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Superfund Record of Decision:

Woodlawn County Landfill, MD

50272-101

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Woodlawn County Landfill, MD
First Remedial Action - Final

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16. Abstract (Limit: 200 words)

The 37-acre Woodlawn County Landfill is a former municipal landfill located in Colora, Cecil County, Maryland. Land use in the area is predominantly residential. The estimated 3,215 people who reside in the area use the ground water as their sole source of drinking water. An unnamed creek crosses the southern end of the site, and in the south-central area of the site, there is a retention basin to collect precipitation runoff from the landfill, of which a portion contains a wetland area. Prior to 1960, the site was a privately-owned sand and gravel quarry. From 1960 to 1978, Cecil County operated a municipal landfill for the disposal and sometimes burning of municipal, industrial, and agricultural waste. The Firestone Tire and Rubber Company initially disposed of PVC sludge, containing residual vinyl chloride, throughout the landfill. From 1978 to 1981 disposal was limited to two disposal cells, known as Cell A and Cell B/C under a State industrial waste disposal permit. In 1981, Firestone covered Cell B/C with eight inches of clay and soil in response to an agreement with the State. In 1978, the landfill was closed for the disposal of municipal waste and the Woodlawn Transfer Station began operations in the northeast corner of the site. The Transfer Station, which is still operating, accepts and compacts municipal and commercial waste

(See Attached Page)

17. Document Analysis a. Descriptors
Record of Decision - Woodlawn County Landfill, MD
First Remedial Action - Final
Contaminated Media: soil, debris, gw
Key Contaminants: VOCs (PCE, TCE, vinyl chloride), other organics (PAHs, pesticides, phthalates), metals (cadium, manganese and mercury)

b. Identifiers/Open-Ended Terms

c. COSATI Field/Group

18. Availability Statement	19. Security Class (This Report) None	21. No. of Pages 106
	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)

for disposal in another County landfill. From 1978 to 1990, liquid waste from the compacting process was discharged to the Transfer Station septic system located west of the Transfer Station. Following an overflow of effluent from the septic system to the ground surface in 1990, liquids from the trash compactors were re-routed to an onsite holding tank and periodically taken offsite to a nearby wastewater treatment plant. In 1981 and 1982, site investigations revealed acetone, methylene chloride, methanol, vinyl chloride, benzene, and toluene contaminants in ground water samples taken from various monitoring wells. This ROD addresses a final remedy for the contaminated soil and ground water at the site. The primary contaminants of concern affecting the soil, debris, and ground water are VOCs, including benzene, PCE, TCE, and vinyl chloride; other organics, including PAHs, pesticides, and phthalates; and metals, including arsenic, cadium, manganese, and mercury.

The selected remedial action for this site includes testing and excavating an estimated 400 yd^3 of mercury-contaminated soil (>1 mg/kg mercury) from the former drain field of the Transfer Station septic system; disposing of soil found not to exhibit the RCRA toxicity characteristic for mercury at the center of the landfill and/or disposing of soil found to be hazardous at an offsite RCRA-permitted disposal facility; relocating the currently operating septic system drain field; capping a 31-acre portion of the landfill and identifiable cells of PVC sludge with a clay cap, with a gas collection system; installing an estimated 40 recovery wells; extracting contaminated ground water from the aquifer using multiple recovery wells; using a three-step treatment process onsite consisting of precipitation and flocculation/coagulation to remove manganese and other inorganics, followed by air stripping to remove VOCs, and granular activated carbon to remove SVOCs; discharging the treated water to the onsite stream; characterizing and disposing of any treatment residuals offsite; implementing ground water, surface water, and air/landfill gas monitoring programs; providing an alternate water supply or wellhead treatment to any residents with wells that are contaminated with site-related contaminants at concentrations that exceed the cleanup levels; characterizing and disposing of any residual wastes that are generated from the wellhead treatment offsite; and implementing institutional controls, including deed and ground water use restrictions. The estimated present worth cost for this remedial action is $23,826,000, which includes an estimated annual O&M cost of $1,609,000 for 30 years.

PERFORMANCE STANDARDS OR GOALS:

Chemical-specific soil excavation goals were based on the Summers Model and EPA guidance, and include mercury 1 m/kg and vinyl chloride 7.7 ug/kg. Chemical-specific ground water cleanup goals are based on risk- or health-based levels, and include arsenic 1 ug/l; manganese 160 ug/l; PCE 1.5 ug/l; TCE 5 ug/l; and vinyl chloride 1 ug/l. If the risk- or health-based levels are found to be lower than background, or below the levels that can be detected, background levels or practical quantitation limits may be taken into account.

RECORD OF DECISION
WOODLAWN LANDFILL SITE

DECLARATION

SITE NAME AND LOCATION

Woodlawn Landfill Site
Colora, Cecil County, Maryland

STATEMENT OF BASIS AND PURPOSE

This decision document presents the selected remedial action for the Woodlawn Landfill site (the Site) located in Colora, Cecil County, Maryland, which was chosen in accordance with the requirements of the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA), as amended, and, to the extent practicable, the National Oil and Hazardous Substances Pollution Contingency Plan (NCP), 40 C.F.R. Part 300. This decision document explains the factual and legal basis for selecting the remedial action for this Site. The information supporting this decision is contained in the Administrative Record for this Site.

The Maryland Department of the Environment (MDE) has not provided a letter to EPA that indicates whether or not the State concurs with the selected remedy. However, MDE has expressed concern that: (1) several of the ground water cleanup levels set forth in the Proposed Plan for the Site are more stringent than the Maximum Contaminant Levels established under the Safe Drinking Water Act, 42 U.S.C. §§ 300f et seq.; and (2) the costs for implementation of the selected remedy may exceed the cost estimate presented in the Proposed Plan.

ASSESSMENT OF THE SITE

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

DESCRIPTION OF THE REMEDY

The Woodlawn Landfill Site is a former municipal landfill comprising approximately 37 acres. The remedial action selected for the Site is a final remedy which will address contaminated ground water, contaminated soils, and wastes buried at the Site. The ground water contamination represents a significant threat. Therefore, remediation of contaminated ground water will be required. The wastes and contaminated soils at the Site pose a relatively low long-term threat. Therefore, the wastes and contaminated soils will be addressed through a combination of engineering and institutional controls.

The selected remedial action includes the following components:

- Excavation and disposal of the soils from the former drain field of the Transfer Station septic system
- Relocation of the current drain field of the Transfer Station septic system
- Capping of the landfill and identifiable cells of PVC sludge
- Extraction of ground water
- Treatment of extracted ground water onsite and discharge to the onsite stream
- Monitoring of ground water, the stream, and landfill gas
- Provision for an alternate water supply, if necessary
- Restrictions on the deed and ground water use
- Perimeter fencing

STATUTORY DETERMINATIONS

The selected remedial action 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 remedial action utilizes permanent solutions and alternative treatment (or resource recovery) technologies to the maximum extent practicable, and satisfies the statutory preference for remedies that employ treatment that reduces toxicity, mobility, or volume as a principal element.

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

for Stanley L. Laskowski
Acting Regional Administrator
Region III

9-28-93
Date

RECORD OF DECISION
WOODLAWN LANDFILL SITE

DECISION SUMMARY

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DECISION SUMMARY

1.0 SITE NAME, LOCATION AND DESCRIPTION

The Woodlawn Landfill site (the Site) is a former municipal landfill located approximately one-half mile north of the Town of Woodlawn and one mile north of the intersection of Routes 275 and 276 in Colora, Cecil County, Maryland. It consists of approximately 37 acres and is owned by the Board of Commissioners of Cecil County (the County).

The Site is situated in an area of gently sloping fields and meadows and gently to steeply sloping creek valleys. Rural residences and properties surround it in all directions. (See Figure 1. The Site occupies parcel 267 on Figure 1). The Site is bounded on the east and south by Waibel Road. The northern boundary of the Site is marked by a jeep trail that formerly served as access to the property. The main access is now located on the northeast corner of the Site, at the intersection of Firetower and Waibel Roads.

Ground water is the sole source of drinking water for the 40 to 50 private residences immediately surrounding the Site. (The closest residence is located approximately 100 feet from the southeast boundary of the Site). It is estimated that 3,215 people utilize ground water drawn from the aquifer which flows beneath the Site.

From 1960 until June of 1978, Cecil County operated a landfill at the Site for the disposal of municipal, industrial and agricultural wastes. In June of 1978, the landfill was closed to municipal waste and the Woodlawn Transfer Station began operating in the northeast corner of the Site. The Transfer Station, which is still operating, accepts and compacts municipal and commercial wastes for disposal in another County landfill. Until May of 1990, liquid wastes from the compacting process were discharged to the Transfer Station septic system.

The primary medium of concern at the Site is contaminated ground water, which presents both a carcinogenic and noncarcinogenic risk to human health. Arsenic, vinyl chloride and beryllium are the chemicals which contribute most to the current carcinogenic risk. Vinyl chloride, benzo(a)pyrene, benzo(b)fluoranthene, arsenic and 1,2-dichloroethane contribute most to potential future carcinogenic risk. Manganese is the contaminant which presents the highest current and potential future noncarcinogenic risk.

There are also potential risks to ecological receptors at the Site. Levels of cadmium and zinc in on-site seep sediments and levels of mercury in the soils above the former drain field of the Transfer Station septic system exceed the criteria that EPA has determined are protective of ecological receptors. Levels of aluminum, copper, lead and silver in a stream that crosses the southern tip of the Site exceed federal ambient water quality criteria for the protection of aquatic life.

2.0 SITE HISTORY AND ENFORCEMENT ACTIVITIES

The 37-acre Site property was a privately-owned sand and gravel quarry before 1960, when it was purchased by the County. The County operated a municipal landfill at the Site from 1960 until June 1978, when the landfill was closed to municipal waste under order from the State of Maryland Department of Health and Mental Hygiene (MDHMH), the predecessor agency to the Maryland Department of the Environment (MDE). The landfill was open 24 hours a day without supervision until 1971, when the County hired contractors to operate the facility.

In June of 1978, the Woodlawn Transfer Station began operations in the northeast corner of the Site. The Transfer Station, which is still operating, accepts and compacts municipal and commercial wastes which are later hauled to the County's Hog Hill Landfill for disposal. Liquid wastes derived from the compacted trash were originally discharged to the Transfer Station septic system. In May of 1990, following an overflow of effluent from the septic system cleanout manhole to the ground surface, liquids from the trash compactors were rerouted to an on-site holding tank. Liquids in the holding tank are periodically taken to the Northeast River Advanced Wastewater Treatment Plant in Charlestown, Maryland.

From 1960 to 1978, agricultural, municipal and industrial wastes were disposed of and sometimes burned at the Site. Some of the wastes contained hazardous constituents or may have released hazardous substances upon combustion.

State records pertaining to the Site document the disposal of polyvinyl chloride (PVC) sludge by the Firestone Tire & Rubber Company (Firestone). The PVC sludge, which contained residual vinyl chloride, was initially disposed of throughout the landfill. In March of 1978, Firestone began disposing of PVC sludge in a designated disposal area, Cell A. On October 17, 1978, MDHMH issued an Industrial Waste Disposal Permit to Firestone authorizing the disposal of PVC sludge in two additional areas on the landfill property, Cells B and C. Sludge disposal Cell C overlies Cell B. The two cells are referred to together as Cell B/C. The approximate locations of Cells A and B/C are shown in Figure 3.

On January 12, 1979, the State of Maryland Water Resources Administration issued a Complaint and Order to the Cecil County Commissioners, directing them to apply for a Maryland Water Resources Designated Hazardous Substance Disposal Permit for the landfill. By March 14, 1979, the County had complied. EPA subsequently determined that PVC sludge is not a hazardous waste and the permit was never issued.

On July 16, 1980, MDHMH renewed Firestone's Industrial Waste Disposal Permit. The State's renewal of the permit was conditioned upon Firestone's agreement to adhere to specific waste disposal practices, to document and report its waste disposal activities at the Site, to implement a ground water monitoring program at the Site, and to provide a final clay and soil cover over PVC sludge disposal Cell C. In September 1980, Firestone installed three ground water monitoring wells to monitor releases from the PVC sludge disposal Cell B/C. Early in 1981 Cell C was covered with eight inches of clay and two and a half feet of soil.

In the summer of 1981, the State found contaminants including vinyl chloride, benzene and toluene in ground water samples collected from the monitoring wells located downgradient of Cell B/C. On December 10, 1981, MDHMH issued a Complaint and Order requiring Firestone to assess the nature and extent of ground water contamination beneath the Site. On the same date, MDHMH issued an identical Complaint and Order to the County.

In January of 1982, Firestone installed seven additional monitoring wells in the vicinity of Cells A and B/C. The County installed five monitoring wells on the landfill property in March of 1982. The State installed an additional six wells in June of 1982. Analyses of monitoring well water samples revealed the presence of acetone, benzene, methanol, methylene chloride, toluene, vinyl chloride and other organic compounds in ground water beneath the landfill property.

EPA proposed the Site for inclusion on the National Priorities List (NPL) on January 22, 1987 and placed it the NPL on July 22, 1987. On June 13, 1988, EPA issued Special Notice Letters to four potentially responsible parties (PRPs), giving them an opportunity to perform a Remedial Investigation/Feasibility Study (RI/FS) for the Woodlawn Landfill Site. On December 28, 1988, two of the PRPs, the Firestone Tire & Rubber Company (now Bridgestone/Firestone, Inc.) and Cecil County, entered into an Administrative Order on Consent (AOC) with EPA whereby Firestone and the County agreed to perform an RI/FS with EPA oversight, in accordance with the Comprehensive Environmental Response, Compensation, and Liability Act of 1980, as amended (CERCLA).

The RI and FS Reports were completed on October 26, 1992 and April 15, 1993, respectively. EPA developed a Proposed Remedial Action Plan (Proposed Plan) for the Site based on the findings in the RI/FS Reports.

3.0 HIGHLIGHTS OF COMMUNITY PARTICIPATION

Pursuant to CERCLA § 113(k)(2)(B)(i)-(v), the RI/FS reports and the Proposed Plan for the Woodlawn Landfill Site were released to the public for comment on May 26, 1993. These documents were made available to the public in the Administrative Record located at the EPA Docket Room in Region III's Philadelphia office, the Elkton Public Library in Elkton, Maryland, and the Perryville Public Library in Perryville, Maryland. The notice of availability of these documents was published in the *Cecil Whig* newspaper on May 26, 1993.

A public comment period on the documents was held from May 26, 1993 to July 26, 1993. In addition, a public meeting was held on June 8, 1993. At this meeting, representatives from EPA and MDE answered questions about conditions at the Site and the remedial alternatives under consideration. A response to the comments received during the public comment period is included in the Responsiveness Summary, which is a part of this Record of Decision (ROD).

This decision document presents the selected remedial action for the Woodlawn Landfill Site in Colora, Maryland, chosen in accordance with CERCLA, SARA, and, to the extent practicable, the National Oil and Hazardous Substances Pollution Contingency Plan (NCP), 40 C.F.R. Part 300. The selection of the remedial action for this Site is based on the Administrative Record.

4.0 SCOPE AND ROLE OF RESPONSE ACTION

The remedy identified in this ROD is the sole response action planned for the Woodlawn Landfill Site.

Contaminated ground water presents the principal risk to human health at this Site due to current and potential future human exposure via ingestion of drinking water. The selected alternative will utilize treatment of ground water to: (1) prevent exposure to contaminated ground water; and (2) restore the affected aquifer.

Wastes buried at the Site are of concern to the extent that they have the potential to act as a continuing source of ground water contamination. In addition, it has been determined that contaminant levels in several media at the Site may produce adverse effects in exposed ecological receptors. These media include soils above the former drain field of the Transfer Station septic system, on-site leachate seep sediments, and surface water of an unnamed creek that crosses the southern end of the Site.

The wastes and contaminated soils at the Site pose a relatively low long-term threat and will be addressed with a combination of engineering and institutional controls. These controls will: (1) prevent migration of contaminants from the landfill and the PVC sludge disposal cells to ground water and surface water; (2) prevent exposure to the landfill contents, the contents of the PVC sludge disposal cells, and contaminated soils and sediments; and (3) control landfill gas to ensure protection of human health and the environment. The surface water and sediments of the unnamed creek will be monitored in order to provide a means for detecting potential future adverse Site-related stream impacts.

5.0 SUMMARY OF SITE CHARACTERISTICS

5.1 Surface Features, Geology, Soils, Hydrogeology, Hydrology

Surface Features and Resources. A portion of the Site is covered by dense trees. Tree cover is densest in the southern and eastern portions of the landfill property. Grasses and shrubs cover the north-central portion of the Site where landfill operations took place.

The land surface in the north-central area of the Site slopes gently to the southwest from the topographic high point near the northeast corner of the Site. The southwestern portion of the Site slopes steeply down to the unnamed creek.

In the south-central area of the Site, there is a retention basin that was designed to collect precipitation runoff from the landfill. A portion of the retention basin contains a palustrine emergent scrub/shrub wetland. The floodplain of the unnamed creek is occupied by a palustrine broad-leaved deciduous forested wetland.

An extensive palustrine forested wetland is located along the unnamed creek, approximately one mile downstream of Waibel Road. This wetland, which occupies an area of about 2000 feet by 500 feet, was not tested for Site contaminants during the RI. However, it is an area where sediment deposition is expected to occur and metals may accumulate.

There are no federally-listed or proposed endangered or threatened species known to exist within a one-mile radius of the Site. Although a bald eagle has been recorded approximately two miles from the Site (in the southeast block of the Conowingo Dam U.S. Geological Survey quadrangle), this federally-listed endangered species is not expected at the Site due to the limited availability of its preferred habitat of lakes, marshes, and rivers. The Site does fall within the known range of the bog turtle (Clemmys muhlenbergi), a U.S. Department of the Interior trust resource currently under consideration for federal listing as a threatened species.

The Maryland Historic Trust (the Trust) conducted a Stage 1A cultural resource survey for the Site. The Trust identified one historic standing structure (McMaster's Delight) southeast of the landfill property on the east side of Waibel Road (parcel 506 in Figure 1). It concluded that activities at the Site would have no effect on National Register-eligible archaeological resources or historic standing structures.

Geology. The Site lies in the Piedmont Plateau region. The rocks of the Piedmont Plateau are metamorphic and igneous. The geology of the Site area has been described as sand and gravel deposits overlying saprolite and the parent metamorphic bedrock. The sand and gravel deposits are of the Upland Gravel unit and are probably fluvial deposits of the ancestral Susquehanna River system.

Two bedrock formations underlie the Site: a gneissic granite and a metadiorite. The gneissic granite underlies the saprolite at the soil/rock interface in all areas of the Site except the northwestern section. The uppermost rock unit in this section is metadiorite. The metadiorite dips beneath the gneissic granite in a zone that appears to coincide with a lineament in the northwestern portion of the Site that was identified on an aerial photograph. The gneissic granite is a pink, coarsely crystalline rock with weak foliation. The metadiorite is a black and white, finely crystalline rock with pronounced schistosity. Both the gneissic granite and the metadiorite contain interlocking crystals of feldspar, quartz, hornblende, mica and other minerals. These minerals contain silica, iron, aluminum, manganese, calcium, sodium, potassium and trace elements. Upon weathering, the gneissic granite and the metadiorite break down into clay minerals, silica and oxides of iron and manganese. The iron and manganese oxides become more soluble in oxygen-poor or reducing environments, and can be transported by the ground water. This natural source may account for some of the iron and manganese in the ground water at the Site.

A thick layer of residual soil (saprolite) overlies the bedrock. The residual soil is very granular. There is no evidence of a layer that might restrict ground water flow between the soil and bedrock. Fractures in the bedrock that intersect the surface provide conduits for ground water flow across the contact between the soil and the bedrock.

Soils. All unconsolidated materials lying above the bedrock are classified here as soils. The stratigraphy of the soils from bottom to top can be generalized as follows: residual soils derived from weathering of the bedrock (saprolite); transported soils including stream-derived sands and gravels (alluvium) and soils washed from hills (colluvium); material such as waste and reworked natural soils (fill).

Saprolite overlies the bedrock throughout the Site. The thickness of the saprolite varies from 90 feet in the northern part of the Site to 15 feet in the southwestern part of the Site. Deposits of alluvium and colluvium lie above the saprolite in many areas of the Site. These deposits were the source materials for a sand and gravel operation at the Site that predated the landfill. The alluvium and colluvium contain layers of silty clay and clay in some areas of the Site. The thickness of the alluvium and colluvium varies from 10 feet in the northern part of the Site to 50 feet in the western part of the Site.

The fill material at the Site consists of waste materials that were deposited into excavations that were created during the time when the sand and gravel operation was in existence, rearranged alluvium and colluvium, and mounds of reworked sand and gravel.

Hydrogeology. The hydraulically-connected saprolite and bedrock comprise a single aquifer in the area of the Site. In the center of the western boundary of the landfill property, there is an irregular bedrock surface as interpreted from differences in depths to bedrock from nearby borings. This irregularity appears to be in or near the area of the contact between the gneissic granite and the metadiorite. South of this area, the soil is unsaturated, except for perched water zones. These factors suggest that this contact zone may be a pathway for ground water flow beneath the bedrock surface.

The ground water potentiometric surface for most of the Site is in the saprolite. Near the southwestern corner of the Site (near monitoring well ITB-4), the soil is unsaturated and the potentiometric surface drops below the bedrock/soil interface.

The local ground water flow directions are shown in Figure 2. There is a ground water divide, or high point in the northeast area of the Site. Ground water from this divide flows downgradient to either the south-southwest, west, or north-northeast. The regional ground water flow is toward the Susquehanna River and Chesapeake Bay (west-southwest). Local ground water flow directions are in part influenced by local topography (land surface and the buried bedrock surface), i.e., the flow directions are usually down slope. Local flow directions are also influenced in the bedrock by fracture orientations.

There is a discontinuous aquitard above the unconfined aquifer. Clay lenses within the alluvium/colluvium in the unsaturated zone intercept infiltration water and create perched water zones in isolated areas of the alluvium/colluvium and fill material. The clay lenses inhibit vertical water flow through the soil and fill and redirect the water laterally to seeps south of Cell B/C and in the western-central portion of the Site.

Site Drainage. Site surface drainage via overland flow is primarily southwestward toward the unnamed creek. Some of the surface flow on the eastern side of the landfill property (near Cell B/C) is channeled south, then west, into the retention basin. When precipitation is heavy or of long duration, accumulated runoff in the retention basin spills over into a man-made swale that extends southwestward into the unnamed creek.

The unnamed creek, which flows to the west-northwest, enters Basin Run Creek, a State-designated trout stream, approximately one-and-a-half miles downstream from the Site. Basin Run discharges into Octoraro Creek approximately three-and-a-half miles northwest of the Site. Octoraro Creek flows westward until it joins the Susquehanna River, which is the major source of fresh water for the Chesapeake Bay.

Surface Water - Ground Water Interactions. The relationship between surface water and ground water is characterized by the following types of recharge: (1) recharge to ground water from the surface of the Site; (2) recharge by precipitation to perched water zones that supply seeps; and (3) recharge to surface water streams by ground water.

The first type of recharge involves the flow of water from the surface of the Site to the ground water. The topographic high area that extends along the northern boundary of the landfill property serves as a major recharge area. This recharge area is the primary area in the vicinity of the Site which allows precipitation falling on the ground to percolate through the soil and into the regional aquifer.

The second type of recharge involves seeps which are fed by ground water in the perched water zone located in the Cell B/C area. Seeps were identified along a bank in the area of monitoring well ITB-5. The seeps occur where a confining clay layer intersects the ground surface, causing water flowing downslope in the perched zone to surface. The perched water zone is recharged directly by precipitation which percolates through the surface soils and buried wastes. An additional seep was identified in the northwest portion of the landfill. This seep coincides with a subsurface lineament and flows from the landfill to the west.

The third type of recharge involves ground water recharge to surface water. Ground water flows to the southwest and to the north away from the ground water divide located in the northeast area of the Site. Ground water flowing to the southwest from the divide eventually reaches and provides some recharge to the unnamed creek. Ground water flowing north from the divide eventually reaches and provides some recharge to Basin Run Creek.

5.2 Nature and Extent of Contamination

In accordance with the Consent Order signed in 1988, Firestone and the County performed a RI/FS to assess the nature and extent of contamination at the Site. They also performed a Risk Assessment in order to evaluate the human health risks and the environmental impacts associated with exposure to Site contaminants.

Three sources of contamination were identified at the Site: PVC sludge disposal Cell B/C, wastes disposed of in the general landfill, and effluent from the Transfer Station septic system. PVC sludge was not encountered in the area thought to be occupied by disposal Cell A. Therefore, it was not possible to verify the location of Cell A or to collect samples of the Cell A sludge for analysis.

During the RI, ground water underneath the landfill property and adjoining properties was sampled and analyzed in order to determine the horizontal and vertical extent of ground water contamination in the aquifer underlying the Site. Ground water samples were also collected from residential wells surrounding the Site. PVC sludge in Cell B/C, soils, leachate seeps and seep sediments, surface water and stream sediments were also sampled and evaluated. The sample results are summarized below.

