUIFER	REASON FOR SELECTION	BEDROCK AQUIFER	REASON FOR SELECTION
INORGANICS				
Arsenic	X	B	X	B
Barium	X	B	X	B
Cadmium	X	B	X	B
Chromium	X	B	X	B
Lead	X	B	X	B
Manganese	X	B	X	B
Mercury	X	B	X	B
Nickel	X	B	X	B
Silver	X	B		
Vanadium	X	B	X	B
Zinc	X	B	X	B

(a) Reasons for selection are as follows (see text for further descriptions of selection criteria):

F = Frequency
O = Other Media
B = Background
T = Toxicity
G,O = Groundwater, organic
G,P = Groundwater, pesticide
G,PCBs = Groundwater, PCBs

TABLE 2.3-1

COMPILATION OF NUMERICAL SCGs FOR SOILS, SEDIMENTS AND LANDFILL SOLIDS

PARAMETER	SCGs
Acetone	-
Chlorobenzene	5.5
1,2-Dichlorobenzene	1.0
1,4-Dichlorobenzene	1.0
Methylene Chloride	-
Trichloroethylene	1.0
Bis(2-ethyl hexyl) phthalate	4.35
Butylbenzyl phthalate	2.0
Di-n-butyl phthalate	8.0
Diethyl phthalate	7.0
N-nitrosodiphenylamine	
Acenaphthene	1.6
Acenaphthylene	-
Anthracene	7.0
Benzo(a) anthracene	-
Benzo(b) fluoranthene	0.33
Benzo(b,k) fluoranthene	0.33
Benzo(g,h,i) perylene	80.0
Benzo(a) pyrene	0.33
Chrysene	0.33
Dibenzo(a,h) anthracene	0.33
Dibenzofuran	2.0
Fluoranthene	19.0
Indeno(1,2,3-cd) pyrene	0.33
Naphthalene	1.0
Phenanthrene	2.2
Phenol	0.33

TABLE 2.3-1 (Cont.)

COMPILATION OF NUMERICAL SCGs FOR SOILS, SEDIMENTS AND LANDFILL SOLIDS

PARAMETER	SCGs
Pyrene	6.65
Aldrin	0.041
Beta - BHC	0.010
Gamma-chlordane	0.20
Dioxins/Furans	-
PCBs	10 a
Arsenic	7.5
Barium	300 or S.B.
Beryllium	0.14
Cadmium	1.0
Chromium	10.0
Copper	25.0
Lead	32.5 or S.B.
Manganese	S.B.
Mercury	0.1
Nickel	13.0
Silver	200.0
Vanadium	150 or S.B.
Zinc	20.0
Cyanide	-

NOTES:

All units in mg/kg or ppm.
a Value shown is subsurface soil guideline values. Value for surface soil criteria is 1 ppm.
S.B. Site Background
SCGs shown are based on draft soil cleanup criteria issued by Technology Section, Bureau of Program Management, Division of Hazardous Waste Remediation, NYSDEC and are guideline values, only.

TABLE 2.3-2

OBSERVED CONTAMINANT RANGES AND GUIDELINE VALUES FOR SOILS AND SEDIMENTS

Parameter	Range of Detected Concentrations in Landfill Soils	Range of Detected Concentrations in Sediments	SCGs
Acetone	21 - 950	15 - 770	—
Chlorobenzene	18 - 2200	10 - 23	5.5
Methylene Chloride	5 - 690	9 - 150	—
Bis(2-ethyl hexyl) phthalate	51 - 100,000	—	4.35
Diethyl phthalate	150	—	7.0
Di-n-butylphthalate	—	250	8.0
Acenaphthylene	—	310	—
Anthracene	39 - 1900	370 - 2,500	7.0
Benzo(a) anthracene	55 - 24,000	150 - 6,000	—
Benzo(b) fluoranthene	70 - 32,000	—	0.33
Benzo(g,h,i) perylene	68 - 300	1,500 - 2,500	80.0
Benzo(a) pyrene	92 - 21,000	280 - 6,000	0.33
Chrysene	53 - 25,000	170 - 7,500	0.33
Dibenzofuran	120 - 1,900,000	2,400 - 13,000	2.0
Fluoranthene	120 - 67,000	160 - 13,000	19.0
Indeno(1,2,3-cd) pyrene	65 - 390	200	0.33
Phenanthrene	5 - 32,000	200 - 10,000	2.2
Pyrene	100 - 49,000	240 - 15,000	6.65
Aldrin	5 - 9	—	0.041
Beta - BHC	9.0	22 - 75	0.010
Gamma-chlordane	4.8 - 9	—	0.20
Dioxins/Furans		—	—
PCBs	3,700 - 8,700	4,000 - 7,700	10 a
Arsenic	3.1 - 575	3.0 - 29.9	7.5
Barium	34.9 - 12,500	95.5 - 2,220	300 or S.B.
Beryllium	0.17 - 2.3	0.23 - 0.63	0.14
Cadmium	1.3 - 39.4	2.2 - 18.5	1.0

TABLE 2.3-2 (cont.)

