United States
Environmental Protection
Agency

Office of
Emergency and
Remedial Response

EPA/ROD/R05-91/158
June 1991

EPA

# Superfund
# Record of Decision:

## Folkertsma Refuse, MI

50272-101

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SUPERFUND RECORD OF DECISION
Folkertsma Refuse, MI
First Remedial Action - Final

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15. Supplementary Notes

16. Abstract (Limit: 200 words)
The 8-acre Folkertsma Refuse site is an inactive industrial landfill in Walker, Kent County, Michigan. Surrounding land use is primarily industrial with a few private residences in the vicinity. The site is partially bordered by woodlands, and migration of contaminants has impacted a 100-year floodplain and scattered wetland areas of Indian Mill Creek located to the south. The site overlies surficial glacial and bedrock aquifers, both of which are used for local drinking water supplies. Onsite features include an uncapped landfill, a man-made creek and a drainage ditch that join and discharge to Indian Mill Creek, an office building, and three warehouses. Prior to 1965, the site was used as a muck farm. From 1965 until 1972, industrial wastes including foundry sand, chemical products, construction debris, and other industrial wastes were disposed of in the onsite landfill. The primary fill material in the landfill is foundry sand. Since 1972, the site has been operated as a pallet repair and manufacturing facility. In 1984, EPA identified elevated contaminant levels in the onsite drainage ditch sediment, but not in onsite ground water. Further investigations in 1985 and 1988 characterized onsite and offsite (Indian Mill Creek) contamination, and determined the potential for future ground

(See Attached Page)

17. Document Analysis a. Descriptors
Record of Decision - Folkertsma Refuse, MI
First Remedial Action - Final
Contaminated Media: sediment, gw
Key Contaminants: VOCs, other organics (PCBs, SVOCs), metals (arsenic, chromium, nickel)

b. Identifiers/Open-Ended Terms

c. COSATI Field/Group

| 18. Availability Statement | 19. Security Class (This Report) None | 21. No. of Pages 74 |
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| | 20. Security Class (This Page) None | 22. Price |

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

Abstract (Continued)

water contamination. This Record of Decision (ROD) addresses engineering controls for source material and management of migration of contaminated ground water as a final remedy. The primary contaminants of concern affecting the landfilled material, sediment, and ground water are VOCs; other organics including SVOCs and PCBs; and metals including arsenic, chromium, and nickel.

The selected remedial action for this site includes excavating and dewatering approximately 1,300 cubic yards of contaminated sediment from the man-made creek, the drainage ditch, and Indian Mill Creek, and consolidating these within the landfill area; capping the landfill area with a clay cap and revegetated soil cover installing passive landfill gas vents, if necessary; converting the man-made creek and the drainage ditch to permeable subsurface drains to provide for landfill surface drainage; monitoring ground water and surface water; and implementing institutional controls such as deed and ground water use restrictions, as well as site access restrictions such as fencing. The estimated present worth cost for this remedial action is $1,500,000, which includes an annual O&M cost of $58,000 for the first year. O&M costs for subsequent years were not provided.

PERFORMANCE STANDARDS OR GOALS: The remedial action is designed to reduce the excess lifetime cancer risk to the $10^{-4}$ to $10^{-6}$ level and the noncarcinogenic HI < 1. Chemical-specific clean-up goals were not provided.

# DECLARATION FOR THE RECORD OF DECISION

## SITE NAME AND LOCATION

Folkertsma Refuse Site
Walker, Michigan

## STATEMENT OF BASIS AND PURPOSE

This decision document presents the selected remedial action for the Folkertsma Refuse Site in Walker, Michigan, which was chosen in accordance with the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA), as amended by the Superfund Amendments and Reauthorization Act of 1986 (SARA), and, to the extent practicable, the National Oil and Hazardous Substances Pollution Contingency Plan (NCP). The decision is based on the Administrative Record for this site.

The State of Michigan concurs with the selected remedy.

## ASSESSMENT OF THE SITE

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

## DESCRIPTION OF REMEDY

This final remedy provides for the containment of the large volume of low level organic and inorganic waste material contained in the landfill and the contaminated muck deposit beneath the landfill; consolidation of the contaminated sediments of the unnamed creek, drainage ditch, and Indian Mill Creek on the landfill; and monitoring of the contaminated groundwater beneath the site. The risks posed by the site will be eliminated or reduced through engineering and institutional controls.

The major components of the selected remedy include:

- Excavate, dewater, and consolidate on top of the landfilled materials approximately 1,300 cubic yards of contaminated sediment from the unnamed creek, drainage ditch, and Indian Mill Creek;
- Convert the unnamed creek and drainage ditch into permeable underground drains to provide for continued site drainage;
- Install and maintain a cap over the contaminated sediments and landfilled areas in accordance with the requirements of the Resource Conservation and Recovery Act Subtitle D and Michigan Act 641;

- Install and maintain passive gas vents on each side of the landfill to prevent the buildup of volatile organic compounds and methane if necessary;
- Install and maintain a layer of topsoil and a vegetative covering over the landfilled areas;
- Install and maintain a fence around the site;
- Impose institutional controls such as deed restrictions to prevent the installation of drinking water wells within the landfilled portion of the site and future disturbance of the cap and landfilled materials;
- Implement long-term groundwater and drainage water monitoring programs to ensure the effectiveness of the remedial action.

STATUTORY DETERMINATIONS

The selected remedy is protective of human health and the environment, complies with Federal and State requirements that are legally applicable or relevant and appropriate to the remedial action, and is cost-effective. This remedy utilizes permanent solutions and alternative treatment (or resource recovery) technologies to the maximum extent practicable for this site. However, because treatment of the large volume of low-level organic and inorganic waste materials at the site was not found to be practicable, this remedy does not satisfy the statutory preference for treatment as a principal element of the remedy.

Because this remedy will result in hazardous substances remaining on-site above health-based levels, a review will be conducted within five years after commencement of remedial action to ensure that the remedy continues to provide adequate protection of human health and the environment.

Valdas V. Adamkus
Regional Administrator

June 28th, 1991.
Date

**DECISION SUMMARY FOR THE RECORD OF DECISION**
**FOLKERTSMA REFUSE SITE**
**WALKER, MICHIGAN**

## SITE NAME, LOCATION AND DESCRIPTION

The Folkertsma Refuse site is a former industrial landfill located at 1426 Pannell Road, N.W. in Walker, Michigan (Figures 1 and 2). The City of Walker, which borders the northwest side of Grand Rapids, is located in southwestern Michigan, approximately 45 miles east of Lake Michigan in Kent County.

The site is a rectangular parcel of land measuring 1,000 by 400 feet and covering approximately 8 acres. The site is generally flat with 10 feet of vertical relief sloping from the northern boundary to the southern boundary. The surface of the landfilled portion of the site rises approximately 4 to 6 feet above the surrounding area. The landfill is not capped and foundry sand, the primary fill material, is exposed at the surface. However, the northeast portion of the site has been covered with a 3 inch layer of gravel. An unnamed creek (manmade) running along the western property line and a drainage ditch running through the center of the landfill join at the southern end of the site and empty into a drain pipe. The drain pipe discharges to Indian Mill Creek just south of the site. Fishing and swimming have been reported to occur in Indian Mill Creek. However, Indian Mill Creek is not a major recreational area. Indian Mill Creek, which flows in an easterly direction, empties into the Grand River approximately 2 miles downstream of the site.

The property is currently leased by a pallet repair and manufacturing company. An office building and three warehouses are located on the site, and stacks of pallets are organized along the graveled area. The remainder of the site is overgrown with weeds, grass and trees and contains several pieces of junk machinery.

The site and the properties surrounding the site are zoned for and occupied by industry. There are, however, about ten to twelve residences along the south side of Pannell Road in close proximity to the north end of the site. These homes obtain water from private wells, which are upgradient from the site. There is also a residential subdivision approximately a quarter of a mile north of the site. The subdivision, also upgradient of the site, is serviced by the Grand Rapids Water Department, which obtains its water from Lake Michigan and the Grand River. Residences also exist south of the site, on the other side of Indian Mill Creek. These homes are downgradient of the site. Michigan Department of Natural Resources well records indicate that there is only one domestic well in this area; the other residences are serviced by the Grand Rapids Water Department. A door to door survey conducted in 1986 did not identify any additional water

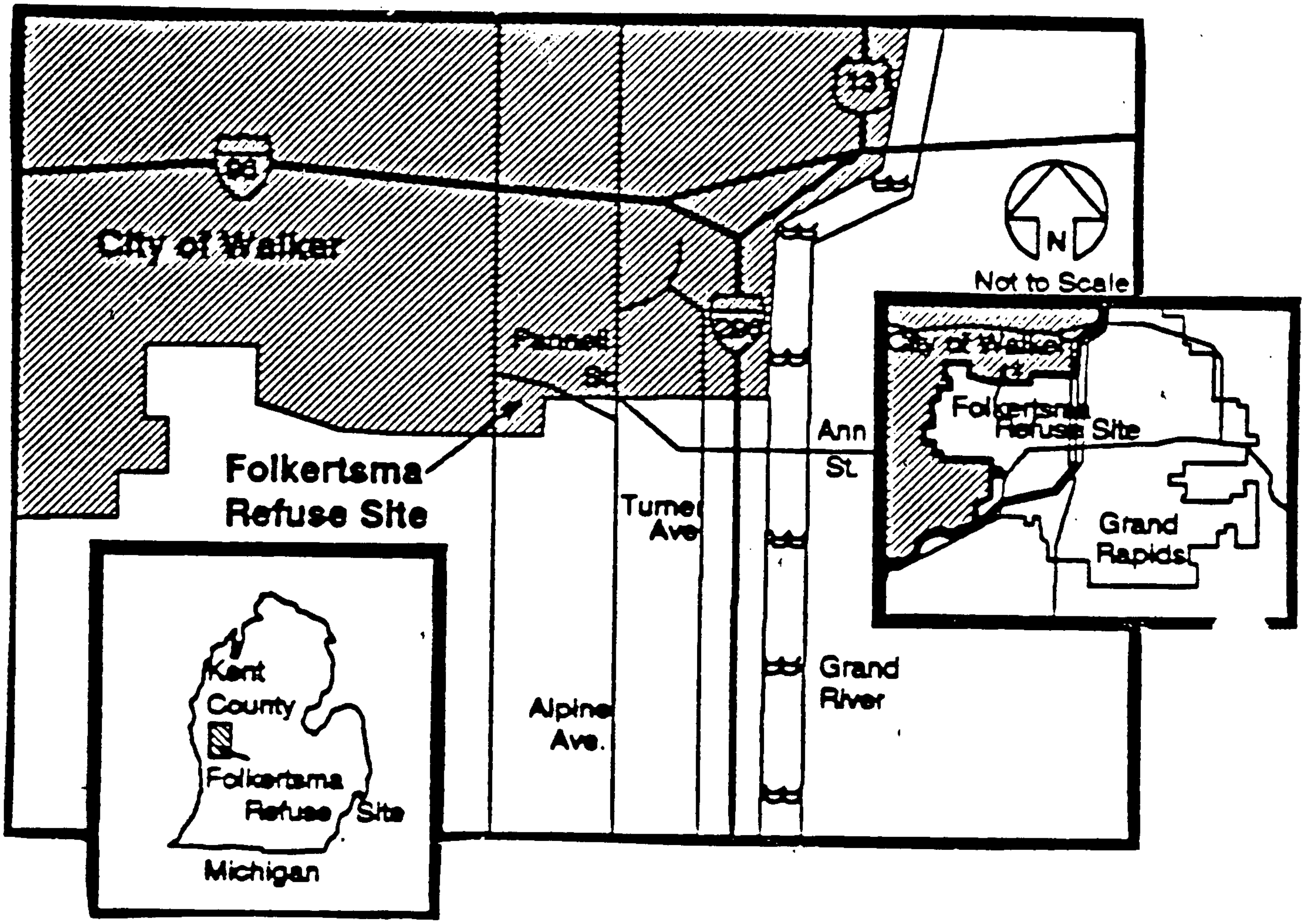


FIGURE 1

SITE AREA MAP

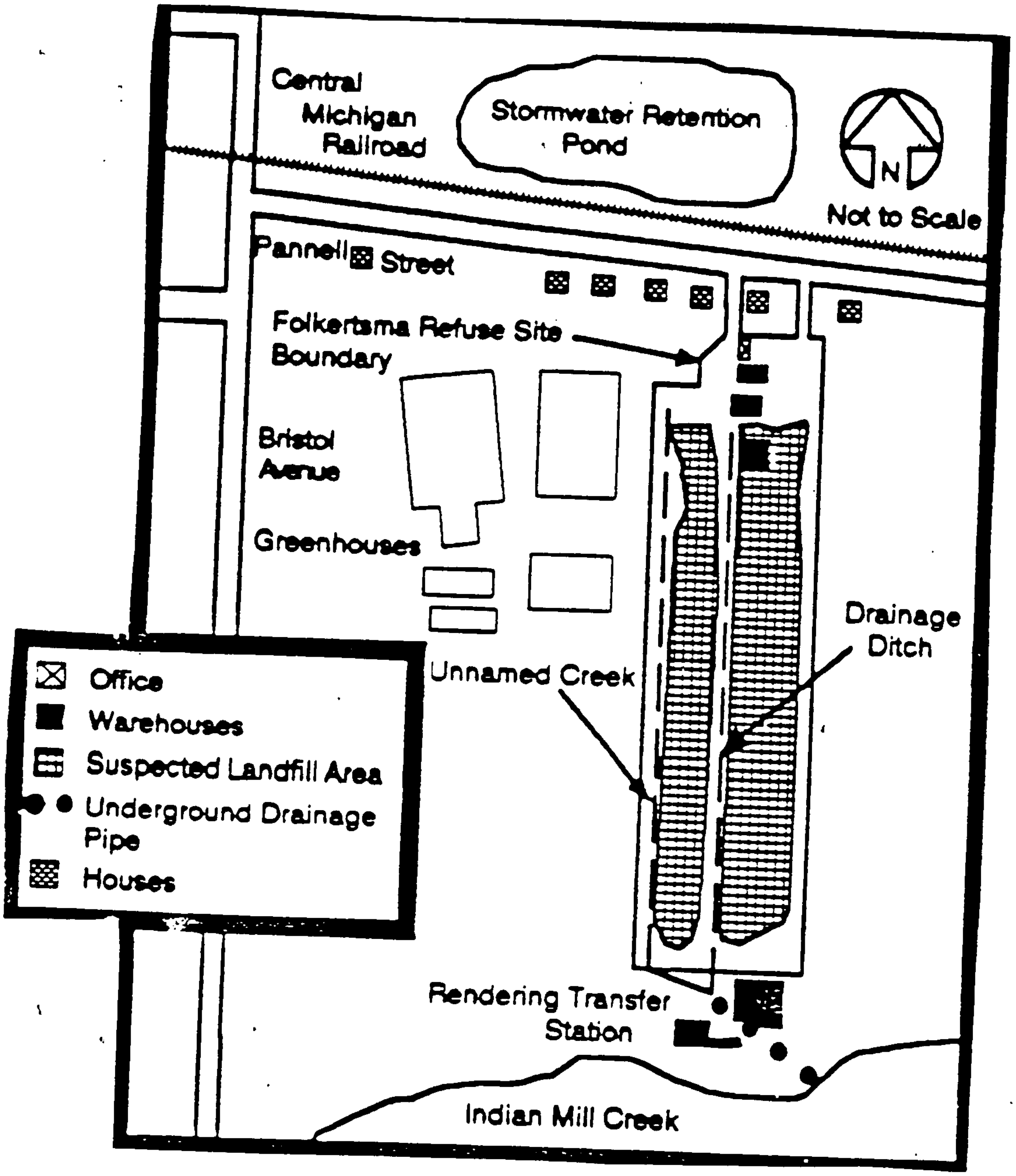


FIGURE 2

SITE DETAIL MAP

wells in this area.

East of the site is a tract of undeveloped woodland which was formerly operated as a muck farm, and the western boundary is bordered by nursery land and greenhouses. South of the site is a transfer station for a rendering company. Wetlands exist along a second drainage ditch approximately 85 feet east of the site, and in scattered areas along the north bank of Indian Mill Creek downstream from the site.

## SITE HISTORY AND ENFORCEMENT ACTIVITIES

Prior to 1965, the Folkertsma Refuse site was operated as a muck farm. In 1965, the owners/operators began to accept industrial waste for disposal in a landfill operated on the southern two-thirds of the property. Disposal activities ceased in 1972 and the property was occupied by a pallet repair and manufacturing company soon after.

The landfill averages 5.8 feet in depth, with a reported maximum thickness of 10 feet at its northern end. It is estimated that the landfill covers 6 acres and contains approximately 57,000 cubic yards of low-level organic and inorganic waste material. Most of this waste material is foundry sand.

As required by CERCLA, the United States Environmental Protection Agency (EPA) was notified of past waste disposal activities at the Folkertsma Refuse site in 1981. A preliminary assessment was completed in 1983. It was determined that an on-site investigation should be conducted. In 1984, an EPA field investigation team sampled groundwater and the sediment of the drainage ditch. Although the groundwater was not found to be contaminated, elevated levels of semi-volatile and inorganic chemicals were detected in the sediment samples. In 1985, the Michigan Department of Natural Resources (MDNR) conducted an assessment of the site, and reported that there was approximately 40,000 cubic yards of waste at the site, consisting of foundry sand, chemical products, construction debris and other industrial wastes from heavy manufacturing operations. The site was proposed for the National Priorities List in 1986. The listing was finalized in 1989.

Special Notice letters for the Remedial Investigation/Feasibility Study (RI/FS) were sent to approximately 12 Potentially Responsible Parties (PRPs) in August, 1987. The PRPs did not submit a "good faith" proposal to EPA to conduct the RI/FS. Negotiations were formally concluded in October, 1987, and the RI/FS was conducted by EPA.

## COMMUNITY RELATIONS HISTORY

Community relations activities for the Folkertsma Refuse site began in October, 1988, shortly before the RI was scheduled to begin. EPA conducted interviews with state and local officials, a local environmental organization, and Walker residents to determine the interest and concern over the site. A Community Relations Plan was finalized in February, 1989.

Fact Sheets describing RI activities were released in February 1989 and May 1989. In addition, an availability session was held in May 1989 to meet with local residents and answer any questions about the RI/FS. Notice of the availability session was released on May 16, 1989.

The RI/FS for the Folkertsma Refuse site was released to the public in mid 1990 and was made available at two local information repositories. The information repositories are maintained at the Kent County Public Library and at the Walker City Hall. The Administrative Record is also maintained at both of these locations.