5.2.1 Ground Water and Perched Water

Thirteen additional monitoring wells were installed at the Site during the RI. Figure 3 identifies the ground water monitoring points. Transfer Station water supply well TSTA-1 and monitoring wells ITB-1 through ITB-6 tap the bedrock portion of the aquifer. Well TSTA-1 was drilled to a depth of 228 feet. The bedrock monitoring wells range in depth from 45 to 163 feet. Wells ITP-1 through ITP-3 are perched water monitoring wells that range in depth from 11 to 20 feet. The remainder of the monitoring wells, i.e., the F-, B-, OW-, and SW-series wells, wells ITS-1 through ITS-3, and well TSW-1, are screened in the soil above the bedrock. The depths of the soil wells range from 13 to 92 feet.

Ground water samples were collected from 30 monitoring wells and the Transfer Station water supply well (TSTA-1). These samples were analyzed for all Target Compound List (TCL) parameters plus acrolein, acrylonitrile and 2-chloroethyl vinyl ether, and for all Target Analyte List (TAL) parameters, except selenium and antimony.

More than 40 different analytes were detected in ground water samples collected from the monitoring wells located on and adjacent to the landfill property, including several at concentrations that exceed Maximum Contaminant Levels (MCLs) for public drinking water supplies. The contaminants that are of greatest concern from a human health perspective are vinyl chloride, 1,2-dichloroethane and other volatile organic compounds (VOCs), polynuclear aromatic hydrocarbons (PAHs), bis(2-ethylhexyl)phthalate, pentachlorophenol, several pesticides, arsenic, cadmium and manganese.

The vinyl chloride contamination is primarily limited to the F-series wells that tap the soil aquifer in the area of PVC sludge disposal Cells A and B/C. The highest concentration of vinyl chloride detected in the ground water was 520 micrograms per liter (μg/L) in well F-6. Vinyl chloride was also detected in a perched water monitoring well downgradient of Cell B/C (7 μg/L in well ITP-2), a bedrock well along the northern border of the landfill (76 μg/L in well ITB-1), a bedrock well located approximately 700 feet beyond the northern boundary of the landfill property (0.71 μg/L in well ITB-6), bedrock wells along the western border of the landfill (up to 0.6 μg/L in well ITB-3), and bedrock wells in the south-central area of the landfill (up to 14 μg/L in well ITB-4). Elevated levels of 1,2-dichloroethane were detected in a soil monitoring well near the northeastern corner of the landfill property (410 μg/L in well TSW-1) and a perched water monitoring well (15 μg/L in ITP-2). Trichloroethene and tetrachloroethene were found in monitoring well TSW-1 at concentrations of 60 μg/L and 8 μg/L, respectively. Maximum total PAH concentrations ranged from 6 μg/L in perched water monitoring well ITP-3 to 44 μg/L in soil aquifer monitoring well TSW-1 and 13 μg/L in bedrock monitoring well ITB-2. Bis(2-ethylhexyl)phthalate was detected in ground water samples collected from bedrock and soil aquifer and perched water monitoring wells throughout the Site at concentrations up to 140 μg/L (well OW-2). Pentachlorophenol was detected in one soil well (7 μg/L in well B-4) and in one bedrock well (4 μg/L in well ITB-4). Various pesticides were found in samples collected from seven soil monitoring wells, a perched water monitoring well and a bedrock monitoring well. The highest pesticide concentration was 0.24 μg/L of Endosulfan I, which was found in well OW-1.

Arsenic and cadmium were detected in ground water and perched water samples at concentrations up to 8 μg/L (well SW-1) and 119 μg/L (well F-6), respectively. Elevated levels of iron and manganese were found in the aquifer underlying the Site and in the perched water zones on-site. Maximum manganese concentrations ranged from 12,600 μg/L in ground water extracted from the bedrock (well ITB-4) to 24,200 μg/L in ground water extracted from the soil (well F-7) to 1,940 μg/L in the perched water zones (well ITP-1). Maximum iron concentrations ranged from 10,200 μg/L (bedrock well ITB-4) to 43,500 μg/L (soil well F-7) to 59,500 μg/L (perched water monitoring well ITP-1).

5.2.2 Domestic Wells

Thirteen domestic wells were sampled by Firestone and the County in both March and November of 1990, and analyzed for the TCL parameters plus acrolein, acrylonitrile and 2-chloroethyl vinyl ether, and for the TAL parameters, except antimony and selenium. EPA analyzed VOCs in samples collected from seven additional domestic wells in August of 1991.

Most of the domestic wells in the area of the Site (Figure 1) are cased to a depth of five feet below the bedrock surface. Below this depth, the well bores are open to the bottom of the hole. Well completion reports indicate that two domestic wells may vary in design from the others near the Site. The well casing at parcel 309 may have been installed to a depth above the bedrock surface. The well at parcel 506 may not extend into the bedrock.

Site-related contaminants were found in two residential wells. The domestic well at parcel 309 is contaminated with detectable levels of vinyl chloride. The highest concentration of vinyl chloride detected in the well was 0.6 µg/L, which is below the MCL for that chemical. A carbon adsorption unit was installed at this residence in December of 1990 in order to remove vinyl chloride. No contamination has been detected in the treated well water. Water collected from the domestic well at parcel 506 was found to contain elevated levels of manganese. The highest concentration of manganese detected in this well was 3,060 µg/L. On September 9, 1993, EPA approved of a work plan submitted by Firestone and the County for the design and installation of a treatment system to reduce the level of manganese in the domestic well at parcel 506 to an acceptable health-based level.

Other residential wells may be contaminated. Arsenic was found in ground water samples collected from the domestic wells located on parcels 530 and 516. However, the level of arsenic detected in these samples (2 µg/L) appears to be within the range of background arsenic concentrations found in Cecil County ground water. Beryllium was found at a concentration of 2.2 µg/L in one of three samples from domestic wells on each of parcels 515 and 516. The beryllium detected in these samples may be the result of laboratory contamination; beryllium was not detected in ground water beneath the landfill property.

5.2.3 Wastes and Subsurface Soils

During the RI, Firestone and the County completed 30 borings in the waste material at the Site in order to define the vertical and lateral extent of the wastes and to evaluate treatment and control options. Five borings were completed in the general landfill area. Twenty borings were completed in the Cell B/C area and five in the area thought to be occupied by Cell A. The samples were analyzed for the TCL parameters plus acrolein, acrylonitrile and 2-chloroethyl vinyl ether, and for the TAL parameters, except antimony and selenium. EPA completed eight additional borings in October 1992 in order to further evaluate the volatile organic constituents of the waste material in PVC sludge disposal Cell B/C.

5.2.3.1 Landfill Contents and Cell A Area

Nineteen samples were collected from ten borings-in-waste completed in the general landfill and suspected Cell A areas. Low concentrations of organic compounds and metals were found in the fill material in the general landfill area, in the native saprolite surrounding the fill, and in the suspected area of Cell A. The organic chemicals included VOCs (which were different from the VOCs found at levels of concern in the ground water) and semivolatile organic compounds, including bis(2-ethylhexyl)-phthalate. Generally low levels of inorganic elements were detected in the subsurface soil and waste samples.

It should be noted that the analytical results for the 19 landfill waste and subsurface soil samples are not considered to be representative of all of the wastes and contaminated soils in the landfill. A statistical sampling plan would need to be implemented in order to obtain a representative measure of the chemical constituents of the landfill wastes. However, detailed characterization of a landfill's contents is costly and the volume and heterogeneity of landfill contents often makes treatment impracticable (*Conducting Remedial Investigations/ Feasibility Studies for CERCLA Municipal Landfill Sites*, EPA/540/P-91/001, February 1991 [hereafter, "EPA Municipal Landfill Guidance"]). Therefore, such detailed characterization is generally not necessary since containment, in accordance with the NCP, is often the most practicable technology and does not require such information.

5.2.3.2 Cell B/C

Twenty-seven samples of PVC sludge were collected from 20 different boreholes drilled into the one-acre Cell B/C waste area, consistent with the EPA Municipal Landfill Guidance regarding potential hot spots at municipal landfill sites. Generally low concentrations of organic compounds and metals were found in the PVC sludge samples. Among the VOCs found in the samples were 1,2-dichloroethane, trichloroethene and vinyl chloride. The highest concentration of vinyl chloride detected in the Cell B/C sludge material was 7.95 milligrams per kilogram (mg/kg). The mean concentration of vinyl chloride in the Cell B/C PVC sludge was estimated to be 290 micrograms per kilogram (μg/kg), based on the analytical data collected for the RI and treatability studies and the additional sludge sample analyses conducted by EPA. Semivolatile organic compounds detected in the Cell B/C sludge samples included bis(2-ethylhexyl)phthalate (at levels up to 1,200,000 μg/kg) and other phthalates. Generally low levels of inorganic elements were detected in the Cell B/C waste material.

5.2.4 Surface Soils

Eleven surface soil samples were collected from the general landfill area and the PVC sludge disposal cell areas. These samples were analyzed for the TCL parameters plus acrolein, acrylonitrile and 2-chloroethyl vinyl ether, and for the TAL parameters, except antimony and selenium. Low levels of organic compounds were detected, generally at concentrations close to the method quantitation level. These compounds included VOCs and semivolatile organic compounds, including PAHs. Inorganic elements, including arsenic and beryllium were also detected in the surface soils at background levels.

5.2.5 Drain Field Soils

Thirteen subsurface soil samples were collected from areas above and below the former septic system drain field, and three surface soil samples were collected from areas downslope of the manhole at the head of the former drain field. (Two of the surface soil samples were collected and analyzed by EPA.) The purpose was to evaluate the impact of releases from the septic system on Site soils and the potential for contaminants in drain field soils to leach into ground water. The drain field soil samples were analyzed for the TCL and TAL parameters.

Low concentrations of organic compounds were detected in drain field soils, generally at levels close to the method quantitation limits. These compounds included VOCs, semivolatile organic compounds, including PAHs, and several pesticides. Several inorganic elements, including arsenic (at levels up to 22.1 mg/kg), mercury (at levels up to 3.9 mg/kg), and beryllium were found in the drain field soils. The levels of beryllium in the drain field soils are within the range of background levels in Cecil County.

5.2.6 Leachate Seeps, Seep Sediments and the Retention Basin

A sediment sample was collected from each of three leachate seeps identified during the RI and from the retention basin in the south-central area of the landfill. A leachate sample was also collected from each of the three seeps. A surface water sample was collected from the retention basin. These samples were analyzed for the TCL parameters plus acrolein, acrylonitrile and 2-chloroethyl vinyl ether, and for the TAL parameters, except antimony and selenium.

Leachate seep samples contained levels of the VOCs benzene, carbon disulfide, chlorobenzene, ethylbenzene, toluene and total xylenes, with maximum concentrations ranging from 2 μg/L to 82 μg/L, and levels of the semivolatile organic chemicals benzoic acid, 1,4-dichlorobenzene, diethylphthalate, naphthalene and phenol, with maximum concentrations ranging from 3 μg/L to 38 μg/L. Levels of aluminum (up to 138 μg/L), copper (2.7 μg/L), iron (up to 69,400 μg/L), lead (up to 10.7 μg/L), manganese (up to 1,090 μg/L), nickel (up to 22.4 μg/L), zinc (up to 23.0 μg/L) and other metals were also found in the leachate seep samples and the surface water sample collected from the retention basin.

Sediment samples collected from seep areas and the retention basin contained VOCs, including acetone, chloroform, 2-butanone, toluene and total xylenes, with maximum concentrations ranging from 2 μg/kg to 78 μg/kg, and semivolatile organic compounds, including bis(2-ethylhexyl)phthalate at levels up to 5,800 μg/kg and a wide range of PAHs, with maximum concentrations ranging from 160 μg/kg to 780 μg/kg. Elevated levels of cadmium (up to 10.5 mg/kg) and zinc (up to 876 mg/kg) were detected in seep sediments. Arsenic and beryllium were also detected in seep sediments at background levels.

5.2.7 Creek Surface Water and Sediments

During the RI, six sediment samples and six surface water samples were collected from upstream and downstream areas of the unnamed creek that flows across the southern tip of the Site. The samples were analyzed for the TCL parameters plus acrolein, acrylonitrile and 2-chloroethyl vinyl ether, and for the TAL parameters, except antimony and selenium.

Low levels of the semivolatile organic compounds di-n-butylphthalate, N-nitrosodiphenylamine and pyrene were found in downstream surface water samples. Di-n-butylphthalate was also found in an upstream surface water sample at a level similar to the downstream level.

Twelve metals were found in downstream surface water samples and eleven were detected in upstream surface water samples. The maximum concentration of manganese found in downstream surface water samples (191 μg/L) exceeded the highest level of manganese detected in upstream surface water samples (21.4 μg/L). Maximum downstream concentrations of some metals were slightly elevated compared to maximum upstream concentrations of those metals: aluminum (143 μg/L and 105.9 μg/L, respectively); copper (6.6 μg/L and 4.2 μg/L, respectively); iron (180 μg/L and 118.8 μg/L, respectively); nickel (7.9 μg/L and 6 μg/L, respectively); and zinc (13.3 μg/L and 9.5 μg/L, respectively). Lead was found in a downstream sample at a maximum concentration of 3.7 μg/L but was not detected in upstream surface water samples. Five other metals occurred at comparable levels in upstream and downstream samples.

Low levels of the VOCs chloroform and tetrachloroethene were found in upstream creek sediments. Chloroform was found in one downstream sediment sample at a concentration of 2 μg/kg. Semivolatile organic compounds, including benzoic acid at a level of 430 µg/kg, bis(2-ethylhexyl)phthalate at a level of 140 µg/kg, and several PAHs at levels ranging from 120 µg/kg to 160 µg/kg, were found in downstream sediment samples. Bis(2-ethylhexyl)-phthalate was also found in an upstream sediment sample at a level of 140 µg/kg. Downstream levels of several metals in creek sediments, including chromium, cobalt, copper, iron, manganese and nickel, were somewhat elevated compared to upstream levels.

6.0 SUMMARY OF SITE RISKS

A baseline Risk Assessment was prepared in order to identify and define possible existing and future health risks and potential environmental impacts associated with exposure to the chemicals present in the various environmental media at the Site if no action were taken. The baseline Risk Assessment provides the basis for taking action and indicates the exposure pathways that need to be addressed by the remedial action. The baseline Risk Assessment can be found in the Remedial Investigation Report (Revision 01, October 1992) prepared by International Technology Corporation (IT).

6.1 Contaminants of Concern

Since the principal risk to human health presented by conditions at the Site is risk from exposure to contaminated ground water, the primary contaminants of concern are those chemicals detected in the ground water at the Site and those chemicals in the wastes buried at the Site which have the potential to contaminate ground water as a result of leaching. These chemicals are presented in Tables 1 through 3.[1]

In addition, mercury was detected in soils above the former drain field of the Transfer Station septic system; cadmium and zinc were found in on-site seep sediments; and aluminum, copper, lead and silver were detected in surface water samples collected from downstream areas of the unnamed creek. These metals are

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[1] As noted in Section 5.2.3.1, characterization of the landfill wastes during the RI would have been costly and was determined to be unnecessary since containment is the most practicable technology for managing a large volume of heterogeneous wastes in a municipal landfill. The PVC sludge in disposal Cell B/C was adequately characterized and its leaching potential evaluated during the RI. The results are summarized in Table 3 of this ROD. Since the wastes in the landfill were not fully characterized, it was not possible to reliably determine the leaching potential of those wastes. However, Tables 1 and 2 include contaminants of concern found in ground water at the Site which have not been detected in the Cell B/C wastes. It is reasonable to conclude that those contaminants were derived from the wastes in the landfill and from the natural soils.

contaminants of concern for ecological receptors.

6.2 Human Health Risk Assessment

6.2.1 Exposure Assessment

The objective of the exposure assessment is to estimate the amount of each chemical of potential concern at a site that is actually taken into the body (i.e., the intake level or dose). The primary components of the exposure assessment include a characterization of the exposure setting, a pathway analysis, identification of possible exposure conditions, and an estimation of exposure. The results of the exposure assessment are combined with chemical-specific toxicity information to characterize potential risks.

6.2.1.1 Exposure Setting

Although some areas of the Site are fenced, most of the Site boundary is unfenced. Therefore, trespassing is possible at the Site. Potentially exposed populations include residential populations located near the Site and child or adolescent trespassers.

6.2.1.2 Exposure Pathways

A complete exposure pathway consists of the following elements: (1) a chemical source or a mechanism for contaminants to be released into the environment; (2) a medium through which contaminants may be transported, such as water, soil or air; (3) a point of actual or potential contact with contaminants (exposure point); and (4) a route or mechanism of exposure, such as ingestion, inhalation, or dermal contact at the exposure point. Both current exposure pathways and potential future exposure pathways were evaluated in the Risk Assessment.

As noted in Section 5.2, above, three sources of contamination were identified at the Site. The release of contaminants into the environment was documented during the RI.

The following contaminated media and potential routes of exposure were evaluated in the Risk Assessment:

- Ground water pathway
  - Ingestion of contaminated ground water, including potential leachate from subsurface soils and PVC sludge
  - Inhalation, during showering, of volatilized ground water contaminants, including contaminants in potential leachate from subsurface soils and PVC

sludge

- Dermal contact, during showering, with contaminated ground water, including potential leachate from subsurface soils and PVC sludge

- Soil pathway

  - Incidental ingestion of contaminated surface soils
  - Inhalation of wind-borne surface soil particulates
  - Incidental dermal contact with contaminated surface soils

- Sediment pathway

  - Incidental ingestion of sediments, including seep, retention basin and creek sediments
  - Incidental dermal contact with sediments, including seep, retention basin and creek sediments

- Surface water pathway

  - Dermal contact with constituents in surface water, including leachate and surface water in the creek and retention basin.

6.2.1.3 Exposure Scenarios

The exposure assessment considered current and potential future use of contaminated ground water and current recreational use of the Site. The averaging time used in all exposure pathway calculations for carcinogens is based on an adult lifetime of 70 years. The averaging time used in all exposure pathway calculations for chemicals with noncarcinogenic health effects is equal to the duration of exposure. The other assumptions used to estimate exposure point concentrations and to quantify exposure are summarized below for each pathway evaluated in the Risk Assessment.

Ground Water Pathway. The risk associated with exposure of area residents to contaminants present in residential well water was quantified in the Risk Assessment. Potential future exposure to contaminants present in ground water beneath the landfill property was also considered in the Risk Assessment based on an assumption that a public water supply well would be placed in the center of the existing contaminant plume. A second future use scenario considered exposure to ground water contaminated with the highest levels of vinyl chloride that were predicted to occur in the aquifer beneath the landfill property and beyond the property boundary 70 years in the future. (The ground water flow and solute transport model that was used to simulate the migration of vinyl chloride is described in detail in the Phase III Report [Revision 01, November 1991] prepared by IT.) In addition, contaminant concentrations that may occur in ground water as a result of leaching from subsurface soils and wastes were considered in the Risk Assessment.

Potential routes of exposure to constituents in ground water are discussed in Section 6.2.1.2, above. A number of assumptions are used to calculate the dose for each exposure route since it is seldom possible to measure a specific dose. The following assumptions were used to estimate exposure to ground water constituents:

- Receptors include a 30-kilogram (kg) child ingesting 1.0 liter per day (L/day) and a 70-kg adult ingesting 2.0 L/day every day for 17 and 30 years, respectively. Showering is assumed to occur daily, with adult and child receptors being exposed for 12 minutes per day.

- Inhalation rates of adult and child receptors are 10 liters per minute (L/min) and 13 L/min, respectively.

- The total skin surface area available for contact during showering or bathing for a child is 10,455 square centimeters (cm^2) and the total surface area for an adult is 19,400 cm^2.

- Dermal permeability coefficient factors presented in EPA's *Interim Guidance for Dermal Exposure Assessment, Review Draft* (March 1991), were used to estimate the mass of organic compounds transferred through the skin.

- It was assumed that significant levels of heavy metals would not be dermally absorbed from water on the skin surface.

Two mathematical models were utilized in the exposure assessment for the ground water pathway. The shower model developed by Foster and Chrostowski (1986)[2] was used to estimate a shower dose, expressed as mg/kg per shower. The contaminant concentrations that may occur in ground water as a result of leaching from subsurface soils and wastes were derived using the model described by Summers, et. al. (1980).

Surface Soil Pathway. Direct contact with and incidental ingestion of soil, and inhalation of wind-borne soil particulates, were evaluated as potential routes of exposure for

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[2] See the List of References appended to this ROD.

a child or adolescent trespasser visiting the area during weekends and other nonschool periods and for an adult dropping off refuse at the Transfer Station. Inhalation of wind-borne soil particulates was also evaluated as an exposure route for individuals residing northeast of the Site on Firetower Road.

The following assumptions were used to estimate current exposure from potential contact with surface soil:

- The exposure frequency for both an adult and child exposed off-site to windblown dust was assumed to be 350 days per year (days/yr). The child trespasser exposure frequency was assumed to be four times a month for nine months, or 36 days/yr. The adult visitation frequency for refuse drop off was assumed to be once a week, or 52 days/yr.

- The off-site exposure duration was assumed to be 30 and 17 years for an adult and child, respectively. The exposure duration for a child six to fourteen years old trespassing on-site was assumed to be nine years.

- The soil ingestion rate for children and adults was assumed to be 100 milligrams per day (mg/day).

- It was assumed that one hundred percent of the chemical adsorbed on soil particles would be absorbed by the adult's or child's gastrointestinal tract.

- The wind direction was assumed to be originating out of the southwest 100 percent of the time, i.e., blowing toward homes closest to the Site on Firetower Road.

- The inhalation rate was assumed to be 20 cubic meters per day (m^3/day) for an adult and 19.2 m^3/day for a child.

- It was assumed that 100 percent of the constituents of soil particulates are absorbed following inhalation.

- The skin surface area available for contact was assumed to be 4,440 cm^2 for a child (the estimated surface area of the hands, arms and legs) and 2,000 cm^2 for an adult (the estimated surface area of the forearms and hands).

- The soil adherence factor was assumed to be 1.45 milligrams per square centimeter per day (mg/cm^2/day).

- It was assumed that one percent of the cadmium in soil is dermally absorbed. No other soil constituents were assumed to be available for dermal absorption.

Three air models were used to determine particulate concentrations at the Site: a soil emission model to determine particulate emission rates from wind erosion (U.S. EPA, 1984); a box model to estimate on-site exposure (Hannah, et al., 1982); and a Gaussian dispersion model to estimate off-site migration of soil particulates (Turner, 1970).

Subsurface Soil Pathway. Direct routes of exposure to subsurface soils and wastes (dermal contact, incidental ingestion and inhalation) were not considered since no excavation or subsurface disturbance is expected to occur at the Site. However, as noted above, the model described by Summers, et al. was used to estimate the concentration of contaminants that would occur in ground water as a result of leaching from subsurface soils and wastes. Exposure to the leachate-contaminated ground water was evaluated in the Risk Assessment based on the assumptions outlined above for the ground water pathway.

Sediments Pathway. Direct contact with sediments and subsequent incidental ingestion were considered potential routes of exposure for a child trespassing on the Site. The following assumptions were used in evaluating a child's exposure for the trespasser scenario:

- The skin surface area available for contact with the seep and settling basin sediments was assumed to be 4,440 cm^2 (the estimated surface area of the arms, hands and legs).

- The skin surface area available for contact with the surface water sediments was assumed to be 1,800 cm^2 (the estimated surface area of the hands, feet and lower legs).

Other exposure parameters, including exposure frequency and duration, and ingestion and absorption rates, were assumed to have the same values as the parameters used in the scenario for exposure of a child trespasser to surface soils.

Surface Water Pathway. Direct contact with surface water constituents during wading in the unnamed creek and trespassing on the landfill property were considered as potential routes of exposure for a child trespasser. Ingestion of potentially contaminated fish was not considered since the creek has a limited ability to support recreational fishing due to its shallow depth. The following exposure factors were used in evaluating the child's exposure in the surface water exposure scenario:

- The skin surface area available for contact with surface water was assumed to be 1,800 cm^2 (the estimated surface area of the hands, feet and lower legs).

- Dermal permeability coefficient factors presented in

EPA's *Interim Guidance for Dermal Exposure Assessment, Review Draft* (March 1991), were used to estimate the mass of organic contaminants transferred through the skin.

- It was assumed that significant levels of heavy metals would not be dermally absorbed from surface water.

The frequency and duration of exposure to surface water were assumed to be the same as the frequency and duration of exposure of a child trespasser to surface soils.

6.2.1.4 Quantitation of Exposure

The reasonable maximum exposure (RME) concentration was used to estimate the level of exposure to chemicals of potential concern. The RME concentration is defined as the upper 95th percent confidence limit on the arithmetic mean of the analytical data for each chemical of potential concern. For some chemicals, the calculated upper 95th percent confidence level exceeded the maximum concentration found in a particular medium. In those cases, the exposure point concentration was set equal to the maximum detected concentration.