OBSERVED CONTAMINANT RANGES AND GUIDELINE VALUES FOR SOILS AND SEDIMENTS

Parameter	Range of Detected Concentrations in Landfill Soils	Range of Detected Concentrations in Sediments	SCGs
Chromium	7.8 - 18,100	9.4 - 43.1	10.0
Copper	—	14.8 - 270	25.0
Lead	12 - 36,200	27.8 - 985	32.5 or S.B.
Manganese	198 - 4,430	132 - 1,770	S.B.
Mercury	0.14 - 4.4	0.18 - 1.2	0.1
Nickel	0.0061 - 565	10.0 - 125	13.0
Silver	0.68 - 11.2	—	200.0
Zinc	64 - 35,300	69.1 - 2,770	20.0
Cyanide	0.74 - 33.4	1.5 - 8	—

NOTES: All units in mg/kg or ppm.
SCGs shown are based on draft soil cleanup criteria issued by Technology Section, Bureau of Program Management, Division of Hazardous Waste Remediation, NYSDEC.

* Value shown is subsurface soil guideline values. Value for surface soil criteria is 1 ppm.

TABLE 2.3-3

PFOHL BROTHERS - FEASIBILITY STUDY
COMPILATION OF NUMERICAL ARARs/SCGs FOR GROUND WATER, LEACHATE AND SURFACE WATERS

PARAMETER	NYSDEC CLASS GA GW	NYSDEC CLASS B SW	NYSDEC CLASS D SW	NYSDOH MCLs (C)	EPA NIPDWR	SDWA MCLG	NYS MCL	7-DAY NAS SNARLS	PWQC (W & FISH INGEST.)
Benzene	ND(2)	6	6	5	-	ZERO	ND(5)	250	0.66
Chlorobenzene	5	5	50	5	-	-	5	-	-
Chloroethane	-	-	-	5	-	-	-	-	-
1,2-Dichlorobenzene				5	-	600	-	300	-
1,4-Dichlorobenzene	4.7	5	50	5	-	75	-	300	400
1,3-Dichlorobenzene	5			5	-	600	-	300	400
1,1-Dichloroethane	5	-	-	5	-	-	-	-	400
1,1-Dichloroethylene	5	-	-	5	-	7	-	-	-
trans-1,2-Dichloroethylene	5	-	-	5	-	-	-	-	-
Ethylbenzene	5	-	-	5	-	700	-	-	1400
Trichloroethylene	5	11	11	5	-	ZERO	-	15000	2.7
1,1,1-Trichloroethane	-	-	-	5	-	200	-	70000	0.6
Toluene	5	-	-	5	-	2000	-	-	14300
Xylenes	5	-	-	5(each)	-	10000	-	11200	-
2-Chlorophenol	-	-	-	50	-	-	-	-	-
2,4-Dimethylphenol	-	-	-	50	-	-	-	-	-
2-Methylphenol	-	-	-	50	-	-	-	-	-
4-Methylphenol	-	-	-	50	-	-	-	-	-
N-nitrosodiphenylamine	50	-	-	50	-	-	-	-	[illegible]

[illegible]PFOHL\T2-3-3.TBL
[illegible]

TABLE 2.3-3 (Cont.)