The Proposed Plan was released to the public in March 1991. The public comment period opened April 1, 1991, and closed April 30, 1991. No extensions were requested. In addition, a public meeting was held April 3, 1991. At the meeting, EPA and State representatives discussed the results of the RI/FS and the preferred alternative as presented in the Proposed Plan for the site, answered questions, and accepted public comments. Notice of the Proposed Plan, the public comment period, the public meeting, and the availability of the RI/FS and other site-related documents was published in the Advance on March 26, 1991, and in the Grand Rapids Press on March 28, 1991. A news release regarding this information was also made on March 27, 1991.

All comments which were received by EPA during the public comment period, including those expressed verbally at the public meeting, are addressed in the Responsiveness Summary, which is part of this Record of Decision.

## SCOPE AND ROLE OF THE RESPONSE ACTION

This final remedy addresses the large volume of low level organic and inorganic waste materials contained within the landfill; the contaminated muck deposit beneath the landfill; the contaminated sediments of the unnamed creek, drainage ditch, and Indian Mill Creek; and the contaminated groundwater beneath the landfill. Unacceptable risks to human health have been calculated for the ingestion of, direct contact with, and the inhalation of, landfilled materials; and for the ingestion of unfiltered groundwater beneath the landfilled portion of the site. Unacceptable risks to the environment are posed through the ingestion of, and direct contact with, landfilled materials and contaminated sediments. There is also the potential for further groundwater contamination, and for the contaminated groundwater to move out from beneath the landfilled materials.

The role of this response action is to prevent current or future exposure to the landfilled materials, the contaminated muck deposit, the contaminated sediments of the unnamed creek, drainage ditch and Indian Mill Creek, and the contaminated groundwater beneath the landfill; to reduce contaminant migration into the groundwater; and to prevent contaminated groundwater from moving out from beneath the landfill.

These objectives will be achieved by containing the contaminated landfill materials and muck deposit; consolidating the contaminated sediments of the unnamed creek, drainage ditch and Indian Mill Creek on the landfill; and monitoring the contaminated groundwater beneath the landfill. Access restrictions (i.e. fencing) and institutional controls will also be implemented.

## SUMMARY OF SITE CHARACTERISTICS

As part of the RI, EPA collected samples of the landfilled material, subsurface soil, groundwater, surface water, and sediments from the site and adjacent areas. Both filtered and unfiltered groundwater and surface water samples were taken. Samples from all media were analyzed for organic and inorganic compounds.

### GEOLOGY AND HYDROLOGY

The geology underlying the site consists of four key subsurface units: the foundry sand fill unit, a glacial fluvial unit, a glacial lacustrine unit, and a bedrock unit. The foundry sand fill unit covers the southern two-thirds of the site and has an average thickness of 5.8 feet. Beneath the fill unit is a glacial fluvial unit consisting of a discontinuous silty clay/muck subunit and a sand and gravel subunit. The silty clay /muck subunit is present only under the landfilled portion of the site and has an average thickness of 1.5 feet. At some locations this unit was removed prior to landfilling operations. The sand subunit underlies the silty clay/muck at the southern two-thirds of the site and is exposed at the surface at the northern third of the site. This sand and gravel subunit is the major geologic formation in the Folkertsma Refuse site area. This subunit consists of fine to medium sand with an average thickness of 50 feet. The glacial lacustrine unit consists of silt and clay, and the bedrock unit is of the Bayport Limestone.

The groundwater table in the site area is encountered approximately 4 feet below the land surface (BLS), saturating the landfilled materials at discrete locations. Generally, groundwater movement is to the south-southeast across the site, with an average hydraulic conductivity of 1.68 ft/day.

Groundwater in the upper zones of the aquifer (less than 15 feet BLS) discharge to the unnamed creek, drainage ditch, and Indian Mill Creek. The deeper portions of the aquifer (greater than 15 feet BLS) flow southward beneath Indian Mill Creek towards the Grand River.

**CONTAMINANT ANALYSES**

The analytical results of the sampling are presented in Table 1. Analysis of the samples indicates that the landfilled materials contain several contaminants at concentrations above background soil levels. The contaminants detected at the site include volatile organic compounds (VOCs), semi-volatile organic compounds (SVOCs), polychlorinated biphenyls (PCBs), pesticides, and metals.

Some contaminants have migrated into the muck deposit beneath the landfill, or, in areas where there is little or no muck, to a limited extent into the sand and gravel unit. Contaminants have also migrated into the sediments of the unnamed creek, excavated ditch, and Indian Mill Creek. It is estimated that there are approximately 57,000 cubic yards of landfilled waste, 12,300 cubic yards of contaminated muck, and 1,300 cubic yards of contaminated sediment.

Contaminants were also detected above Maximum Contaminant Levels (MCLs) in unfiltered groundwater samples from beneath the landfill. A comparison of the filtered and unfiltered groundwater data indicates that these contaminants (arsenic and polynuclear aromatic hydrocarbons (PAHs)) are not dissolved in the groundwater, but rather sorbed onto particulate matter in the groundwater. PAHs were not detected in any of the filtered groundwater samples, and arsenic was removed or reduced to below acceptable intake levels when the sample was filtered. In addition, the well in which the PAHs were detected was redeveloped and additional unfiltered samples were collected. PAHs were not detected in any of the unfiltered groundwater samples collected during this round.

Two contaminants, beryllium and cadmium, were detected above water quality criteria for freshwater in unfiltered surface water samples collected from the drainage ditch. Beryllium was detected above the chronic standard at one location, while cadmium was detected above both the chronic and acute standards at two locations. These chemicals were not detected in any of the filtered surface water samples, which indicates that these chemicals are suspended in the surface water, rather than dissolved. A third contaminant, mercury, was detected in all filtered and unfiltered surface water samples collected from the unnamed creek and drainage ditch. Although the levels at which mercury was detected exceed the chronic freshwater standard established for that chemical, the field blanks were also

## TABLE 1

## ANALYTICAL DATA

| MEDIA | CONCENTRATION (ppb)* MEAN[a] | MAXIMUM | DETECTION RATIO[b] |
|---|---|---|---|
| **LANDFILLED MATERIALS** | | | |
| Methylene Chloride | 0.685 | 9.75 | 3/10 |
| Acetone | 15.0 | 560. | 8/12 |
| Carbon disulfide | 1.86 | 10.0 | 2/12 |
| 2-Butanone | 9.78 | 180. | 6/12 |
| Trichloroethene | 2.75 | 8.00 | 1/12 |
| Benzene | 2.64 | 5.00 | 1/12 |
| Tetrachloroethene | 2.80 | 10.0 | 1/12 |
| Toluene | 99.3 | 1,800. | 12/12 |
| Ethylbenzene | 2.72 | 7.00 | 1/12 |
| Xylenes | 2.61 | 110. | 3/12 |
| Phenol | 92.3 | 1080. | 4/13 |
| Benzoic acid | 170. | 460. | 3/11 |
| Naphthalene | 332 | 2,900. | 9/11 |
| Methylnaphthalene | 263 | 880. | 8/11 |
| Acenaphthylene | 170 | 320. | 1/11 |
| Acenaphthene | 186. | 2,400 | 7/11 |
| Dibenzofuran | 73.3 | 3,300 | 7/11 |
| Fluorene | 147 | 4,800 | 6/11 |
| Phenanthrene | 1135. | 34,000 | 11/11 |
| Anthracene | 303 | 6,300. | 7/11 |
| Di-n-butylphthalate | 24.8 | 46.7 | 1/11 |
| Fluoranthene | 2,166 | 27,000. | 11/11 |
| Pyrene | 2,300 | 30,000. | 11/11 |
| Butylbenzylphthalate | 49.5 | 93.0 | 1/11 |
| Benzo(a)anthracene | 1,865 | 20,000. | 10/11 |
| Chrysene | 2,852 | 23,000 | 11/11 |
| bis(2-Ethylhexyl)phthalate | 163 | 820 | 7/11 |
| Benzo(b)fluoranthene | 2303 | 45,000 | 10/11 |
| Benzo(k)fluoranthene | 211. | 22,000. | 5/11 |
| Benzo(a)pyrene | 2032 | 27,000 | 10/11 |
| Indeno(1,2,3-cd)pyrene | 2607 | 31,000 | 6/11 |
| Dibenz(a,h)anthracene | 1485 | 12,000 | 6/11 |
| Benzo(g,h,i)perylene | 1340 | 11,000. | 6/11 |
| gamma-BHC | 2.69 | 48.0 | 2/12 |
| gamma-Chlordane | 8.41 | 15.0 | 2/12 |
| Aroclor-1254 | 233. | 2,500 | 3/12 |
| Antimony | 16.8 | 16.8 | 1/11 |
| Calcium | 8336 | 59,750 | 10/10 |
| Chromium | 46.6 | 2400 | 11/11 |
| Cobalt | 4.39 | 31.0 | 4/6 |
| Copper | 95.2 | 544 | 11/11 |
| Iron | 13,589. | 36,600 | 11/11 |
| Lead | 60.9 | 4,140 | 11/11 |

**TABLE 1 (cont'd)**

| MEDIA | CONCENTRATION MEAN | CONCENTRATION MAXIMUM | DETECTION RATIO |
|---|---|---|---|
| **LANDFILLED MATERIALS (cont'd)** | | | |
| Magnesium | 3675 | 81,585 | 8/8 |
| Nickel | 35.2 | 277 | 8/8 |
| Selenium | 0.213 | 4.40 | 1/5 |
| Silver | 0.535 | 16.5 | 1/11 |
| Sodium | 239 | 980 | 1/3 |
| Vanadium | 15.5 | 28.2 | 3/3 |
| **SEDIMENTS** | | | |
| Methylene Chloride | 1.85 | 11.0 | 2/5 |
| Acetone | 39.8 | 120. | 5/5 |
| 2-Butanone | 10.6 | 34.0 | 3/5 |
| Toluene | 47.6 | 120. | 5/5 |
| Naphthalene | 55.4 | 175. | 2/5 |
| 2-Methylnaphthalene | 101. | 175. | 1/5 |
| Acenaphthylene | 19.0 | 26.2 | 1/5 |
| Acenaphthene | 45.9 | 95.0 | 3/5 |
| Fluorene | 35.3 | 61.5 | 1/5 |
| Pentachlorophenol | 336. | 585 | 1/5 |
| Phenanthrene | 596 | 1250 | 5/5 |
| Anthracene | 71.8 | 235. | 4/5 |
| Di-n-butylphthalate | 47.0 | 82.0 | 1/5 |
| Fluoranthene | 1722 | 3050 | 5/5 |
| Pyrene | 2244. | 3600 | 5/5 |
| Benzo(a)anthracene | 1525 | 2450 | 5/5 |
| Chrysene | 2083 | 3050 | 5/5 |
| bis(2-Ethylhexyl)phthalate | 450 | 930 | 3/5 |
| Benzo(b)fluoranthene | 2832. | 4400 | 5/5 |
| Benzo(k)fluoranthene | 2064. | 3150 | 5/5 |
| Benzo(a)pyrene | 2319. | 3650 | 5/5 |
| Indeno(1,2,3-cd)pyrene | 2242 | 3850 | 5/5 |
| Dibenzo(a,h)anthracene | 382 | 940 | 3/5 |
| Benzo(g,h,i)perylene | 2903 | 5100 | 5/5 |
| gamma-BHC(Lindane) | 4.53 | 29.0 | 2/5 |
| 4,4'-DDE | 12.6 | 22.0 | 1/5 |
| Endosulfan II | 10.6 | 18.5 | 1/5 |
| gamma-Chlordane | 9.27 | 26.5 | 2/5 |
| Aroclor-1254 | 141. | 245. | 1/5 |
| Arsenic | 9.62 | 13.5 | 4/4 |
| Barium | 165. | 235 | 3/3 |
| Calcium | 29,038. | 51,400. | 5/5 |
| Copper | 337 | 1,425 | 3/3 |
| Iron | 11,345 | 24,700 | 5/5 |
| Lead | 80.9 | 449 | 4/4 |
| Magnesium | 5,959 | 8,280 | 3/3 |

TABLE 1 (cont'd)

| MEDIA | CONCENTRATION MEAN | MAXIMUM | DETECTION RATIO |
|---|---|---|---|
| **SEDIMENTS (cont'd)** | | | |
| Nickel | 12.3 | 35.5 | 2/3 |
| Zinc | 184 | 1085 | 5/5 |
| **SHALLOW GROUNDWATER** | | | |
| Toluene | 2.57 | 21.0 | 7/15 |
| Naphthalene | 4.96 | 5.50 | 2/16 |
| Acenaphthen | 4.84 | 3.00 | 1/16 |
| Dibenzofuran | 5.00 | 5.00 | 1/16 |
| Fluorene | 5.64 | 8.00 | 1/16 |
| Phenanthrene | 6.00 | 45.0 | 2/16 |
| Anthracene | 5.22 | 10.0 | 1/16 |
| Fluoranthene | 5.86 | 36.0 | 2/16 |
| Pyrene | 5.68 | 26.0 | 2/16 |
| Benzo(a)anthracene | 5.25 | 14.0 | 2/16 |
| Chrysene | 5.29 | 14.0 | 2/16 |
| Benzo(b)fluoranthene | 5.19 | 13.0 | 2/16 |
| Benzo(k)fluoranthene | 5.07 | 9.0 | 2/16 |
| Benzo(a)pyrene | 5.11 | 12.0 | 2/16 |
| Arsenic | 13.7 | 287 | 6/8 |
| Manganese | 347 | 1,740 | 14/14 |
| Mercury | 0.150 | 0.430 | 6/14 |
| Silver | 8.55 | 350 | 2/11 |
| **DEEP GROUNDWATER** | | | |
| Beta-BHC | 0.0266 | 0.0470 | 1/10 |
| Aluminum | 731 | 8,080 | 6/7 |
| Barium | 45.1 | 204 | 1/2 |
| Cadmium | 1.83 | 4.25 | 1/12 |
| Copper | 14.1 | 34.0 | 2/3 |
| Iron | 1,065 | 22,800 | 12/12 |
| Lead | 2.96 | 20.0 | 4/8 |
| Manganese | 99.9 | 660 | 12/12 |
| Potassium | 2,454 | 3,500 | 2/2 |
| Arsenic | 1.12 | 12.7 | 4/4 |
| Mercury | 0.136 | 0.270 | 4/12 |
| **SURFACE WATER** | | | |
| Beryllium | 1.1 | 6.30 | 1/6 |
| Cadmium | 3.0 | 8.30 | 2/7 |
| Chromium | 6.8 | 38.10 | 4/7 |
| Iron | 244 | 440 | 7/7 |
| Lead | 10.6 | 10.6 | 1/1 |
| Magnesium | 27,623 | 29,800 | 7/7 |
| Manganese | 49.9 | 66.1 | 7/7 |

TABLE 1 (cont'd)

| MEDIA | CONCENTRATION MEAN | CONCENTRATION MAXIMUM | DETECTION RATIO |
|---|---|---|---|
| **SURFACE WATER (cont'd)** | | | |
| Mercury | 0.38 | 0.60 | 7/7 |
| Silver | 4.89 | 13.3 | 1/4 |
| Zinc | 34.7 | 45.5 | 7/7 |
| Trichloroethene | 0.862 | 2.00 | 1/5 |

* Inorganic concentrations for landfilled materials and sediments are reported in ppm.

(a) Mean concentration is the geometric mean of the data results. If the chemical was not detected, the concentration was assumed to be one-half the detection limit. If a chemical result was due to blank contamination, the result was omitted from the mean calculation.

(b) The detection ratio is the number of samples in which the chemical was detected to the number of samples in which the chemical was analyzed.

contaminated with equal levels of mercury. This indicates that the levels of mercury detected in the surface water samples are the result of contamination from the field equipment.

**POTENTIAL MIGRATION PATHWAYS**

The potential migration pathways that have been identified for the Folkertsma Refuse site include infiltration, surface runoff, wind erosion and dust emissions, and groundwater, surface water, and sediment transport. However, except for the small area of contamination in the sediments of Indian Mill Creek (immediately surrounding the outfall pipe), contamination has not spread beyond the site boundaries. The migration of contaminants is somewhat limited by the low water solubilities and high sorption potentials of many of the chemicals detected at the site. These chemicals tend to sorb onto soils and sediment, and their mobility is decreased. Migration is also retarded by the high total organic carbon content of the muck deposit, which averages 32% and provides a strong sorption site for most of the contaminants. In addition, the majority of the contaminants at the site have minimal or no volatilization potential.

**SUMMARY OF SITE RISKS**

A baseline risk assessment was conducted for the Folkertsma Refuse site as part of the Remedial Investigation (Chapter 6 - Remedial Investigation Report, PRC, June 1989). The baseline risk assessment was conducted in accordance with the Superfund Public Health Evaluation Manual (U.S. EPA, 1986), and the Risk Assessment Guidance for Superfund (U.S. EPA, 1989) when appropriate. Unacceptable risks to human health have been identified for the ingestion of, direct contact with, and inhalation of landfilled materials; and for the ingestion of unfiltered groundwater from beneath the landfilled portion of the site. Unacceptable risks to the environment are posed through the ingestion of and direct contact with the landfilled materials and the contaminated sediments of the unnamed creek, drainage ditch, and Indian Mill Creek. The risk assessment, which includes the identification of site-specific contaminants of concern, an exposure assessment, a toxicity assessment, and a risk characterization, is described in greater detail in the following sections.

**CONTAMINANTS OF CONCERN**

Contaminants of concern (COCs) are those chemicals which potentially pose the greatest risk to human health and the environment at the site. The selection of COCs is based on the concentration, the frequency of detection, and the toxicity and persistence of the contaminants. The COCs at the Folkertsma Refuse Site include VOCs, SVOCs, PCBs, and heavy metals such as arsenic, chromium, and nickel. Table 2 lists the specific COCs

**TABLE 2**

**CONTAMINANTS OF CONCERN**

**LANDFILLED MATERIALS**

Toluene
Trichloroethene
Benzo(a)anthracene
Benzo(b)fluoranthene
Benzo(a)pyrene
Crysene
Dibenzo(a,h)anthracene
Fluoranthene
Pyrene
Aroclor-1254

Chromium
Lead
Nickel

**SEDIMENTS**

Toluene
Arsenic
Benzo(a)anthracene
Benzo(b)fluoranthene
Benzo(a)pyrene
Chrysene
Dibenzo(a,h)anthracene
Fluoranthene
Pyrene
Aroclor-1254

Cadmium
Lead
Manganese
Mercury
Nickel

**SHALLOW GROUNDWATER**

Toluene
Benzo(a)anthracene
Benzo(b)fluoranthene
Benzo(a)pyrene
Chrysene

Arsenic
Manganese
Mercury

**DEEP GROUNDWATER**

Arsenic
Cadmium
Manganese
Mercury

**SURFACE WATER**

Trichloroethene

Cadmium
Chromium
Manganese
Mercury

identified for each medium (reference Table 1 for the range of detected concentrations).