Contaminated ground water was the only medium at the Site found to pose a threat to human health. The chemicals found in ground water samples collected from Site monitoring wells and the RME values for the chemicals are presented in Table 1. The chemicals found in ground water samples collected from residential wells and the RME values for the chemicals are presented in Table 2. The concentrations of contaminants predicted to occur in ground water as a result of potential future leaching from Cell B/C wastes is presented in Table 3.

Although ground water is the only medium at the Site that contains contaminants at levels that would result in unacceptable levels of risk to exposed human populations, all of the chemicals with available toxicity factors in each of the environmental media evaluated at the Site were used to estimate potential health risks in the Risk Assessment. Exposure scenarios for each pathway were evaluated together with the exposure point concentrations to derive intakes (expressed as mg/day) for each population subgroup. By dividing the intake value by the appropriate body weight, a dose expressed in milligrams of contaminant per kilogram of body weight per day (mg/kg/day) was determined for each age group. This dose is referred to as the chronic daily intake (CDI). The CDI values for each exposure pathway are presented in Appendix N of the RI Report.[3]

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[3] The oral reference dose (RfD) for manganese was revised subsequent to the preparation of the RI Report. Therefore, the CDI values for manganese in Appendix N of the RI Report do not

6.2.2 Toxicity Assessment

A toxicity evaluation of the chemicals present at the Site was conducted in order to identify relevant carcinogenic potency factors and chronic reference doses against which daily intake levels could be compared.

Cancer slope factors (CSFs) have been developed by EPA's Carcinogenic Assessment Group for estimating excess lifetime cancer risks associated with exposure to potentially carcinogenic chemicals. Cancer slope 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. CSFs, which are expressed in units of $(mg/kg/day)^{-1}$, are multiplied by the estimated chronic daily intake of a potential carcinogen, expressed 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 CSF. Use of this approach makes underestimation of the actual cancer risk highly unlikely. CSFs for contaminants of potential concern at the Site which contribute to the carcinogenic risk are presented in Table 4.

Table 4 also reflects the degree of confidence in the data used to determine that the chemical is a human carcinogen. EPA toxicologists recognize that the risk associated with a known human carcinogen, based on epidemiological studies, should be evaluated differently from the risk attributed to a chemical that causes tumor growth in laboratory animals. Each carcinogen is assigned to a group according to the quality and quantity of evidence for carcinogenicity in humans and nonhuman animals. The definitions of Cancer Groups A through E are presented in Table 5.

Reference doses (RfDs) have been developed by EPA for indicating the potential for adverse noncancer health effects from exposure to toxic chemicals. The model used to develop RfDs is based on the assumption that threshold levels exist for certain toxic effects. Two chronic toxicity parameters are used to establish RfDs: the lowest-observed-adverse-effect level (LOAEL), and the no-observed-adverse-effect level (NOAEL). The LOAEL is the lowest exposure level at which there are statistically significant increases in adverse effects in an exposed animal population. The NOAEL is the highest exposure level at which there are no demonstrated adverse effects in an exposed animal population. Uncertainty factors are applied to the NOAELs or

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reflect the revised RfD for manganese. The summary risk calculations presented in Tables 6 through 8 of this ROD do reflect the revised RfD for manganese.

LOAELs to adjust for data limitations and for differences between the exposure conditions of laboratory animals and human exposure situations. The resulting RfD, expressed in units of mg/kg/day, can be compared to the estimated human intakes of chemicals from environmental media in order to evaluate the potential for adverse health effects. The RfDs for the contaminants of potential concern at the Woodlawn Landfill Site are presented in Table 4.

6.2.3 Risk Characterization

The risk characterization combines the dose (or CDI) and the toxicity value to generate a numerical value for risk. There are several differences between the approach used to describe risk for carcinogens and noncarcinogens. Both approaches are summarized below.

6.2.3.1 Carcinogenic Risks

For carcinogens, risks are estimated as the incremental probability of an individual developing cancer over a lifetime as a result of exposure to the carcinogen. Excess lifetime carcinogenic risk is calculated by multiplying the dose (CDI) by the cancer slope factor. Carcinogenic risk estimates for each chemical and each exposure pathway may be added together to determine the aggregate risk associated with exposure to multiple contaminants in multiple media. These risks are probabilities that are generally expressed in scientific notation (e.g., 1×10^{-6}). An excess lifetime carcinogenic risk of 1×10^{-6} indicates that, as a plausible upper bound, an individual has a one in one million chance of developing cancer as a result of exposure to Site-related contaminants over a 70-year lifetime under the specific exposure conditions at the Site.

Table 6 presents a summary of current carcinogenic risk estimates for the exposure of adult and child receptors to ground water containing all of the chemical constituents that were found in each of 13 residential wells sampled during the RI. The total cancer risk associated with exposure to residential well water via each of the identified exposure routes (ingestion, inhalation and dermal contact) is 1.6×10^{-4} for adults and 1.0×10^{-4} for children. The majority of the risk is attributed to beryllium, arsenic and vinyl chloride. However, as noted in Section 5.2.2, above, the beryllium detected in the domestic well samples may be the result of laboratory contamination. When beryllium is eliminated from the risk calculations, arsenic and vinyl chloride contribute 90 and 8.3 percent, respectively, of the total adult cancer risk of 4.6×10^{-5} associated with exposure to residential well water.

The total cancer risks for a child receptor exposed to surface soils in the general landfill area (1.0×10^{-6}) and for adult and child receptors exposed to surface soils of the former drain field (3.5×10^{-6} and 1.7×10^{-6}, respectively) fall within EPA's target risk range of 1×10^{-6} to 1×10^{-4}. The total cancer risk associated with exposure to each of the other environmental media evaluated at the Site is less than 1×10^{-6}. Summary risk tables for each of the media evaluated in the Risk Assessment can be found in the RI Report.

Table 7 provides a summary of the total cancer risk estimates that are based on potential current exposure of adult and child receptors to Site contaminants through all of the pathways (ground water, surface water, sediments and surface soils except drain field surface soils) that were evaluated in the Risk Assessment. A comparison of the risk estimates in Tables 6 and 7 underscores the fact that contaminated ground water is the primary medium of concern at the Site.

As discussed above, the risks associated with potential future exposure to Site contaminants were evaluated in addition to the risks associated with current exposure. Table 8 presents a summary of carcinogenic risk estimates for exposure of adult and child receptors to contaminated ground water for three hypothetical future use scenarios: (1) exposure to contaminants currently present in ground water beneath the landfill property, assuming a public water supply well is placed in the center of the contaminant plume (existing conditions scenario); (2) exposure to ground water contaminated with the highest levels of vinyl chloride that, with the aid of a model, were predicted to occur in the aquifer beneath the landfill property (on-site) and beyond the property boundary (off-site) 70 years in the future, assuming water supply wells are placed in the portions of the aquifer that are expected to be most highly contaminated at that time (modeled scenario); and (3) exposure to ground water containing levels of contaminants that were predicted to occur in ground water beneath the landfill property as a result of future leaching from Cell B/C wastes, assuming a water supply well is placed on the landfill property in the leachate-contaminated ground water (leachate scenario).

The future cancer risks for adult and child receptors potentially exposed to the existing concentrations of the chemicals in the aquifer immediately below the landfill are 5.8×10^{-3} and 4.0×10^{-3}, respectively. The chemicals in on-site ground water that contribute most to this total cancer risk are vinyl chloride, benzo(a)pyrene, benzo(b)fluoranthene, arsenic and 1,2-dichloroethane. Vinyl chloride and benzo(a)pyrene represent 53 and 35 percent, respectively, of the total adult cancer risk of 5.8×10^{-3}.

The future cancer risks for adult receptors exposed to ground water containing the highest levels of vinyl chloride that were predicted to occur in the aquifer 70 years in the future are 1.5

X 10^{-2} for on-site receptors and 1.8 X 10^{-3} for off-site receptors.

The cancer risks associated with potential future exposure to on-site leachate-contaminated ground water are 7.8 X 10^{-2} for an adult receptor and 5.8 X 10^{-2} for a child receptor. Nearly 100 percent of the risk is attributed to vinyl chloride.

6.2.3.2 Noncarcinogenic Risks

The potential for adverse noncarcinogenic health effects as a result of exposure to a single contaminant in a single medium is expressed as the hazard quotient (HQ), or the ratio of the estimated daily intake of a contaminant in a given medium to the contaminant's reference dose. The hazard index (HI) is obtained by adding the HQs for all of the contaminants in a medium or across all media to which a given population may reasonably be exposed. The HI provides a useful reference point for gauging the potential significance of multiple contaminant exposures within a single medium or across media. HI values less than or equal to 1.0 indicate that lifetime exposure has limited potential for causing an adverse effect in sensitive populations. HI values greater than 1.0 show that acceptable levels of intake have been exceeded.

Table 6 presents the chronic hazard index estimates for exposure of adult and child receptors to ground water containing contaminants found in residential wells adjacent to the Site. The HI values exceeded 1.0 for both children (2.6) and adults (2.3). Manganese is the contaminant with the highest noncarcinogenic risk for this pathway, with a HQ of 2.0 for children and 1.8 for adults.

The HI values associated with exposure to contaminants in the other environmental media evaluated at the Site are less than 1.0, indicating that lifetime exposure to these media is not expected to result in adverse noncarcinogenic health effects in the exposed populations. Summary risk tables for each of the media evaluated in the Risk Assessment are included in the RI Report.

Table 7 presents a summary of the chronic hazard index estimates for exposure of adult and child receptors to all of the contaminated media (ground water, surface water, sediments and surface soils except drain field surface soils) that were evaluated in the Risk Assessment. A comparison of the HI values in Tables 6 and 7 again demonstrates that contaminated ground water is the medium of concern at the Site.

Table 8 presents a summary of the chronic hazard index estimates for exposure of adult and child receptors to contaminated ground water for two of the hypothetical future use scenarios described in Section 6.2.3.1, above. (Noncarcinogenic risks were not assessed for the modeled scenario since the noncancer health effect for vinyl chloride is negligible compared to the cancer risk and, therefore, no reference dose is available for vinyl chloride.)

The HI values for child and adult receptors potentially exposed to the existing concentrations of the chemicals in the aquifer immediately below the landfill are 59 and 50, respectively. Manganese is the contaminant with the highest noncarcinogenic risk for this potential future pathway, with a HQ of 56 for children and 48 for adults.

The HI values associated with potential future exposure to on-site leachate-contaminated ground water are less than 1.0.

6.3 Environmental Risk Assessment

Potential risks to nonhuman biological receptors were evaluated in the Ecological Risk Assessment which is included in the RI Report.

No critical habitats, endangered species or endangered species habitats have been identified in the Site area. However, wetlands occupy limited areas of the Site as discussed in Section 5.1, above. In addition, a tributary of Basin Run crosses the southern end of the Site.

As discussed in Section 5.2.7, above, several metals were found in downstream surface water samples collected from the unnamed creek that flows across the Site. Levels of aluminum, copper, lead and silver were found to exceed federal ambient water quality criteria for the protection of aquatic life.

Levels of mercury found in soil above the former drain field of the Transfer Station septic system exceed the 1 mg/kg soil criterion that EPA has determined is protective of ecological receptors at the Site, and may cause sublethal effects in area birds that feed on exposed earthworms.

Levels of cadmium and zinc found in on-site seep sediments also exceed criteria that EPA has determined are protective of ecological receptors at the Site. The levels of cadmium found in the sediments may cause sublethal effects in area predators as a result of bioaccumulation. Levels of zinc present in the seep sediments may inhibit plant growth.

6.4 Conclusion

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

7.0 REMEDIAL OBJECTIVES AND CLEANUP LEVELS

The overall remedial objectives for the Site are: (1) to prevent exposure to contaminated ground water; (2) to prevent migration of contaminants from the landfill and PVC sludge disposal cells to ground water and surface water; (3) to restore ground water to its beneficial use; (4) to prevent exposure to the contents of the landfill and the PVC sludge disposal cells, and contaminated soils and sediments; and (5) to control landfill gas to ensure protection of human health and the environment.

7.1 Remedial Objectives and Cleanup Levels for Ground Water

The Risk Assessment indicates that the carcinogenic and noncarcinogenic risks associated with exposure to contaminated ground water at the Site exceed acceptable levels and therefore warrant remedial action to clean up ground water at the Site. Ordinarily, MCLs and non-zero Maximum Contaminant Level Goals (MCLGs) would be used as cleanup levels for ground water. At this Site, however, because there are multiple contaminants, the cumulative carcinogenic risk associated with MCLs for those contaminants exceeds 1×10^{-4}. In addition, the hazard index associated with MCLs and MCLGs for Site ground water contaminants is greater than 1.0. Under such circumstances, risk- or health-based levels are used to develop cleanup levels. Risk-based cleanup levels are levels that would result in a cumulative carcinogenic risk within EPA's target risk range of 1×10^{-4} to 1×10^{-6}; health-based cleanup levels correspond to a HI of 1.0 or less. Occasionally, calculated risk- and health-based concentrations are found to be lower than background levels, or below the levels that can actually be detected or accurately measured in the laboratory. When these situations arise, EPA may also take background conditions, or Practical Quantitation Limits and Instrument Detection Limits into account when establishing cleanup levels.

The following remedial objectives and cleanup levels were developed for ground water at the Site based on the considerations outlined above:

1. Prevent exposure to ground water that contains Site-related contaminants at concentrations that exceed the cleanup levels presented in Tables 9 and 10, until the ground water cleanup levels are achieved.

2. Remediate ground water in the area of attainment[4] so that: (a) the levels of contaminants with carcinogenic health effects do not exceed the ground water cleanup levels presented in Table 9; and (b) the levels of contaminants with noncarcinogenic health effects (presented in Table 10) do not exceed MCLs, non-zero MCLGs, or levels that would result in an aggregate HI greater than 1.0. As noted in Tables 9 and 10, EPA will take background levels of arsenic and manganese into account in determining whether the remediation objectives have been achieved.

7.2 Remedial Objectives and Cleanup Levels for Wastes

Some form of control of the wastes in PVC sludge disposal Cell B/C (and Cell A, if found) is necessary in order to ensure that leachate generation does not result in an exceedance of the ground water cleanup levels. In order to evaluate treatment options for this material, a cleanup level was developed for these wastes based on the Summers model. The results of the Summers model indicated that technologies for treatment of the waste must meet a treatment standard (cleanup level) of 7.7 micrograms of vinyl chloride per kilogram of waste in order to sufficiently reduce the concentration of contaminants in the leachate that could be derived from the PVC sludge. Alternatively, waste containment technologies must be designed to minimize the infiltration of rainwater and resulting leachate generation.

7.3 Remedial Objectives and Cleanup Levels for Soils

Levels of mercury in the soils above the former drain field of the Transfer Station septic system are above normal background levels and may provide an opportunity for mercury to enter the food chain via exposure of soil organisms to the contaminated soils. EPA has determined that a soil mercury concentration of 1 mg/kg is the cleanup level that would be protective of ecological receptors at this Site. Alternatively, waste containment technologies must be designed to prevent exposure of ecological receptors to soils contaminated with mercury in excess of this level.

8.0 DESCRIPTION OF ALTERNATIVES

The Feasibility Study prepared by IT (April 1993) evaluated six alternatives to address the risks posed by current and potential future exposure to contaminants at the Woodlawn Landfill Site. Alternative 1 provides no remediation, monitoring or controls,

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[4] The area of attainment is defined as the area outside the boundary of any waste remaining in place up to and including the boundary of the contaminant plume.

but was retained as a baseline for comparison with other alternatives. Alternatives 2 and 3 are considered limited action since they include monitoring, institutional controls and measures to eliminate exposure to contaminated ground water and, in the case of Alternative 3, a landfill cap in order to comply with State landfill closure requirements. Alternative 4 provides active remediation of contaminated ground water. Alternatives 5 and 6 offer two options, in addition to capping, for addressing PVC sludge disposal Cell B/C and Cell A, if found: on-site treatment and off-site disposal, respectively.

COMMON ELEMENTS:

Alternatives 2 through 6, which are described in greater detail below, include several common elements. First, each of these alternatives provides for construction of a perimeter security fence around the landfill property boundary in order to secure the Site from unauthorized access and usage.

Second, each of Alternatives 2 through 6 calls for the institution of landfill property deed restrictions and area ground water use restrictions as necessary to prevent exposure to contaminated ground water and wastes and to ensure that the alternative may be effectively implemented.

Third, each of Alternatives 2 through 6 includes regular monitoring of ground water, the unnamed creek and landfill gas. The monitoring programs include the following activities: installation of three or four new monitoring wells around the perimeter of the landfill; quarterly sampling of nine to eleven monitoring wells and six domestic wells during the post-construction remediation phase; quarterly sampling of surface water and sediments from four or five locations in the unnamed creek during the post-construction remediation phase; installation of a network of nested soil-gas probes at approximately 53 locations around the perimeter of the landfill; and quarterly collection of gas samples from each of the soil-gas probes. The monitoring costs associated with each alternative are based on these assumptions. Final determination of the specific number and location of monitoring points, the frequency and duration of sampling, and the analytical parameters and methods to be included in the monitoring program, will be made by EPA, in consultation with MDE,[5] during the remedial design and,

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[5] In accordance with 40 C.F.R. § 300.515(h)(3) in Subpart F of the NCP, the phrase "EPA, in consultation with MDE" when used in this ROD means that EPA (the lead agency) shall provide MDE (the support agency) an opportunity to review and comment on the remedial design and any proposed determinations on potential applicable or relevant and appropriate requirements (ARARs) or criteria, advisories or guidance "to be considered" (TBCs).

as appropriate, during implementation of the selected remedy.

Fourth, each of Alternatives 2 through 6 provide for an alternate water supply at residences where Site-related contaminants are determined to be present in domestic well water at concentrations that exceed the ground water cleanup levels presented in Tables 9 and 10. The costs for maintaining the well water treatment system at parcel 309 were included in the cost figures for Alternatives 2 through 6. However, the costs for installation and maintenance of additional treatment systems were not included in the cost estimates.

Finally, Alternatives 2 through 6 provide for interim monitoring of select residential wells. Because of the potential public health risk posed by contaminated ground water at the Site, EPA required annual monitoring of seven residential wells to begin prior to the post-construction remediation phase (interim monitoring). Interim monitoring began in May of 1993 and would continue under Alternatives 4 through 6 until the post-construction quarterly ground water monitoring program begins. If determined to be necessary by EPA, in consultation with MDE, the number and location of residential wells in the interim monitoring program and the frequency of monitoring shall be modified. The costs for the interim monitoring program were not included in the cost figures for Alternative 2 through 6.

COST EVALUATION:

The cost evaluation of each alternative includes consideration of capital costs and annual operation and maintenance costs (O&M). A present worth analysis is also included, allowing all remedial action alternatives to be compared on the basis of a single figure. A discount factor of ten percent and a zero percent inflation factor were used in the analysis and a 30-year monitoring and maintenance period was assumed for cost estimating purposes. All costs and implementation time frames provided for the alternatives below are estimates and should be used for comparative purposes only. The actual duration of the monitoring and maintenance period will be determined by EPA, in consultation with MDE, based on the results of environmental monitoring and statutory five-year reviews.

The following is a brief summary of each of the alternatives evaluated for remediation of the Site.

Alternative 1: No Action

Capital Costs:	0
Annual O&M Costs:	0
Present Worth:	0
Years to Implement:	0

The NCP requires that the "no action" alternative be evaluated at every site as a baseline for comparison with other alternatives. This alternative provides no remediation (other than what might occur through naturally-occurring processes), monitoring or security activities at the Site. This alternative would not prevent or eliminate exposure to contaminated ground water in residential wells and would allow continued migration of contaminants from source areas into ground water and surface water.

Alternative 2: Monitoring, Deed and Ground Water Use Restrictions (Institutional Controls), Perimeter Fencing, Treatment at Impacted Residential Wells

Capital Costs:	$562,000
Annual O&M Costs:	$514,000
Present Worth:	$4,436,000
Years to Implement:	3

In Alternative 2, deed restrictions would be implemented to limit the future use and development of the landfill property. In addition, ground water use restrictions, which are currently in effect, would continue to be enforced and modified as necessary to prevent exposure to contaminated ground water and to ensure that the selected remedy could be effectively implemented. A security fence would be erected around the perimeter of the landfill property boundary (parcel 267), excluding the Transfer Station building and rear loading area, in order to secure the Site against unauthorized access. Bare areas of the landfill surface would be revegetated in order to facilitate maintenance of the existing landfill cover material.

Alternative 2 includes no action to remediate ground water or to eliminate future contamination of ground water. Constituents of wastes and soils would continue to leach into ground water, contaminant levels in the ground water would continue to exceed the cleanup levels, and contaminated ground water would continue to migrate downgradient. However, ground water and stream sampling and analysis would be conducted until the ground water contaminant concentrations were reduced to acceptable levels as a result of natural attenuation.

As previously mentioned, ground water sampling and analysis would be performed for certain existing monitoring wells and new wells would be installed in conformance with Code of Maryland Annotated Regulation (COMAR) 26.04.04. Samples from select residential wells would also be analyzed. Ground water elevation, pH, temperature and conductivity measurements would be recorded for each sampling period. Ground water samples would be analyzed for volatile and semivolatile organic compounds, pesticides and metals.

Wellhead treatment or a replacement well would be provided at any residence where Site-related contaminants were determined to be present in domestic well water at concentrations that exceed the ground water cleanup levels presented in Tables 9 and 10. The objective of the wellhead treatment would be to reduce the concentrations of contaminants to the ground water cleanup levels. The type of wellhead treatment system to be used would depend on the contaminants found during monitoring. Zeolite filters or ion-exchange resins would remove inorganic contaminants, including manganese, from the household water supplies. Carbon adsorption units have been shown to be effective in removing VOCs. Air stripping units are also commercially available for VOC removal for residential applications. Alternatively, a replacement well would be required to provide a sufficient quantity of water that meets the ground water cleanup levels. EPA, in consultation with MDE, would determine the choice of alternate water supply and the exact components and configuration of the wellhead treatment system during the remedial design.

Residual wastes from the wellhead treatment units in the form of spent carbon or filtration media would be evaluated in accordance with the hazardous waste identification requirements of 40 C.F.R. § 261.24, COMARs 10.51.02.10, .11 and .12 (1985), and COMARs 26.13.02.11, .12 and .13.[6] On-site handling of any residual wastes found to exhibit a characteristic of a hazardous waste would comply with standards applicable to generators of hazardous waste (COMARs 10.51.03.01, .03, .04, .05 and .06 [1985], and COMARs 26.13.03.01, .03, .04, .05, .06 and .08) and transporters of hazardous waste (COMARs 10.51.04.01, .02, .03 and .04 [1985], and COMARs 26.13.04.01, .02, .03 and .04). The federal land disposal restrictions contained in 40 C.F.R. Part 268 would also apply to any off-site disposal of residual wastes found to exhibit a characteristic of a hazardous waste. As previously noted, the costs for provision of an alternate water supply and disposal of treatment residuals were not included in the cost figures listed above for this alternative.

Surface water and sediment samples would be collected from upstream and downstream locations in the unnamed creek. These samples would be analyzed for volatile and semivolatile organic compounds, pesticides and metals. In addition, surface water

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[6] The 1985 Maryland regulations cited in this ROD are the federally-authorized Resource Conservation and Recovery Act (RCRA) regulations. These regulations have been subsequently amended by the State of Maryland and recodified in Title 26, Subtitle 13, of the Code of Maryland Regulations (COMARs). Where the 1985 regulations appear in this ROD, the Title 26 COMARs are cited after them. A copy of the 1985 Maryland regulations is contained in the Administrative Record.

parameters such as temperature, dissolved oxygen, pH, conductivity and flow rate would be measured at each sampling station. Surface water samples from each station would also be analyzed for total suspended solids, alkalinity and hardness. Similarly, the temperature, oxidation-reduction potential (Eh), pH, conductivity and color (as determined by comparison with the Munsell Soil Color Charts) of sediments at each sample location would be measured. Sediment samples from each sampling location would also be analyzed for total organic carbon, grain size, percent moisture and percent solids. Biological monitoring of aquatic macroinvertebrates would be conducted twice a year for the first year of monitoring and once a year thereafter.

Several criteria would be used to evaluate the stream monitoring data and assess the need for additional remedial action to address any adverse Site-related impacts on the stream. The criteria for surface water include upgradient stream conditions, State water quality standards and federal ambient water quality criteria. For sediments, Apparent Effects Thresholds (AETs) and National Oceanic and Atmospheric Administration (NOAA) Biological Effects Range - Low (ER-L) values would be considered in interpretation of the monitoring data. Methods described in EPA's guidance document, *Rapid Bioassessment Protocol for Use in Streams and Rivers: Benthic Macroinvertebrates and Fish*[7] (EPA/444/4-89-001, May 1989), would also be used to detect the existence and characterize the severity of potential Site-impacts on the unnamed creek that crosses the Site.

In order to evaluate potential off-site migration of landfill gas, a network of nested soil gas monitoring probes would be installed around the landfill near the Site boundary. Gas samples would be collected on a quarterly basis and analyzed for VOCs and methane. EPA, in consultation with MDE, would evaluate the monitoring results in order to determine the need for further actions to protect the health and safety of surrounding residents (e.g., installation of a perimeter passive-gas collection system).