PFOHL BROTHERS - FEASIBILITY STUDY
COMPILATION OF NUMERICAL ARARs/SCGs FOR GROUND WATER, LEACHATE AND SURFACE WATERS

PARAMETER	NYSDEC CLASS GA GW	NYSDEC CLASS B SW	NYSDEC CLASS D SW	NYSDOH MCLs (C)	EPA NIPDWR	SDWA MCLG	NYS MCL	7-DAY NAS SNARLS	FWQC (W & FISH INGEST.)
Phenol	1 a	5 b	5 b	50	-	-	-	-	30
Dibenzofuran	-	-	-	50	-	-	-	-	-
Diethylhexylphthalate (DEHP)	50	0.6	-	50	-	ZERO	-	-	-
Aldrin	ND(0.05)			-	-	-	-	-	0.074
Dieldrin	ND(0.05)	0.001	0.001	-	-	-	-	-	.000071
DDD	ND(0.05)	0.001	0.001	-	-	-	-	-	-
Endrin	NC(0.005)	0.002	0.002	0.0002	0.2	2	0.0002	-	1
Endosulfan II	-	0.009	0.22	50	-	-	-	-	-
PAHs	-	-	-	-	-	-	-	-	0.0028
PCBs	0.1	0.001	0.001	-	-	-	-	50	.000079
Aluminum	-	100	-	-	-	-	-	5000	-
Arsenic	25	190	360	-	50	ZERO	50	-	2.2
Barium	1000	-	-	-	1000	5000	1000	4700	1000
Beryllium	3	11,1100	-	-	-	ZERO	-	-	0.004
Cadmium	10	1.7	7	-	10	10	10	5	10
Chromium	50	3187	-	-	50	100	50	-	50
Cobalt	-	5	29	-	-	-	-	-	-
Copper	200	18.5	2688	-	-	1300	1000	-	170000
Lead	25	6.3	160.5	-	50	ZERO	50	-	50

TABLE 2.3-3 (Cont.)

PFOHL BROTHERS - FEASIBILITY STUDY
COMPILATION OF NUMERICAL ARARs/SCGs FOR GROUND WATER, LEACHATE AND SURFACE WATERS

PARAMETER	NYSDEC CLASS GA GW	NYSDEC CLASS B SW	NYSDEC CLASS D SW	NYSDOH MCLs (C)	EPA NIPDWR	SDWA MCLG	NYS MCL	7-DAY NAS SNARLS	FWQC (W & FISH INGEST.
Endosulfan II	-	0.009	0.22	50	-	-	-	-	-
PAHs	-	-	-	-	-	-	-	-	0.0028
PCBs	0.1	0.001	0.001	-	-	-	-	50	.000079
Aluminum	-	100	-	-	-	-	-	5000	-
Arsenic	25	190	360	-	50	ZERO	50	-	2.2
Barium	1000	-	-	-	1000	5000	1000	4700	1000
Beryllium	3	11,1100	-	-	-	ZERO	-	-	0.004
Cadmium	10	1.7	7	-	10	10	10	5	10
Chromium	50	3187	-	-	50	100	50	-	50
Cobalt	-	5	29	-	-	-	-	-	-
Copper	200	18.5	2688	-	-	1300	1000	-	170000
Lead	25	6.3	160.5	-	50	ZERO	50	-	50
Manganese	300	-	-	-	-	-	300	-	50
Mercury	2	0.2	0.2	-	2	2	2	-	0.144
Nickel	-	142	2748	-	-	100	-	-	[illegible]
Selenium	10	1.0	-	-	10	50	10	-	10
Silver	50	0.1	10	-	50	-	50	-	50
Vanadium	-	14	190	-	-	-	-	-	-
Zinc	300	30	497	-	-	-	5000	-	5000
Cyanide	100	5.2	22	-	-	200	-	-	200

NOTES:

a - Includes pesta and 2,4-dichlorophenols
b - Total unchlorinated phenols
c - Total organics not to exceed 100 μg/L.
d - New Jersey DEP criteria for total volatile organic compounds - 10 μg/L.
ZERO - Implies nondetect criteria
FWQC - Federal Water Quality Criteria
Effluent limits from 6NYCRR, Parts 702 and 703
MCLG - Maximum Contaminant Limit Goal
SNARLS - Suggest No Adverse Response Levels