**EXPOSURE ASSESSMENT**

The potential risks to human health and the environment were calculated based on the assumption that no future remedial actions would be taken at the site. The human populations potentially exposed to the contamination at the site include persons working at the site, children and young adults trespassing on the site, and persons living and working downwind of the site. Persons downgradient of the site who use private wells as a drinking water supply are also potentially at risk (only one has been identified). If a drinking water supply well was installed at the site, or additional wells were installed downgradient of the site, users of these wells may also become exposed.

Animals potentially at risk include those living at or near the site or traveling through the site. Animal populations include fish, amphibians and reptiles, mammals and birds. Common species are listed in Table 3. Threatened or endangered species that may be found in the Grand Rapids area include the peregrine falcon, Cooper's hawk, red shouldered hawk, marsh hawk, osprey, black rat snake, Eastern box turtle (locally common in the Grand Rapids area), and least shrew.

The following potential routes of exposure were identified for the human and animal populations at or near the Folkertsma Refuse site. The pathways include exposure through ingestion, direct contact, and inhalation and reflect both current and future conditions.

**Human Populations**

- Ingestion of and direct contact with landfilled materials;
- Inhalation of fugitive dusts/volatiles;
- Ingestion of groundwater (shallow and deep zones);
- Incidental ingestion of and direct contact with surface water (unnamed creek, drainage ditch, and Indian Mill Creek);
- Direct contact with sediments (unnamed creek, drainage ditch, and Indian Mill Creek).

**Animal Populations**

- Direct contact with and ingestion of landfilled materials;

**TABLE 3**

**SUMMARY OF COMMON ANIMAL SPECIES**

**FISH**

Brook trout
Brown trout
Minnows
Salmon (occasional)
Sculpin
Steelhead (occasional)
Suckers

**AMPHIBIANS AND REPTILES**

Spotted salamander
American toad
Mud puppy
Bullfrog
Eastern garter snake
Northern snapping turtle
Five lined skink

**MAMMALS**

White tail deer
Racoon
Muskrat
Eastern cottontail rabbit

**BIRDS**

Ring-necked pheasant
Mallard
Red-bellied woodpecker
Robin
Red-winged blackbird

- Ingestion of and direct contact with surface water (unnamed creek, drainage ditch, and Indian Mill Creek);
- Ingestion of and direct contact with sediments (unnamed creek, drainage ditch, and Indian Mill Creek).

Intake of the contaminants of concern was evaluated for the human populations in these scenarios under probable and worst case conditions. Chronic intake represents the average daily dose of a chemical received over a lifetime and is used in conjunction with cancer potency factors to assess carcinogenic risk. This type of intake was calculated using parameters such as chemical concentration, relative percent of absorption, frequency of exposure, and body weight, as illustrated in Equations 1.1 and 1.2 in Table 4.

Acute intake represents the estimated dose of a chemical received from a 1-day exposure and is used in conjunction with allowable daily intakes to assess risks that are noncarcinogenic. The parameters used to calculate acute exposures are similar to those used in deriving chronic exposure, as illustrated in Equations 2.1 and 2.2 in Table 4.

The major assumptions (e.g., body weight, frequency, and duration) used to evaluate the chronic and acute intakes for the identified scenarios under probable and worst case conditions are presented in Table 5.

**TOXICITY ASSESSMENT**

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

Reference doses (RfDs) have been developed by EPA for indicating the potential for adverse health effects from exposure to chemicals exhibiting noncarcinogenic effects. RfDs, which are expressed in units of mg/kg-day, are estimates of lifetime daily exposure levels for humans, including sensitive individuals. Estimated intakes of chemicals from environmental media (e.g.,

## TABLE 4

## CALCULATIONS FOR CHRONIC AND ACUTE INTAKES

**EQUATION 1.1 - CHRONIC INTAKE**

$$\text{Average Lifetime Dose (ug or mg/kg/day)} = \text{Concentration in Media (mg/kg or ug/m}^3\text{)} \times \text{Amount of Exposure (kg/day or m}^3\text{/day)} \times \text{Relative Percent Absorption} \times \frac{1}{\text{Body Weight (kg)}} \times \frac{\text{Frequency of Contact (days)}}{\text{365 days}} \times \frac{\text{Years of Exposure}}{\text{70 Year Lifetime}}$$

**EQUATION 1.2 - CHRONIC INTAKE (For Direct Contact with Surface Water)**

$$\text{Exposure Dose (ug or mg/kg/day)} = \text{Concentration in Media (ug/L)} \times \text{Skin Surface Available for Contact (cm}^2\text{)} \times \text{Permeability Constant (cm/hr)} \times \text{Duration of Exposure (hr)} \times \frac{1\ \text{L}}{1000\ \text{cm}^3} \times \frac{1}{\text{Body Weight (kg)}} \times$$

$$\text{Frequency of Exposure (days/365 days)} \times \frac{\text{Years of Exposure}}{\text{70 Year Lifetime}}$$

**EQUATION 2.1 - ACUTE INTAKE**

$$\text{Exposure Dose (ug or mg/kg/day)} = \text{Concentration in Media (mg/kg or ug/m}^3\text{)} \times \text{Amount of Exposure (kg/day or m}^3\text{/day)} \times \text{Relative Percent Absorption} \times \frac{1}{\text{Body Weight (kg)}}$$

**EQUATION 2.2 - ACUTE INTAKE (For Direct Contact with Surface Water)**

$$\text{Exposure Dose (ug or mg/kg/day)} = \text{Concentration in Media (ug/L)} \times \text{Skin Surface Available for Contact (cm}^2\text{)} \times \text{Permeability Constant (cm/hr)} \times \text{Duration of Exposure (hr)} \times \frac{1\ \text{L}}{1000\ \text{cm}^3} \times \frac{1}{\text{Body Weight (kg)}}$$

TABLE 5

PARAMETERS USED IN EXPOSURE DOSE CALCULATIONS

| | Amount of Exposure: Adult | Amount of Exposure: Young Adult | Amount of Exposure: Child | Relative Percent Absorption | Body Weight (kg): Adult | Body Weight (kg): Young Adult | Body Weight (kg): Child | Frequency of Contact (days/year): Adult | Frequency of Contact (days/year): Young Adult | Frequency of Contact (days/year): Child | Years of Exposure |
|---|---|---|---|---|---|---|---|---|---|---|---|
| (1) Ingestion of Ground Water | 2L/day | NA | 1L/day | 100 | 70 | NA | 10 | 365 | NA | 365 | 70 |
| (2) Ingestion of Soils | | | | | | | | | | | |
| Probable Case | 2.5E-05 kg/day | 2.5E-05 kg/day | 1.0E-04 kg/day | 100 | 70 | 70 | 25 | 30 | 30 | 4 | 40(4)(a) |
| Worst Case | 1.0E-04 kg/day | 1.0E-04 kg/day | 2.0E-04 kg/day | 100 | 70 | 70 | 25 | 60 | 60 | 7 | 40(4) |
| (3) Direct Contact with Soils | | | | | | | | | | | |
| Probable Case | 2.56E-03 kg/day | 2.56E-03 kg/day | 3.17E-03 kg/day | Chemical Specific (b) | 70 | 70 | 25 | 60 | 60 | 7 | 40(4) |
| Worst Case | 4.85E-03 kg/day | 4.85E-03 kg/day | 3.17E-03 kg/day | | 70 | 70 | 25 | 120 | 120 | 14 | 40(4) |
| (4) Direct Contact with Surface Water | | | | | | | | | | | |
| Probable Case | 3,630 $cm^2$ | NA | 1,880 $cm^2$ | 8.00E-04 cm/hr | 70 | NA | 25 | 2 (1 hr/day) | NA | 2 (1 hr/day) | 40 |
| Worst Case | 3,630 $cm^2$ | NA | 2,350 $cm^2$ | 8.00E-04 cm/hr | 70 | NA | 25 | 4 (1 hr/day) | NA | 4 (1 hr/day) | 40 |
| (5) Incidental Ingestion of Surface Water | | | | | | | | | | | |
| Probable Case | 0.1L/day | NA | 0.05L | 100 | 70 | NA | 25 | 1 | NA | 1 | 1 |
| Worst Case | 0.1L/day | NA | 0.05L | 100 | 70 | NA | 25 | 2 | NA | 2 | 1 |
| (6) Inhalation of Fugitive Dusts/Volatiles | | | | | | | | | | | |
| Probable Case | 1.3 $m^3$/hr | 1.3 $m^3$/hr | 1.4 $m^3$/hr | 100 | 70 | 70 | 25 | 93 | 60 | 7 | 40(4) |
| Worst Case | 2.6 $m^3$/hr | 2.6 $m^3$/hr | 2.1 $m^3$/hr | 100 | 70 | 70 | 25 | 93 | 120 | 14 | 40(4) |
| (7) Direct Contact with Sediments | | | | | | | | | | | |
| Probable Case | 1.27E-03 kg/day | NA | 6.58E-04 kg/day | Chemical Specific | 70 | NA | 25 | 2 | NA | 2 | 40 |
| Worst Case | 1.27E-03 kg/day | NA | 1.13E-03 kg/day | | 70 | NA | 25 | 4 | NA | 4 | 40 |

(a) Exposure doses were calculated assuming a 40-year exposure for on-site workers and a 4-year exposure for young adults exposed as a result of riding recreactional motor vehicles on-site.

(b) See Table 5a.

TABLE 5a

RELATIVE PERCENT ABSORPTION VIA DIRECT CONTACT

| Contaminant | Percent Absorption Via Direct Contact | Percent Absorption Via Ingestion | Relative Percent Absorption |
|---|---|---|---|
| PCB | 5 | 30 | 5/30 = 17% |
| Lead | 1 | 50 | 1/50 = 2% |
| Arsenic | 1 | 95 | 1/95 = 1.1% |
| Mercury | 1 | 7.5 | 1/7.5 = 13.3% |
| Nickel | 1 | 10 | 1/10 = 10% |
| Toluene | 3 | 37 | 3/37 = 8.1% |
| PAHs | 5 | 50 | 5/50 = 10% |
| Chromium | 0.5 | 26 | 0.5/26 = 1.92% |
| Copper | 1 | 60 | 1/60 = 1.67% |
| Cadmium | 1 | 6 | 1/6 = 17% |
| Manganese | 1 | 5 | 1/5 = 20% |

the amount of a chemical ingested from contaminated drinking water) can be compared to the RfD (hazard index). RfDs are derived from human epidemiological studies or animal studies to which uncertainty factors have been applied (e.g., to account for the use of animal data to predict effects on humans). These uncertainty factors help ensure that the RfDs will not underestimate the potential for adverse noncarcinogenic effects to occur.

The cancer potency factors and the reference doses used to evaluate the potential risks at the Folkertsma Refuse site are presented in Table 6. Arsenic, chromium, cadmium, and nickel have been identified as human carcinogens, and PCBs, trichloroethene, and PAHs are probable human carcinogens. These chemicals, and the other contaminants of concern (toluene, lead, mercury, and manganese), also have the potential for causing acute and chronic noncarcinogenic health effects in humans.

**RISK CHARACTERIZATION**

Excess lifetime cancer risks are probabilities that are generally expressed in scientific notation (e.g., $10^{-6}$ or 1E-6). An excess lifetime cancer risk of $10^{-6}$ indicates that, as a plausible upper bound, an individual has a one in a million chance of developing cancer as a result of site-related exposure to a carcinogen over a 70-year lifetime under the specific exposure conditions identified for the site. EPA seeks to manage sites such that the carcinogenic risk from any medium generally falls within a range of $10^{-4}$ to $10^{-6}$. EPA's preference is to be at the more protective end of the risk range ($10^{-6}$).

Potential concern for noncarcinogenic effects of a single contaminant in a single medium is expressed as the hazard quotient (HQ) (or the ratio of the estimated intake derived from the contaminant concentration in a given medium to the contaminant's reference dose). By adding the HQs for all contaminants within a medium or across all media to which a given population may reasonably be exposed, the hazard index (HI) can be generated. The HI provides a useful reference point for gauging the potential significance of multiple contaminant exposures within a single medium or across media. Noncarcinogenic risks are considered to be unacceptable if the hazard index is greater than 1.0, that is, if the intake of a chemical exceeds the established reference dose for that chemical.

At the Folkertsma Refuse site, unacceptable health risks have been calculated for exposure to the landfilled materials and the groundwater (Table 7). The landfilled materials pose an unacceptable carcinogenic risk under worst case conditions for ingestion ($10^{-4}$), direct contact ($10^{-3}$), and inhalation ($10^{-4}$).

TABLE 6

CANCER POTENCY FACTORS (CPFs) AND REFERENCE DOSES (RfDs)[a]

| | CPF (mg/kg/day) | RfD (mg/kg/day) |
|---|---|---|
| **INGESTION OF AND DIRECT CONTACT WITH LANDFILLED MATERIALS** | | |
| Toluene | -[b] | 0.4 |
| Benzo(a)anthracene | 11.5[c] | - |
| Benzo(b)fluoranthene | 11.5 | - |
| Benzo(a)pyrene | 11.5 | - |
| Chrysene | 11.5 | - |
| Dibenz(a,h)anthracene | 11.5 | - |
| Aroclor-1254 | 7.7 | - |
| Chromium | - | 1.0 |
| Nickel | - | 0.02 |
| **INHALATION OF FUGITIVE DUST** | | |
| Benzo(a)anthracene | 6.1 | - |
| Benzo(b)fluoranthene | 6.1 | - |
| Benzo(a)pyrene | 6.1 | - |
| Chrysene | 6.1 | - |
| Dibenz(a,h)anthracene | 6.1 | - |
| Aroclor-1254 | 7.7 | - |
| Chromium | 41.0 | 1.0 |
| Nickel | 0.84 | - |
| **INGESTION OF UNFILTERED GROUNDWATER (shallow and deep)** | | |
| Toluene | - | 0.3 |
| Benzo(a)anthracene | 11.5 | - |
| Benzo(b)fluoranthene | 11.5 | - |
| Benzo(a)pyrene | 11.5 | - |
| Chrysene | 11.5 | - |
| Arsenic | 1.75 | 0.001 |
| Cadmium | - | 0.0005 |
| Manganese | - | 0.02 |
| Mercury | - | 0.0003 |
| **INGESTION OF AND DIRECT CONTACT WITH SURFACE WATER** | | |
| Trichloroethene | 0.011 | 0.09 |
| Cadmium | - | 0.0005 |
| Chromium | - | 0.005 |
| Manganese | - | 0.2 |
| Mercury | - | 0.0003 |

TABLE 6 (cont'd)

| DIRECT CONTACT WITH SEDIMENTS | CPF (mg/kg/day) | RfD (mg/kg/day) |
|---|---|---|
| Toluene | - | 0.4 |
| Benzo(a)anthracene | 11.5 | - |
| Benzo(b)fluoranthene | 11.5 | - |
| Benzo(a)pyrene | 11.5 | - |
| Chrysene | 11.5 | - |
| Dibenz(a,h)anthracene | 11.5 | - |
| Aroclor-1254 | 7.7 | - |
| Arsenic | 1.8 | 0.001 |
| Cadmium | - | 0.0005 |
| Manganese | - | 0.2 |
| Mercury | - | 0.0003 |
| Nickel | - | 0.02 |

(a) Sources include SPHEM, HEAST, and IRIS.

(b) Denotes not applicable. Chemical not carcinogenic/noncarcinogenic.

(c) The carcinogenic potency factor for all the Polynuclear Aromatic Hydrocarbons (PAHs) is 11.5 mg/kg/day, the carcinogenic potency factor for benzo(a)pyrene.

## TABLE 7

## SUMMARY OF SITE RISKS

| | CARCINOGENIC RISK | | NONCARCINOGENIC RISK | |
|---|---|---|---|---|
| | PROBABLE CASE | WORST CASE | PROBABLE CASE | WORST CASE |
| INGESTION OF LANDFILLED MATERIALS | NS* | $10^{-4}$ | NS | NS |
| DIRECT CONTACT WITH LANDFILLED MATERIALS | NS | $10^{-3}$ | NS | NS |
| INHALATION OF FUGITIVE DUST | NS | $10^{-4}$ | NS | NS |
| INGESTION OF UNFILTERED SHALLOW GROUNDWATER | $10^{-3}$ | $10^{-2}$ | 1.62 | 29.7 |
| INGESTION OF UNFILTERED DEEP GROUNDWATER | NS | $10^{-4}$ | NS | 2.54 |
| INGESTION OF SURFACE WATER | NS | NS | NS | NS |
| DIRECT CONTACT WITH SURFACE WATER | NS | NS | NS | NS |
| DIRECT CONTACT WITH SEDIMENTS | NS | NS | NS | NS |
| TOTAL SITE RISK | $10^{-3}$ | $10^{-2}$ | 1.62 | 32.24 |

*NS - Not Significant. EPA defines unacceptable risks are those which exceed a $10^{-4}$ cancer risk or have a hazard index greater than 1.0.

The main contaminants posing these risks are PAHs (ingestion and direct contact) and chromium (inhalation). No unacceptable health risks were identified for exposure to the landfilled materials under probable case conditions.

The ingestion of unfiltered shallow groundwater poses unacceptable carcinogenic and noncarcinogenic risks under probable and worst case conditions. The ingestion of unfiltered shallow groundwater presents for probable and worst case conditions a $10^{-3}$ and $10^{-2}$ risk, respectively. The Hazard Indices calculated for the ingestion of unfiltered shallow groundwater for probable and worst case conditions are 1.62 and 29.7, respectively. The ingestion of unfiltered deep groundwater poses unacceptable carcinogenic and noncarcinogenic risks under worst case conditions. The carcinogenic and noncarcinogenic risks calculated for the ingestion of unfiltered deep groundwater under worst case conditions are $10^{-4}$ and 2.54, respectively. These risks are based on the high levels of arsenic detected in the unfiltered samples from beneath the landfill, and on the concentrations of PAHs detected in unfiltered samples from beneath the landfill. As these chemicals were found to have low mobility potentials and were not detected in downgradient samples, the risks are limited to the ingestion of unfiltered groundwater from beneath the site.