The costs listed above are based on quarterly monitoring of ground water, including the water in domestic wells, and the unnamed creek. However, EPA, in consultation with MDE, could determine that the sampling frequency should be decreased at the end of a one- or two-year period to semiannual or annual sampling if measured concentrations remained below the ground water cleanup levels or stream action levels and no upward trends in the concentrations of contaminants of concern were observed between sampling events.

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[7] This guidance document was developed for streams in the Appalachian Plateau region. If necessary, EPA would adjust the methods prescribed therein for local conditions.

Alternative 3: Excavation of Drain Field Soils, Capping, Monitoring, Institutional Controls, Perimeter Fencing, Treatment at Contaminated Residential Wells

Capital Costs:	$17,712,000
Annual O&M Costs:	$538,000
Present Worth:	$15,856,000
Years to Implement:	5

All of the elements described in Alternative 2, with the exception of the revegetation of the existing landfill cover, would also be included in Alternative 3. Alternative 3 would not provide any action to remediate ground water but would provide physical containment of the source materials.

Capping of the source areas under this alternative would minimize the amount of precipitation that may infiltrate into waste materials and soils and mobilize constituents therein. Capping would also create a physical barrier that would prevent contact of ecological receptors with contaminated surface soils and seep sediments.

Prior to installation of the cap, approximately 400 cubic yards of mercury-contaminated surface soils would be tested and excavated from the abandoned septic system drain field. If the soils did not exhibit the characteristic of toxicity as defined in 40 C.F.R. § 261.24, they would be consolidated near the center of the landfill. If the soils did exhibit the toxicity characteristic, they would be disposed of at an off-site Resource Conservation and Recovery Act (RCRA) hazardous waste (Subtitle C) disposal facility. On-site handling of any such hazardous wastes would be in compliance with standards applicable to generators of hazardous waste (COMARs 10.51.03.01, .03, .04, .05 and .06 [1985], and COMARs 26.13.03.01, .03, .04, .05, .06 and .08) and transporters of hazardous waste (COMARs 10.51.04.01, .02, .03 and .04 [1985], and COMARs 26.13.04.01, .02, .03 and .04). The federal land disposal restrictions contained in 40 C.F.R. Part 268 would also apply to the off-site disposal of any soils found to exhibit the toxicity characteristic.

The currently-operating septic system drain field, located west of the Transfer Station, would be relocated in order to eliminate any flow of water from the septic system into areas where PVC sludge and other wastes were placed.

A cap would be placed over the landfill and identified cells of PVC sludge. It would consist, from the bottom up, of a prepared subbase, gas collection zone, low permeability layer, drainage layer, cover material, topsoil and a vegetative layer. The total area to be capped would be approximately 31 acres. The cap specifications would be consistent with the single-barrier cap requirements presented in the EPA Municipal Landfill Guidance and would meet or exceed the landfill closure cap requirements specified in COMARs 26.04.07.21 B and E.

Predesign studies would be conducted in order to delineate the boundaries of the fill material, including the boundaries of PVC sludge disposal Cells A and B/C. The actual areal extent of the cap will be based on the data gathered during the RI and predesign studies and will be determined by EPA, in consultation with MDE, during the design phase.

Both passive and active gas collection systems were evaluated as components of the cap in the FS. The primary function of a passive system is to provide a mechanism for the release of landfill gases to the atmosphere in order to minimize potentially dangerous conditions due to gas buildup beneath the cap. An active gas collection system would prevent the buildup of gases beneath the cap and control emissions of landfill gases to the atmosphere. Additional studies would be performed prior to the design of the cap in order to determine landfill gas constituents and the rate of emissions. Based on the results of these studies, EPA, in consultation with MDE, would determine during the design phase whether an active gas collection system is required in order to comply with the substantive portions of State requirements governing air quality (COMARs 26.11.06.02, .03, .06, .08 and .09; COMAR 26.11.15; and COMAR 26.11.19.02 G) or in order to protect human health, welfare, or the environment.

The cost figures above reflect estimates for installation of a passive gas collection system. The capital cost of an active gas collection and treatment system would be approximately $1.6 million, about $800,000 more than the cost of the passive system. The annual O&M costs associated with the active collection system would be approximately $850,000, assuming the gas would be thermally treated in flarestacks.

The low permeability layer of the cap would consist of two feet of clay with a permeability less than or equal to 1×10^{-7} centimeters per second (cm/sec) or a synthetic liner that is equally protective, as determined by EPA, in consultation with MDE, during the remedial design. For cost-estimating purposes, the low permeability layer was assumed to consist of two feet of clay with a permeability of 1×10^{-7} cm/sec.

A drainage layer would be constructed immediately above the low permeability layer to collect water that percolates through the soil cover. The drainage layer would consist of natural materials (e.g., sand with a permeability equal to or greater than 10^{-2} cm/sec) or a synthetic, high permeability geonet "sandwiched" between layers of filter fabric which would inhibit the migration of fine soil particles into the flow area of the geonet. This highly permeable layer would divert percolated water away from the clay layer to a network of slotted or perforated collection pipes. The pipes would, in turn, convey the percolated water to drainage ditches along the edges of the cap.

An 18-inch-thick layer of cover material would be installed above the drainage layer. Six inches of topsoil would be placed on the surface of the cover material. A vegetative layer would be established on the completed cap.

Alternative 4: Excavation of Drain Field Soils, Capping, Ground Water Extraction and Treatment, Monitoring, Institutional Controls, Perimeter Fencing, Wellhead Treatment at Contaminated Residential Wells

Capital Costs:	$20,997,000
Annual O&M Costs:	$1,609,000
Present Worth:	$23,826,000
Years to Implement:	6

The monitoring program, institutional controls and perimeter fencing described for Alternative 2 and the soil excavation and cap described for Alternative 3 would also be included in Alternative 4. In addition, Alternative 4 would provide remediation of contaminated ground water.

An estimated 40 extraction wells would be installed in the area of Cell B/C and around the perimeter of the landfill in order to effectively capture the plume and to withdraw ground water until the concentrations of contaminants remaining in the ground water no longer exceed the ground water cleanup levels. The extracted ground water would be treated on-site to reduce contaminant levels to concentrations that are protective of surface water quality, and would be discharged to the stream at the southern end of the landfill property.

The approximate locations of the ground water extraction wells are shown in Figure 4. The well configuration shown in Figure 4 is preliminary and may be further refined during remedial design. The estimated peak flow rate of the ground water recovery system would be 200 gallons per minute. The actual flow rate of extracted ground water would be expected to decrease significantly with time.

It is expected that the concentration of vinyl chloride in ground water would decrease to the 1 $\mu g/L$ cleanup level within the area of attainment after 12 years of operation of the ground water recovery system. However, ground water extraction and treatment would continue until the ground water cleanup levels were achieved for all contaminants identified in Tables 9 and 10, including semivolatile organic compounds and metals. As noted in

Tables 9 and 10, EPA will take background levels of arsenic and manganese into account in determining whether the ground water remedial objectives have been achieved. EPA, in consultation with MDE, will determine background levels of arsenic and manganese at the Site during the remedial design, based on the results of a predesign study.

Extracted ground water would be treated on-site in a three-step process. The first step would entail precipitation and flocculation/coagulation to remove manganese and other inorganic contaminants. A treatability study would be performed before final design of the treatment system in order to optimize conditions for removal of metals. In the second step, the filtered effluent from the precipitation unit would be piped to an air stripper column for removal of VOCs. Finally, the ground water discharged from the air stripper would be passed through granular activated carbon to remove semivolatile organic compounds and any remaining contaminants. The treated ground water would then be discharged to the stream that crosses the southern end of the Site. Discharge limitations would be developed based on State water quality standards (COMARs 26.08.02.03-.03-3), federal ambient water quality criteria established pursuant to Section 304 of the Clean Water Act, 33 U.S.C. § 1314, which apply to the protection of aquatic life, MCLs and non-zero MCLGs. The discharge would also comply with substantive portions of State and Clean Water Act requirements pertaining to point source discharges to surface water, including discharge limitations (Section 402 of the Clean Water Act, 33 U.S.C. § 1342; COMARs 26.08.03.01 and .07), standards for best management practices (40 C.F.R. Part 125, Subpart K), and test procedures (40 C.F.R. Part 136).

Potential impacts to human health from the air stripper which would be used to treat contaminated ground water were evaluated in the FS. The maximum predicted air emission rate of vinyl chloride from the air stripper was estimated to be 4.5×10^{-3} pounds per hour (5.7×10^{-4} grams per second [g/sec]). However, the emission rate is expected to decline as ground water remediation progresses. Based on current projections regarding the progressive reduction in the vinyl chloride concentration over time, an average annual vinyl chloride emission rate of 6.2 pounds per year (8.9×10^{-5} g/sec) was predicted. Using the methods prescribed in *Screening Methods for the Development of Air Toxics Emission Factors* (EPA-450/4-91-021, September 1991) and preliminary information regarding the location of the proposed air stripper, and assuming a vinyl chloride air emission rate of 8.9×10^{-5} g/sec, a maximum hourly vinyl chloride concentration of 0.27 $\mu g/m^3$ was projected in the ambient air at the location of the nearest residential receptor.

The estimated excess lifetime cancer risk for a child exposed to this level of vinyl chloride in ambient air over a 12-year period (the estimated time frame for attainment of the ground water cleanup levels for vinyl chloride) is 5.8 X 10^{-7}. This incremental cancer risk estimate does not exceed the 1 X 10^{-6} lower limit of EPA's target risk range. However, the estimate does not include incremental risk associated with exposure to emissions of VOCs other than vinyl chloride. In addition, the assumptions used to calculate this risk may not remain valid if conditions at the Site or design considerations change prior to remedy design and implementation. Therefore, air emission and dispersion modeling and a long-term exposure evaluation would be performed during the predesign phase in order to better define potential risk to human health resulting from exposure to VOC emissions from the air stripper.

Emission controls would be provided if EPA, in consultation with MDE, determined that emissions from the air stripper stack could result in an excess lifetime cancer risk greater than 1.0 X 10^{-6} for exposed individuals. Air emission controls would also be provided if necessary to comply with State regulations pertaining to toxic air pollutants (COMAR 26.11.15), federal air emission standards for process vents (40 C.F.R. Part 264, Subpart AA), or State requirements pertaining to emission of VOCs (COMAR 26.11.06.06). The EPA guidance document, *Control of Air Emissions from Superfund Air Strippers at Superfund Groundwater Sites* (OSWER Directive 9355.0-28, June 15, 1989), would also be considered in determining the need for air emission controls. The costs for evaluating potential human health impacts from exposure to air emissions from the stripper column and for providing emission controls were not included in the cost figures listed above for this alternative.

The treatment of ground water under Alternative 4 may result in the generation of residual wastes. Any residual wastes would be evaluated in accordance with the hazardous waste identification requirements of 40 C.F.R. § 261.24, COMARs 10.51.02.10, .11 and .12 (1985), and COMARs 26.13.02.11, .12 and .13. On-site handling of any residual wastes found to exhibit a characteristic of a hazardous waste would comply with standards applicable to generators of hazardous waste (COMARs 10.51.03.01, .03, .04, .05 and .06 [1985], and COMARs 26.13.03.01, .03, .04, .05, .06 and .08) and transporters of hazardous waste (COMARs 10.51.04.01, .02, .03 and .04 [1985], and COMARs 26.13.04.01, .02, .03 and .04). The federal land disposal restrictions contained in 40 C.F.R. Part 268 would also apply to any off-site disposal of residual wastes found to exhibit a characteristic of a hazardous waste.

Some uncertainty exists as to whether ground water collection will significantly reduce the concentrations of contaminants in ground water. Increased flow velocities caused by pumping may not allow enough time for contaminants in ground water and soil in the saturated zone to reach equilibrium. The desorption of contaminants from the aquifer soils may be the rate-limiting step in contaminant removal from the aquifer. In order to overcome this potential problem, pulsed pumping may have to be employed to promote equilibration between contaminants in soils and ground water so that contaminants may be more effectively removed from the aquifer. Aquifer tests would need to be performed during remedial design, and possibly during the remedial action, in order to optimize recovery of contaminants with a pulsed pumping system. The pumping rates and other operational considerations associated with the ground water collection system would be determined by EPA, in consultation with MDE, during the remedial design phase.

Alternative 5: Excavation of Drain Field Soils, Excavation and On-site Low Temperature Thermal Treatment of PVC Sludge, Capping, Ground Water Extraction and Treatment, Monitoring, Institutional Controls, Perimeter Fencing, Wellhead Treatment at Contaminated Residential Wells

Capital Costs:	$35,372,000
Annual O&M Costs:	$1,609,000
Present Worth:	$30,902,000
Years to Implement:	7

All elements of Alternative 4 would also be included in Alternative 5. Alternative 5 would provide institutional controls, perimeter fencing, ground water extraction and treatment, monitoring, soil excavation, and a cap over the landfill and PVC sludge disposal cells. In addition, approximately 36,000 cubic yards of PVC sludge and contaminated soils would be excavated from Cell B/C and Cell A (if found) and treated on-site using low temperature thermal desorption.

The sludge treatment process would comply with federal standards for air emissions from process vents (40 C.F.R. Part 264, Subpart AA) and the requirements for thermal treatment of hazardous waste (40 C.F.R. Part 264, Subpart X, and 40 C.F.R. Part 265, Subpart P). Samples of the treated material would be analyzed to ensure attainment of cleanup levels. The treated sludge would be backfilled into the excavated cell area if the material did not exhibit any of the characteristics of hazardous waste as defined in 40 C.F.R. § 261.24, COMARs 10.51.02.10, .11 and .12 (1985), and COMARs 26.13.02.11, .12 and .13.

The total time required for treatment of the waste is estimated at one-and-a-half to two years. Construction of the 31-acre cap and installation of certain recovery wells would not begin until the sludge treatment had been completed.

A preliminary treatability study was performed during the FS in order to investigate the feasibility of treating the PVC sludge wastes using low temperature thermal desorption. Tests were run over a range of temperatures extending from 125 to 700 degrees Celsius. The test results indicated the formation and persistence of chlorinated "daughter" products and other thermal degradation products at certain temperatures. Further pilot-testing would be required prior to implementation of this alternative in order to optimize the design of the thermal treatment unit.

The cost figures listed above do not include pilot-testing or the treatment of Cell A wastes. It was not possible to determine the volume of material in Cell A because no PVC sludge was found during the RI in the area thought to be occupied by Cell A.

Alternative 6: Excavation of Drain Field Soils, Excavation and Off-site Disposal of PVC Sludge, Capping, Ground Water Extraction and Treatment, Monitoring, Institutional Controls, Perimeter Fencing, Wellhead Treatment at Contaminated Residential Wells

Capital Costs:	$41,253,000
Annual O&M Costs:	$1,609,000
Present Worth:	$37,135,000
Years to Implement:	7

All elements of Alternative 4 would also be included in Alternative 6. Alternative 6 would provide institutional controls, perimeter fencing, ground water extraction and treatment, monitoring, and a cap over the landfill and PVC sludge disposal cells. In addition, approximately 36,000 cubic yards of PVC sludge and contaminated soils would be excavated from Cell B/C and Cell A, if it is found, and transported to an off-site landfill for disposal.

An industrial waste landfill was identified in York, Pennsylvania, approximately 80 miles from Cecil County. The cost estimate for this alternative is based on disposal of the PVC sludge and contaminated soils at that landfill.

Testing conducted during the RI/FS indicates that the PVC sludge in Cell B/C does not exhibit the characteristics of hazardous waste as defined in 40 C.F.R. Part 261, Subpart C, and that this material may be accepted by a RCRA industrial waste (Subtitle D) landfill. However, the receiving facility may require additional testing to verify the ability of the disposal facility to accept the sludge and contaminated soils. In the event that future analyses of excavated PVC sludge and contaminated soils indicates that any portion of the material exhibits any characteristic of hazardous waste as defined in 40 C.F.R. § 261.24, COMARs 10.51.02.10, .11 and .12 (1985), and COMARs 26.13.02.11, .12 and .13, that portion of the material would have to be treated on-site or disposed of at an off-site RCRA hazardous waste (Subtitle C) facility. On-site handling of any such hazardous wastes would be in compliance with standards applicable to generators of hazardous waste (COMARs 10.51.03.01, .03, .04, .05 and .06 [1985], and COMARs 26.13.03.01, .03, .04, .05, .06 and .08) and transporters of hazardous waste (COMARs 10.51.04.01, .02, .03 and .04 [1985], and COMARs 26.13.04.01, .02, .03 and .04). The federal land disposal restrictions contained in 40 C.F.R. Part 268 would also apply to the off-site disposal of any soils found to exhibit the toxicity characteristic.

Costs for on-site treatment of the PVC sludge, or disposal of the PVC sludge at a RCRA hazardous waste (Subtitle C) facility, were not included in the cost figures listed above for this alternative. In addition, since sludge disposal Cell A could not be found during the RI, costs for excavation and off-site disposal of Cell A wastes were not included in the cost figures.

9.0 SUMMARY OF COMPARATIVE ANALYSIS OF ALTERNATIVES

The six remedial action alternatives described above were compared against the nine evaluation criteria set forth in the NCP, 40 C.F.R. § 300.430(e)(9). These nine evaluation criteria can be categorized into three groups: threshold criteria, primary balancing criteria, and modifying criteria. The criteria associated with each category are as follows:

THRESHOLD CRITERIA

- Overall protection of human health and the environment
- Compliance with applicable or relevant and appropriate requirements (ARARs)

PRIMARY BALANCING CRITERIA

- Long-term effectiveness
- Reduction of toxicity, mobility, or volume through treatment
- Short-term effectiveness
- Implementability
- Cost

MODIFYING CRITERIA

- Community acceptance
- Support agency acceptance

These evaluation criteria relate directly to requirements in Section 121 of CERCLA, 42 U.S.C. § 9621, which determine the overall feasibility and acceptability of the remedy. Threshold criteria must be satisfied in order for a remedy to be eligible for selection. Primary balancing criteria are used to weigh major trade-offs between remedies. Support agency and community acceptance are modifying criteria which are taken into account after public comment is received on the Proposed Plan.

The following discussion evaluates the six remedial alternatives developed for the Woodlawn Landfill Site against the nine criteria set forth in the NCP.

9.1 Overall Protection of Human Health and the Environment

A primary requirement of CERCLA is that the selected remedial action be protective of human health and the environment. A remedy is protective if it reduces current and potential risks associated with each exposure pathway at a Site to acceptable levels.

Alternative 1 (No Action) contains no provisions for preventing exposure to contamination, and is not protective of human health and the environment. Although Alternative 2 includes measures for preventing human exposure to unacceptable levels of Site contaminants, Alternative 2 does not include capping, and would not prevent exposure of ecological receptors to mercury-contaminated soils and contaminated seep sediments. Therefore, Alternative 2 would not be considered protective of the environment. Since Alternatives 1 and 2 do not satisfy the threshold criterion of protectiveness, they will not be considered further in this analysis.

Alternatives 3 through 6 would provide adequate protection of human health by preventing exposure to contaminated ground water through provision of an alternate water supply or point-of-entry treatment and institution of ground water use restrictions. Alternatives 3 through 6 would also inhibit migration of contaminants into ground water through capping, which would reduce the amount of precipitation that may infiltrate and mobilize contaminants in the wastes, and prevent exposure of ecological receptors to mercury-contaminated soils and contaminated seep sediments.

Alternatives 3 through 6 call for monitoring of the stream that crosses the Site, which would identify conditions that warrant additional actions to protect aquatic life and comply with ARARs. Alternatives 4 through 6 offer advantages over Alternative 3, however, because they provide for active treatment of ground water, which would minimize migration of contaminants and diminish loading of contaminants to the stream.

Following the completion of the remedial action, the residual risks for each of Alternatives 4, 5 and 6 would be the same because each of these alternatives would achieve the same ground water cleanup levels and prevent exposure to contaminated soils and sediments.

9.2 <u>Compliance with ARARs</u>

This criterion addresses whether a remedy will meet all of the applicable or relevant and appropriate requirements (ARARs) of federal and state environmental laws and/or will provide grounds for invoking a waiver.

The Maximum Contaminant Levels (MCLs) and non-zero Maximum Contaminant Level Goals (MCLGs) for public drinking water supplies established under the Safe Drinking Water Act, 42 U.S.C. §§ 300f <u>et</u> <u>seq</u>., are considered to be relevant and appropriate standards for ground water cleanup under the Superfund program. The concentrations of several contaminants in ground water underlying the landfill property exceed MCLs. Since Alternative 3 would do nothing to reduce the concentration of these contaminants, it would not result in compliance with this ARAR. Therefore, it will not be considered further in this analysis.

Under Alternatives 4, 5 and 6, ground water would be extracted and treated. These alternatives would ultimately comply with MCLs and non-zero MCLGs for inorganic and organic chemicals (40 C.F.R. §§ 141.11-.12, 141.50-.51, and 141.61-.62). Health Effects Assessments and U.S. EPA Health Advisories were considered in establishing ground water cleanup levels for the Site, and would be considered in evaluating the protectiveness of Alternatives 4 through 6.

The treatment of ground water in Alternatives 4 through 6 would result in VOC emissions from an air stripper to ambient air. Air emission controls may be necessary in order to meet State and federal requirements for air emissions from air strippers. These requirements include State regulations pertaining to toxic air pollutants, including the regulations that establish standards for hazardous air pollutants (COMAR 26.11.15), federal air emission standards for process vents (40 C.F.R. Part 264, Subpart AA), and State requirements pertaining to emissions of VOCs (COMAR 26.11.06.06). The EPA guidance document entitled *Control of Air Emissions from Superfund Air Strippers at Superfund Groundwater Sites* (OSWER Directive 9355.0-28, June 15, 1989) would be considered in assessing the need for controlling air emissions from the air stripper.

The treatment of ground water in Alternatives 4 through 6 may also result in the generation of residual wastes. Any residual wastes would be evaluated in accordance with the hazardous waste identification requirements of 40 C.F.R. § 261.24, COMARs 10.51.02.10, .11 and .12 (1985), and COMARs 26.13.02.11, .12 and .13. On-site handling of any residual wastes found to exhibit a characteristic of a hazardous waste would comply with standards applicable to generators of hazardous waste (COMARs 10.51.03.01, .03, .04, .05 and .06 [1985], and COMARs 26.13.03.01, .03, .04, .05, .06 and .08) and transporters of hazardous waste (COMARs

10.51.04.01, .02, .03 and .04 [1985], and COMARs 26.13.04.01, .02, .03 and .04). The federal land disposal restrictions contained in 40 C.F.R. Part 268 would also apply to any off-site disposal of residual wastes found to exhibit a characteristic of a hazardous waste.

Alternatives 4, 5 and 6 each entail on-site discharge of treated ground water to the stream that crosses the southern end of the Site. Although the stream is not currently used as a public water supply, its potential for use as a public water supply is protected under State regulations. State environmental regulations also require the protection of aquatic life in the stream. Therefore, the discharge of treated ground water in each of these alternatives would result in in-stream compliance with the MCLs and non-zero MCLGs listed above, State water quality standards (COMARs 26.08.02.03-.03-3), and federal ambient water quality criteria established pursuant to Section 304 of the Clean Water Act, 33 U.S.C. § 1314, which apply to the protection of aquatic life.

In accordance with CERCLA § 121(e), no federal, state or local permit is required for the portion of any remedial action conducted entirely on-site. However, Alternatives 4, 5 and 6 would comply with the substantive portions of State and Clean Water Act requirements pertaining to point source discharges to surface water (Section 402 of the Clean Water Act, 33 U.S.C. § 1342), including discharge limitations (COMARs 26.08.03.01 and .07), standards for best management practices (40 C.F.R. Part 125, Subpart K) and test procedures (40 C.F.R. Part 136).

Alternatives 5 and 6 require the excavation and placement of waste material from the PVC sludge disposal cells and would comply with federal and State hazardous waste identification requirements (40 C.F.R. § 261.24, COMARs 10.51.02.10, .11 and .12 [1985], and COMARs 26.13.02.11, .12 and .13). Alternative 5 provides for on-site treatment of the wastes by low temperature thermal desorption. Alternative 6 provides for off-site disposal of the wastes. On-site handling of any Cell B/C or Cell A wastes or treated residuals found to exhibit any characteristic of a hazardous waste would comply with standards applicable to generators of hazardous waste (COMARs 10.51.03.01, .03, .04, .05 and .06 [1985], and COMARs 26.13.03.01, .03, .04, .05, .06 and .08) and transporters of hazardous waste (COMARs 10.51.04.01, .02, .03 and .04 [1985], and COMARs 26.13.04.01, .02, .03 and .04). The federal land disposal restrictions contained in 40 C.F.R. Part 268 would also apply to any off-site disposal of Cell B/C or Cell A wastes or treated residuals found to exhibit a characteristic of a hazardous waste.