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TABLE 2.3-4

GROUND WATER AND LEACHATE SEEPS: COMPARISON OF OBSERVED CONCENTRATION RANGES WITH CLASS GA STANDARDS

Parameter	Range of Detected Concentrations in Shallow Ground Water	Range of Detected Concentrations in Bedrock Ground Water	Range of Detected Concentrations in Leachate Seeps	Class GA Standards
Benzene	2.7 - 290	23	3 - 8	ND(2)
Chlorobenzene	1,200 - 11,000	—	2 - 140	5
Chloroethane	900	3.7	1 - 31	—
1,2-Dichlorobenzene	4	—	4 - 57	
1,4-Dichlorobenzene	2 - 240	—	2 - 6	4.7
1,3-Dichlorobenzene	82	—	4 - 89	5
1,1-Dichloroethane	5.6 - 4900	4.1	2.3 - 4.9	5
1,1-Dichloroethylene	240	—		5
trans-1,2-Dichloroethylene	9.2	9.2	64 - 85	5
Ethylbenzene	—	—	6	5
1,1,1-Trichloroethane	26 - 15,000	—	—	—
Toluene	3 - 43	3	—	5
Xylenes	400	—	—	5
2-Chlorophenol	13	—	—	—
2,4-Dimethylphenol	630 - 940	—	30	—
2-Methylphenol	72	—	—	—
4-Methylphenol	75	—	—	—
Phenol	6 - 4,000	16	7 - 10	1 a
Dibenzofuran	15 - 20	—	20 - 63	—
Diethylhexylphthalate (DEHP)	3 - 66	3 - 42	9 - 60	50
Endosulfan II	0.69	—	0.032 - 0.054	—
PCBs	110	0.05	—	0.1
PAHs	—	—	2 - 39	—
Aldrin	—	—	0.007 - 0.008	ND(0.05)
Dieldrin	—	—	0.007 - 0.028	ND(0.05)
DDD	—	—	0.011	ND(0.05)
Endrin	—	—	0.028	ND(0.05)

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TABLE 2.3-4 (cont.)

GROUND WATER AND LEACHATE SEEPS: COMPARISON OF OBSERVED CONCENTRATION RANGES WITH CLASS GA STANDARDS

Parameter	Range of Detected Concentrations in Shallow Ground Water	Range of Detected Concentrations in Bedrock Ground Water	Range of Detected Concentrations in Leachate Seeps	Class GA Standards
Aluminum	224-74,000	56.1 - 1,830	39 - 303,000	—
Arsenic	2.1 - 22.3	2.4 - 4.7	2.2 - 16.7	25
Barium	52.2 - 1,530	24.9 - 240	80.3 - 10,000	1000
Cadmium	1.3 - 12	1.1 - 4.2	3.7 - 122	10
Chromium	2 - 196	2.4-728	3.5 - 426	50
Cobalt	2 - 46.9	7.1	3.4 - 157	—
Copper	2.7 - 3,060	3.7 - 28.4	13.9 - 784	200
Lead	2.3 - 369	2.3 - 6.8	6.7 - 1,640	25
Manganese	62.1 - 3450	5.9 - 428	123 - 16,100	300
Mercury	0.23 - 3.3	0.48	0.25 - 4.7	2
Nickel	11.8 - 141	10.7 - 198	20.4 - 521	—
Silver	2.1 - 23.7	2	3.4 - 16.6	50
Vanadium	1.4 - 124	1.4 - 35.3	3.3 - 471	—
Zinc	7.5 - 1490	1.4 - 44	66 - 8,270	300
Cyanide	30	—	18 - 31	100

NOTES: Effluent limits from 6NYCRR Parts 702 and 703.
All units in micrograms per liter (µg/L).

APPENDIX C

Table 3-1

ARAR VALUES:
CHEMICALS EXCEEDING ARARs AND/OR CONTRIBUTING SIGNIFICANTLY TO RISK

Media	Exposure Pathway	Chemicals contributing to significant risk	ARAR	Chemicals exceeding ARARs (ppb)	ARAR
Surface Water (Ellicott Creek & Aero Lake)	• Ingestion of surface water and dermal contact with Aero Lake surface water while swimming			Chlorobenzene	5[a]
				Aluminum	100[a]
				Cadmium	1.7[a]/7[b]
				Iron	300[a]/300[b]
	• Dermal adsorption of drainage ditch surface waters and Ellicott Creek surface water			Lead	6.3[a]
				Zinc	30[a]
				Mercury	0.2[a]/0.2[b]
Leachate Seeps	• Dermal exposure by children and workers	Bis (2-ethylhexyl)phthalate	50[a]	1,2 trans dichloroethene	5[a]
		PAHs (Carc)	0.8[d]	phenol	1[a]
				1,2 dichlorobenzene	4.7[a]
				Aldrin	0.05[a]
				Endrin	0.05[a]
				4,4 - DDD	0.05[a]
				Barium	1,000[a]
				Beryllium	3[a]
				Cadmium	10[a]
				Chromium	50[a]
				Copper	200[a]
				Iron	300[a]
				Lead	25[a]
				Magnesium	35,000[a]
				Manganese	300[a]
				Zinc	300[a]

TABLE 3-1 (cont.)