The landfilled materials and the contaminated sediments of the unnamed creek, drainage ditch, and Indian Mill Creek pose an unacceptable risk to the environment through ingestion and direct contact. These risks are posed to the animal populations living at or near the site (refer to "Exposure Assessment," p. 5 for specific species) who may wade or swim in the streams, or walk, lay, or burrow in the landfilled materials. These risks will not be significant if exposure is infrequent. Frequent exposure, however, may result in the bioaccumulation of trichloroethene, PCBs, and metals (arsenic, cadmium, chromium, lead, mercury, manganese, and nickel).

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

## DESCRIPTION OF ALTERNATIVES

Based on the results of the Remedial Investigation and Baseline Risk Assessment, a Feasibility Study was conducted to identify and evaluate different alternatives for protecting human health and the environment from the unacceptable risks posed at the Folkertsma Refuse site. The remedial action objectives for the site is to prevent current or future exposure to the landfilled materials, the contaminated muck deposit, the contaminated sediments of the unnamed creek, drainage ditch and Indian Mill Creek, and the contaminated groundwater beneath the landfill; to reduce contaminant migration into the groundwater; and to prevent contaminated groundwater from moving out from beneath the landfill and beyond the waste boundary.

The Feasibility Study identified nine remedial alternatives, including the no action alternative, for protecting human health and the environment from the unacceptable risks posed at the site. The alternatives that were considered involved a variety of containment, removal, and treatment technologies, and are described in greater detail in the following sections.

**ALTERNATIVE 1: NO ACTION**

The NCP requires that the no action alternative be considered at every Superfund site. Under this alternative, EPA would take no further action to control the source of contamination. Long-term monitoring of the site, however, would be necessary to monitor contaminant migration. Monitoring would be implemented by using the previously installed groundwater monitoring wells.

**Capital Cost:** $ 99,000
**1st Year O&M:** 49,000
**Present Worth:** $ 561,000

**Time to Implement:** 0 months

**ALTERNATIVE 2: CLAY CAP**

With this alternative, the contaminated sediments of the unnamed creek, drainage ditch, and Indian Mill Creek (approximately 1,300 cubic yards) would be excavated, dewatered, and consolidated on top of the landfilled materials. The filtrate from dewatering will be collected, sampled, and discharged to Indian Mill Creek. If the contaminant concentration in the filtrate exceeds federal or state standards, the filtrate will be treated prior to discharge. The contaminated sediments, the landfilled materials, and the contaminated muck deposit beneath the landfill (approximately 70,600 cubic yards) would be contained with a compacted layer of clay. The low-permeability cap would be constructed over the landfilled areas in accordance with the Resource Conservation and Recovery Act (RCRA) Subtitle D and the Michigan Solid Waste Management Act (MSWMA 641). The capped areas would be covered with a layer of topsoil and revegetated. The unnamed creek and drainage ditch would be converted to permeable underground drains to provide for continued site drainage, and the capped areas would be graded to direct surface runoff into the drains. Gas vents would be installed on each side of the landfill if necessary to prevent the buildup of volatile organic compounds and methane. The site would be fenced to restrict access, and institutional controls such as deed restrictions would be imposed to prohibit the installation of water wells within the landfilled portion of the site and any activities that might disturb the cap or the landfilled materials. In addition, long-term monitoring of the groundwater and the drainage water from the underground drains would be conducted.

**Capital Cost:** $ 990,000
**1st Year O&M:** 58,000
**Present Worth:** $ 1,500,000

**Time to Implement:** 3 to 5 months

**ALTERNATIVE 3: CONCRETE CAP**

This alternative is the same as Alternative 2, except a layer of concrete would be substituted for the layer of clay. As with Alternative 2, the contaminated sediments of the unnamed creek, drainage ditch and Indian Mill Creek (approximately 1,300 cubic yards) would be excavated, dewatered, and consolidated on top of the landfilled materials. The filtrate from dewatering will be collected, sampled, and discharged to Indian Mill Creek. If the contaminant concentration in the filtrate exceeds federal or state standards, the filtrate will be treated prior to discharge. An impermeable concrete cap would be constructed over the landfilled areas to contain the contaminated sediments, landfilled materials, and the contaminated muck deposit beneath the landfill (approximately 70,600 cubic yards). The unnamed creek and drainage ditch would be converted to permeable underground drains to provide for continued drainage of the site, and the capped areas would allow for surface runoff to drain into the drains. Gas vents would be installed on each side of the landfill if necessary to prevent the buildup of volatile organic compounds and methane. The site would be fenced to restrict access, and institutional controls such as deed restrictions would be imposed to prohibit the installation of water wells within the landfilled portion of the site and any activities that might disturb the cap or landfilled materials. In addition, long-term monitoring of the groundwater and the drainage water from the underground drains would be conducted.

**Capital Cost:** $ 2,700,000
**1st Year O&M:** 58,000
**Present Worth:** $ 3,300,000

**Time to Implement:** 3 to 5 months

**ALTERNATIVE 4: EXCAVATE/OFF-SITE DISPOSAL AT RCRA SUBTITLE D SOLID WASTE LANDFILL**

With this alternative, the landfilled materials (approximately

57,000 cubic yards), the contaminated muck deposit beneath the landfill (approximately 12,300 cubic yards), and the contaminated sediments of the unnamed creek, drainage ditch, and Indian Mill Creek (approximately 1,300 cubic yards) would be excavated and transported to an off-site RCRA Subtitle D solid waste landfill for containment. The contaminated sediments would be dewatered prior to transport. The filtrate from dewatering will be collected, sampled, and discharged to Indian Mill Creek. If the contaminant concentration in the filtrate exceeds federal or state standards, the filtrate will be treated prior to discharge. The excavated areas would be backfilled and restored. The western portion of the site would be covered with topsoil and revegetated; the eastern portion of the site would be covered with a layer of gravel similar to original conditions. The unnamed creek and the drainage ditch would be converted to permeable underground drains to provide for continued site drainage. The surface of the backfilled areas would be graded to direct surface runoff into the drains. A temporary fence would be installed to restrict access during implementation.

**Capital Cost:** $ 9,500,000
**1st Year O&M:** 0
**Present Worth:** $ 9,500,000

**Time to Implement:** 6 to 12 months

**ALTERNATIVE 5: EXCAVATE/OFF-SITE DISPOSAL AT RCRA SUBTITLE C HAZARDOUS WASTE LANDFILL**

This alternative is the same as Alternative 4, except that the landfilled materials (approximately 57,000 cubic yards), the contaminated muck deposit beneath the landfill (approximately 12,300 cubic yards), and the contaminated sediments of the unnamed creek, drainage ditch, and Indian Mill Creek (approximately 1,300 cubic yards) would be transported to an off-site RCRA Subtitle C hazardous waste landfill for containment. The contaminated sediments would be dewatered prior to transport. The filtrate from dewatering will be collected, sampled, and discharged to Indian Mill Creek. If the contaminant concentration in the filtrate exceeds federal or state standards, the filtrate will be treated prior to discharge. As with Alternative 4, the excavated areas would be backfilled, and the site restored. The western portion of the site would be covered with topsoil and revegetated; the eastern portion of the site would be covered with a layer of gravel similar to original conditions. The unnamed creek and the drainage ditch would be converted to permeable underground drains to provide for continued site drainage. The surface of the backfilled areas would be graded to direct surface runoff into the drains. A temporary fence would be installed to restrict access during implementation.

**Capital Cost:** $ 22,700,000
**1st Year O&M:** 0
**Present Worth:** $ 23,000,000

**Time to Implement:** 6 to 12 months

**ALTERNATIVE 6: EXCAVATE/THERMAL TREATMENT/ON-SITE DISPOSAL**

Under this alternative the landfilled materials (approximately 57,000 cubic yards), the contaminated muck deposit beneath the landfill (approximately 12,300 cubic yards), and the contaminated sediments of the unnamed creek, drainage ditch, and Indian Mill Creek (approximately 1,300 cubic yards) would be excavated and thermally treated. The contaminated sediments would be dewatered prior to treatment. The filtrate from dewatering will be collected, sampled, and discharged to Indian Mill Creek. If the contaminant concentration in the filtrate exceeds federal or state standards, the filtrate will be treated prior to discharge. It is expected that most of the organic contaminants would be destroyed in the process, as a permitted incinerator is required to achieve a destruction and removal efficiency of 99.99 percent. The heating value of the waste materials has not yet been tested, but it is estimated to be low (approximately 1,000 to 2,000 Btu/lb). Results from the trial burn and EP toxicity analyses during site remediation would determine if the treatment residuals require additional treatment (e.g., solidification) prior to disposal.

The treatment residuals (approximately 56,000 to 64,000 cubic yards) would be used as backfill material for the excavated areas. Prior to being placed in the excavated areas, the treated material would be analyzed to determine if it exhibits any characteristics of a hazardous waste under RCRA. Although it is not anticipated, further remedial actions (e.g., solidification) may be needed if the residual material is found to be a characteristic waste. The excavated area would be backfilled, covered with topsoil and seeded. As with the other alternatives, the unnamed creek and the drainage ditch would be converted into underground drains to provide continued site drainage. The surface of the backfilled areas would be graded to direct surface runoff into the drains.

As the treatment residuals would be disposed of on-site, fencing would be installed to restrict access, and institutional controls such as deed restrictions would be imposed to prohibit the installation of water wells within the backfilled portion of the site and any activities that might disturb the treatment residuals. In addition, long-term monitoring of the groundwater and the drainage water from the underground drains would be conducted.

**Capital Cost:** $ 38,900,000

**1st Year O&M:** 49,000
**Present Worth:** $ 39,000,000

**Time to Implement:** 30 to 36 months

**ALTERNATIVE 7: EXCAVATE/SOLIDIFY/ON-SITE DISPOSAL**

This alternative involves excavating the contaminated landfilled materials (approximately 57,000 cubic yards), the contaminated muck deposit beneath the landfilled materials (approximately 12,300 cubic yards) and the contaminated sediment of the unnamed creek, drainage ditch, and Indian Mill Creek (approximately 1,300 cubic yards), and solidifying the materials. The contaminated sediments would be dewatered prior to solidification. The filtrate from dewatering will be collected, sampled, and discharged to Indian Mill Creek. If the contaminant concentration in the filtrate exceeds federal or state standards, the filtrate will be treated prior to discharge. The solidification process would be conducted on site.

Several solidification processes have been demonstrated and evaluated at other Superfund sites as part of EPA's Superfund Innovative Technology Evaluation (SITE) program. The HAZCON and the Soliditech processes are two examples of solidification processes that might be used for this alternative. The HAZCON process is a cement-based process in which the contaminated material is mixed with cement. The Soliditech process mixes the contaminated materials with cement, fly ash, or kiln dust, and incorporates a reagent into this mixture. The mixture may then be pumped or poured back into the excavated area for curing, or placed into forms for curing. There are less handling requirements if the mixture is disposed of directly into the excavated area rather than placed into forms for curing. The strength of the solidified mass may be less.

The additives in the HAZCON and Soliditech processes will increase the volume of materials. The HAZCON process, using equal ratios by weight of waste and cement, has been found to result in an average volume increase of 120 percent. The Soliditech process, which uses a 2:1 ration by weight of waste to cement, was found to result in an average volume increase of 22 percent.

As with the other alternatives, the unnamed creek and drainage ditch would be converted into permeable underground drains to provide continued site drainage, and the surface of the solidified areas would be sloped to direct runoff into the underground drains.

Site access would be controlled by fencing, and institutional controls such as deed restrictions would be imposed to prohibit the installation of water wells within the solidified portion of the site and any activities that might disturb the solidified materials. In addition, long-term monitoring of the groundwater and the drainage water from the underground drains would be conducted.

**Capital Cost:** $ 22,900,000
**1st Year O&M:** 49,000
**Present Worth:** $ 23,000,000

**Time to Implement:** 3 to 6 months

**ALTERNATIVE 8: IN-SITU STABILIZATION/SOLIDIFICATION**

With this alternative, the contaminated sediments of the unnamed creek, drainage ditch, and Indian Mill Creek (approximately 1,300 cubic yards) would be excavated, dewatered, and consolidated on top of the landfilled materials. The filtrate from dewatering will be collected, sampled, and discharged to Indian Mill Creek. If the contaminant concentration in the filtrate exceeds federal or state standards, the filtrate will be treated prior to discharge. The contaminated sediment, the landfilled materials (approximately 57,000 cubic yards), and the contaminated muck deposit beneath the landfilled materials (approximately 12,300 cubic yards) would then be solidified by an in-situ stabilization/solidification process which involves injecting and mixing a grout-like agent into the materials.

The Geo-Con Deep Soil Mixing (DSM) system is one example of an in-situ stabilization/solidification process that might be used. The grouting agent produces a complex crystalline network of inorganic polymers. The polymers reportedly have a high resistance to acids and other naturally existing deteriorating factors. Structural bonding in the polymers is mostly covalent. There is a two-phased reaction, in which the toxic elements and compounds are complexed: first in a fast-acting reaction, and then permanently by the building of macromolecules, which generate over a long period of time. The mixing and injection system consists of one set of cutting blades and two sets of mixing blades attached to a vertical drive auger, which rotates at approximately 15 revolutions per minute. Two conduits in the drive rod are used to inject the grouting agent at the bottom of the shaft. The agent is injected as the auger is advanced into the contaminated material. Further mixing occurs as the auger is withdrawn. The grouted soil columns are 36 inches in diameter and are positioned in an overlapping pattern.

As with the other alternatives, the unnamed creek and drainage ditch would be converted into underground drains to provide continued site drainage, and the surface of the stabilized/solidified areas would be graded to direct surface runoff into the drains. Access would be controlled by site fencing, and institutional controls such as deed restrictions would be imposed to prohibit the installation of water wells within the stabilized/solidified portion of the site and any activities that might disturb the stabilized/solidified materials. In addition, long-term monitoring of the groundwater and the drainage water from the underground drains would be conducted.

**Capital Cost:** $ 16,300,000
**1st Year O&M:** 49,000
**Present Worth:** $ 17,000,000

**Time to Implement:** 10 to 16 months

**ALTERNATIVE 9: IN-SITU VITRIFICATION**

With this alternative the contaminated sediment of the unnamed creek, drainage ditch, and Indian Mill Creek (approximately 1,300 cubic yards) would be excavated, dewatered, and consolidated on top of the eastern portion of the landfill. The filtrate from dewatering will be collected, sampled, and discharged to Indian Mill Creek. If the contaminant concentration in the filtrate exceeds federal or state standards, the filtrate will be treated prior to discharge. As a thickness of 9 to 10 feet is needed to optimize the efficiency of vitrification, the fill material and the underlying muck deposit in the western portion of the landfill (approximately 17,500 cubic yards) would be excavated and consolidated on the eastern portion of the landfill. This would bring the thickness of the contaminated materials to 10 feet. The landfilled materials, the contaminated muck deposit beneath the landfill, and the contaminated sediments of the unnamed creek, drainage ditch, and Indian Mill Creek would be vitrified in-situ with an innovative technology that destroys organic contaminants and immobilizes inorganic contaminants in a vitrified mass. Due to the high permeability of the foundry sand fill material, in-situ vitrification is not effective for treating contaminated material below the water table. A trench drain would be installed upgradient of the site to divert and lower the elevation of ground water during vitrification.

The Geo-Safe process is one example of a process that might be used. With this process, four electrodes are inserted into the soil down to the bottom of the contaminated material. A conductive mixture of flaked graphite and glass frit is usually placed among the electrodes to act as the starter path for the electrical circuit. Heat from the high current of electricity passing through the electrodes and graphite creates a melt. The graphite starter path is eventually consumed by oxidation, and the current is transferred to the molten soil, which is not electrically conductive. As the melt grows downward and outward, it incorporates nonvolatile elements and destroys organic components by pyrolysis. The pyrolyzed byproducts migrate to the surface of the vitrified zone, where they combust in the presence of oxygen. Inorganic materials are dissolved into or are encapsulated in the vitrified mass. Convection currents within the melt uniformly mix materials that are present in the soil. When the electric current ceases, the molten volume cools and solidifies. The off-gasses and combustion products are drawn from the hood into a treatment system and treated.

The unnamed creek and drainage ditch would be converted into underground drains to provide continued site drainage, and the surface of the vitrified area would be graded to direct surface runoff into the drains. Access would be controlled by site fencing, and institutional controls such as deed restrictions would be imposed to prohibit the installation of water wells within the vitrified portion of the site and any activities that might disturb the vitrified materials. In addition, long-term monitoring of the groundwater and the drainage water from the underground drains would be conducted.

**Capital Cost:** $ 42,200,000
**1st Year O&M:** 0
**Present Worth:** $ 42,200,000

**Time to Implement:** 27 to 30 months

**SUMMARY OF COMPARATIVE ANALYSIS OF ALTERNATIVES**

The remedial alternatives developed in the FS were evaluated using the following 9 criteria. The advantages and disadvantages of each alternative were then compared to identify the alternative providing the best balance among these 9 criteria.

- **Overall protection of human health and the environment** -- Addresses whether a remedy provides adequate protection and describes how risks posed through each pathway are eliminated, reduced, or controlled through treatment, engineering controls or institutional controls.

- **Compliance with ARARs** -- Addresses whether a remedy will meet all of the applicable or relevant and appropriate requirements (ARARs) of other Federal and State environmental statutes and/or provide grounds for invoking a waiver.

- **Long-Term Effectiveness and Permanence** -- Addresses the magnitude of residual risk and the ability of a remedy to maintain reliable protection of human health and the environment over time, once cleanup goals have been met.

- **Reduction of Toxicity, Mobility, or Volume Through Treatment** -- Addresses the anticipated performance of the treatment technologies that may be employed in a remedy.

- **Short-Term Effectiveness** -- Addresses the period of time needed to achieve protection and any adverse impacts on human health and the environment that may be posed during the construction and implementation period.

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

- **Cost** -- Addresses the estimated capital and operation and maintenance costs, as well as present worth.

- **State Acceptance** -- Addresses whether, based on its review of the RI/FS and Proposed Plan, the State concurs with, opposes, or has no comment on the preferred alternative.

- **Community Acceptance** -- Addresses the public's comments on and concerns about the Proposed Plan and RI/FS Report.

The first two criteria, overall protection of human health and the environment and compliance with ARARs are threshold requirements that must be met. The next five criteria are balancing criteria used to evaluate the advantages and disadvantages of each alternative. The final two criteria, state and community acceptance, are modifying criteria which are used in a final evaluation of each alternative. The comparative analysis of the alternatives is summarized below and proceeds from the alternative that best satisfies the criterion to the one that least satisfies the criterion.