Any on-site storage of hazardous wastes in Alternatives 5 and 6 would comply with COMAR 10.51.05.09 (1985) and COMAR 26.13.05.09, which regulate containers, COMAR 10.51.05.10 (1985) and COMAR

26.13.05.10, which regulate tanks, COMAR 10.51.05.11 (1985) and COMAR 26.13.05.11, which regulate surface impoundments, COMAR 10.51.05.12 (1985) and COMAR 26.13.05.12, which regulate waste piles, and COMAR 10.51.05.07 (1985) and COMAR 26.13.05.07, which regulate the closure and post-closure care of the storage units. The alternatives would comply with the substantive requirements of 40 C.F.R. Part 264, Subpart F, for detecting, characterizing and responding to releases from solid waste management units.

On-site treatment of Cell B/C wastes in Alternative 5 would comply with federal standards for air emissions from process vents (40 C.F.R. Part 264, Subpart AA) and the requirements for thermal treatment of hazardous waste (40 C.F.R. Part 264, Subpart X, and 40 C.F.R. Part 265, Subpart P).

Alternatives 4, 5 and 6 each call for construction of a landfill cap and post-closure monitoring and maintenance in compliance with appropriate State landfill closure regulations (COMARs 26.04.07.21 A, B, D and E and COMAR 26.04.07.22 A, B and C). COMAR 26.04.07.21 E establishes minimum design requirements for municipal landfill closure caps which have been found, through modeling, not to be adequate for this Site. Therefore, the single-barrier cap specifications presented in the EPA Municipal Landfill Guidance were taken into consideration in developing alternatives for the FS and would be considered in evaluating the protectiveness of the cap design. Landfill gas emissions would be controlled, if determined by EPA, in consultation with MDE, to be necessary in order to comply with the substantive portions of State requirements governing air quality (COMARs 26.11.06.02, .03, .06, .08 and .09, COMAR 26.11.15 and COMAR 26.11.19.02 G).

Alternatives 4, 5 and 6 would also comply with the substantive requirements of the following federal and State environmental laws: State requirements associated with well construction and abandonment (COMAR 26.04.04), erosion and sediment control (COMARs 26.09.01.01, .07 B and .08 A), stormwater management (COMAR 26.09.02) and noise pollution control (COMARs 26.02.03.02 A(2) and B(2) and COMAR 26.02.03.03 A); federal and State regulations for the protection of wetlands (Executive Order 119900 and COMAR 08.05.04); and federal regulations for the protection of endangered species (16 U.S.C. § 1531; 50 C.F.R. Part 402) and historical sites (16 U.S.C. § 469 and 16 U.S.C. §§ 470 et seq.).

In summary, Alternatives 4, 5 and 6 would comply with all ARARs associated with drinking water (MCLs and non-zero MCLGs), surface water (State water quality standards, federal water quality criteria, and federal and State requirements pertaining to point source discharges) and air (State regulations pertaining to hazardous air pollutants and air quality and federal air emission standards for process vents). Alternatives 4 through 6 would also comply with State landfill closure and well construction and abandonment requirements, and all ARARs pertaining to hazardous waste management (federal and State hazardous waste identification requirements, federal land disposal restrictions, and State requirements pertaining to generators and transporters of hazardous waste). In addition, Alternatives 4 through 6 would comply with federal and State regulations pertaining to sensitive environments and natural and historic resources. Alternatives 5 and 6 would further comply with federal and State requirements associated with storage of hazardous waste. In addition, Alternative 5 would comply with federal requirements for thermal treatment of hazardous waste.

9.3 Long-Term Effectiveness and Permanence

Alternatives 4, 5 and 6 would reduce risks to acceptable levels for the ground water pathway since the ground water extraction and treatment system would permanently remove the contaminants of concern from the aquifer which underlies the Site. Therefore, Alternatives 4 through 6 satisfy the requirements for long term effectiveness and permanence with regard to ground water. Ground water use restrictions affecting properties near the landfill could be eliminated once the ground water cleanup levels were achieved for each of these alternatives.

Alternative 4 provides containment of landfill wastes and wastes in PVC sludge disposal Cells A and B/C through capping. Capping is a proven technology; a properly-maintained cap would provide long-term isolation of source materials and risk reduction when implemented together with a ground water recovery and treatment system.

Alternative 5 provides for the treatment of PVC sludge disposal cell wastes by low temperature thermal desorption. This technology has the potential to provide a permanent reduction in the concentration of contaminants that are available for leaching. However, additional pilot-testing of the low temperature thermal desorption process would be required to ensure that the technology is compatible with the PVC sludge and would meet the cleanup level for vinyl chloride without generating new chemicals in the waste material that may pose unacceptable levels of risk.

Alternative 6 provides off-site disposal of Cell B/C wastes and would permanently eliminate one of the sources of ground water contamination at the Site.

Treatment and off-site disposal of the PVC sludge wastes (Alternatives 5 and 6) would not provide significant advantages over capping alone (Alternative 4) with respect to the activities required to maintain effectiveness of the remedy over time. Each of these alternatives would require long-term maintenance of the landfill cap, monitoring networks and deed restrictions.

9.4 Reduction of Toxicity, Mobility, or Volume Through Treatment

Alternatives 4, 5 and 6 would reduce the toxicity and volume of contaminated ground water at the Site with equal effectiveness. Although VOCs in ground water would ultimately be transferred to the ambient air, controls for reducing the level of air emissions to the atmosphere would be implemented if they were determined to be necessary by EPA, in consultation with MDE. In addition, the precipitation, flocculation/coagulation, and carbon adsorption components of the ground water treatment process would produce contaminated sludges and materials which would have to be disposed of off-site.

Alternatives 4, 5 and 6 would each provide in-place containment of landfill wastes and consolidation and containment of mercury-contaminated soils. Alternative 4 provides in-place containment of Cell B/C wastes and does not reduce the toxicity or volume of these wastes. However, the cap would decrease the mobility of contaminants by reducing the amount of water that may infiltrate the wastes and cause certain constituents to leach into ground water.

Alternative 5 provides for treatment of Cell B/C wastes using low temperature thermal desorption. If the low temperature thermal treatment process can be designed and regulated to provide removal of VOCs without generation of toxic by-products, Alternative 5 would provide a long-term reduction in the toxicity, mobility and mass of contaminants at the Site.

Alternative 6 entails off-site landfill disposal of Cell B/C waste materials and would not result in any overall reduction of toxicity or volume of hazardous substances.

9.5 Short-term Effectiveness

Alternatives 4 through 6 would effectively manage risk during the construction and implementation phases by employing controls (i.e., ground water monitoring, deed and ground water use restrictions, and alternate water supply or point-of-entry treatment) until the time that cleanup levels are achieved, thereby preventing exposure to contaminated ground water in residential wells.

Implementation of each of these alternatives would present a potential for exposure of workers to Site contaminants during cap construction activities, installation of ground water monitoring and extraction wells, construction and operation of the ground water treatment system, and sampling activities. In addition, workers would be exposed to normal construction hazards. However, these risks could be reduced by following proper health and safety practices for well drilling, sampling and construction.

Alternatives 4 through 6 also entail emissions of VOCs from the air stripper to ambient air. However, these emissions may be effectively controlled with air emission control equipment in order to prevent unacceptable levels of exposure.

Alternatives 5 and 6 would pose an additional short-term risk to workers and neighboring populations as a result of the generation of dust and VOCs during the excavation and transportation of Cell B/C wastes. There is also the potential for exposure to hazardous vapors in the event of a malfunction of the thermal desorption unit. These additional risks can be reduced through the implementation of an air monitoring program, emission controls, the continuous monitoring of the thermal treatment system, and the incorporation of automatic shut-off features.

9.6 Implementability

Construction of the fence, the landfill cap and the ground water collection and treatment systems would be easily accomplished using conventional methods and materials for each of Alternatives 4 through 6. The ground water treatment technologies that would be implemented under Alternatives 4 through 6 have been successfully demonstrated in full-scale operations for the contaminants of concern. However, treatability studies would be necessary before remedy design in order to optimize the treatment processes and ensure that discharge of treated ground water to surface water would comply with the substantive requirements of the National Pollutant Discharge Elimination System program under Section 402 of the Clean Water Act, 33 U.S.C. § 1342, and would not result in an in-stream exceedance of MCLs, non-zero MCLGs, State water quality standards, or federal ambient water quality criteria for the protection of aquatic life.

Alternatives 5 and 6 would be more difficult to implement than Alternative 4. Both of these alternatives involve substantial excavation of waste which would require additional controls in order to minimize VOC exposure to workers. Low temperature thermal desorption has been included in Alternative 5 as a potentially feasible technology for treatment of PVC sludge wastes. However, pilot-testing would be required to confirm that a suitable temperature range exists in which the materials can be satisfactorily treated without creating hazardous PVC decomposition products. Additional monitoring and controls would also be required to protect against potential malfunction of the thermal desorption unit.

Implementation of Alternative 6 would depend upon acceptance of the PVC sludge wastes by an off-site disposal facility. Results of treatability testing conducted during the Feasibility Study indicate that the Cell B/C waste does not exhibit the toxicity characteristic of a hazardous waste and that the material may be accepted by a RCRA Subtitle D industrial waste landfill.

However, in the event that future analyses of excavated wastes indicate that any portion of the material exhibits any characteristic of hazardous waste as defined in 40 C.F.R. Part 261, Subpart C, that portion of the material would have to be treated on-site or transported to an off-site RCRA Subtitle C (hazardous waste) disposal facility. This situation would result in delays in implementation and additional costs.

The remaining components of Alternatives 4 through 6 would not present any major implementation difficulties. Ground water, stream and landfill gas monitoring would be performed using widely practiced techniques. Point-of-entry treatment systems have been shown to be effective in removing the types of contaminants associated with this Site. Residential well replacement, if necessary, would be conducted in accordance with State regulations. Cooperation from property owners would be necessary for well installation, maintenance and sampling. Ground water use restrictions are currently in effect in the area of the Site and mechanisms exist within the State and County governments for enforcement and modification of ground water use restrictions as necessary to ensure protection of public health. Ground water use restrictions would continue to be reviewed and revised as additional Site data becomes available. Future use of the landfill property can be effectively controlled through the use of deed restrictions.

9.7 Cost

The present worth of the selected alternative (Alternative 4) is estimated at $23,826,000. Alternative 4 is less costly than Alternatives 5 and 6 but provides the same degree of risk reduction as those alternatives.

9.8 State Acceptance

MDE has not provided a letter to EPA that indicates whether or not the State concurs with the selected remedy. However, MDE has expressed concern that: (1) several of the ground water cleanup levels set forth in the Proposed Plan for the Site are more stringent than the MCLs established under the Safe Drinking Water Act, 42 U.S.C. §§ 300f *et seq.*; and (2) the costs for implementation of the selected remedy may exceed the cost estimate presented in the Proposed Plan.

9.9 Community Acceptance

Local residents expressed no opposition to most of the elements of the selected remedy. However, several residents have voiced their dissatisfaction with the ground water use restrictions which have been in effect at the Site since 1987 and which would continue to be implemented until the ground water cleanup levels have been achieved. The PRPs submitted comments regarding the landfill cap and the ground water cleanup levels identified in the Proposed Plan for the Site. Comments received during the public comment period concerning the Administrative Record and the various alternatives are summarized in the Responsiveness Summary which is a part of this ROD.

10.0 SELECTED REMEDY: DESCRIPTION AND PERFORMANCE STANDARDS

Following review and consideration of the information in the Administrative Record file, the requirements of CERCLA and the NCP, and public comment, EPA has selected Alternative 4 (Capping, Ground Water Extraction and Treatment, Monitoring, Institutional Controls and Fencing) as the remedy for this Site. Alternative 4 meets the threshold criteria of overall protection of human health and the environment and compliance with ARARs, and provides the best balance of long-term effectiveness and permanence, reduction of toxicity, mobility or volume of contaminants through treatment, short-term effectiveness, implementability and cost.

The selected remedy consists of the following major components:

- Excavation and disposal of soils from the former drain field of the Transfer Station septic system
- Relocation of the current drain field of the Transfer Station septic system
- Capping of the landfill and identifiable cells of PVC sludge
- Ground water extraction
- On-site treatment of extracted ground water and discharge to the on-site stream
- Ground water, stream and landfill gas monitoring
- Provision of an alternate water supply, if necessary
- Deed and ground water use restrictions
- Perimeter fencing

Each component of the remedy and mandatory performance standards are described below.

A. Excavation and Disposal of Soils from the Former Drain Field of the Transfer Station Septic System

An estimated 400 cubic yards of mercury-contaminated soils shall be excavated from the former drain field of the Transfer Station septic system. Soil samples shall be collected and analyzed for mercury prior to excavation in order to determine the exact area and volume of soils requiring removal. The number and location of soil samples and the analytical method to be used shall be determined by EPA, in consultation with MDE. Soils requiring removal shall be subjected to the Toxicity Characteristic Leaching Procedure (TCLP) as described in 40 C.F.R Part 261, Appendix II, prior to excavation in order to determine whether those soils exhibit the characteristic of toxicity.

Performance Standards for the Excavation and Disposal of Soils from the Former Drain Field:

> All soils containing greater than 1 mg/kg of mercury shall be excavated from the former drain field. Excavated soils that are found not to exhibit the characteristic of toxicity as defined in 40 C.F.R. § 261.24 shall be disposed of near the center of the landfill prior to its closure. Excavated soils that are found to exhibit the toxicity characteristic shall be disposed of at a RCRA hazardous waste (Subtitle C) off-site disposal facility and shall be managed on-site in compliance with standards applicable to generators of hazardous waste (COMARs 10.51.03.01, .03, .04, .05 and .06 [1985], and COMARs 26.13.03.01, .03, .04, .05, .06 and .08) and transporters of hazardous waste (COMARs 10.51.04.01, .02, .03 and .04 [1985], and COMARs 26.13.04.01, .02, .03 and .04). The federal land disposal restrictions contained in 40 C.F.R. Part 268 shall also apply to the off-site disposal of any soils found to exhibit the toxicity characteristic.

B. Relocation of the Current Drain Field of the Transfer Station Septic System

Prior to installation of the cap on the landfill, the septic system drain field which is currently in use shall be relocated from the west side of the Transfer Station in order to prevent the discharge of liquids from the septic system into areas occupied by buried wastes.

C. Capping of the Landfill and Identifiable Cells of PVC Sludge

Predesign studies shall be conducted in order to more clearly delineate the boundaries of the fill material, including the boundaries of PVC sludge disposal Cells A and B/C. A cap consisting of a prepared subbase, gas collection zone, low permeability layer, drainage layer, cover material, topsoil and vegetative layer shall be placed over the landfill and identified cells of PVC sludge. A cap vegetation design and management plan that enhances habitat values for migratory birds shall be developed in consultation with the U.S. Fish and Wildlife Service. The cap will cover an estimated 31 acres. The approximate areal extent of the cap is shown in Figure 4. The actual areal extent of the cap will be determined by EPA, in consultation with MDE, during the design phase, based on data gathered during the RI and predesign studies.

Further studies shall be performed prior to the design of the cap in order to determine the landfill gas constituents and the emission rate. Cecil County, Maryland is located in an area designated as a "severe-15" ozone non-attainment area under the Clean Air Act. Therefore, if the landfill emits more than 25 tons per year of VOCs, reasonably available control technology (RACT), as defined in COMAR 26.11.19.02 G, shall be required in order to control landfill gas. EPA, in consultation with MDE, will determine during the remedial design phase whether an active gas collection system is required in order to comply with State regulations governing air quality or whether a passive gas collection system will be sufficient to meet those requirements.

An operation and maintenance plan shall be developed for the cap and submitted to EPA for approval during the remedial design phase. Inspection and maintenance of the cap shall continue for an estimated 30 years or such other time period that EPA, in consultation with MDE, determines to be necessary, based on the statutory reviews of the remedial action which shall be conducted no less often than every five years from initiation of the remedial action, in accordance with the EPA guidance document, *Structure and Components of Five-Year Reviews* (OSWER Directive 9355.7-02, May 23, 1991). Statutory reviews will be conducted as long as hazardous substances remain on-site and prevent unlimited use of, and unrestricted exposure at, the Site. If determined to be necessary by EPA, the operation and maintenance plan shall be revised after construction of the cap has been completed. The revised operation and maintenance plan shall be submitted to EPA for approval.

Performance Standards for the Cap:

1. The cap shall be designed and constructed to function with minimum maintenance, to promote drainage and minimize erosion of the cover and to accommodate settling so that the cover's integrity is maintained.

2. The cap shall be constructed in compliance with all location-specific ARARs, including the Archaeological and Historical Preservation Act of 1974, 16 U.S.C. § 469, the National Historic Preservation Act of 1986, 16 U.S.C. §§ 470 et seq., the Endangered Species Act (16 U.S.C. § 1531; 50 C.F.R. Part 402) and federal and State regulations for the protection of wetlands (Executive Order 119900 and COMAR 08.05.04).

3. The cap shall completely cover the landfill, PVC sludge

disposal Cell B/C, and Cell A, if Cell A is found during the predesign studies.

4. The cap shall consist of a prepared subbase, a gas collection zone, a low permeability layer, a drainage layer, cover material, topsoil and a vegetative layer in conformance with the single-barrier cap specifications presented in the EPA Municipal Landfill Guidance. The cap shall also meet the landfill closure cap requirements of COMARs 26.04.07.21 B and E.

5. The low permeability layer of the cap shall consist of 24 inches of clay with a permeability less than or equal to 1×10^{-7} centimeters per second (cm/sec), or a synthetic liner that is equally protective, as determined by EPA. The choice of materials for the low permeability layer shall be made by EPA, in consultation with MDE, during the remedial design.

6. An active gas collection system, utilizing RACT, shall be installed if EPA, in consultation with MDE, determines that such a system is necessary in order to comply with the substantive portions of State requirements governing air quality (COMARs 26.11.06.02, .03, .06, .08 and .09; COMAR 26.11.15; and COMAR 26.11.19.02 G). If EPA, in consultation with MDE, determines that an active gas collection system will not be necessary in order to comply with these ARARs, a passive gas collection system shall be installed. The requirements for the gas collection system will be determined by EPA, in consultation with MDE, during remedial design.

D. Ground Water Extraction

Ground water shall be extracted from the aquifer using a collection system of multiple recovery wells, the exact location and number of which will be determined by EPA, in consultation with MDE. At least one round of samples shall be collected from existing Site monitoring wells during the predesign phase and analyzed for volatile and semivolatile organic compounds, pesticides and metals, in order to determine the extent of the ground water contaminant plume at that time. Aquifer tests shall be performed during the predesign phase in order to define aquifer characteristics, if such tests are determined to be necessary by EPA, in consultation with MDE.

An operation and maintenance plan shall be developed for the ground water recovery system and submitted to EPA for approval during the remedial design phase. Operation and maintenance of the ground water recovery system shall continue for an estimated 30 years or such other time period as EPA, in consultation with

MDE, determines to be necessary, based on the statutory reviews of the remedial action which shall be conducted no less often than every five years from initiation of the remedial action in accordance with the EPA guidance document, *Structure and Components of Five-Year Reviews* (OSWER Directive 9355.7-02, May 23, 1991). Statutory reviews will be conducted as long as hazardous substances remain on-site and prevent unlimited use and unrestricted exposure at the Site. The operation and maintenance plan shall be revised after construction of the collection system has been completed, if it is determined to be necessary by EPA. The revised operation and maintenance plan shall be submitted to EPA for approval.

Performance Standards for Ground Water Extraction:

1. The number and location of recovery wells will be determined by EPA, in consultation with MDE, during the remedial design phase and shall be sufficient to control the migration of contaminants and to achieve the ground water cleanup levels listed in Tables 9 and 10 throughout the area of attainment. The area of attainment is defined as the area outside the boundary of any waste remaining in place up to and including the boundary of the contaminant plume.

2. Recovery wells shall be installed in accordance with State regulations governing well construction (COMAR 26.04.04).

3. The extraction of ground water shall reduce the levels of the contaminants of concern in the area of attainment to the ground water cleanup levels listed in Tables 9 and 10. The concentrations of contaminants in ground water beneath the area of any wastes left in place (waste management area) need not meet the ground water cleanup levels. However, the extraction of ground water shall reduce the contaminant concentrations in the ground water beneath the waste management area so that subsequent migration of contaminants from this area will not result in an exceedance of ground water cleanup levels within the area of attainment. The points at which compliance with the cleanup levels will be measured (points of compliance) shall include all well locations included in the monitoring program discussed below.

   If sampling confirms that cleanup levels have been achieved throughout the area of attainment at the points of compliance, and that the concentrations of the contaminants of concern remain at or below cleanup levels for 12 consecutive quarters, operation of the collection system can be suspended. If, subsequent to the collection system shutdown, semi-annual monitoring shows that the concentrations of contaminants of concern within the area of attainment exceed the cleanup levels, the collection system shall be restarted and ground water extraction shall continue until the cleanup levels have once more been attained for twelve consecutive quarters. Semi-annual monitoring shall continue until EPA, in consultation with MDE, determines that the contaminant concentrations have stabilized at or below the cleanup levels.

E. On-site Treatment of Extracted Ground Water and Discharge to the On-site Stream

Extracted ground water shall be treated on-site in a three-step process. The first step shall entail precipitation and flocculation/coagulation to remove manganese and other inorganic contaminants. In the second step, the filtered effluent from the precipitation unit shall be piped to an air stripper column for removal of VOCs. Finally, the ground water discharged from the air stripper shall be passed through granular activated carbon to remove semivolatile organic compounds and any remaining contaminants. The treated ground water shall then be discharged to the stream that crosses the southern end of the Site.

Predesign studies shall be performed in order to determine the conditions and procedures required to meet the performance standards and comply with the ARARs set forth below.

Air emission and dispersion modeling and a human health risk assessment shall be conducted during the predesign phase in order to evaluate the risks associated with exposure to emissions from the air stripper. The risk assessment shall be submitted to EPA for approval. EPA, in consultation with MDE, will determine the actual treatment conditions and emission control requirements for the air stripper based on the results of the predesign studies and the risk assessment.

The management and ultimate disposition of treatment residuals shall be determined during the predesign phase and is subject to EPA approval. Such management shall entail treatment and/or disposal.

An operation and maintenance plan shall be developed for the ground water treatment system and submitted to EPA for approval during the remedial design phase. Operation and maintenance of the ground water treatment system shall continue for an estimated 30 years or such other time period as EPA, in consultation with MDE, determines to be necessary, based on the statutory reviews of the remedial action which shall be conducted no less often than every five years from initiation of the remedial action in accordance with the EPA guidance document, *Structure and*

Components of Five-Year Reviews (OSWER Directive 9355.7-02, May 23, 1991). Statutory reviews will be conducted as long as hazardous substances remain on-site and prevent unlimited use and unrestricted exposure at the Site. The operation and maintenance plan shall be revised after construction of the treatment system has been completed, if is determined to be necessary by EPA. The revised operation and maintenance plan shall be submitted to EPA for approval.

The performance of the ground water recovery and treatment systems shall be carefully monitored on a regular basis. If EPA, in consultation with MDE, determines that alteration of the system is appropriate, based on performance data collected during operation, the system shall be modified. These modifications may include any or all of the following:

1. discontinuation of pumping at individual wells where cleanup levels have been attained;

2. alternating pumping at wells to eliminate stagnation points;

3. pulse pumping to allow adsorbed contaminants to partition into ground water and facilitate aquifer equilibration; and

4. installation of additional recovery wells to facilitate or accelerate cleanup of the contamination.

The Performance Standards for the On-site Treatment of Extracted Ground Water and Discharge to the On-Site Stream:

1. The collection, treatment and discharge facilities shall be constructed and sited in compliance with the requirements in the Archaeological and Historical Preservation Act of 1974, 16 U.S.C. § 469, the National Historic Preservation Act of 1986, 16 U.S.C. §§ 470 et seq., the Endangered Species Act (16 U.S.C. § 1531; 50 C.F.R. Part 402) and federal and State regulations for the protection of wetlands (Executive Order 119900 and COMAR 08.05.04).

2. The on-site treatment system shall reduce contaminant levels in the extracted ground water to concentrations that EPA, in consultation with MDE, has determined: (1) shall achieve compliance with State water quality standards (COMARs 26.08.02.03-.03-3) and federal ambient water quality criteria established for the protection of aquatic life pursuant to Section 304 of the Clean Water Act (33 U.S.C. § 1314); and (2) shall not result in an exceedance of MCLs (40 C.F.R. §§ 141.11-.12 and 141.61-.62) and non-zero MCLGs (40 C.F.R. §§ 141.50-.51) in the

receiving body of water.

3. Emissions from the air stripper shall not result in an excess lifetime cancer risk greater than 1 X 10^{-6} for exposed individuals. Air emission controls shall be installed if EPA, in consultation with MDE, determines that emissions from the air stripper stack could result in such excess lifetime cancer risk. Air stripper emissions shall also meet the substantive requirements of State regulations pertaining to toxic air pollutants (COMAR 26.11.15), federal air emission standards for process vents (40 C.F.R. Part 264, Subpart AA), and State regulations pertaining to emissions of VOCs (COMAR 26.11.06.06). The EPA guidance document, *Control of Air Emissions from Superfund Air Strippers at Superfund Groundwater Sites* (OSWER Directive 9355.0-28, June 15, 1989), shall also be considered in determining the need for air emission controls.