ARAR VALUES:
CHEMICALS EXCEEDING ARARs AND/OR CONTRIBUTING SIGNIFICANTLY TO RISK

Media	Exposure Pathway	Chemicals contributing to significant risk	ARAR	Chemicals exceeding ARARs (ppb)	ARAR
Drainage Ditches, Aero Creek & Ellicott Creek Sediments	• Dermal absorption • Ingestion	PAHs (carc)	1.32[f] mg/kg		
Landfill Soils	• Dermal absorption • Ingestion	PAHs (carc)	1.32[f]mg/kg	Chlorobenzene	5.5[g]
		PCBs	1[g]	BEHP	4.4[g]
		2,3,7,8 TCDD TEQ	0.001[g]	PAHs (noncarc)	114.8[g]
		Arsenic	7.5[g]	b-BHC	0.01[g]
		Lead	32.5[g]	Chlordane	0.2[g]
Groundwater (Unconsolidated Aquifer)	• Ingestion of drinking water • Dermal contact • Inhalation of airborne contaminants	Benzene	2[e]	Xylenes	5[e]
		1,4 dichlorobenzene	4.7[e]	Chromium	50[e]
		Bis(2-ethylhexyl)phthalate	50[e]	Iron	300[e]
		PCBs	0.1[e]	Magnesium	35,000[e]
		Arsenic	25[e]	Sodium	20,000[e]
		Chlorobenzene	5[e]		
		1,1,1-Trichloroethene	5[e]		
		2,4 dimethylphenol	50[e]		
		Barium	100[e]		
		Manganese	300[e]		
		1,4 dichlorobenzene	4.7[e]		

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TABLE 3-1 (cont.)

ARAR VALUES:
CHEMICALS EXCEEDING ARARs AND/OR CONTRIBUTING SIGNIFICANTLY TO RISK

Media	Exposure Pathway	Chemicals contributing to significant risk	ARAR	Chemicals exceeding ARARs (ppb)	ARAR
- Bedrock Aquifer	• Ingestion of drinking water	Benzene	2[e]		
		Bis(2-ethylhexyl) phthalate	50[e]		
	• Dermal contact while showering	Aldrin	0.05[e]		
		Arsenic	25[e]		
	• Inhalation of airborne contaminants while showering	Barium	1,000[e]		
		Cadmium	10[e]		
		Nickel	100[h]		
		Vanadium	14[e]		
		Lead	25[e]		

[a] Class B Standards
[b] Class D Standards
[c] 6NYCRR Part 703.5 Class GA Standards/BA TOGS
[d] EPA 1990: Drinking Water Regs and Health Advisories
[e] NYSDOH MCL
[f] Guideline Values from Technology Section Division of Hazardous Waste
[g] Draft Soil Cleanup Guideline Values (TBC's) issued by Technology Section, Division of Hazardous Waste Remediation, NYSDEC.
[h] SDWA MCLG

APPENDIX D

ADMINISTRATIVE RECORD

1. CAMP DRESSER AND MCKEE REPORTS

   a) Phase I Radiation Walkover Survey, 1988
   b) Leachate Surface Water and Sediment Report, 1990
   c) Geophysical Investigation, 1990
   d) Phase II Radiation Investigation, 1990
   e) Soil Borings and Groundwater Investigation, 1990
   f) Exposed Drum Investigation, 1990
   g) Baseline Human Health Risk Assessment, 1991
   h) Remedial Investigation Report, 1991
   i) Feasibility Study Report, 1991
   j) Project Operations Plan
   k) Modified Brossman QA/CC Short Form for the Collection of Environmental Samples

2. NYSDEC AND NYSDOH REPORTS

   a) Radiochemical Analysis Report 1989
   and Addendum 1 Groundwater 1990
   Addendum 2 Soil/Waste 1990

   b) June 1990 Supplemental Sample Report . . 1991

   c) Contaminant Concentrations in Fish from Waters Associated with Pfohl Brothers Landfill 1991

   d) Pfohl Brothers Landfill Residential Sump Sampling Report 1990

   e) Surficial Soil Sampling . . . . 1990 - June

   f) NYSDOH Summary of Survey Results . . . . 1991 - March

   g) Cancer Incidence in the Cheektowaga/ Ellicott Creek Area, Erie Co., N.Y.

   h) Public Participation Plan . . . . 1988 (Revised '89)

3. GUIDANCE DOCUMENT

   OSWER Directive 9355.3-11, February 1991, "Conducting Remedial Investigations/Feasibility Studies for CERCLA Municipal Landfill Sites.

4. POLICY DOCUMENTS

   Technical and administrative Guidance Memorandum (TAGM)

5. ANALYTICAL DATA RESULTS, DATA VALIDATION AND QA/QC REPORTS

6. PREVIOUS SITE INVESTIGATION REPORTS