**OVERALL PROTECTION OF HUMAN HEALTH AND ENVIRONMENT**

All of the remedial alternatives considered for the Folkertsma Refuse site, except the no action alternative, are protective of human health and the environment. These alternatives eliminate, reduce, or control the risks through various combinations of treatment, engineering and/or institutional controls. As the no action alternative does not provide protection of human health and the environment, it is not eligible for selection and shall not be discussed further in this document.

Alternatives 2, 3, 4, 5, 7 and 8 protect human health and the environment by containing the contaminated materials and isolating the public and animals from the contaminants. Alternatives 2, 3, 7 and 8 contain the materials on-site, while Alternatives 4 and 5 transport the contaminated materials to an off-site facility for containment. Alternatives 6 and 9 reduce the risk to human health and the environment by destroying the organic contaminants at the site and containing the inorganic contaminants. In addition, the institutional controls employed in Alternatives 2, 3 and 6 through 9 restrict site access and the use of groundwater. These controls also reduce exposure to contaminants. All of the alternatives reduce the potential for contaminants to migrate to the groundwater, and for the contaminated groundwater to move out from beneath the landfill and beyond the waste boundary. All of the alternatives also reduce the potential for contaminants to migrate to Indian Mill Creek.

**COMPLIANCE WITH ARARs**

This section discusses how each alternative complies with major ARARs. Alternatives 2 through 9 are in compliance with all identified ARARs (Table 8). Alternative 2, which involves capping the waste materials, would be required to comply with the requirements of the Resource Conservation and Recovery Act (RCRA) Subtitle D and the Michigan Solid Waste Management Act 641 (MSWMA). Alternatives 4, 5, 6 and 7, which involve the excavation and disposal of contaminated materials, or the excavation, treatment, and disposal of treatment residuals, must comply with the requirements of RCRA and the Michigan Hazardous Waste Management Act 64 (MHWMA). Alternatives 4, 5, 6, 7, and 9 require excavation below the water table, which may affect the wetlands near the site. These alternatives would be required to meet the requirements of the Goemaere Anderson Wetlands Protection Act of Michigan. All alternatives involve the excavation of sediment. As excavation would occur below the 100 year flood elevation, these alternatives must comply with the conditions of federal and state floodplain regulations. All alternatives involve excavation, construction, or treatment activities which may release contaminants into Indian Mill Creek. As such, the standards set forth in the Clean Water Act and the Michigan Water Resources Commission Act 245 (MWRCA) must be met. Alternatives 2 and 3 involve the installation of gas vents, if necessary, to prevent the buildup of VOCs and methane. If installed, these alternatives would be required to comply with the Michigan Air Pollution Act 348 (MAPA). In addition, Alternatives 2 through 7 and 9 involve excavation, construction, or treatment activities which may result in the release of contaminants into the air. These alternatives must comply with the air quality standards in the Clean Air Act and MAPA.

**LONG-TERM EFFECTIVENESS AND PERMANENCE**

Alternative 9 provides the greatest degree of long-term effectiveness and permanence by destroying organic contaminants and immobilizing inorganic contaminants. Any organics that may volatilize during the process are captured in a hood over the melting zone and treated. Metals are encapsulated in a glass mass that is very resistent to leaching.

Alternative 6 provides a very high degree of long-term

**TABLE 8**

**APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS (ARARs)**

Federal ARARs

- o National Ambient Air Quality Standards (40 CFR 50)
- o Resource Conservation and Recovery Act (RCRA)
- o Clean Water Act (CWA)
- o Occupational Safety and Health Act (OSHA)
- o Endangered Species Conservation Act
- o Federal floodplain regulations

State ARARs

- o Michigan Air Pollution Act 348 (MAPA)
- o Michigan Hazardous Waste Management Act 64 (HWMA)
- o Thomas J. Anderson, Gordon Rockwell Environmental Protection Act 127
- o Michigan Occupational Safety and Health Act 154 (MIOSHA)
- o Michigan Natural River Act 231
- o Michigan Water Resources Commission Act 245 (MWRCA)
- o Michigan Environmental Response Act 307 (MERA)
- o Michigan Inland Lakes and Streams Act 346
- o Michigan Soil Erosion and Sedimentation Control Act 347
- o Michigan Solid Waste Management Act 641 (MSWMA)
- o Gomaere Anderson Wetlands Protection Act
- o Michigan Endangered Species Act 203
- o State floodplain regulations

effectiveness and permanence by destroying the organic contaminants with a thermal treatment technology. The alternative is considered very reliable; however, the residual ash may contain metals at levels that pose a risk and thus require additional treatment.

Alternatives 7 and 8 provide a high degree of long-term effectiveness and permanence by containing the contaminated materials with stabilization/solidification processes. These processes reduce the potential for contaminants to leach into the underlying soils and groundwater. However, Alternatives 7 and 8 may not be very effective on the materials containing organic contaminants at the site.

Alternatives 4 and 5 provide a high degree of long-term effectiveness and permanence at the site by removing all the contaminated materials from the site. Although these alternatives are extremely reliable in removing the residual risk at the Folkertsma site, they move the materials to another location without providing treatment.

Both Alternatives 2 and 3 reduce the risk at the site to the same degree as any of the above alternatives in the short term. As the contaminated materials are left in place, however, these alternatives rely on institutional controls and operation and maintenance for long-term effectiveness.

**REDUCTION OF TOXICITY, MOBILITY, OR VOLUME THROUGH TREATMENT**

Alternatives 6 and 9 reduce the toxicity and the volume of the contaminated materials at the site. Alternative 6 uses thermal destruction; Alternative 9 employs in-situ vitrification. Alternative 9 also reduces the mobility of the treatment residuals.

Alternatives 2, 3, 4, 5, 7 and 8 are containment remedies and do not treat the contaminated materials. None of these alternatives reduces the mobility, toxicity, or volume of contaminants through treatment. In addition, the additives used in the solidification/stabilization processes in Alternatives 7 and 8 will increase the volume of materials.

**SHORT TERM EFFECTIVENESS**

Alternatives 2, 3, 4, and 5 provide the lowest short-term risk to site workers and the community. Each of these alternatives has a potential for contaminated dust emissions; however, standard dust control measures and strict air monitoring should minimize any dust emissions. Alternatives 2 and 3 will take only 3 to 5 months to complete as compared to Alternatives 4 and 5 which will take 6 to 12 months to complete.
Alternatives 7 and 8 provide greater short-term risks than

Alternatives 2 through 5. The stabilization/solidification processes may release volatile organics into the atmosphere, increasing the risk to site workers and the community. The time to complete Alternative 7 is the same as Alternatives 2 and 3 (approximately 3 to 6 months), and Alternative 8 is expected to take 10 to 16 months to complete.

Thermal destruction (Alternative 6) and in-situ vitrification (Alternative 9) present the greatest risk to site workers and the community. The generation of contaminated dust and air emissions could potentially pose a risk to the community over an extended period of time. The time to complete these alternatives is the longest: 30 to 36 months for Alternative 6, and 27 to 30 months for Alternative 9.

**IMPLEMENTABILITY**

Alternatives 2 and 3 are the easiest to construct and operate. Periodic maintenance of the caps and the groundwater and drainage water monitoring systems will provide for continued reliability of these alternatives. Additional remedial actions would also be easy to implement if the 5-year review or the groundwater or drainage water monitoring programs indicate additional actions are necessary. These alternatives use standard engineering practices and should not present any administrative difficulties.

Alternatives 4 and 5 are also easy to construct. As the contaminated material would be removed from the site, the potential need for additional remedial actions at the site would be eliminated. Administrative difficulties may be encountered in identifying a landfill willing to accept the contaminated materials for disposal.

Alternatives 7 and 8 are slightly more difficult to construct than Alternatives 2, 3, 4, and 5 due to additional materials handling requirements for the solidification/stabilization process. Of the two alternatives, Alternative 7 is slightly easier to construct because large pieces of buried steel can interfere with the in-situ process required in Alternative 8. If the 5-year review or the groundwater or drainage water monitoring programs indicate that additional remedial action is necessary, both of these alternatives present a greater difficulty for implementing further actions. Vendors for solidification are readily available, but in-situ solidification vendors are slightly less available. Finally, Alternative 7 may be more difficult to complete administratively because the increased volume of materials may necessitate that land adjacent to the site be purchased.

Alternative 9 is more difficult to implement than Alternatives 7 and 8 because fewer vendors are available and the in-situ vitrification process requires specialized equipment. The process is not effective for treating highly permeable soils in contact with ground water; therefore, groundwater would need to be diverted at the site. In addition, buried metal objects in the foundry sand may decrease the implementability of the process if the objects must be removed.

Alternative 6 is considered the most difficult to implement because thermal treatment requires the same amount of materials handling as Alternatives 7 and 8, as well as complex operation procedures for the safe destruction of contaminants. Prior to operation, a trial burn would need to be conducted and the ash tested to determine appropriate disposal options. During operation, this alternative would require the most monitoring and testing. This alternative also requires a large amount of space for the incinerator and materials staging areas, and may require that land adjacent to the site be leased. As many federal, state, and local air standards need to be met, this alternative presents the most administrative difficulties.

**COST**

The FS evaluated several alternatives with a wide range of costs. The estimated capital costs, 1st year operation and maintenance costs, and the present worth costs of the alternatives are summarized below.

| ALTERNATIVE | CAPITAL COST | 1ST YEAR O & M | PRESENT WORTH |
|---|---|---|---|
| Alternative 1 | $ 99,000 | $ 49,000 | $ 561,000 |
| Alternative 2 | $ 990,000 | $ 58,000 | $ 1,500,000 |
| Alternative 3 | $ 2,700,000 | $ 58,000 | $ 3,300,000 |
| Alternative 4 | $ 9,500,000 | $ 0 | $ 9,500,000 |
| Alternative 5 | $ 22,700,000 | $ 0 | $ 23,000,000 |
| Alternative 6 | $ 38,900,000 | $ 49,900 | $ 39,000,000 |
| Alternative 7 | $ 22,900,000 | $ 49,000 | $ 23,000,000 |
| Alternative 8 | $ 16,300,000 | $ 49,000 | $ 17,000,000 |
| Alternative 9 | $ 42,200,000 | $ 0 | $ 42,200,000 |

Alternative 2 (clay cap) is the least costly, and Alternative 9 (in-situ vitrification) is the most costly. Within this cost range, the remaining alternatives have a wide range of present worth costs. Alternatives 4, 5, and 9 do not have O&M costs, while the remaining six alternatives have O&M costs comparable to each other.

**STATE ACCEPTANCE**

Michigan Department of Natural Resources has concurred with the selected remedy.

**COMMUNITY ACCEPTANCE**

Community acceptance is assessed in the attached Responsiveness Summary. The Responsiveness Summary provides: 1) a thorough review of the public comments received on the RI/FS and Proposed Plan; and 2) EPA's and MDNR's responses to the comments received.

**THE SELECTED REMEDY**

The selected remedy is Alternative 2, the clay cap alternative. This alternative will provide for a cost-effective and appropriate remedial action for the landfilled areas. The type of cap utilized in Alternative 2 is appropriate since the majority of landfilled material is foundry sands. Foundry sands are not a listed waste under RCRA and the Agency does not have any information indicating that the foundry sands disposed of in the landfill are characteristic wastes under RCRA. In addition, samples collected from the landfill during the RI were not determined to be EP Toxic (a RCRA characteristic test).

The major components of the selected remedy are illustrated in Figure 3 and include:

- Excavate, dewater, and consolidate approximately 1,300 cubic yards of contaminated sediment from the unnamed creek, drainage ditch, and Indian Mill creek on top of the landfilled materials;
- Convert the unnamed creek and drainage ditch into permeable underground drains to provide for continued site drainage;
- Install and maintain a cap over the contaminated sediments and landfilled areas in accordance with the requirements of the Resource Conservation and Recovery Act Subtitle D and Michigan Act 641;
- Install and maintain passive gas vents on each side of the landfill, to prevent the buildup of volatile organic compounds and methane if necessary;
- Install and maintain a layer of topsoil and a vegetative covering over the landfilled areas;
- Install and maintain a fence around the site;
- Impose institutional controls such as deed restrictions to prevent the installation of drinking water wells within the landfilled portion of the site and future disturbance of the cap and landfilled materials;
- Implement long-term groundwater and drainage water monitoring programs to ensure the effectiveness of the

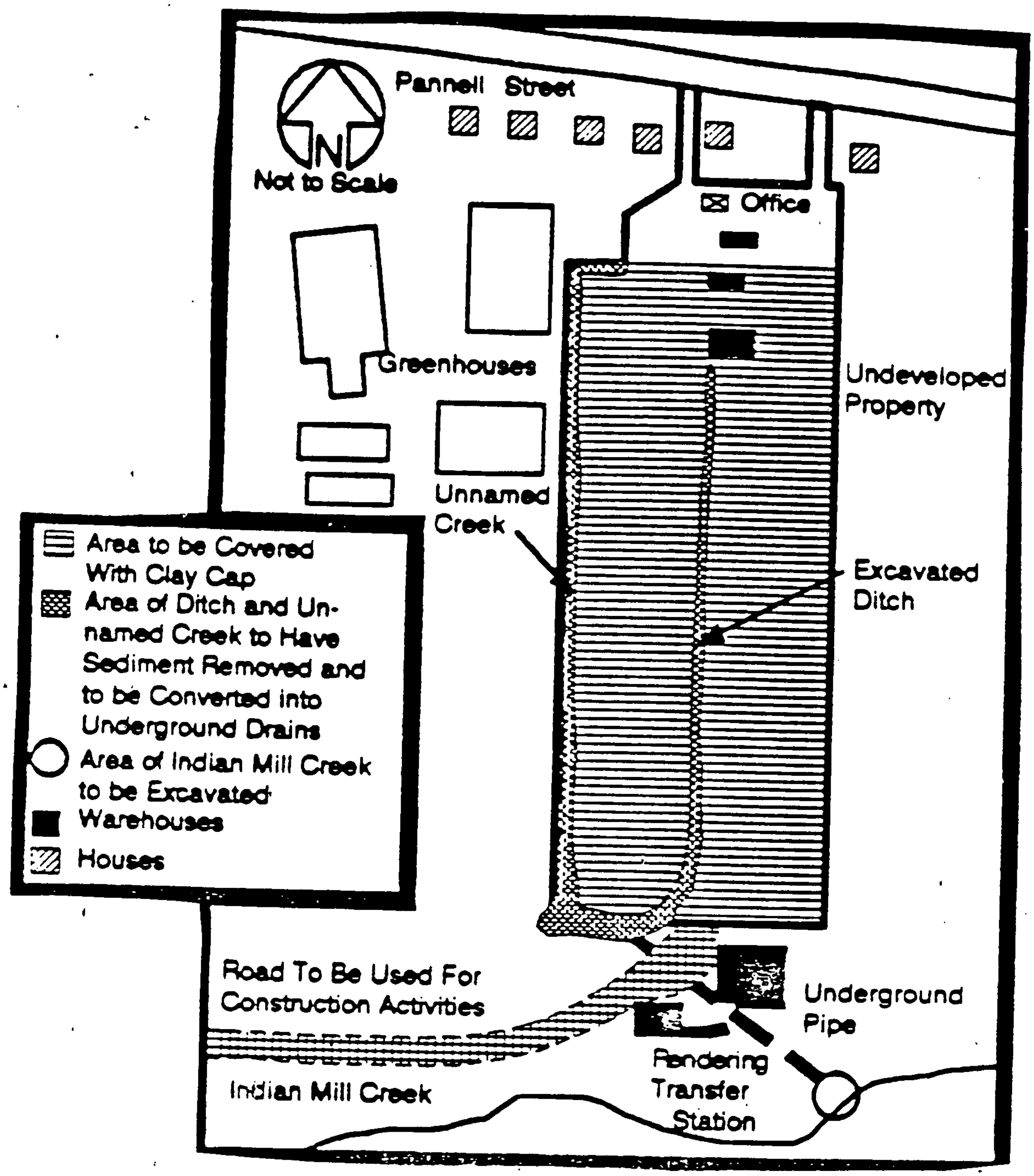


FIGURE 3
ALTERNATIVE 2 - CLAY CAP

remedial action.

**SITE PREPARATION**

Portions of the site to be capped, that are not under permanent structures (buildings and loading docks), will be cleared. Clearing the site would involve removing all scrap metal, unused machinery, and pallets. In addition, trees and shrubs in the landfilled area will be removed and disposed of at an appropriate off-site facility. Approximately 6 acres will have to be cleared of scrap metal, unused machinery, and pallets. Approximately 3 acres will have to be cleared of trees and shrubs.

General site preparation includes activities and costs associated with on-site mobilization. This includes setting up administration and decontamination trailers, improving access roads, and constructing a vehicle decontamination area. Heavy truck traffic to and from the site will take place on the access road south of the site owned by the Darling Rendering Company. This road will need to be widened and improved to withstand the additional traffic flow. In addition, 300 feet of additional access road will be constructed on the site. A vehicle decontamination area will be constructed to restrict contaminated materials to the site. The decontamination area will include a sump to collect decontamination fluids and a storage area for drummed decontamination fluids and contaminated materials. Decontamination fluids will be analyzed and properly disposed of. Contaminated materials will also be properly disposed of.

The utilities that now service the site will need to be improved. Additional water and gas hookups will involve minor site preparation costs.

**SEDIMENT EXCAVATION AND CONVERSION TO UNDERGROUND DRAINS**

The unnamed creek and drainage ditch will be converted into underground drainageways before placing the low-permeability clay cap over the landfilled area. Although groundwater discharges to the creek and ditch, the conversion to drains is not expected to significantly affect the current groundwater flow pattern at the site. As part of the conversion, the contaminated sediment and muck in the unnamed creek and drainage ditch will be excavated to the underlying sand unit (approximately 1,300 cubic yards). The excavated material will be dewatered by a filter press. The solids will subsequently be capped as part of the landfill, along with the contaminated sediments excavated from Indian Mill Creek. The filtrate from the dewatered sediments will be collected, sampled, and discharged to Indian Mill Creek. If the contaminant concentration in the filtrate exceeds federal or state National Pollutant Elimination Discharge System standards, the filtrate will be treated prior to discharge. During the excavation of sediment and muck, the surface water will be collected upstream of the site and pumped directly to Indian Mill Creek. Engineering controls will also be implemented to prevent contaminated materials from migrating to Indian Mill Creek during construction. Clean material (approximately 1,100 cubic yards) will be placed in the excavations to provide a suitable bedding. Perforated drain tile (approximately 1,500 feet of 48-inch diameter tile) and filter material (approximately 1,700 cubic yards) will be placed in the excavations and covered with coarse aggregate to the land surface. Both underground drains will have permeable covers to capture surface water runoff from the clay cap.