4. Residual wastes shall be evaluated in accordance with the hazardous waste identification requirements of 40 C.F.R. § 261.24, COMARs 10.51.02.10, .11 and .12 (1985), and COMARs 26.13.02.11, .12 and .13. On-site handling of any residual wastes found to exhibit a characteristic of a hazardous waste shall comply with standards applicable to generators of hazardous waste (COMARs 10.51.03.01, .03, .04, .05 and .06 [1985], and COMARs 26.13.03.01, .03, .04, .05, .06 and .08) and transporters of hazardous waste (COMARs 10.51.04.01, .02, .03 and .04 [1985], and COMARs 26.13.04.01, .02, .03 and .04). The federal land disposal restrictions contained in 40 C.F.R. Part 268 shall also apply to any off-site disposal of residual wastes found to exhibit a characteristic of a hazardous waste.

5. Discharge of treated ground water to the on-site stream shall comply with the substantive requirements of State and federal regulations pertaining to point source discharges to surface water, including discharge limitations (COMARs 26.08.03.01 and .07), standards for best management practices (40 C.F.R. Part 125, Subpart K) and test procedures (40 C.F.R. Part 136).

F. Ground Water Monitoring

A ground water monitoring program shall be implemented during the remediation phase in order to evaluate the effectiveness of the ground water collection and treatment system in meeting cleanup levels and to ensure protection of nearby residents. EPA, in consultation with MDE, will determine the number and location of new monitoring wells and the exact location of the existing monitoring wells and residential wells to be included in the ground water monitoring network during the remedial design phase. The frequency and duration of sampling and the analytical parameters and methods to be used will be determined by EPA, in consultation with MDE, during the remedial design phase.

Annual monitoring of select residential wells (interim monitoring) began in May 1993 and shall continue until the post-construction ground water monitoring program begins. If determined to be necessary by EPA, in consultation with MDE, the number and location of residential wells in the interim monitoring program, the frequency of monitoring, and/or the analytical parameters and methods to be used for interim monitoring activities shall be modified.

An operation and maintenance plan for implementation of the ground water monitoring program and maintenance of the ground water monitoring network shall be prepared and submitted to EPA for approval during the remedial design phase. Monitoring and maintenance shall continue for an estimated 30 years or such other time period as EPA, in consultation with MDE, determines to be necessary based on the statutory reviews of the remedial action which shall be conducted no less often than every five years from initiation of the remedial action in accordance with the EPA guidance document, *Structure and Components of Five-Year Reviews* (OSWER Directive 9355.7-02, May 23, 1991). Statutory reviews will be conducted as long as hazardous substances remain on-site and prevent unlimited use and unrestricted exposure at the Site.

Performance Standards for New Monitoring Wells:

New monitoring wells shall be installed in accordance with State requirements for well construction (COMAR 26.04.04).

G. Stream and Wetland Monitoring

An unnamed creek, which is a tributary of Basin Run, flows across the southern end of the Site. A post-construction stream and wetland monitoring program shall be implemented in order to: (1) evaluate Site impacts on the unnamed creek and potential Site impacts on a forested wetland area located along the creek approximately one mile downstream from Waibel Road; (2) identify any changes in conditions in the stream or forested wetland due to implementation of the selected remedy; and (3) assess the need for additional stream and wetland studies or additional remedial action.

Surface water and sediment samples shall be collected from upstream and downstream locations in the unnamed creek and from the palustrine forested wetland that is located along the unnamed creek, approximately one mile downstream from Waibel Road. The exact number and location of samples will be determined by EPA, in consultation with MDE, during the remedial design phase. These samples shall be analyzed for volatile and semivolatile organic compounds, pesticides and metals. In addition, surface water parameters such as temperature, dissolved oxygen, pH, conductivity and flow rate shall be measured at each sampling station. Surface water samples from each station shall also be analyzed for total suspended solids, alkalinity and hardness. Similarly, the temperature, oxidation-reduction potential (Eh), pH, conductivity and color (as determined by comparison with the Munsell Soil Color Charts) of sediments at each sample location shall be measured. Sediment samples from each sampling location shall also be analyzed for total organic carbon, grain size, percent moisture and percent solids. Biological monitoring of aquatic macroinvertebrates, in accordance with EPA's guidance document, *Rapid Bioassessment Protocol for Use in Streams and Rivers: Benthic Macroinvertebrates and Fish* (EPA/444/4-89-001, May 1989), shall be conducted twice a year for the first year of post-construction monitoring and once a year thereafter. EPA, in consultation with MDE, will determine the need for additional stream studies or further remedial action to address the quality of water in the unnamed creek based on the stream monitoring data and the following conditions and criteria: upgradient stream conditions, State water quality standards and federal ambient water quality criteria. EPA, in consultation with MDE, will determine the need for additional stream and wetland studies or further remedial action to address the quality of the sediments in the unnamed creek or the downstream wetland based on the stream and wetland monitoring data and the following conditions and criteria: upgradient stream conditions, Apparent Effects Thresholds (AETs) and NOAA Biological Effects Range - Low (ER-L).

In order to establish a baseline for the long-term stream monitoring program, before construction of the selected remedy begins, at least one round of samples shall be collected from upstream and downstream locations in the unnamed creek, including a station in the forested wetland that is located about one mile downstream of Waibel Road. These samples shall be analyzed for the chemical and physical parameters specified above. In addition, a macroinvertebrate survey shall be performed for upstream and downstream locations in the unnamed creek and the forested wetland, in accordance with the methods prescribed above. The stream sampling and macroinvertebrate survey shall be conducted in the late spring or early autumn. EPA, in consultation with MDE, will determine the specific number and location of pre-construction monitoring points during the remedial design phase.

H. Landfill Gas Monitoring

A network of soil-gas monitoring probes shall be installed around the perimeter of the landfill in order to evaluate the potential for off-site migration of landfill gas and to assess the need for further remedial action to prevent the migration of landfill gas toward residences near the Site. The number and location of soil-gas probes shall be determined by EPA, in consultation with MDE, during the remedial design phase. Samples shall be collected from the gas monitoring probes on a quarterly basis until EPA, in consultation with MDE, determines that the frequency of the monitoring should be changed or that landfill gas monitoring is no longer necessary. The soil-gas samples shall be analyzed for VOCs and methane. Additional remedial action shall be required to control off-site migration of landfill gas if EPA, in consultation with MDE, determines that it is necessary in order to protect human health, welfare, or the environment, or to comply with COMAR 26.04.07.21(5)(b), which specifies that the concentration of methane at the landfill property boundary may not exceed the lower explosive limit for methane in air, or 5.40 percent by volume.

I. Provision of an Alternate Water Supply, if Necessary

If EPA, in consultation with MDE, determines that any residential well is contaminated with Site-related contaminants at concentrations that exceed the ground water cleanup levels, an alternate water supply shall be provided at that residence. The alternate water supply shall consist of either wellhead treatment at the point of entry or installation of a new well in an uncontaminated area of the aquifer. The choice of alternate water supply will be made by EPA, in consultation with MDE. Wellhead treatment may include physical and/or chemical processes. The choice of the wellhead treatment unit or process will be made by EPA, in consultation with MDE, and will be based on the type and concentration of contaminant(s) detected. Wellhead treatment units shall be maintained according to manufacturer's specifications so that the contaminant concentrations in the water exiting the treatment system remain at or below ground water cleanup levels. An operation and maintenance plan for the wellhead treatment systems shall be submitted to EPA for approval.

The wellhead treatment systems may result in the production of residual treatment wastes. These wastes (e.g., spent carbon adsorption units or filtration media) shall be evaluated in accordance with the hazardous waste identification requirements of 40 C.F.R. § 261.24, COMARs 10.51.02.10, .11 and .12 (1985), and COMARs 26.13.02.11, .12 and .13. On-site handling of any residual wastes found to exhibit a characteristic of a hazardous waste shall comply with standards applicable to generators of hazardous waste (COMARs 10.51.03.01, .03, .04, .05 and .06 [1985], and COMARs 26.13.03.01, .03, .04, .05, .06 and .08) and transporters of hazardous waste (COMARs 10.51.04.01, .02, .03 and .04 [1985], and COMARs 26.13.04.01, .02, .03 and .04). The federal land disposal restrictions contained in 40 C.F.R. Part

268 shall also apply to any off-site disposal of residual wastes found to exhibit a characteristic of a hazardous waste.

Performance Standard for Alternate Water Supply:

1. A wellhead treatment system shall reduce the concentrations of the contaminants of concern in the residential well water to the ground water cleanup levels in Tables 9 and 10.

2. A replacement well shall be installed in an uncontaminated portion of the aquifer in order to provide a sufficient quantity of water which meets the ground water cleanup levels identified in Tables 9 and 10. Replacement wells shall be installed in accordance with State requirements for well construction (COMAR 26.04.04).

J. Deed Restriction

As soon as practicable, restrictions shall be placed on the deed to the Site (parcel 267) in order to prevent installation of drinking water wells on the property and any future uses of the property that could compromise the effectiveness of the selected remedy. The deed restrictions shall remain in effect until EPA, in consultation with MDE, determines that they are no longer required to protect human health and welfare and the environment.

K. Ground Water Use Restriction

MDE and the County currently restrict the use of ground water in the area of the Site through restrictions on the installation of new water supply wells. These restrictions on the installation of new water supply wells will continue to be reviewed and revised as additional Site data becomes available and will remain in effect until the ground water cleanup levels have been achieved throughout the area of attainment. Mechanisms exist within MDE and the Cecil County Health Department for the enforcement and modification of the ground water use restrictions.

Performance Standard for Ground Water Use Restrictions

The ground water use restriction zone shall encompass the landfill property (parcel 267), the area of attainment as defined in paragraph 10.D.1, above, and an appropriate buffer zone. The objectives of these restrictions is to limit the potential for exposure to contaminated ground water and to minimize the extent to which the contaminant plume could be extended as a result of additional ground water use.

L. Perimeter Fencing

A chain-link fence shall be constructed around the perimeter of the landfill property, excluding the Transfer Station building and rear loading area, in order to prevent unauthorized access to the Site. Plans for maintenance of the fence shall be submitted to EPA for approval during the remedial design phase.

Performance Standard for Perimeter Fencing

1. The chain-link fence shall have a minimum height of six feet and shall be equipped with locking gates.

2. The fence shall be maintained in a manner sufficient to prevent unauthorized access to the landfill until such time as EPA, in consultation with MDE, determines that access restrictions are no longer required.

M. Ecological Actions

The Site is located within the known range of the bog turtle (Clemmys muhlenbergi), which is a candidate for federal listing as a threatened species. A predesign investigation shall be conducted by a qualified herpetologist in order to determine whether or not bog turtles occur on the Site and, if they are present, ways to avoid or minimize disturbance of the turtles during remedial action. In addition, a habitat impact analysis which evaluates the potential impact of remedial activities on migratory bird and anadromous fish habitats shall be prepared during the predesign phase, in consultation with the U.S. Fish and Wildlife Service, and submitted to EPA for approval. If determined to be necessary by EPA, in consultation with MDE, detailed habitat restoration and replacement plans shall be developed for EPA approval during the remedial design phase and implemented in order to rectify any unavoidable adverse effects of remedial activities on the U.S. Department of the Interior trust resource habitats.

11.0 GROUND WATER REMEDY IMPLEMENTATION

This remedial action shall restore ground water to its beneficial use, which at this Site includes its use as a drinking water source. It may become apparent during implementation or operation of the remedy that contaminant levels have ceased to decline and are remaining constant at levels higher than the ground water cleanup levels over some portion of the area of attainment. If EPA, in consultation with MDE, determines that implementation of the selected remedy demonstrates, with corroborating hydrogeologic and chemical evidence, that it will be technically impracticable to achieve and maintain the cleanup levels throughout the entire area of ground water contamination, EPA may require that any or all of the following measures be taken, for an indefinite period of time, as further modifications of the in-place system:

1. long-term gradient control may be provided by low level pumping, as a containment measure;

2. cleanup levels may be modified and chemical-specific ARARs may be waived for those portions of the aquifer for which EPA, in consultation with MDE, determines that it is technically impracticable to achieve further contaminant reduction;

3. institutional controls may be modified or maintained to restrict access to those portions of the aquifer where contaminants remain above cleanup levels; and

4. remedial technologies for ground water restoration may be reevaluated.

The decision to invoke any or all of these measures may be made by EPA, in consultation with MDE. If necessary, EPA will issue an Explanation of Significant Differences or a ROD amendment.

12.0 STATUTORY DETERMINATIONS

EPA's primary responsibility at Superfund sites is to undertake remedial actions that are protective of human health and the environment. In addition, Section 121 of CERCLA, 42 U.S.C. § 9621, establishes several other statutory requirements and preferences. These requirements specify that when complete, the selected remedial action for each site must comply with applicable or relevant and appropriate environmental standards established under federal and state environmental laws (ARARs) unless a statutory waiver is invoked. The selected remedy also must be cost effective and utilize treatment technologies or resource recovery technologies to the maximum extent practicable. Finally, the statute includes a preference for remedies that permanently and significantly reduce the volume, toxicity or mobility of hazardous substances. The following sections discuss how the selected remedy for this Site meets these statutory requirements.

12.1 Protection of Human Health and the Environment

The selected remedy protects human health and the environment by controlling exposure to contaminated ground water, soils and seep sediments and by reducing contaminant loading to ground water and local surface water.

Capping and ground water collection and treatment will prevent further migration of contamination from the Site and effectively reduce contaminant levels in the aquifer. Consequently, these measures will reduce the potential for exposure to contaminated ground water and the potential for Site contaminants to enter the unnamed creek. Ground water monitoring will provide data for evaluating the effectiveness of the remedial action and will ensure that any unacceptable levels of contaminants in residential wells will be detected and addressed prior to and during the remediation phase. If necessary, wellhead treatment will reduce contaminant levels to acceptable ground water cleanup levels or well replacement will provide water from an uncontaminated portion of the aquifer, thereby reducing or eliminating exposure. Ground water use restrictions will prevent future exposure to contaminated ground water by limiting the future installation of wells in the contaminated aquifer until ground water cleanup levels have been achieved. Once the cleanup levels have been achieved, the carcinogenic risk associated with exposure to ground water shall be within EPA's target risk range of 1×10^{-6} to 1×10^{-4} and there will be no significant potential for adverse noncarcinogenic health effects as a result of exposure to ground water (i.e, the hazard index shall be less than or equal to one).

Stream monitoring and landfill gas monitoring will provide a basis for additional remedial action, if it is determined to be necessary by EPA, in consultation with MDE, in order to mitigate Site impacts on the stream and prevent off-site migration of landfill gas. Deed restrictions will prohibit on-site activities that could compromise the effectiveness of the remedy or result in unacceptable levels of exposure to Site contaminants.

Air emissions from the air stripping unit will be reduced to acceptable risk-based levels by the installation of emission controls, if they are determined to be necessary by EPA, in consultation with MDE. Treated ground water which is discharged to the unnamed creek will meet all appropriate water quality standards in order to prevent any adverse environmental effects. Through monitoring, institutional controls and treatment, this remedy will be protective of human health and the environment during and upon completion of the remedial action.

12.2 Compliance with Applicable or Relevant and Appropriate Requirements

The selected remedy shall attain all action-, location- and chemical-specific applicable or relevant and appropriate requirements for the Site which are listed in Table 11. Also included in the table are criteria, advisories or guidance "to be considered" (TBCs) for implementation of this remedy.

12.3 Cost-Effectiveness

The selected remedy, Alternative 4, is cost-effective in that it mitigates the risks posed by the contaminants associated with the

Site, meets all other requirements of CERCLA, and affords overall effectiveness proportionate to the cost. The estimated present worth cost for the selected remedy is $23,826,000. The costs associated with the alternatives that did not include ground water extraction and treatment, Alternatives 2 and 3, are comparatively lower ($4,436,000 and $15,856,000, respectively) than the costs of the selected remedy, but those alternatives would not achieve all of the remedial action objectives. The costs associated with Alternatives 5 and 6 are comparatively higher ($30,902,000 and $37,135,000, respectively).

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

The selected remedy for the Site utilizes permanent solutions and treatment technologies to the maximum extent practicable. Although Alternative 5 includes low temperature thermal desorption of the volatile constituents of Cell B/C wastes and would provide some additional level of treatment, it provides no additional risk reduction as compared with the selected remedy since both of these alternatives would attain the same ground water cleanup levels and prevent exposure to contaminated soils and sediments. In addition, Alternative 5 is more costly and would require the same level of maintenance activities as the selected remedy, as well as institutional controls.

12.5 Preference for Treatment as a Principal Element

The selected remedy uses treatment as a principal element to address the threats posed by contaminants in the ground water at the Site. Wastes buried at the site and contaminated soils pose a relatively low long-term threat and shall be managed with a combination of engineering and institutional controls.

13.0 DOCUMENTATION OF SIGNIFICANT CHANGES

The following changes have been made since the Proposed Plan was issued on May 26, 1993:

1. The Proposed Plan presented specific and unique ground water cleanup levels for each of 20 contaminants. Based on comments received during the public comment period, EPA has modified the cleanup levels for six of the ground water contaminants. The final ground water cleanup levels take into account background concentrations of arsenic and manganese and provide flexibility in meeting the ground water cleanup levels for those chemicals that may result in noncarcinogenic adverse health effects in exposed populations.

2. At least one monitoring station shall be sited in the palustrine forested wetland that is located along the

unnamed creek approximately one mile downstream of Waibel Road.

3. A predesign study shall be conducted in order to determine if the bog turtle (Clemmys muhlenbergi) occurs at the Site. If the turtle is found to occur at the Site, remedial activities shall be conducted in such a way as to avoid or minimize disturbance of the turtle.

4. A habitat impact analysis which evaluates the potential impact of remedial activities on migratory bird and anadromous fish habitats shall be prepared during the predesign phase. Detailed habitat restoration and replacement plans shall be developed and implemented, if they are determined to be necessary by EPA.

List of References

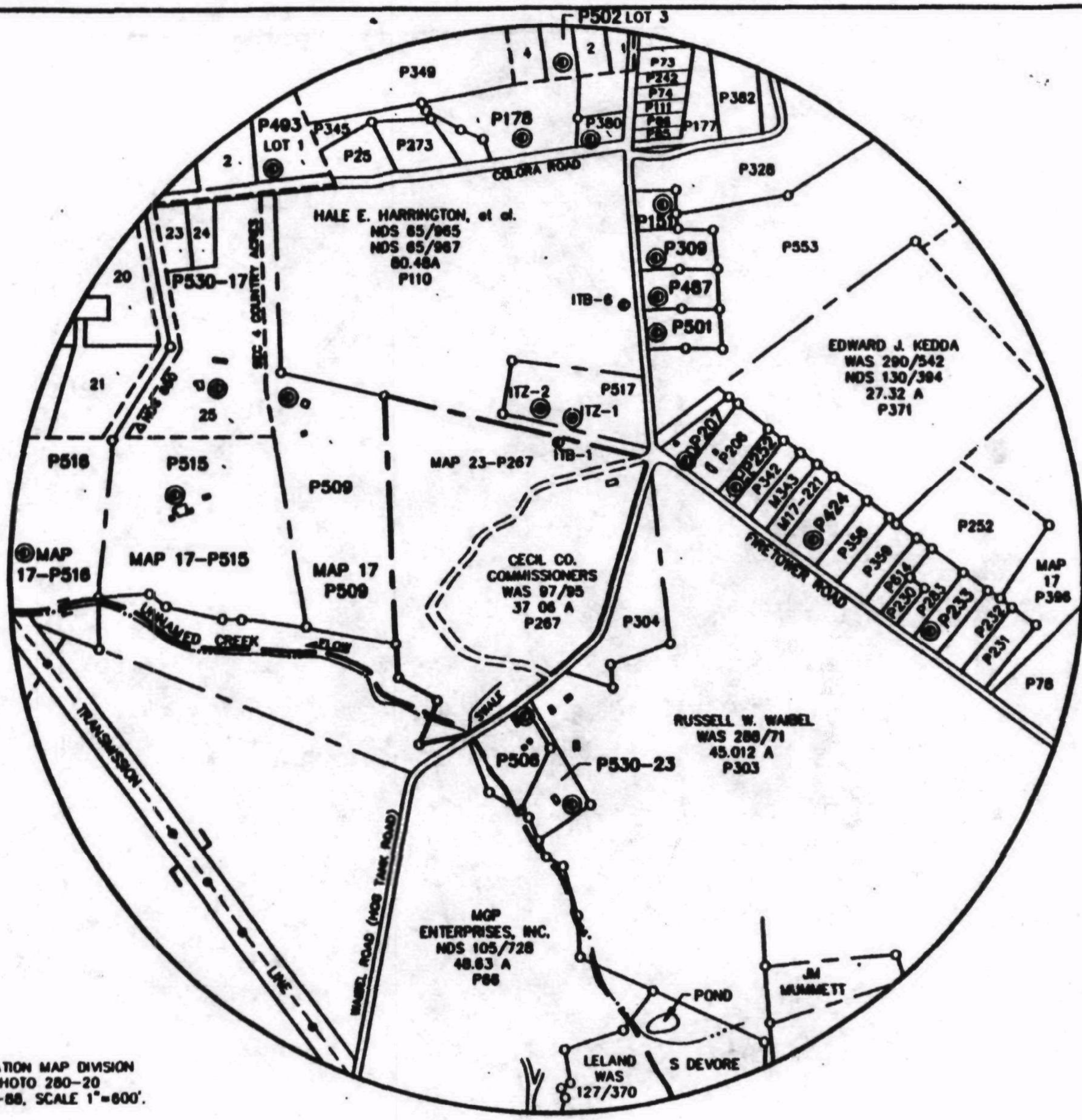
Foster, S.A. and P.C. Chrostowski, 1986, "Integrated Household Exposure Model for Use of Tap Water Contaminated with Volatile Organic Chemicals," presented at the 79th Annual Meeting of the Air Pollution Control Association, Minneapolis, Minnesota, June 22-27, 1986.

Hannah, S.R., G.A. Briggs, and R.P. Hosku, Jr., 1982, *Handbook on Atmospheric Diffusion*, Atmospheric Turbulence and Diffusion Laboratory, NOAA.

Summers, K.S., S. Cherini and C. Chen, Tetra Tech, Inc., 1980, "Methodology to Report the Potential for Groundwater Contamination from Geothermal Fluid Releases," EPA/600/7-80/117.

Turner, D.B., 1970, *Workbook of Atmospheric Dispersion Estimates*, Air Resources Field Research Office, Environmental Science Services Administration, U.S. EPA Office of Air Programs, Research Triangle Park, North Carolina.

U.S. EPA, 1984, *Rapid Assessment of Exposure to Particulate Emissions for Surface Contaminant Sites*, Office of Health and Environmental Assessment, U.S. Environmental Protection Agency, Contract No. 68-03-3116.



LEGEND:

- P309 — DOMESTIC BEDROCK WELL
- ITB-1 — BEDROCK WELL INSTALLED BY IT CORPORATION
- ITZ-1 — SOIL PIEZOMETER INSTALLED BY IT CORPORATION

NOTE:

1. PARCEL NUMBERS (e.g. P309) IN BOLD FACE ARE CROSS-REFERENCED TO CURRENT HOMEOWNER NAMES IN TABLE 6 OF APPENDIX D.
2. MONITORING WELL ITB-6 INSTALLED DURING PHASE IV WORK.
3. DOMESTIC WELL P-506, LISTED AS A BEDROCK WELL, MAY NOT ACTUALLY EXTEND INTO THE BEDROCK.