## INSTALLATION OF CLAY CAP

A clay cap will be placed over the landfilled area to isolate human and animal receptors from contaminated materials. The cap will be installed and maintained in accordance with RCRA Subtitle D and MSWMA 641. The area to be capped, including the contaminated sediments from the unnamed creek, drainage ditch, and Indian Mill Creek, will be graded and compacted. The cap material will consist of two layers, a compacted clay layer and a surficial layer of topsoil. The compacted clay layer will have a compacted thickness of 2 feet and a hydraulic permeability less than or equal to $10^{-7}$ centimeters per second. The compacted clay layer will be covered with 6 inches of topsoil and seeded with natural grass seed. The capped areas will be graded so that surface runoff enters the underground drains described above. The western portion of the landfilled area to be capped covers approximately 9,000 square yards and will require approximately 6,000 cubic yards of compacted clay and 1,500 cubic yards of topsoil. The eastern portion of the landfilled area to be capped covers approximately 17,300 square yards and will require 11,500 cubic yards of compacted clay and approximately 2,900 cubic yards of topsoil.

The construction of a low permeability cap over the landfilled materials may result in the buildup of VOCs or methane; therefore, a passive gas control system will be installed if necessary. As the landfilled material is already of high permeability ($10^{-3}$ centimeters per second), the gas control system will consist of five vents on each side of the landfill.

## GROUNDWATER AND DRAINAGE WATER MONITORING

The groundwater and the drainage water in the underground drains will be monitored for hazardous substances that may leach out of the contaminated materials. Groundwater samples will be collected from the existing monitoring wells. The drainage water will be monitored in each of the drains at a location downgradient of the landfilled area, yet prior to the convergence of the two drains. The specific details of the groundwater and drainage water monitoring programs will be developed in the Remedial Design.

**SITE MAINTENANCE**

Annual operation and maintenance activities will include maintaining the cap and drains, and quarterly monitoring of the groundwater and the drainage water from the underground drains. In addition, the gas vents will need to be monitored for flow and chemical speciation of emissions. As the contaminated materials will be left on-site, the remedial action would be reviewed every five years.

**IMPLEMENTATION TIME AND COSTS**

The selected remedy will take approximately 3 to 5 months to implement. A detailed cost summary is provided in Table 9. The capital cost is approximately $990,000, and O & M is estimated to be $58,000 for the first year. The present worth cost of the remedy over a 30-year period is $1.5 million.

## STATUTORY DETERMINATIONS

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

**PROTECTION OF HUMAN HEALTH AND THE ENVIRONMENT**

The selected remedy protects human health and the environment through containment of the landfilled materials and contaminated sediments of the unnamed creek, drainage ditch, and Indian Mill Creek. The cap will be constructed in accordance with RCRA Subtitle D and MSWMA 641.

Capping the landfilled materials and contaminated sediments will eliminate or reduce human and animal exposure through ingestion, direct contact, and inhalation. The cap will also reduce the

**TABLE 9**

**ESTIMATED COST OF ALTERNATIVE 2 - CLAY CAP**

| | Capital | O & M |
|---|---|---|
| Site Preparation | $ 73,300 | |
| Drainage System | 190,000 | |
| Clay Cap | 264,000 | |
| Health and Safety Equipment | 4,500 | |
| Groundwater Monitoring | 61,400 | $ 49,000 |
| Site Maintenance | | 6,600 |
| Gas Control System Monitoring | | 2,400 |
| | $ 593,200 | $ 58,000 |
| Mobilization/Demobilization (4%) | 23,700 | |
| Bid Contingency (15%) | 88,900 | |
| Scope Contingency (20%) | 119,000 | |
| Construction Subtotal | $ 824,800 | |
| Permitting and Legal Activities (5%) | 41,200 | |
| Engineering Design (7%) | 57,700 | |
| Services During Construction | 65,900 | |
| Total Capital Cost | $ 990,000 | |
| Present Worth at 30 years @ 10 Percent Discount Rate | $1,500,000 | |

potential for contaminants to migrate to the groundwater, and for the contaminated groundwater to move out from beneath the landfill and beyond the waste boundary. A groundwater and drainage water monitoring program will also be implemented. Fencing and institutional controls such as deed restrictions will further restrict exposure to the landfilled materials and contaminated sediments, as well as reduce the potential for the ingestion of contaminated groundwater beneath the landfill.

The selected remedy does not pose any short-term threats that cannot be readily controlled, and no adverse cross-media impacts are expected from its implementation.

By implementing the selected remedy, the risks at the Folkertsma Refuse site will be reduced to within EPA's acceptable risk range for carcinogens ($10^{-4}$ to $10^{-6}$) and to an acceptable level for noncarcinogens (Hazard Index $\leq 1$).

**COMPLIANCE WITH APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS**

The selected remedy of excavation, consolidation, and containment will comply with all applicable or relevant and appropriate chemical, action, and location-specific requirements (ARARs). The ARARs considered for the selected remedy at the Folkertsma Refuse site are presented below.

**Action-Specific ARARs:**

Action-specific ARARs are requirements that define acceptable treatment and disposal procedures for hazardous substances.

Federal ARARs

RCRA Subtitle D 40 CFR Part 241 establishes requirements for the disposal of solid waste in landfills. As the selected remedy involves placing a cap over the landfilled area of the site, this regulation would be applicable or relevant and appropriate to the action.

State ARARs

Michigan Solid Waste Management Act 641 provides regulations for the construction, operation, and closure of solid waste landfills. This act is applicable or relevant and appropriate to the action as the selected remedy involves placing a cap over the landfilled area of the site. Requirements for solid waste closure include a minimum 2 feet of compacted clay with a hydraulic permeability less than or equal to $10^{-7}$,and a slope not to exceed 1 vertical to 4 horizontal nor less than 2%.

Michigan Environmental Response Act 307, as amended, provides for the identification, risk assessment, and evaluation of contaminated sites within the State; therefore, Act 307 is applicable or relevant and appropriate to the Folkertsma Refuse site. These rules provide that remedial actions shall be protective of human health, safety, the environment, and the natural resources of the State. To achieve the standard of protectiveness, Act 307 rules specify that a remedial action shall achieve a degree of cleanup under either Type A (cleanup to background levels), Type B (cleanup to risk-based levels), or Type C (cleanup to risk-based levels under site-specific considerations). At the Folkertsma Refuse site, EPA has determined that Type C criteria would be appropriate. The selected remedy utilizes a containment technology, and cleanup standards developed under Type A and Type B criteria could not be met unless the source materials were removed. Type C criteria would provide for a cost-effective and appropriate remedial action for the landfilled areas.

Michigan Inland Lakes and Streams Act 346, as amended, regulates inland lakes and streams in the state. Act 346 would be applicable or relevant and appropriate to the excavation of sediments in Indian Mill Creek.

Michigan Soil Erosion and Sedimentation Control Act 347 regulates earth changes, including cut and fill activities, which may contribute to soil erosion and sedimentation of the surface waters in the state. Act 347 would be applicable or relevant and appropriate to the excavation of sediments in the unnamed creek, drainage ditch and Indian Mill Creek, and the installation of the cap, as these actions could impact Indian Mill Creek.

**Chemical-Specific ARARs:**

Chemical-specific ARARs regulate the release to the environment of specific substances having certain chemical characteristics.

<u>Federal ARARs</u>

National Ambient Air Quality Standards 40 CFR 50 provide air emission requirements for actions which may release contaminants into the air. As the selected remedy involves excavation and construction activities which may release contaminants or particulates into the air, this act is relevant and appropriate.

Clean Water Act provides surface water quality criteria for the protection of human health and aquatic life. The Federal Ambient Water Quality Criteria (AWQC) are nonenforceable guidelines that set pollutant concentration limits to protect surface waters and are applicable to point source discharges. At Superfund sites, AWQC are relevant and appropriate requirements for the discharge of treated water. As the filtrate from the dewatered sediments will be discharged into Indian Mill Creek, the Clean Water Act is applicable.

Occupational Safety and Health Act 29 CFR 1910 regulates the health and safety of workers. As the contamination at the site could potentially pose a health risk to response workers, this act is applicable.

State ARARs

Michigan Air Pollution Act 348 provides air emission requirements for actions which may release contaminants into the air. As the selected remedy involves excavation and construction activities which may release contaminants or particulates into the air, this act is relevant and appropriate. In addition, if it is determined that it is necessary to install gas vents to prevent the buildup of VOCs and methane, Act 348 is also applicable or relevant and appropriate.

Michigan Water Resources Commission Act 245, as amended, establishes surface water quality standards to protect human health and the environment. The National Pollutant Discharge Elimination System (NPDES) is administered by the State. As the filtrate from the dewatered sediments will be discharged into Indian Mill Creek, Act 245 is applicable.

Michigan Occupational Safety and Health Act 154 provides regulations to ensure safe and healthy working environments. As the contamination at the site could potentially pose a health risk to response workers, this act is applicable.

**Location-Specific ARARs:**

Location-specific ARARs are those requirements that relate to the geographical position of a site. These include:

Federal ARARs

Endangered Species Conservation Act provides for the identification and protection of endangered/threatened species and their habitat. As several threatened or endangered species have been identified in the Grand Rapids Area, this act is relevant and appropriate to those activities necessary to implement the selected remedy which may impact these endangered species.

Executive Order 11988 provides regulations for the protection of floodplains. This order is applicable to all actions occurring below the 100-year flood elevation. As the selected remedy includes activities which would occur below the 100-year flood elevation (the excavation of sediment in the unnamed creek, drainage ditch, and Indian Mill Creek; and the installation of underground drains in the unnamed creek and drainage ditch), this order may be applicable.

Executive Order 11990 provides regulations which protect against the loss or degradation of wetlands. As wetlands have been identified in the vicinity of the site, this order is applicable to those actions which may impact these wetlands.

State ARARs

Thomas J. Anderson, Gordon Rockwell Environmental Protection Act 127 provides for the protection of natural resources from impairment and destruction by pollution. As such, this act is applicable or relevant and appropriate to the selected remedy.

Michigan Natural River Act 231 provides for the protection of natural waterways as well as the protection of fish and wildlife resources associated with these waterways. As the site is 100 to 300 feet from Indian Mill Creek, and the selected remedy involves activities which may impact the creek, this act is applicable or relevant and appropriate.

Michigan Endangered Species Act 203 provides for the protection and regulation of activities occurring in the vicinity of endangered/threatened species or their habitat. As several threatened or endangered species have been identified in the Grand Rapids Area, this act is relevant and appropriate to those activities in the selected remedy which may impact these endangered species.

Goemaere-Anderson Wetland Protection Act regulates any activity which may take place within wetlands in the State of Michigan. If the remedial action occurs in a wetland area, this act will be applicable or relevant and appropriate.

**Other Criteria, Advisories or Guidance to be Considered for this Remedial Action:**

State Recommended Allowable Air Concentrations have been established by Michigan Department of Natural Resources, Air Quality Division. The standards established for benzo(a)pyrene are relevant to consider, as this chemical has been detected in the landfilled materials at the site and may be released via fugitive dusts.

EPA and the State have agreed to incorporate institutional controls such as deed restrictions to prohibit the installation of water wells beneath the landfilled portion of the site and any activities which might disturb the cap or landfilled materials.

The RCRA Land Disposal Restrictions (LDRs) are not ARARs for the Folkertsma Refuse site. The consolidation of the contaminated sediments from the unnamed creek, drainage ditch, and Indian Mill Creek on the landfill is considered the movement of wastes within a single area of contamination (AOC). The movement of wastes within an AOC does not constitute land disposal or placement. As land disposal or placement will not occur at the Folkertsma Refuse site, the RCRA LDRs are not triggered.

**COST-EFFECTIVENESS**

The selected remedy is cost-effective because it has been determined to provide overall effectiveness proportional to its costs, the net present worth value being $1.5 million. The selected remedy is the least costly of those alternatives which protect human health and the environment.

**UTILIZATION OF PERMANENT SOLUTIONS AND ALTERNATIVE TREATMENT TECHNOLOGIES (OR RESOURCE RECOVERY TECHNOLOGIES) TO THE MAXIMUM EXTENT PRACTICABLE**

EPA and the State of Michigan have determined that the selected remedy represents the maximum extent to which permanent solutions and treatment technologies can be utilized in a cost-effective manner for the final action at the Folkertsma Refuse site. Of those alternatives which protect human health and the environment and comply with ARARs, EPA and the State have determined that the selected remedy provides the best balance of tradeoffs in terms of long-term effectiveness and permanence, reduction in toxicity, mobility, or volume achieved through treatment, short-term effectiveness, implementability, cost, also considering the statutory preference for treatment as a principal element, and considering State and community acceptance.

In addition to protecting human health and the environment and complying with ARARs, the selected remedy provides the lowest short-term risks to site workers and the community, and can be implemented in 3 to 5 months. The remedy is easy to construct and operate, presents little or no administrative difficulty, and is the least costly alternative. Institutional controls and operation and maintenance will ensure that the remedy is effective in the long-term. In addition, the State of Michigan has concurred with the selected remedy.

The selected remedy is a containment remedy, however, and does not meet the criterion for reducing toxicity, mobility, or volume through treatment; nor does it satisfy the preference for treatment as a principal element. The only alternatives to meet these criteria are Alternatives 6 and 9, incineration and in-situ vitrification. These alternatives, however, pose the greatest short-term risks to site workers and the community and take 2 to 3 years to implement. These alternatives are more difficult to construct and operate, and present greater administrative difficulty. In addition, as the risks at the site are posed by a large volume of low-level organic and inorganic waste material, the selected remedy is consistent with the expectation within the NCP that these types of materials will be addressed by engineering controls.

**PREFERENCE FOR TREATMENT AS A PRINCIPAL ELEMENT**

As discussed above, the selected remedy does not satisfy the preference for treatment as a principal element. The risks at the Folkertsma Refuse site are posed by a large volume of low-level organic and inorganic waste material. Containment satisfies the NCP expectation that low-level, long-term threats, like those posed by the materials at the Folkertsma Refuse site, will be addressed by engineering controls.

**DOCUMENTATION OF SIGNIFICANT CHANGES**

The Proposed Plan for the Folkertsma Refuse site was released for public comment in March, 1991. The Proposed Plan identified Alternative 2, the clay cap, as the preferred alternative. EPA reviewed all written and verbal comments submitted during the public comment period. Upon review of these comments, it was determined that no significant changes to the remedy, as it was originally identified in the Proposed Plan, were necessary.

# RESPONSIVENESS SUMMARY
# FOLKERTSMA REFUSE SITE
# WALKER, MICHIGAN

## I. RESPONSIVENESS SUMMARY OVERVIEW

The U.S. Environmental Protection Agency (EPA) held a public comment period from April 1, 1991 through April 30, 1991 for interested parties to comment on the Remedial Investigation/Feasibility Study (RI/FS) report and the Proposed Plan for the Folkertsma Refuse site in Walker, Michigan.

The Proposed Plan provides a summary of the background information leading up to the public comment period. Specifically, the Proposed Plan includes information pertaining to the history of the site, the scope of the proposed cleanup action and its role in the overall site cleanup, the risks posed by the site, the descriptions of the remedial alternatives evaluated by EPA, the identification of EPA's preferred alternative, the rationale for EPA's preferred alternative, and the community's role in the remedy selection process.

EPA held a public meeting at 7:00 p.m. on April 3, 1991, at the Walker Community Building in Walker, Michigan, to discuss the results of the RI/FS and to present EPA's proposed remedial alternative for controlling contamination at the landfill.

The responsiveness summary, required by the Superfund Law, provides a summary of citizens' comments and concerns identified and received during the public comment period, and EPA's responses to those comments and concerns. All comments received by EPA during the public comment period were considered in EPA's final decision for selecting the remedial alternative for addressing contamination at the Folkertsma Refuse site.

This responsiveness summary is organized into sections as described below:

I. **RESPONSIVENESS SUMMARY OVERVIEW.** This section outlines the purpose of the Public Comment period and the Responsiveness Summary. It also references the appended background information leading up to the Public Comment period.

II. **BACKGROUND ON COMMUNITY INVOLVEMENT AND CONCERNS.** This section provides a brief history of community concerns and interests regarding the Folkertsma Refuse site.

III. **SUMMARY OF MAJOR QUESTIONS AND COMMENTS RECEIVED DURING THE PUBLIC MEETING AND EPA RESPONSES TO THESE COMMENTS.** This section summarizes the oral comments received by EPA at the April 3, 1991 public meeting, and provides EPA's responses to these comments.

IV. **WRITTEN COMMENTS RECEIVED DURING THE PUBLIC COMMENT PERIOD AND EPA RESPONSES TO THESE COMMENTS.** This section summarizes the written comments received by EPA during the public comment period, as well as EPA's responses to these comments.

## II. BACKGROUND ON COMMUNITY INVOLVEMENT AND CONCERN

Community interviews were conducted in October 1988, to determine the interest and concerns of the community over the Folkertsma Refuse site. EPA interviewed state and local officials, a local environmental organization, and local residents. The respondents indicated that there was a strong interest in learning more about the Superfund program and the activities planned for the site. However, no history of community concern regarding the site had been identified.

Most of the residents and local officials interviewed were surprised that the Folkertsma Refuse site was considered to be potentially hazardous. Many of them did not consider foundry sand, the primary material disposed of at the site, to be a potentially hazardous waste. There is a foundry approximately a half-mile southwest of the site, employing many Walker residents, and foundry sand has been a familiar form of landfill material to the residents in the vicinity of the site. In addition, landfilling operations at the site ceased in 1972, and a pallet company has been operating on the site ever since. This passage of time, as well as the fact that the site does not visibly give the impression as being potentially hazardous, also seems to have influenced the lack of concern.

The concerns expressed by the community during these interviews are summarized below:

- Local officials and residents were concerned that EPA's findings regarding foundry sand could have many implications for the other foundry sand landfills in the community.

- Residents were concerned that their private wells might be contaminated.

- Local officials were concerned that the contamination at the site would migrate to the Grand River, endangering alternate drinking water supplies and recreational activities.

- Residents, local officials, and the pallet company expressed concern that publicity of the site be kept to a minimum in order that the public not be alarmed.

As part of EPA's responsibility and commitment to the Superfund program, the community has been kept informed of ongoing activities conducted at the Folkertsma Refuse site. EPA has established two information repositories where relevant site documents may be reviewed. One repository is located at Walker City Hall; the other is at the Kent County Public Library. Documents stored at the repositories include:

- RI Workplan, Health and Safety Plan, Quality Assurance

Project Plan, Community Relations Plan;

- o RI/FS Reports;
- o Proposed Plan;
- o Fact sheets, summarizing the technical studies conducted at the site;
- o Public Meeting Transcript;
- o Written comments received during the public comment period.

EPA's selection of the remedy to control contamination at the Folkertsma Refuse site is presented in a document known as a Record of Decision (ROD). The ROD and the documents containing information which EPA used in making its decision (except for documents that are published and generally available) will also be placed in the information repositories, as will this responsiveness summary.

## III. SUMMARY OF QUESTIONS AND COMMENTS RECEIVED DURING THE PUBLIC MEETING AND EPA RESPONSES TO THESE COMMENTS.

Oral comments raised during the public meeting for the Folkertsma Refuse site have been summarized below together with EPA's response to these comments.

COMMENT: One resident stated that he did not believe the materials disposed of at the site posed a risk to human health and the environment.

RESPONSE: EPA's determination of risk at the Folkertsma Refuse site is based on the findings of the Remedial Investigation (RI) and Risk Assessment, which were conducted in accordance with the National Contingency Plan (NCP). During the RI, EPA collected and analyzed samples of the landfilled material, soil, groundwater, surface water, and sediment. The analytical results of these samples indicate that the landfilled materials are contaminated, and that the contamination has spread into the soil, groundwater, surface water, and sediment. The data collected during the RI was then used in conjunction with established toxicity information and standard exposure scenarios to determine if the contamination at the site poses a risk to human health and the environment. The risk values generated in the Risk Assessment for the Folkertsma Refuse Site exceed the acceptable risk range established under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) and warrant a remedial action.

COMMENT: One resident stated that he did not feel the contamination detected at the site was great enough to warrant a remedial action.

RESPONSE: CERCLA gives EPA the authority to conduct remedial actions when there is a release or threatened release of any hazardous substance, pollutant, or contaminant into the environment which may present an imminent and substantial endangerment to human health and the environment. At the Folkertsma Refuse site, unacceptable risks to human health have been calculated for exposure to the landfilled material and groundwater. These risks range from $10^{-2}$ to $10^{-3}$ (one additional case of cancer for every 100 to 1,000 people exposed). In addition, the landfilled material and the sediments of the unnamed creek, drainage ditch, and Indian Mill Creek pose unacceptable risks to the environment. As these risks exceed EPA's acceptable risk range of $10^{-4}$ to $10^{-6}$ (one additional case of cancer for every 10,000 to 1,000,000 people exposed), an action is justified.

COMMENT: One resident expressed his preference for the remedial alternatives which involved excavating the landfilled materials and contaminated sediment and transporting them to an off-site landfill for disposal.

RESPONSE: CERCLA provides EPA with a set of nine criteria for evaluating remedial alternatives. These criteria include overall protection of human health and the environment; compliance with applicable or relevant and appropriate requirements (ARARs); long-term effectiveness and permanence; reduction of toxicity, mobility, or volume through treatment; short-term effectiveness; implementability; cost; and state and community acceptance. After the alternatives are evaluated, the advantages and disadvantages of each alternative are compared to identify the alternative which provides the best balance among the nine criteria.

Considering that the risks at the Folkertsma Refuse site were calculated under worst case conditions, EPA believes that the alternatives involving excavation and off-site disposal do not provide the best balance among the nine evaluation criteria. While these alternatives are protective of human health and the environment, comply with ARARs, are effective in the short-term, and remove the risk from the Folkertsma Refuse site, they move the materials to another location without providing treatment. The long-term effectiveness of these alternatives relies upon effective disposal at the receiving landfill. In addition, these alternatives do not reduce toxicity, mobility, or volume through treatment; may present administrative difficulties in identifying a landfill willing to accept the contaminated materials for disposal; and are more costly than other alternatives having the same advantages.

Based on the nine evaluation criteria and the comparative analysis of alternatives, EPA believes that the clay cap alternative provides the best balance among the nine criteria. The clay cap is protective of human health and the environment, complies with ARARs, is effective in the long and short term, presents little or no administrative or technical difficulties, and has the least cost. Although this alternative does not satisfy the criterion for reducing toxicity, mobility, or volume through treatment, the risks at the site are posed by a large volume of low-level waste material, and it is not practical to utilize a treatment technology.

COMMENT: The owner of the pallet company and two residents expressed concern that the clay cap alternative be revised to include a top covering which would enable the pallet company to continue operations on the site.

RESPONSE: CERCLA authorizes EPA to provide for remedial actions which protect human health and the environment from a release or threatened release of any hazardous substance, pollutant, or contaminant into the environment. EPA's authority is limited to the protection of human health and the environment, and does not include human occupancy or economic considerations.

EPA is, however, willing to consider during the remedial design, the placement of additional cover material, such as asphalt, over the cap once it is in place. The owners of the pallet company and the owner of the property may be able asphalt those portions of the site they wish to resume operations on, provided that the construction specifications (including thickness and composition of the asphalt) meet EPA's approval, and that the parties involved provide EPA with assurance that they will properly install, inspect and maintain the covering. The owner of the pallet company and the owner of the property would not be permitted to access or extend business operations beyond the asphalted area. In addition, the owners of the pallet company and the owner of the property would be responsible for installing and maintaining a fence between the asphalted portions of the site they expect to be operating on and the remainder of the capped area.

## IV. SUMMARY OF WRITTEN COMMENTS RECEIVED DURING THE PUBLIC COMMENT PERIOD AND EPA RESPONSES TO THESE COMMENTS.

Written comments received during the public comment period for the Folkertsma Refuse site have been summarized below together with EPA's response to these comments. Copies of the original letters are available for review in the information repositories.

COMMENT: A representative of the Kent County Health Department expressed agreement with EPA's proposed plan to cap the landfilled materials. He went on to comment, however, that without disputing EPA's Risk Assessment, he felt that the public health risks relating to the Folkertsma Refuse site were over emphasized in comparison to the risk of injury, disease, or death by living in our every day environment.

RESPONSE: Although the risks posed by the contamination at the Folkertsma Refuse site may be overemphasized in comparison to the risk of injury, disease, or death by living in our every day environment, CERCLA requires EPA to take an action at sites where the carcinogenic risk has been determined to be greater than $10^{-4}$ (more than one additional case of cancer for every 10,000 people exposed). At the Folkertsma Refuse site, unacceptable risks to human health have been calculated for exposure to the landfilled material and groundwater. These risks range from $10^{-2}$ to $10^{-3}$ (one additional case of cancer for every 100 to 1,000 people exposed). In addition, the landfilled material and the sediments of the unnamed creek, drainage ditch, and Indian Mill Creek pose unacceptable risks to the environment. As these risks exceed EPA's acceptable risk range of $10^{-4}$ to $10^{-6}$ (one additional case of cancer for every 10,000 to 1,000,000 people exposed), an action is justified.

COMMENT: The representative of the Kent County Health Department also raised the issue as to whether it would be appropriate to similarly address other known foundry sand disposal areas in Kent County.

RESPONSE: EPA cannot respond to this comment unless further information on the other foundry sand disposal areas is provided. The question as to whether it would be appropriate to similarly address other known foundry sand disposal areas in Kent County is a site specific issue. The conclusions drawn from the investigations conducted at the Folkertsma Refuse site are particular to that facility and cannot be applied to other foundry sand landfills. In addition, not all sites warrant the expenditure of Fund money. CERCLA establishes a pre-remedial process for determining which sites are eligible for investigation and cleanup under Superfund (the National Priorities List (NPL)). Eligibility for the NPL is determined by the Hazard Ranking Score for the site. The Hazard Ranking Score is based on the results of a preliminary assessment and on-site inspection of the facility. Although many sites have been brought to the attention of EPA and the State, not all of them have ranked high enough to warrant expenditures from the Fund. In addition, these foundry sand disposal areas may be regulated by current state laws.

The status of specific foundry sand landfills in Kent County can be determined by contacting the Environmental Response Division of the Michigan Department of Natural Resources.

COMMENT: The owners of the pallet company and the owner of the property have already asphalted some areas of the site and submitted a map depicting additional areas they would like to asphalt. They need the buildings and the eastern portion of the site (approximately 5 acres) to operate their two-family owned business. According to the owners, they cannot afford to move, purchase another 5 acres, or build new buildings without someone off-setting the cost; otherwise, they will be forced to go out of business.

RESPONSE: CERCLA requires that all remedial actions comply with applicable or relevant and appropriate requirements (ARARs). The capping remedy selected for the Folkertsma Refuse site is required to comply with the Resource Conservation and Recovery Act (RCRA) Subtitle D and the requirements of the Michigan Solid Waste Management Act 641 (MSWMA 641). Specifically, this includes a minimum of two feet of compacted clay cover with a permeability less than or equal to $1 \times 10^{-7}$ centimeters/second, and a slope not to exceed 1 vertical to 4 horizontal nor less than 2%.

EPA is, however, willing to consider the placement of additional cover material, such as asphalt, over the cap once it is in place. The owners of the pallet company and the owner of the property may be able to asphalt those portions of the site they wish to resume operations on, provided that the construction specifications (including thickness and composition of the asphalt) meet EPA's approval, and that the parties involved provide EPA with assurance that they will properly install, inspect and maintain the covering. The owner of the pallet company and the owner of the property would not be permitted to access or extend business operations beyond the asphalted area. In addition, the owners of the pallet company and the owner of the property would be responsible for installing and maintaining a fence between the asphalted portions of the site they expect to be operating on and the remainder of the capped area.

**The owners of the pallet company and the property owner also expressed the following comments:**

COMMENT: The landfill has been in existence for 20 years and has not contaminated any wells or streams.

RESPONSE: Although contamination has not yet impacted any off-site water well supplies, groundwater sampling indicates that the groundwater beneath the landfill is contaminated, and that there is a potential for the contaminated groundwater to move out from beneath the landfill. Arsenic was detected in unfiltered groundwater samples collected from beneath the landfill at concentrations as high as 116 and 287 parts per billion (ppb). Background water samples collected from wells installed upgradient of the landfill only contained arsenic at concentrations ranging from 0 to 9 ppb.

Contamination was also detected above background levels in surface water samples collected from the unnamed creek and drainage ditch. Cadmium and chromium were detected at concentrations of 8 and 38 ppb; neither of these chemicals were detected in surface water samples collected from upstream locations.

**COMMENT:** The sediments in the unnamed creek and Indian Mill Creek are contaminated before reaching the landfill.

**RESPONSE:** Analysis of the sediment data indicates that the landfill is the source of sediment contamination in Indian Mill Creek and the unnamed creek. Contaminants such as polynuclear aromatic hydrocarbons, cadmium, chromium, and nickel were detected in the sediments of the unnamed creek and Indian Mill Creek at concentrations two to three times greater than those detected in background sediment samples. This indicates that the landfill, not an off-site source, is the cause of the contamination.

**COMMENT:** The landfill is not the only landfill containing foundry sand; foundry sand has been landfilled throughout the river valley area.

**RESPONSE:** Although there may be other areas where foundry sand has been disposed of, the landfill at the Folkertsma Refuse site was found to pose an unacceptable risk to human health and the environment. CERCLA gives EPA the authority to conduct remedial actions when there is a release or threatened release of any hazardous substance, pollutant, or contaminant into the environment which may present an imminent and substantial endangerment to human health and the environment. At the Folkertsma Refuse site, unacceptable risks to human health and the environment have been calculated for exposure to the landfilled material, groundwater, and contaminated sediment. These risks exceed EPA's acceptable risk range of $10^{-4}$ to $10^{-6}$ (one additional case of cancer for every 10,000 to 1,000,000 people exposed) and therefore justify an action.

**COMMENT:** The western portion of the landfill should be capped with top soil or gravel to prevent exposure; the sediments of the unnamed creek and drainage ditch should be excavated; and the creek and ditch should be lined with clay or tile.

**RESPONSE:** CERCLA requires that all remedial actions comply with applicable or relevant and appropriate requirements (ARARs). The capping remedy selected for the Folkertsma Refuse site must comply with the Resource Conservation and Recovery Act (RCRA) Subtitle D and the Michigan Solid Waste Management Act (MSWMA). These ARARs require that a solid waste cap consist of a minimum of two feet of compacted clay. A soil covering or a layer of gravel alone would not meet the requirements of these regulations.

**COMMENT:** Legal counsel for the owner of the site expressed their concurrence with the comments submitted by the Potentially Responsibility Party (PRP) group (discussed on the following pages), and also expressed their belief that the Proposed Plan for the Folkertsma Refuse site was deficient in that it did not address the impact of the proposed remedy upon present uses of the site.

RESPONSE: The Proposed Plan supports only preliminary decisions for a site and includes only observations and tentative recommendations. It is not the intent of the Proposed Plan to make definitive findings or declarative statements that cannot be revised. As such, EPA believes that the Proposed Plan for the Folkertsma Refuse site is sufficient in addressing the impact of the proposed remedy upon present uses of the site. The description of the preferred remedy discloses that the site would be fenced to restrict access, and that deed restrictions would be imposed to prohibit the installation of water wells beneath the landfilled portion of the site and any future development which might disturb the landfilled materials. Any other statements regarding the impact of the proposed remedy on present uses of the site at this time would be premature, as it is not the intent of the agency to preclude activities that can be compatible with the clay cap, only to exclude those activities which may damage the cap material.

COMMENT: Legal counsel for one of the PRPs summarized the comments submitted by the PRP group and expressed their support of these comments. They additionally submit that the use of institutional and access controls alone would be adequate to control human exposure to the surface contaminants and prevent use of groundwater beneath the site.

RESPONSE: EPA does not believe that the use of institutional and access controls alone would be adequate to protect human health and the environment from the contamination at the Folkertsma Refuse site. Fencing would not prevent erosion and off-site migration of the contaminated landfilled materials; nor would it prevent the contaminated sediments from migrating into Indian Mill Creek and beyond. In addition, EPA's experience has been that a fence is not sufficient to prevent humans and animals from coming into contact with contaminated materials, as fences may be crawled under, climbed, or cut.

**A group of Potentially Responsible Parties (PRPs) for the Folkertsma Refuse site submitted several comments in response to the RI/FS and the Proposed Plan. These comments are summarized below with EPA's response.**

COMMENT: Portions of the site are underlain by from 3 to 10 feet of fill material comprising foundry sand and construction debris. There appears to be some inconsistency in the Remedial Investigation report (RI) regarding the extent of fill material which may affect where application of the selected remedy is appropriate. Specifically, the extent of fill depicted in the map of Figure 3-5 is greater than that depicted in the Geologic Cross Section A-A' of Figure 3-3. The former was apparently derived from verbal reports while the cross section depiction was generated from boring log data and, as such, presumably is more reflective of actual conditions.

RESPONSE: The extent of fill material depicted in Figure 3-5 was not derived from verbal reports. As noted on the figure, the estimated extent of the landfilled area is based on aerial photographs dated spring 1969, spring 1976, and the results of the soil sampling conducted in 1989. If there is a slight discrepancy between Figure 3-5 and Cross Section A-A', it is because of the limitations encountered in extrapolating soil boring data into a cross section. Figure 3-3 is not meant to be a strict portrayal of the geology directly beneath A-A', but rather a general representation of the area based on soil boring data obtained from discrete locations.

COMMENT: The Risk Assessment is designed to represent worst case conditions, and, as such, follows a conservative approach. A more realistic approach to risk evaluation is to calculate a "maximum likely" exposure dose based on a 95% confidence level determined from a statistical analysis of the data.

RESPONSE: The Risk Assessment for the Folkertsma Refuse site was conducted in accordance with the Superfund Public Health Evaluation Manual (SPHEM), the appropriate guidance when the Risk Assessment was conducted. Under SPHEM, risks are assessed in terms of probable case conditions and worst case conditions. EPA has since published a new manual, Risk Assessment Guidance for Superfund (RAGS), in which risk is assessed in terms of reasonable maximum exposure. Issuance of the new manual does not invalidate risk assessments conducted under previous guidance. The new guidance was applied to the Risk Assessment for the Folkertsma Refuse site where practical.

COMMENT: In the evaluation of risks associated with drinking groundwater underlying the site, EPA's conservative approach appears to have been carried to an unrealistic extreme because the analytical results from unfiltered groundwater samples were used in the evaluation. People do not drink unfiltered groundwater. The suspended sediments responsible for the elevated analytical results will be filtered out of the water as it migrates through the aquifer sediments on its way to any potential receptor. Further, an even marginally designed and constructed water supply well will remove such sediments through an engineered or naturally developed filter pack surrounding the well screen.

The significance of this assumption to the risk assessment process is that most of the calculations involved are linear, producing risk values that are directly proportional to the raw data (groundwater quality results, in this case) used. As a result, the apparent risk posed by a given contaminant in the groundwater will be over 100 times higher for some of the parameters than if the realistic (filtered) analytical results had been used. The net result of this unrealistically conservative approach is that existing groundwater quality is portrayed and treated as significantly worse than it actually is, elevating concerns about present and potential future groundwater quality to inappropriate levels which are reflected in the remedy selection process.

RESPONSE: Although the use of unfiltered groundwater data in the risk assessment may be a conservative approach, EPA does not believe it represents an "unrealistic extreme". Although no one is currently drinking the contaminated groundwater beneath the landfilled portion of the site, EPA must consider that there is a potential for contaminated groundwater to migrate off-site, and for wells to be installed in areas of groundwater contamination. In addition, EPA cannot assume that each of the residences using water from a contaminated well will have a properly installed and working filter on the tap.

It is also the position of the Agency that unfiltered groundwater samples are more representative of the chemical concentrations found in groundwater from an unfiltered tap. Filtering groundwater samples may actually underestimate the chemical concentrations found in unfiltered tap water.

EPA recognizes the assumptions that were involved in assessing the risks at the Folkertsma Refuse site. EPA has indicated several times (Proposed Plan, public meeting and Record of Decision) that the use of unfiltered groundwater data in the risk assessment is a conservative approach. EPA has also stated that groundwater contamination is limited to the groundwater beneath the landfill, and that no one is currently using this groundwater as a water supply. EPA further explained that filtering the groundwater samples removed or reduced the contamination to below Maximum Contaminant Levels (MCLs) established under the Safe Drinking Water Act.

The assumptions involved in assessing the risks at the Folkertsma Refuse site are reflected in the selected remedy. EPA believes it is more appropriate to implement institutional controls such as deed restrictions and groundwater monitoring at the site rather than install a system which would pump and treat contaminated groundwater. The deed restrictions would prevent exposure to contaminated groundwater by prohibiting the installation of water supply wells beneath the landfilled portion of the site, and groundwater monitoring would ensure that the chemical concentrations in the groundwater did not increase. In addition, the low-permeability nature of the cap would also enhance the effectiveness of the deed restrictions by reducing infiltration and the potential for further groundwater contamination.