SCALE

0 600 1200 FEET

FIGURE 1

LOCATION OF DOMESTIC WELLS

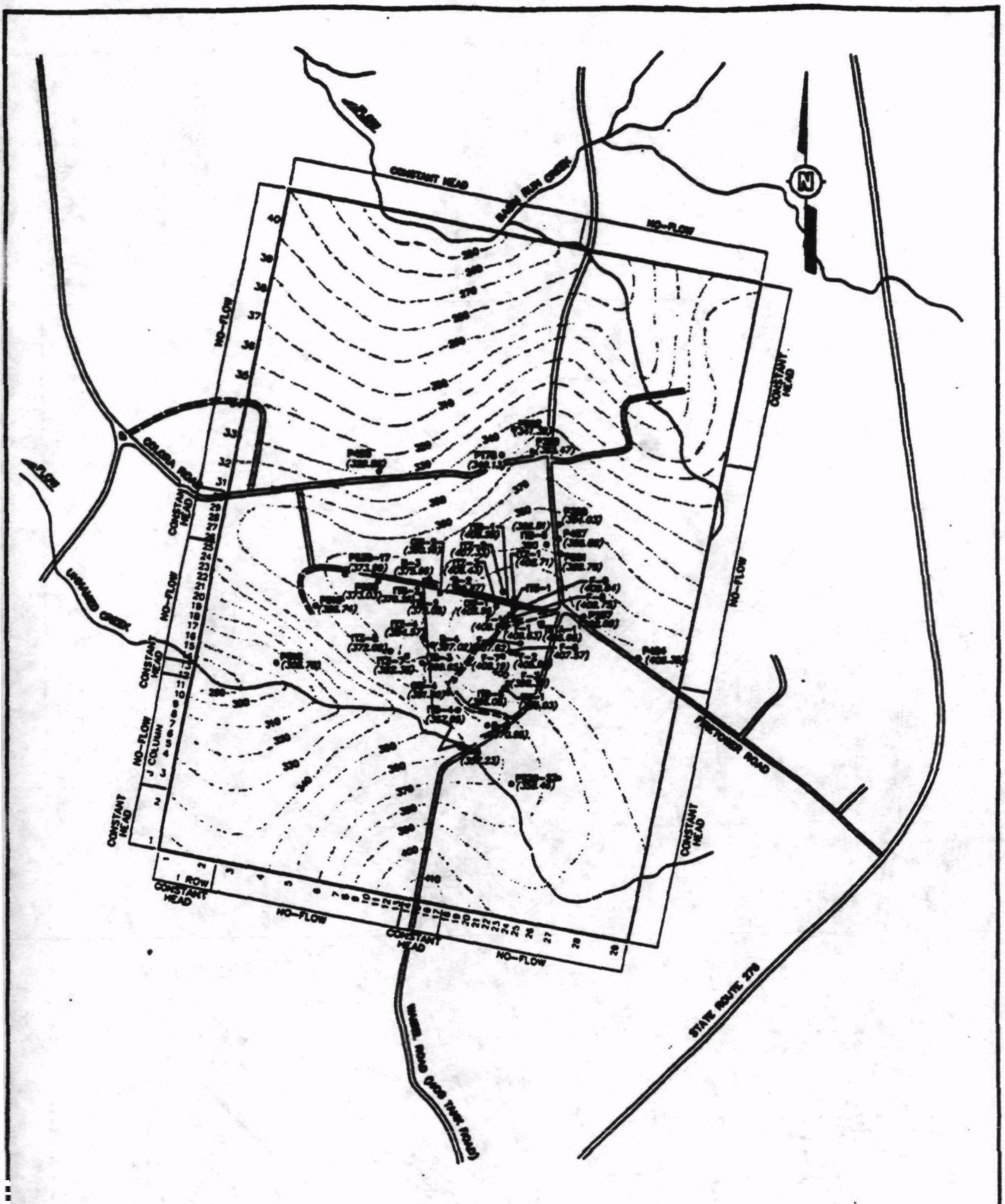
PREPARED FOR

WOODLAWN LANDFILL RI/FS
RI REPORT

INTERNATIONAL TECHNOLOGY CORPORATION

REFERENCE:

DEPT OF ASSESSMENTS & TAXATION MAP DIVISION
QUADRANGLE RISING SUN 53, PHOTO 280-20
MAP NOS 17 & 23 DATED 5-1-88, SCALE 1"=600'.



LEGEND:

- WELL NAME AND LOCATION GROUNDWATER ELEVATION (MEASURED 2/26-28/91)
- GROUNDWATER CONTOURS (FEET MSL) INFERRED WHERE DASHED
- ANOMALOUS DATA POINT
- NO-FLOW — GROUNDWATER MODEL BOUNDARY CONDITION

SCALE

0 1000 2000 FEET

REFERENCE:

U.S.G.S. 7.5 MINUTE TOPOGRAPHIC MAP
RISING SUN QUADRANGLE, MARYLAND-PENNSYLVANIA
PHOTOREVISED 1985, SCALE: 1"=2000'

NOTE:

1. PARCEL NUMBERS (e.g. P309) ARE CROSS-REFERENCED TO CURRENT HOMEOWNER NAMES IN TABLE 6.
2. BOUNDARY CONDITION IS NO-FLOW IF NOT SPECIFIED.

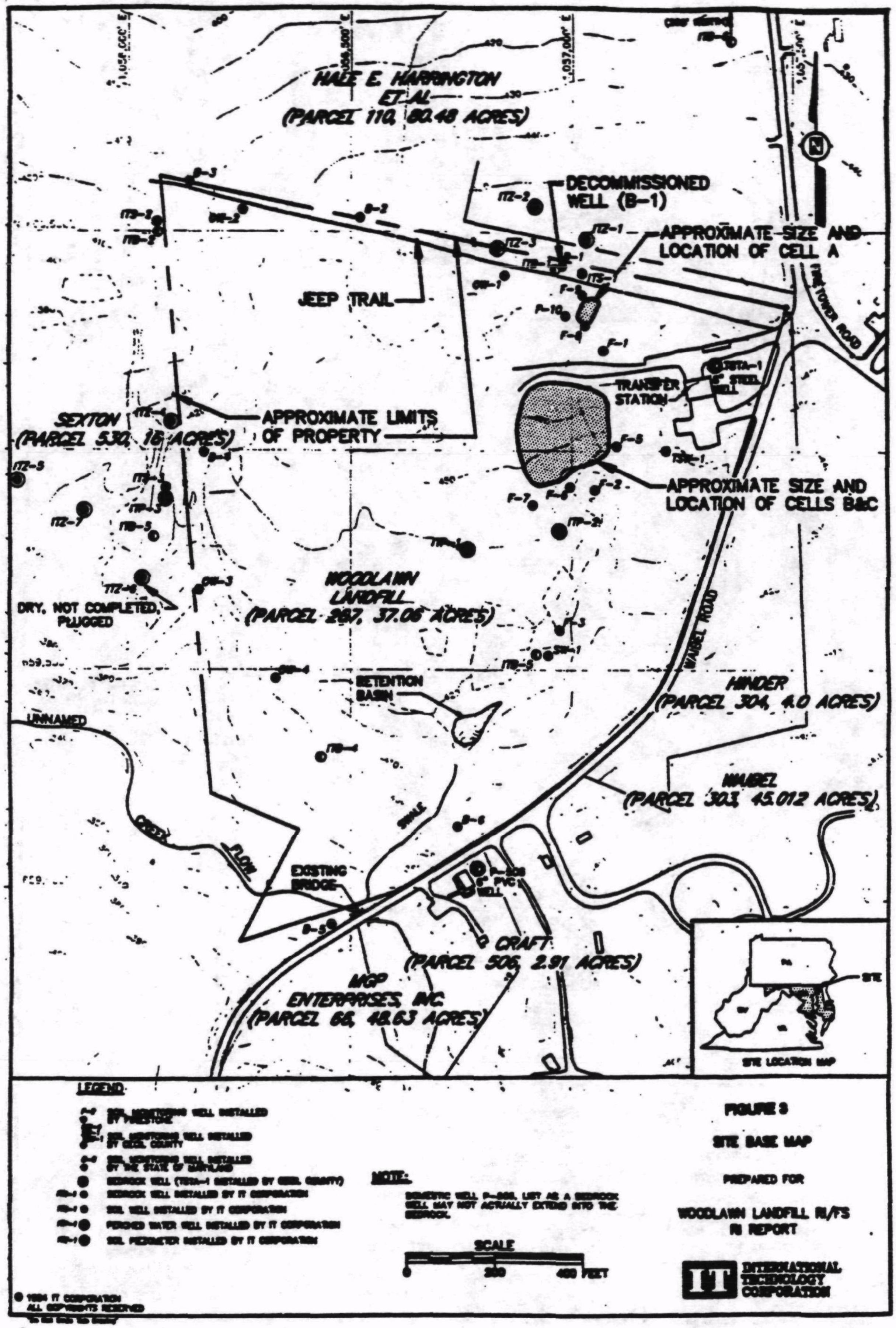
FIGURE 2

GROUNDWATER ELEVATIONS
REGIONAL AQUIFER

PREPARED FOR

WOODLAWN LANDFILL RI/FS
PHASE III

INTERNATIONAL TECHNOLOGY CORPORATION


HALE E. HARRINGTON
ET AL
(PARCEL 110, 80.48 ACRES)
DECOMMISSIONED
WELL (B-1)
APPROXIMATE SIZE AND
LOCATION OF CELL A
JEEP TRAIL
FIRE TOWER ROAD
TRANSFER
STATION
SEXTON
(PARCEL 530, 16 ACRES)
APPROXIMATE LIMITS
OF PROPERTY
APPROXIMATE SIZE AND
LOCATION OF CELLS B&C
DRY, NOT COMPLETED,
PLUGGED
WOODLAWN
LANDFILL
(PARCEL 287, 37.06 ACRES)
RETENTION
BASIN
WAIBEL ROAD
HINDER
(PARCEL 304, 4.0 ACRES)
UNNAMED
CREEK
FLOW
SWALE
WAIBEL
(PARCEL 303, 45.012 ACRES)
EXISTING
BRIDGE
PVC
WELL
CRAFT
(PARCEL 506, 2.91 ACRES)
MGP
ENTERPRISES, INC.
(PARCEL 66, 48.63 ACRES)
SITE
SITE LOCATION MAP
LEGEND
BEDROCK WELL INSTALLED BY IT CORPORATION
SOIL WELL INSTALLED BY IT CORPORATION
PERCHED WATER WELL INSTALLED BY IT CORPORATION
SOIL PIEZOMETER INSTALLED BY IT CORPORATION
NOTE:
DOMESTIC WELL P-808, LIST AS A BEDROCK WELL MAY NOT ACTUALLY EXTEND INTO THE BEDROCK.
SCALE
0
200
400 FEET
FIGURE 3
SITE BASE MAP
PREPARED FOR
WOODLAWN LANDFILL RI/FS
RI REPORT
INTERNATIONAL
TECHNOLOGY
CORPORATION
© 1994 IT CORPORATION
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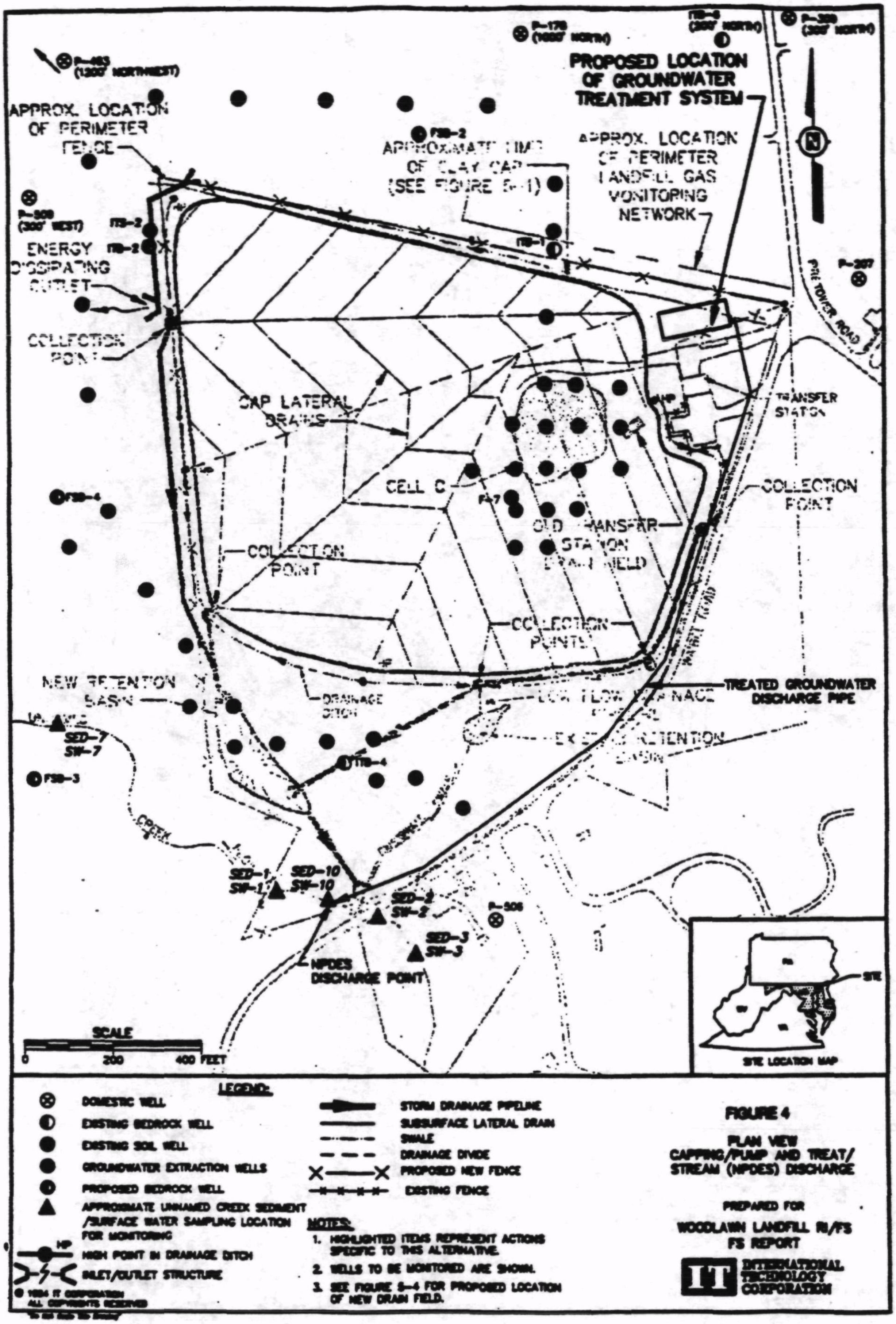

FIGURE 4
PLAN VIEW
CAPPING/PUMP AND TREAT/
STREAM (NPDES) DISCHARGE

Table 1

Constituents Detected in Site Ground Water Wells[a]
Woodlawn Landfill, Cecil County, Maryland

(Page 1 of 4)

Constituent	Range of Concentrations[b]	Frequency of Occurrence	95% Upper Bound Concentration[c]
Volatiles (μg/L)			
Acetone	ND10-600	4/15	115
Benzene	ND5-4	9/15	2.56
2-Butanone	ND10-63	3/15	15.8
Chlorobenzene	ND5-23	4/15	8.93
Chloroethane	ND10-3	3/15	4.98[d]
1,1-Dichloroethane	ND5-7	4/15	3.17
1,2-Dichloroethane	ND5-410	1/15	77.5
1,2-Dichloroethene	ND5-3	1/15	2.59
Ethylbenzene	ND5-4	3/15	2.91
Methylene chloride	ND5-38	5/15	10.4
Tetrachloroethene	ND5-8	2/15	3.44
Toluene	ND5-12	5/15	5.00
Trichloroethene	ND5-60	3/15	13.1
Vinyl chloride	ND0.18-520	14/18	126
Xylenes (total)	ND5-13	5/15	5.53
Semivolatiles (μg/L)			
Benzoic acid	ND50-100	6/48	29.4
Diethylphthalate	ND10-24	11/48	6.70
Di-n-butylphthalate	ND10-4	22/48	4.14[d]
Bis(2-ethylhexyl)phthalate	ND10-140	19/48	18.1
Di-n-octylphthalate	ND10-2	1/48	5.04[d]
Pentachlorophenol	ND50-7	1/48	25.2[d]

See footnotes at end of table.

Table 1

Constituent	Range of Concentrations[b]	Frequency of Occurrence	95% Upper Bound Concentration[c]
Fluoranthene	ND10-3	2/48	5.02[d]
Pyrene	ND10-5	4/48	4.99
Butylbenzylphthalate	ND10-2	1/48	5.04[d]
Benzo(a)anthracene	ND10-6	5/48	5.02
Chrysene	ND10-5	5/48	4.99
Benzo(b)fluoranthene	ND10-5	4/48	5.01[d]
Benzo(k)fluoranthene	ND10-6	2/48	5.05
Benzo(a)pyrene	ND10-5	2/48	5.00
1,3-Dichlorobenzene	ND10-4	1/48	5.01[d]
1,4-Dichlorobenzene	ND10-4	7/48	4.87[d]
Naphthalene	ND10-2	1/48	5.04[d]
Dimethylphthalate	ND10-1	1/48	5.05[d]
Phenanthrene	ND10-10	1/48	5.27
1,2-Dichlorobenzene	ND10-7	1/39	5.13
2-Methylnaphthalene	ND10-3	1/39	5.03[d]
Acenaphthene	ND10-19	1/39	5.96
Dibenzofuran	ND10-15	1/39	5.68
Fluorene	ND10-25	1/39	6.37
Anthracene	ND10-4	1/39	5.01[d]
Carbazole	19	1/1	19[d]
Pesticides (μg/L)			
Alpha-BHC	ND0.05-0.19	7/39	0.044
Endosulfan I	ND0.05-1.7	3/39	0.15
Heptachlor	ND0.05-0.082	2/39	0.029
Gamma BHC (Lindane)	ND0.05-0.02	1/39	0.025[d]
Gamma Chlordane	ND0.5-0.028	1/39	0.25[d]

See footnotes at end of table.

Table 1
(Page 3 of 4)

Constituent	Range of Concentrations[b]	Frequency of Occurrence	95% Upper Bound Concentration[c]
Aldrin	ND0.05-0.18	1/39	0.035
Endrin Ketone	ND0.1-0.024	1/39	0.050[d]
Metals (mg/L)			
Aluminum	ND0.2-1.84	10/15	0.414
Arsenic	ND0.01-0.008	3/15	0.0056
Barium	ND0.1-0.214	14/15	0.104
Cadmium	ND0.005-0.119	5/15	0.024
Chromium	ND0.01-0.0169	7/15	0.010
Cobalt	ND0.05-0.0512	9/15	0.030
Copper	ND0.025-0.0043	3/15	0.012[d]
Iron	ND0.05-43.5	14/15	17.0
Lead	ND0.003-0.278	3/15	0.053
Magnesium	0.929-34.8	15/15	15.7
Manganese	0.112-24.2	15/15	8.76
Mercury	ND0.0002-0.0026	4/15	0.00091
Nickel	ND0.04-0.0152	7/15	0.0179[d]
Silver	ND0.01-0.0097	5/15	0.00602
Vanadium	ND0.05-0.0202	8/15	0.0203[d]
Zinc	ND0.02-0.0994	10/15	0.0396

[a]On-site ground water monitoring wells used for purposes of the Risk Assessment include ITB-1, ITB-2, ITB-3, ITB-5, ITS-1, F-2, F-3, F-5 through F-10, B-2 through B-4, OW-1, OW-2, SW-1, and TSW-1 for semivolatile and pesticide compounds; and ITB-5, F-2, F-3, F-5 through F-7, SW-1 and TSW-1 for volatile and metal constituents.

[b]ND = Not detected at concentration shown. In some instances, constituents were detected at trace concentrations below the detection limit. As a result, some of the maximum range values are below the detection limit.

[c]The concentration of the 95 percentile upper bound of the mean calculated using one-half of nondetect values. In instances where the upper bound value was greater

than the maximum concentration, the maximum concentration was used in the Risk Assessment.

[d]Maximum observed concentration was used in the Risk Assessment for potential exposure to this compound.

Table 2
Constituents Detected in Off-site Residential Ground Water Wells[a]
Woodlawn Landfill, Cecil County, Maryland
(Page 1 of 2)

Constituent	Range of Concentrations[b]	Frequency of Occurrence	95% Upper Bound Concentration[c]
Volatiles (μg/L)			
Acetone	ND10-10	3/21	7.60
Xylenes (total)	ND5-1	1/21	3.34[d]
Vinyl chloride	ND0.12-0.6	5/22	0.17
Semivolatiles (μg/L)			
Bis(2-ethylhexyl)phthalate	ND10-5	1/20	6.93[d]
Di-n-butylphthalate	ND10-3	4/20	6.14[d]
Diethylphthalate	ND10-5	2/20	6.86[d]
Metals (mg/L)			
Aluminum	ND0.2-0.051	14/20	0.0655[d]
Arsenic	ND0.01-0.002	1/20	0.0067[d]
Barium	0.0046-0.0596	20/20	0.0268
Beryllium	ND0.005-0.0022	1/20	0.00344[d]
Cadmium	ND0.005-0.0034	1/20	0.00352[d]
Chromium	ND0.01-0.0072	10/20	0.00754[d]
Cobalt	ND0.05-0.0154	4/20	0.0296[d]
Copper	ND0.025-0.255	19/20	0.0875
Iron	ND0.1-6.075	11/20	0.801[d]
Lead	ND0.003-0.0518	13/20	0.00684
Magnesium	0.412-6.12	20/20	4.26
Manganese	ND0.015-3.015	18/20	0.313

See footnotes at end of table.

Table 2
(Page 2 of 2)

Constituent	Range of Concentrations[b]	Frequency of Occurrence	95% Upper Bound Concentration[c]
Nickel	ND0.04-0.0124	2/20	0.0263[d]
Silver	ND0.01-0.0032	2/20	0.00668[d]
Vanadium	ND0.05-0.0154	17/20	0.00976
Zinc	ND0.02-0.0613	16/20	0.0270

[a] Off-site residential ground water monitoring wells include those on parcels 309, 487, 151, 530-17, 380, 233, 509, 506, 252, 530-23, 516, and 501.

[b] ND = Not detected at the concentration shown. In some instances constituents were detected at trace concentrations below the detection limit. As a result, some of the maximum range values are below the detection limit.

[c] The concentration of the 95 percentile upper bound of the mean calculated using one-half of nondetect values. In instance where the upper bound value was greater than the maximum concentration, the maximum concentration was used in the Risk Assessment.

[d] Maximum observed concentration was used in the Risk Assessment for potential exposure to this compound.

Table 3

Predicted Leachate Concentration of Constituents in Site Ground Water From Subsurface Soils[a]
Woodlawn Landfill, Cecil County, Maryland

(Page 1 of 2)

Constituents	Cell B/C Area	Areas of the Landfill Excluding Cell B/C
Volatiles (μg/L)		
2-Butanone	-[b]	5.12
1,1-Dichloroethane	0.59	-
1,2-Dichloroethane	0.11	-
1,2-Dichloroethene	0.13	-
2-Hexanone	0.12	-
4-Methyl-2-pentanone	0.22	2.0
Acetone	9.0	16.5
Chlorobenzene	1.37	0.077
Chloroethane	6.66	-
Ethylbenzene	0.028	0.028
Toluene	0.012	0.044
Xylenes (total)	0.12	0.054
Trichloroethene	0.010	-
Vinyl chloride	3,242	-
Semivolatiles (μg/L)		
1,3-Dichlorobenzene	-	1.1
1,4-Dichlorobenzene	-	0.89
Benzoic acid	42.5	9.33
Bis(2-ethylhexyl) phthalate	5.54	0.21

Table 3
(Page 2 of 2)

Constituents	Cell B/C Area	Areas of the Landfill Excluding Cell B/C
Butylbenzylphthalate	0.013	0.020
Di-n-butylphthalate	-	0.0067
Di-n-octylphthalate	0.00026	0.0000054
N-Nitrosodiphenylamine	0.46	-
Pentachlorophenol	0.0066	-
Phenanthrene	0.014	-
2-Methylnaphthalene	0.62	-

[a]Ground water concentrations were modeled for the leaching of subsurface soil constituents into the underlying aquifer. (See Tables 6-9 and 6-10 of the RI Report for soil borings associated with each area).

[b]Dash indicates this compound not detected within the designated area.

Table 4
Toxicity Values for Chemicals of Potential Concern
(Page 1 of 5)

Compound	Cancer Group	Inhalation CSF $(mg/kg/d)^{-1,a}$	Oral CSF $(mg/kg/d)^{-1,a}$	Inhalation Rfd (mg/kg/d)[a]	Oral Rfd (mg/kg/d)[a]
1,1-Dichloroethane	C	--	--	1×10^{-1}	1×10^{-1}
1,2-Dichlorobenzene	--	--	--	4×10^{-2}	9×10^{-2}
1,2-Dichloroethane	B2	9.1×10^{-2}	9.1×10^{-2}	--	--
1,2-Dichloroethene	--	--	--	--	1×10^{-2}
1,2-Dichloropropane	B2	--	6.8×10^{-2}	1.1×10^{-3}	--
1,3-Dichlorobenzene	--	--	--	4.2×10^{-2}	$9 \times 10^{-2,b}$
1,4-Dichlorobenzene	C	--	--	1.4×10^{-1}	$9 \times 10^{-2,b}$
2-Butanone	--	--	--	9×10^{-2}	5×10^{-2}
2-Methylnaphthalene	--	--	--	--	$4 \times 10^{-3,c}$
4-Methyl-2-pentanone (MIBK)	--	--	--	2×10^{-2}	5×10^{-2}
4-Methylphenol (p-cresol)	--	--	--	$1 \times 10^{-1,d}$	5×10^{-2}
Acenaphthene	--	--	--	--	6×10^{-2}
Acenaphthylene	--	--	--	--	$3 \times 10^{-2,e}$
Acetone	--	--	--	$3 \times 10^{0,d}$	1×10^{-1}
Aldrin	B2	1.7×10^{1}	1.7×10^{1}	--	3×10^{-5}
Alpha-BHC	B2	6.3×10^{0}	6.3×10^{0}	--	--
Anthracene	--	--	--	--	3×10^{-1}

Refer to notes at end of table.