COMMENT: One critical assertion regarding the groundwater on page 6-13 of the RI states: "Total metals were analyzed for in both unfiltered and filtered samples. The results for the two fractions were very similar, indicating that the majority of metals present were dissolved in the groundwater samples." This statement directly contradicts interpretations presented elsewhere and is not supported by the analytical results for filtered and unfiltered samples presented in Table 4-6 of the RI which shows declines exceeding two orders of magnitude (100-fold) in some cases when comparing the filtered to the unfiltered results. Additionally, the two unfiltered shallow groundwater samples that exceeded the ARAR of 50 parts per billion (ppb) (the Safe Drinking Water Act Maximum Contaminant Level (MCL) for arsenic), and contributed to the unrealistic exposure dose calculation, failed the Contract Laboratory Program quality assurance protocol. Although not a catastrophic quality assurance failure, the discrepancy in the matrix spike recovery does cast some doubt on the validity of the analytical results and calls into question the appropriateness of basing even "worst case" risk assessments on these numbers.

RESPONSE: The statement on page 6-13 is incorrect. The sentence should have read: "The results for the two fractions were dissimilar, indicating that the majority of metals present were sorbed onto particulate matter in the groundwater samples."

Although the discrepancy in the matrix spike recovery indicates that the actual concentrations of arsenic detected in these samples may have been overestimated or underestimated (they were reported as 287 ppb and 116 ppb), the presence of the chemical is verified, and risk assessment guidance indicates that this data may be included in the quantitative risk assessment. In addition, comparison with the risk analysis for the ingestion of unfiltered deep groundwater indicates that unacceptable risks to human health have been calculated for arsenic concentrations as low as 12 ppb. As such, it appears likely that the arsenic detected in the shallow groundwater, regardless of the uncertainty associated with concentration, results in unacceptable risks to human health.

COMMENT: Individual cancer potency factors (toxicological data) do not exist for three of the five polynuclear aromatic hydrocarbons (PAHs) of concern. In the absence of individual data, the potency factor for benzo(a)pyrene was used to represent the toxicity of the other chemicals. Although the qualification is made that this may overestimate the risks posed by these compounds, it is still a conservative assumption on the part of the Agency.

RESPONSE: Although individual cancer potency factors do not exist for the other PAHs (benzo(a)anthracene, benzo(b)fluoranthene, dibenzo(a,h)anthracene and chrysene), the most recent studies conclude that these PAHs are probable carcinogens. Benzo(a)pyrene has been the most widely studied of the PAHs, and research indicates that most of the data pertaining to benzo(a)pyrene is applicable to all PAHs, especially those that are carcinogenic. As such, the Agency uses the cancer potency factor for benzo(a)pyrene in calculating the risk from all carcinogenic PAHs.

COMMENT: The exposure scenario for the inhalation of fugitive dust is overly conservative. The only risk in excess of EPA's $1 \times 10^{-4}$ acceptable threshold appears to be to adults living and working at the site boundary. The risk is based on the assumption that contaminated dust will be generated during the on-site operation of all terrain vehicles (ATVs). This assumption is unrealistic, as the operation of ATVs on the site will be precluded by the institutional controls and fencing included in the selected remedy.

In addition, the only contaminant theoretically posing a risk above the $1 \times 10^{-4}$ threshold is chromium. For chromium, the conservative assumption is made that all of the chromium present is the toxic species, hexavalent chromium. The statement is made elsewhere in the report that hexavalent chromium realistically probably constitutes less than one percent of the total. Experience at other sites has shown that chromium in the environment is virtually never of the hexavalent species as reduction through time converts the hexavalent fraction to trivalent chrome. Even if the actual percentage of hexavalent chromium approached thirty, the resulting estimated risk would fall below the $1 \times 10^{-4}$ threshold.

In light of the critical significance of this highly questionable assumption, a limited program of sampling and laboratory analysis was undertaken to assess the validity of the assumption. Samples of shallow fill (foundry sand) were taken at or near four locations indicated by the RI data to contain detectable levels of chromium. At each location, samples were taken at the surface and at a depth of one or two feet below grade as permitted by site conditions. The results of these analyses demonstrate conclusively that the chrome in the shallow fill at the site is, in fact, the trivalent species, rendering the contrary assumption in the risk assessment excessively conservative and inaccurate. There are no toxicological data demonstrating that trivalent chrome is carcinogenic; in the absence of hexavalent chrome, the resulting theoretical risk falls well below the $1 \times 10^{-4}$ threshold. This finding indicates that the concerns about airborne dust from the site are unfounded.

RESPONSE: The components of remedial action cannot be considered when assessing the risks at a site. This would defeat the purpose of risk assessment, as well as be inconsistent with the NCP. The objective of risk assessment is to characterize current and potential threats to human health and the environment posed by contaminants at or released from a site, under baseline (e.g. no remedial action) conditions. The results of the baseline risk assessment are used to determine if an action is warranted, and then to develop the remedial alternatives. Consideration of remedial action in the baseline risk assessment would only mask the potential risks at a site. As such, fencing and institutional controls cannot be considered when determining exposure scenarios for the baseline risk assessment.

The assumption that all chromium present at the site is hexavalent chromium is conservative. EPA does not believe, however, that the results of eight samples from four locations are adequate to "demonstrate conclusively" that the chrome in the shallow fill at the site is entirely of the trivalent species. It is also debatable as to whether the eight samples were actually taken "at or near" the four locations indicated by the RI data to contain detectable levels of chromium: two of the samples are shown as being approximately fifteen feet from the corresponding RI sampling locations; the other two are shown as being between forty-five and fifty feet from the corresponding RI sampling locations. In addition, chromium (total) is a contaminant regulated under the Safe Drinking Water Act. Even if the inhalation risks are overestimated, the Agency would still be concerned about the potential impacts of chromium on groundwater.

As such, EPA believes that the data and assumptions used in the risk assessment are valid, and thereby believes that exposure to airborne dust presents a potentially unacceptable risk. Even if the risk for exposure to airborne dust is overestimated, there are still potentially unacceptable risks for exposure to the landfilled materials through direct contact and ingestion.

COMMENT: Other factors contributing to the overly conservative nature of the risk assessment are apparent discrepancies in values used to calculate the exposure frequency and those used to calculate particulate air emissions from the Folkertsma Refuse site, and the use of concentration values from samples collected from one to eight feet below land surface in the inhalation exposure endangerment assessment for all indicator parameters with the exception of PAHs. The RI appropriately uses adjustment factors for windless days and precipitation when calculating particulate emissions from the site, however, these corrections are ignored when estimating both probable and worst case exposure scenarios for windborne material. When calculating the inhalation exposure for the endangerment assessment for PAHs, the RI used concentration values from that fraction of surface soil samples that would pass a 200 mesh sieve (diameter < 75 uM). This fraction represents the portion likely to become airborne. For all other including chrome, concentration values for samples collected at depth were used.

These practices introduce unrealistic components to the airborne risk assessment through several avenues, 1) chemical concentrations from samples collected at depth may not be representative of levels likely to become airborne, 2) PRC's data indicate, as might be expected, that the proportion of sample that passes the 200 mesh sieve - and correspondingly the respirable portion - increases with depth.

RESPONSE: At the Folkertsma Refuse site, factors for windless days and precipitation were taken into consideration when determining the amount of particulate emissions from the site. As these factors (i.e., windless days and precipitation) were used in the calculation for particulate emission intake, it would have been inappropriate to adjust for these factors again when determining the exposure frequency. This would have resulted in misrepresenting the exposure dose.

As the airborne concentrations of inorganic compounds are based on unsieved soil samples collected from 1 to 8 feet below the land surface, EPA cannot definitively assert that these concentrations are representative of levels likely to become airborne. Sieved surface soil data for inorganic compounds is not available. Considering these factors, EPA does believe that there may be some uncertainty in the risks calculated for the inhalation exposure pathway. EPA does not believe, however, that the analytical results of the four surface soil samples collected by the commentator adequately defines the chromium concentrations likely to become airborne from the site.

In addition, there is no basis for the statement that PRC's data indicate that the proportion of sample that passes the 200 mesh sieve - and correspondingly the respirable portion - increases with depth. As indicated in the RI Report, the only soil samples sieved were those collected at the surface. None of the soil samples collected at depth were sieved. In the absence of data, it is inappropriate to conclude that the respirable portion of the sample increases with depth.

Although EPA believes that there may be some uncertainty in the risks calculated for the inhalation pathway, unacceptable risks have been calculated for exposure to the landfilled materials through direct contact and ingestion. Even if the risks posed through inhalation were disregarded, the risks posed through direct contact and ingestion still support the need for remedial action at the Folkertsma Refuse site.

COMMENT: The risks associated with the Folkertsma Refuse site are only marginally above the envelope of risks identified as acceptable by EPA. Considering the conservative approach that was taken in assessing the risks at the site, this finding appears reflective of the reality that the site poses a truly minimal threat to human health and the environment.

RESPONSE: Although the Risk Assessment for the Folkertsma Refuse site may have taken a conservative approach, it was conducted in accordance with guidance (SPHEM, and RAGS where appropriate) and the NCP. At the site, risks to human health have been identified for exposure to landfilled materials and groundwater. The risk calculated for direct contact with landfilled materials is $2 \times 10^{-3}$

(two additional cases of cancer for every 1,000 people exposed). Risks associated with the ingestion of landfilled materials and inhalation of fugitive dust range from 2 x $10^{-4}$ to 3 x $10^{-4}$ (two to three additional cases of cancer for every 10,000 people exposed). The risk calculated for the ingestion of shallow groundwater is 3 x $10^{-2}$ (three additional cases of cancer for every 100 people exposed); and the risk associated with the ingestion of deep groundwater is 6 x $10^{-4}$ (six additional cases of cancer for every 10,000 people exposed).

The NCP defines unacceptable risks as those exceeding 1 x $10^{-4}$ (one additional case of cancer for every 10,000 people exposed). As the risks calculated for the Folkertsma Refuse site exceed the acceptable level of 1 x $10^{-4}$, they are, by definition of the NCP, unacceptable and warrant an action.

COMMENT: The RI data indicate clearly that contaminants contained in the unsaturated fill materials are essentially immobile, presenting a negligible potential for migration to underlying groundwater. The refinement of the understanding of the presence of hexavalent chrome in the shallow fill should largely resolve concerns about airborne transport of dust from the site. This leaves direct contact with and ingestion of fill or ditch sediments as the only exposure routes by which risk might be incurred. A low-permeability clay cap clearly is not required to address these potential exposure routes. Virtually any type of cover material would serve the purpose. Sand would actually meet the objective but may present an excessive erosion potential if a vegetative cover cannot be maintained. A sand cover with a veneer of topsoil to support vegetation, however, might be entirely suitable.

The issue of meeting ARARs would also appear arguable in this case. Many foundry sand disposal sites in Michigan are regulated as containing "inert, site-specific wastes" and are closed with minimal engineered safeguards. Many other historic foundry sand disposal sites in Michigan were never regulated much less "closed" with engineered features and now have residential neighborhoods built over them.

In light of these realities, it is recommended that a cover of one foot of native soil overlain by six inches of topsoil be considered for installation at the site.

RESPONSE: The risks identified for the Folkertsma Refuse site are, by definition of the NCP, unacceptable and warrant an action. Under CERCLA, remedial actions at Superfund sites must comply with chemical-specific, action-specific, or location-specific applicable or relevant and appropriate requirements (ARARs), or a waiver must be invoked.

The waste in the landfill at the Folkertsma Refuse Superfund site is, by definition of the Resource Conservation and Recovery Act (RCRA), a solid waste. Capping and closure of solid waste landfills are actions which are regulated under RCRA Subtitle D and the Michigan Solid Waste Management Act 641 (MSWMA 641). Any cover installed over solid waste landfills must meet the minimum requirements of these acts. Specifically, these include a minimum of two feet of compacted clay cover and a slope not to exceed 1 vertical to 4 horizontal nor less than 2%. The recommendation of a cover of one foot of native soil overlain by six inches of topsoil would not meet the requirements of RCRA Subtitle D and MSWMA 641, and therefore, cannot be considered further.

COMMENT: The configuration for the cap presented in the Proposed Plan includes covering the ditches. Excavating the sediments beforehand to prevent contact is clearly redundant in this scenario.

RESPONSE: The Proposed Plan does not include covering the ditches; although they will be modified, their functions will remain the same. In addition to lowering the local water table level, the ditches will continue to capture surface water runoff from the cap for site drainage. After sediment excavation, the ditches will be lined with drainage tile and then filled to the surface grade level with coarse aggregate. The tile and coarse aggregate will protect the cap from erosion, as well as prevent contaminated landfilled materials from eroding from the sides of the ditches and migrating downstream.

COMMENT: The estimated costs presented in the Feasibility Study (FS) for sediment excavation in the ditches include significant expenditures for dewatering, presumably after excavation and before they are placed on the fill. While dewatering might be required for off-site transport and disposal, the rationale for dewatering these sediments is unclear. It should be noted that the surface water quality data indicate that these sediments do not contain leachable contaminants.

RESPONSE: EPA believes that dewatering the sediments from the ditches is a sound engineering practice which will technically enhance implementation of the selected remedy. It is impractical to spread water-logged sediments over the landfilled materials (or portions thereof), transforming the currently compacted surface of the landfill into a slurry. Delays would be encountered in allotting time for the sediments to dry out, otherwise grading would be difficult, if not impossible. In addition, the sediments would detract from the strength of the foundation provided by the foundry sand, and the cap could be prone to excess settling in various locations.

The costs associated with dewatering the sediments constitute 2% of the capital costs estimated for the selected remedy. Given the engineering and technical benefits of this practice, EPA does not consider these costs to present a significant expense.

COMMENT: The recommended alternative includes converting the ditches into underground drains. The reasoning behind this is not presented in the documentation and cannot be reasonably inferred. The excavated ditch, explicitly, and the unnamed creek, probably, were originally installed to dewater the site slightly to facilitate removal of the peat and muck originally present. In light of the highly permeable nature of the fill materials at the site (as reflected by the gently horizontal hydraulic gradients in the fill revealed by the RI) and the reduction of infiltration which will result from virtually any type of cap installed, the continued need for these drainage features is non existent. The potential direct contact and sediment transports will be resolved by removal of the sediments. The $164,000 estimated for the design and construction of these features (tiled and covered drains), therefore, is unjustified.

RESPONSE: As discussed in a previous response, the ditches perform two functions at the site: they lower the local water table level and promote surface drainage by capturing runoff. These functions are significant. A lower water table indicates a reduced potential for saturation of the fill material, and hence leachate formation and groundwater contamination. In addition, the ditches capture surface water that would otherwise infiltrate into the landfill. This also reduces the potential for leachate formation and groundwater contamination. As such, it is not the intent of the proposed alternative to alter the functions of the ditches. The ditches, however, must be modified with drainage tile and gravel to protect the cap from erosion and prevent contaminated materials from eroding from the sides of the ditches and migrating downstream.

COMMENT: The preferred alternative includes the installation of venting structures through the cap to prevent the buildup of methane gas or volatile organic compound (VOC) vapors under the cap. This is a standard feature of caps placed over municipal refuse landfills in which methane is generated as the refuse decomposes. This element of the alternative, however, would appear to be completely unnecessary at this site. The RI detected no confirmed VOCs in any media at the site, much less at concentrations which would cause concern about vapor buildup. Foundry sand does not yield methane gas as it ages. Even if it did, the fill has been in place for twenty years or more and almost certainly has come essentially to equilibrium with its environment. Finally, the proposed vents present several negative features such as jeopardizing the integrity of the cover, unnecessarily restricting future site use and increased overhead and maintenance costs.

RESPONSE: Although foundry sand may not yield methane gas as it ages, portions of the Folkertsma Refuse site are underlain by deposits of muck and peat. In addition, VOCs were detected at low concentrations at several locations within the landfilled material. The VOCs detected in the landfilled material include 2-butanone, xylene, tetrachloroethane, trichloroethene, benzene, carbon disulfide, acetone, methylene chloride, and toluene. Whenever a low-permeability cap is placed over material of greater permeability, there is a potential for methane gas and VOCs (if present) to buildup and migrate to other areas (such as basements).

At the Folkertsma Refuse site, however, the potential for the buildup of methane and VOCs is low. This has been recognized by the Agency and reflected in the selection of a final remedy. The description of the selected remedy in the Record of Decision (ROD) reads "a passive gas control system would be installed if necessary."

COMMENT: The data on existing groundwater quality at the site indicate the absence of significant impacts upon usable groundwater some two decades after disposal at the site was discontinued. This data should therefore reflect equilibrium conditions for the unremediated site. Furthermore, the scope of the monitoring program outlined in the FS looks like it is designed more for an uncontrolled site in which chlorinated solvents had been placed. It includes sampling ten wells four times a year and analyzing each sample for complete scans of organic and inorganic parameters.

It seems much more reasonable to design a monitoring program tailored to known and reasonable expectable conditions associated with the site and reflecting the essentially static nature of site processes. In such an approach, the analytical parameter list would be pared to one reflective of present knowledge and monitoring frequency might decline through time if no unexpected findings appear.

RESPONSE: The ten existing wells to be sampled in the FS included three shallow and three deep wells downgradient of the landfilled area, three shallow wells screened beneath the fill materials, and one upgradient shallow well. These wells, the parameters to be analyzed, and the sampling frequency outlined in the FS were utilized primarily for costing purposes. The ROD states that the specific details of the groundwater monitoring program will be developed in the Remedial Design.

COMMENT: Given that concerns about direct contact with or airborne migration of contaminants will be resolved by the proposed cap, it appears that the primary purpose of the proposed fence is to protect the cap. The primary threat to the cap is inappropriate vehicular traffic and the fencing program proposed should reflect a level of protection appropriate to this threat. A six-foot high, chain-link fence with three strands of barbed wire would be excessive in the prevention of entry by all-terrain vehicles.

RESPONSE: Although EPA is concerned about protecting the integrity of the clay cap, the main objective of the fence is to restrict unauthorized access during construction of the remedy. Many activities will be going on during this time: on-site mobilization, clearing and grubbing, construction of the additional access road, decontamination, sediment excavation and conversion to underground drains, consolidation of contaminated materials, grading, and installation of the cap. Trespassers may be exposed to site contaminants, or hurt themselves by falling over construction debris and other equipment. In addition, some trespassers may be inclined to vandalize the trailers or other property. It has been the experience of EPA that measures such as barbed wire are necessary to deter unauthorized access to site premises during construction. In addition, the site currently has an operating pallet company on the property. A permanent fence will not only preclude unauthorized access to the site during construction, but will also prevent access to the cap over the long-term.