Table 4
(Page 2 of 5)

Compound	Cancer Group	Inhalation CSF (mg/kg/d)$^{-1,a}$	Oral CSF (mg/kg/d)$^{-1,a}$	Inhalation Rfd (mg/kg/d)[a]	Oral Rfd (mg/kg/d)[a]
Arsenic	A	1.5×10^{1}	1.75	–	3×10^{-4}
Barium	–	–	–	1×10^{-4}	7×10^{-2}
Benzene	A	2.9×10^{-2}	2.9×10^{-2}	–	–
Benzo(a)anthracene	B2	–	1.67[f]	–	$3 \times 10^{-2,e}$
Benzo(a)pyrene	B2	6.1	11.5	–	$3 \times 10^{-2,e}$
Benzo(b)fluoranthene	B2	–	1.61	–	$3 \times 10^{-2,e}$
Benzo(ghi)perylene	–	–	0.253[f]	–	$3 \times 10^{-2,e}$
Benzo(k)fluoranthene	B2	–	0.759[f]	–	$3 \times 10^{-2,e}$
Benzoic Acid	–	–	–	–	4×10^{0}
Beryllium	B2	8.4×10^{0}	4.3	–	5×10^{-3}
Bis(2-ethylhexyl)phthalate	B2	–	1.4×10^{-2}	–	2×10^{-2}
Bromodichloromethane	B2	–	1.3×10^{-1}	–	2×10^{-2}
Butylbenzylphthalate	C	–	–	–	2×10^{-1}
Cadmium	B1	6.3×10^{0}	–	–	5×10^{-4}
Carbon Disulfide	–	–	–	2.9×10^{-3}	1×10^{-1}
Chlorobenzene	–	–	–	5×10^{-3}	2×10^{-2}
Chloroform	B2	8.1×10^{-2}	6.1×10^{-3}	–	1×10^{-2}
Chromium (Total)	–	–	–	5.7×10^{-7}	1×10^{0}

Refer to notes at end of table.

Table 4
(Page 3 of 5)

Compound	Cancer Group	Inhalation CSF $(mg/kg/d)^{-1,a}$	Oral CSF $(mg/kg/d)^{-1,a}$	Inhalation Rfd (mg/kg/d)[a]	Oral Rfd (mg/kg/d)[a]
Chrysene	B2	–	0.0506[f]	–	$3 \times 10^{-2,e}$
Copper	–	–	–	–	$3.7 \times 10^{-2,a,g}$
Di-n-butylphthalate	–	–	–	–	1×10^{-1}
Di-n-octylphthalate	–	–	–	–	2×10^{-2}
Dibenzo(ah)anthracene	B2	–	12.77[f]	–	$3 \times 10^{-2,e}$
Diethylphthalate	–	–	–	–	8×10^{-1}
Dimethylphthalate	–	–	–	–	1×10^{0}
Endosulfan	–	–	–	–	5×10^{-5}
Endrin ketone[h]	–	–	–	–	3×10^{-4}
Ethylbenzene	–	–	–	2.9×10^{-1}	1×10^{-1}
Fluoranthene	–	–	–	–	4×10^{-2}
Fluorene	–	–	–	–	4×10^{-2}
Gamma BHC (Lindane)	C	–	–	–	3×10^{-4}
Gamma Chlordane	B2	1.3×10^{0}	1.3×10^{0}	–	6×10^{-5}
Heptachlor	B2	4.5	4.5×10^{0}	–	5×10^{-4}
Indeno (1,2,3-cd)pyrene	B2	–	2.668[f]	–	$3 \times 10^{-2,e}$
Lead[i]	B2	–	–	–	–
Manganese	–	–	–	1.1×10^{-4}	5×10^{-3}
Mercury	–	–	–	8.6×10^{-5}	3×10^{-4}

Refer to notes at end of table.

Table 4

Compound	Cancer Group	Inhalation CSF $(mg/kg/d)^{-1,a}$	Oral CSF $(mg/kg/d)^{-1,a}$	Inhalation Rfd $(mg/kg/d)^{a}$	Oral Rfd $(mg/kg/d)^{a}$
Methylene Chloride	B2	1.65×10^{-3}	7.5×10^{-3}	8.6×10^{-1}	6×10^{-2}
N-Nitrosodiphenylamine	B2	–	4.9×10^{-3}	–	–
Naphthalene	–	–	–	–	4×10^{-3}
Nickel	–	–	–	–	2×10^{-2}
Pentachlorophenol	B2	–	1.2×10^{-1}	–	3×10^{-2}
Phenanthrene	–	–	–	–	$3 \times 10^{-2,e}$
Phenol	–	–	–	–	6×10^{-1}
Pyrene	–	–	–	–	3×10^{-2}
Silver	–	–	–	–	5×10^{-3}
Tetrachloroethene	B2	1.82×10^{-3}	5.1×10^{-2}	–	1×10^{-2}
Thallium	–	–	–	–	7×10^{-5}
Toluene	–	–	–	5.7×10^{-1}	2×10^{-1}
Trichloroethene	B2	1.7×10^{-2}	1.1×10^{-2}	–	–
Vanadium	–	–	–	–	7×10^{-3}
Vinyl Chloride	A	2.9×10^{-1}	1.9×10^{0}	–	–
Xylenes (Total)	–	–	–	8.6×10^{-2}	2×10^{0}
Zinc	–	–	–	–	2×10^{-1}

Refer to notes at end of table.

Table 4
(Page 5 of 5)

[a]Cancer Slope Factors (CSFs) and Reference Doses (RfDs) obtained from U.S. EPA, 1991, Health Effects Assessment Summary Tables, Annual FY-1991, U.S. EPA, OSWER (OS-230), January, 1991, and IRIS (January 1992).

[b]Value for 1,2-Dichlorobenzene used as a surrogate based on analogy.

[c]Value for Naphthalene used as a surrogate based on analogy.

[d]U.S. EPA, 1986, Superfund Public Health Evaluation Manual (SPHEM), U.S. EPA 540/1-86/060.

[e]Value for Pyrene used as a surrogate based on analogy.

[f]Calculated at Benzo(a)pyrene relative potency equivalent level (Clements, 1988).

[g]Conversion of 1.3 mg/l drinking water standard into reference dose.

[h]Value for Endrin used as a surrogate based on analogy.

[i]Potential health effects associated with exposure to lead evaluated using "Users Guide for Lead: A PC Software Application of the Uptake/Biokinetic Model-Version 0.50," prepared by Environmental Criteria and Assessment Office, Office of Health and Environmental Assessment, U.S. EPA, Cincinnati, Ohio, January 1991.

Table 5

EPA Categories for Potential Carcinogens

EPA Category	Group Description	Evidence
Group A	Human Carcinogen	Sufficient evidence from epidemiologic studies to support a causal association between exposure and cancer in humans
Group B1	Probable Human Carcinogen	Limited evidence in humans from epidemiologic studies
Group B2	Possible Human Carcinogen	Sufficient evidence in animals, inadequate evidence in humans
Group C	Possible Human Carcinogen	Limited evidence in animals and/or carcinogenic properties in short-term studies
Group D	Not Classified	Inadequate evidence in animals
Group E	No evidence	No evidence in at least two adequate animal tests or in both epidemiologic and animal studies

Table 6

Summary Health Risks and Hazards From Exposure to Off-site Residential Ground Water[a] Woodlawn Landfill, Cecil County, Maryland

	INCREASED LIFETIME CANCER RISK			
	Routes of Exposure			
Receptor	Ingestion	Dermal Contact[b]	Inhalation[c]	Total
Adult	1.6×10^{-4}	6.1×10^{-8}	2.6×10^{-7}	1.6×10^{-4}
Child	1.0×10^{-4}	4.4×10^{-8}	4.6×10^{-7}	1.0×10^{-4}
	NONCARCINOGENIC HAZARD INDEX			
	Routes of Exposure			
Adult	2.3	0.000017	0.00012	2.3
Child	2.6	0.000021	0.00036	2.6

[a]Compound-specific cancer risks and hazard indices are presented in Appendix N of the RI Report. See Table 2 notes for wells included in off-site residential risk characterization.

[b]Dermal contact with organic constituents in ground water while showering.

[c]Inhalation of volatilized constituents in ground water while showering.

Table 7

Summary Risk Estimates (Current Conditions) for Selected Child and Adult Receptors Across Multiple Exposure Pathways Woodlawn Landfill, Cecil County, Maryland

	INCREASED LIFETIME CANCER RISK		
	Routes of Exposure		
Exposure Scenario	Ingestion/Dermal Contact	Inhalation	Total
Off-site Adult[a]	1.6×10^{-4}	4.9×10^{-7}	1.6×10^{-4}
Off-site Child[b]	1.0×10^{-4}	7.5×10^{-7}	1.0×10^{-4}
On-site Child[c]	3.0×10^{-6}	2.4×10^{-10}	3.0×10^{-6}
Child On- and Off-site[d]	1.0×10^{-4}	7.5×10^{-7}	1.0×10^{-4}
	NONCARCINOGENIC HAZARD INDEX		
	Routes of Exposure		
Exposure Scenario	Ingestion/Dermal Contact	Inhalation	Total
Off-site Adult[a]	2.3	0.25	2.6
Off-site Child[b]	2.6	0.56	3.2
On-site Child[c]	0.12	0.00088	0.12
Child On- and Off-site[d]	2.7	0.56	3.3

[a]Includes exposure to off-site residential ground water and surface soil particulates from areas of the landfill excluding Cell B/C.

[b]Includes exposure to downstream surface water and sediments, off-site residential ground water, and inhalation of surface soil particulates from areas of the landfill excluding Cell B/C.

[c]Includes ingestion/dermal contact with on-site surface soil, seeps (sediment and liquid), settling basin sediment, and inhalation of surface soil particulates while trespassing on Site.

[d]Assumes child living in nearby residential area also trespasses on Site.

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Summary Ground Water Risk Estimates (Future Conditions) for Selected Child and Adult Receptors Woodlawn Landfill, Cecil County, Maryland

INCREASED LIFETIME CANCER RISK

Exposure Scenario	Routes of Exposure: Ingestion/Dermal Contact	Routes of Exposure: Inhalation	Total
On-site Adult-Leachate[a]	7.3×10^{-2}	5.0×10^{-3}	7.8×10^{-2}
On-site Child-Leachate[a]	4.9×10^{-2}	8.6×10^{-3}	5.8×10^{-2}
On-site Adult-Existing[b]	5.6×10^{-3}	2.3×10^{-4}	5.8×10^{-3}
On-site Adult-Modelled[c]	1.4×10^{-2}	7.8×10^{-4}	1.5×10^{-2}
Off-site Adult-Modelled[d]	1.7×10^{-3}	9.4×10^{-5}	1.8×10^{-3}

NONCARCINOGENIC HAZARD INDEX

Exposure Scenario	Routes of Exposure: Ingestion/Dermal Contact	Routes of Exposure: Inhalation	Total
On-site Adult-Leachate[a]	0.46	0.0028	0.46
On-site Child-Leachate[a]	0.53	0.0084	0.53
On-site Adult-Existing[b]	50	0.021	50
On-site Child-Existing[b]	59	0.064	59

[a]Exposure to leachate-contaminated ground water using the Summers leachate model, assuming a well is placed on the Site. The mean vinyl chloride concentration in the Cell B/C sludge, based on the results for the 27 samples collected during the RI/FS, is 290 µg/kg. However, the predicted leachate concentrations for this exposure scenario are based on the 95% upper bound concentrations for constituents in just 5 Cell B/C sludge samples. The 95% upper bound concentration for vinyl chloride in

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those 5 samples was 4.98 mg/kg. Therefore, the risks from exposure to leachate-contaminated ground water are overestimated.

[b]Exposure to constituents currently present in the aquifer immediately below the landfill, assuming a well is placed in the center of the plume.

[c]Exposure to modeled on-site vinyl chloride concentrations; 70 years in the future at the highest on-site well (633 ug/L at well F-6).

[d]Exposure to modeled off-site vinyl chloride concentrations; 70 years in the future at the point along the site boundary predicted to have the highest concentration of vinyl chloride (75 ug/L along Waibel Road east of Cell B/C).

Table 9

Ground Water Cleanup Levels for Contaminants with Carcinogenic Health Effects

Contaminant	MCL[1] (µg/l)[2]	MCLG[3] (µg/l)	Cleanup Level (µg/l)	Carcinogenic[4] Risk
1,2-Dichloroethane	5	0	1 (PQL)[5]	1.4×10^{6}
Tetrachloroethene	5	0	1.5 (Risk-based)[6]	1.0×10^{6}
Trichloroethene	5	0	5	1.0×10^{6}
Vinyl Chloride	2	0	1 (PQL)	2.4×10^{5}
Benzo(a)anthracene	-	-	0.13 (PQL)	2.6×10^{6}
Benzo(a)pyrene	0.2	0	0.023 (MDL)[7]	9.2×10^{6}
Benzo(b)fluoranthene	-	-	0.18 (PQL)	8.3×10^{6}
Benzo(k)fluoranthene	-	-	0.17 (PQL)	3.7×10^{6}
Bis(2-ethylhexyl)phthalate	6	0	6	1.0×10^{6}
Chrysene	-	-	1.5 (PQL)	2.2×10^{6}
Pentachlorophenol	1	0	1	2.7×10^{6}
Aldrin	-	-	0.01 (PQL)	2.0×10^{6}
Alpha BHC	-	-	0.013 (Risk-based)	1.0×10^{6}
Heptachlor	0.4	0	0.016 (Risk-based)	1.0×10^{6}
Arsenic	50	-	1 (IDL)[8] or background[9], whichever is greater	2.1×10^{5} [10]

[1] MCL: Maximum Contaminant Level
[2] µg/l: micrograms per liter
[3] MCLG: Maximum Contaminant Level Goal
[4] Excess lifetime carcinogenic risk associated with the cleanup level.
[5] PQL: Practical Quantitation Limit
[6] Risk-based: cleanup level based on carcinogenic health effects
[7] MDL: Method Detection Limit
[8] IDL: Instrument Detection Limit
[9] EPA will determine the background level of arsenic in the area of the Site based on predesign studies.
[10] Excess lifetime carcinogenic risk from residential exposure to 1 µg/L of arsenic.

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Ground Water Cleanup Levels for Contaminants with Noncarcinogenic Adverse Health Effects

Contaminant	MCL[1] (µg/l)[2]	MCLG[3] (µg/l)	Cleanup Level (µg/l)
Endosulfan I	-	-	-[4]
Arsenic	50	-	-[4]
Cadmium	5	5	-[4]
Manganese	-	-	-[4]
Mercury	2	2	-[4]
Vanadium	-	-	-[4]

[1] MCL: Maximum Contaminant Level
[2] µg/l: micrograms per liter
[3] MCLG: Maximum Contaminant Level Goal

[4] Ground water cleanup levels for contaminants with noncarcinogenic adverse health effects will be based on the Risk Assessment and developed in accordance with the following approach. EPA, in consultation with MDE, will determine background levels of arsenic and manganese in ground water in the area of the Site based on predesign studies. The background levels of these two chemicals will determine which of equations (1a) through (2b) below are utilized to develop cleanup levels corresponding to an aggregate hazard index less than or equal to 1.0. Each equation represents a different possible Site condition with regard to the background levels for arsenic and manganese.

In each equation,

[Endosulfan I]	= the cleanup level for Endosulfan I in µg/L
[As]	= the cleanup level for arsenic in µg/L
[Cd]	= the cleanup level for cadmium in µg/L
[Mn]	= the cleanup level for manganese in µg/L
[Hg]	= the cleanup level for mercury in µg/L
[V]	= the cleanup level for vanadium in µg/L

The number in each denominator in equations (1a) through (2b) below represents the concentration in µg/L of the chemical in the respective numerator which is associated with a hazard quotient (HQ) of 1.0 (i.e., a concentration of 1.6 µg/L of Endosulfan I is associated with a HQ of 1.0). The HQs for these chemicals are presented in the baseline Risk Assessment.

The cleanup levels for all six contaminants will be set such that:

(1a) $[\text{Endosulfan I}]/1.6 + [As]/9.3 + [Cd]/16 + [Mn]/160 + [Hg]/9.4 + [V]/220 \leq 1.0$

where $[As] = 1$ µg/L (the cleanup level for arsenic, pursuant to Table 9)
$[Cd] \leq 5$ µg/L
$[Hg] \leq 2$ µg/L

or,

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(1b) $[\text{Endosulfan I}]/1.6 + [Cd]/16 + [Mn]/160 + [Hg]/9.4 + [V]/220 \leq 1.0$

where $[Cd] \leq 5\ \mu g/L$
$[Hg] \leq 2\ \mu g/L$

and the cleanup level for arsenic shall be the background arsenic concentration, pursuant to Table 9

unless EPA, in consultation with MDE, determines that such cleanup levels are infeasible due to the natural occurrence of manganese in local ground water. If EPA determines that the ground water cleanup levels that would satisfy equations (1a) or (1b), above, cannot be achieved because the background level for manganese approaches or exceeds 160 $\mu g/L$, the cleanup levels will be set such that:

(2a) $[\text{Endosulfan I}]/1.6 + [As]/9.3 + [Cd]/16 + [Hg]/9.4 + [V]/220 \leq 1.0$

where $[As] = 1\ \mu g/L$ (the cleanup level for arsenic, pursuant to Table 9)
$[Cd] \leq 5\ \mu g/L$
$[Hg] \leq 2\ \mu g/L$

and the cleanup level for manganese shall be the background manganese concentration

or,

(2b) $[\text{Endosulfan I}]/1.6 + [Cd]/16 + [Hg]/9.4 + [V]/220 \leq 1.0$

where $[Cd] \leq 5\ \mu g/L$
$[Hg] \leq 2 \mu g/L$

and the cleanup levels for arsenic and manganese shall be the background concentrations of arsenic and manganese, respectively.

EPA, in consultation with MDE, will determine which of conditions (1a) through (2b) shall be used to calculate the ground water cleanup levels for contaminants with noncarcinogenic adverse health effects based on the background levels of arsenic and manganese.

Applicable or Relevant and Appropriate Requirements (ARARS) and Guidance to Be Considered (TBCs) for the Woodlawn Landfill Site

ARAR or TBC	Legal Citation	Classification	Summary of Requirement	Applicability to Selected Remedy
I. CHEMICAL SPECIFIC				
A. Water				
1. Safe Drinking Water Act	42 U.S.C. §§ 300f et seq.			
a. Maximum Contaminant Levels (MCLs)	40 C.F.R §§ 141.11-.12 and 141.61-.62	Relevant and Appropriate	MCLs are enforceable standards for public drinking water supply systems which have at least 15 service connections or are used by at least 25 persons. These requirements are not directly applicable since ground water at the Site is used as a private drinking water supply. However, under the circumstances of this Site, MCLs are relevant and appropriate requirements.	The NCP requires that remedial actions for ground water that is a current or potential source of drinking water shall meet the MCL for each site-related contaminant if the Maximum Contaminant Level Goal (MCLG) for that contaminant is set at a level of zero and MCLs are relevant and appropriate under the circumstances of the site. In addition, the discharge of treated ground water to the on-site stream shall not result in an exceedance of MCLs in the waters of the stream.
b. Maximum Contaminant Level Goals (MCLGs)	40 C.F.R § 141.50-.51	Relevant and Appropriate	MCLGs are non-enforceable health goals for public water supplies which have at least 15 service connections or are used by at least 25 persons. Under the circumstances of this Site, MCLGs are relevant and appropriate requirements.	The NCP requires that remedial actions for ground water that is a current or potential source of drinking water shall meet non-zero MCLGs for contaminants of concern for which they exist, where they are relevant and appropriate requirements. In addition, the discharge of treated ground water to the on-site stream shall not result in an exceedance of non-zero MCLGs in the waters of the stream.

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ARAR or TBC	Legal Citation	Classification	Summary of Requirement	Applicability to Selected Remedy
2. Clean Water Act; Federal Ambient Water Quality Criteria for the Protection of Aquatic Life	33 U.S.C. § 1314	Relevant and Appropriate	These are non-enforceable guidelines established pursuant to Section 304 of the Clean Water Act that set the concentrations of pollutants which are considered adequate to protect aquatic life. Federal ambient water quality criteria may be relevant and appropriate to CERCLA cleanups based on the uses of a receiving water body.	These criteria are relevant and appropriate because the State has designated the on-site stream for protection of aquatic life. Contaminant concentrations in treated ground water that will be discharged to the on-site stream shall not exceed the levels that will ensure compliance with these criteria.
3. Maryland Surface Water Quality Criteria	COMARs 26.08.02.03-.03-3	Relevant and Appropriate	These are criteria to maintain surface water quality for public water supplies, protection of aquatic life, recreational purposes, and other beneficial uses.	Contaminant concentrations in treated ground water that will be discharged to the on-site stream shall not exceed the levels that will ensure compliance with these criteria.
4. Integrated Risk Information System (IRIS)	EPA Office of Research and Development	To Be Considered	IRIS is an EPA data base containing up-to-date health risk and EPA regulatory information for numerous chemicals. IRIS contains only those reference doses (RfDs) and cancer slope factors that have been verified by the RfD or Carcinogen Risk Assessment Verification Endeavor Workgroups, and is the preferred source of toxicity information.	These non-enforceable toxicity values shall be considered where remedial alternatives address risk-based criteria or when setting standards for cleanups.
5. EPA Health Advisories on Drinking Water	EPA Office of Drinking Water	To Be Considered	These advisories are non-enforceable guidelines for public water supply systems.	These advisories shall be considered for remedial actions involving ground water monitoring, recovery and treatment.
6. Health Effects Assessment	EPA Environmental Criteria and Assessment Office	To Be Considered	These are assessments of chemical-specific health effects that are based on non-enforceable toxicity data.	These assessments shall be considered where remedial alternatives address risk-based criteria or when setting standards for cleanups.

ARAR or TBC	Legal Citation	Classification	Summary of Requirement	Applicability to Selected Remedy
II. LOCATION SPECIFIC				
A. The Endangered Species Act of 1978	16 U.S.C § 1531 50 C.F.R Part 402	Applicable	Act requires federal agencies to ensure that any action authorized by an agency is not likely to jeopardize the continued existence of any endangered or threatened species or adversely affect its critical habitat.	Potentially affected endangered species have not been identified. The remedial action shall be implemented so as not to adversely affect such resources should any be identified in the future.
B. The Archaeological and Historical Preservation Act of 1974	16 U.S.C § 469	Applicable	Requires actions to avoid potential loss or destruction of significant scientific, historical, or archaeological data	Actions shall be taken to mitigate any adverse effects on identified off-site historic resources that might result from implementation of the remedial action.
C. Maryland Wetlands Regulations	COMAR 08.05.04	Applicable	Protects nontidal wetlands of the State from dredging, filling, removal, or other alteration and requires State oversight and approval.	These regulations shall be applicable if construction of the cap or discharge to surface water could affect wetlands.
D. Procedures for Implementing the Requirements of the Council on Environmental Quality on the National Environmental Policy Act	40 C.F.R Part 6 Appendix A	Applicable	This is EPA's policy for carrying out the provisions of Executive Order 11990 (Protection of Wetlands). No activity that adversely affects a wetland shall be permitted if a practicable alternative that has less effect is available. If there is no other practicable alternative, impacts must be mitigated.	This shall be applicable if construction of the cap or discharge to surface water could affect wetlands.
E. Ground Water Protection Strategy of 1984	EPA 440/6-84-002	To Be Considered	Identifies ground water quality to be achieved during remedial actions based on aquifer characteristics and use.	The EPA classification of the aquifer at the Site (IIA) shall be taken into consideration during design and implementation of the ground water remedy.
F. National Historic Preservation Act of 1986	16 U.S.C. §§470 et seq. 36 C.F.R. Part 800	Applicable	Requires remedial action to take into account effects on properties included in or eligible for the National Register of Historic Places and to minimize harm to National Historic Landmarks.	Actions shall be taken to mitigate any adverse effects on property eligible for or included on the National Register of Historic Places that could result from implementation of the remedial action.

ARAR or TBC	Legal Citation	Classification	Summary of Requirement	Applicability to Selected Remedy
III. ACTION SPECIFIC				
A. Control of Noise Pollution	COMARs 26.02.03.02 A(2) and B(2) and COMAR 26.02.03.03 A	Applicable	Provides limits on noise levels for the protection of human health and welfare.	Maximum Allowable Noise Levels shall not be exceeded at the landfill property boundaries during construction and operation of the remedy.
B. Water				
1. Clean Water Act National Pollutant Discharge Elimination System and Maryland Discharge Limitations	33 U.S.C. § 1342 and COMARs 26.08.03.01 and .07	Applicable	Establishes effluent limitations for discharges to waters of the State and controls discharge of toxic substances to surface waters.	These limitations shall be applicable to the discharge of treated ground water to surface water.
2. Criteria and Standards for Best Management Practices	40 C.F.R. Part 125, Subpart K	Applicable	Requires a clear description of a best management practices (BMP) program to be submitted as part of the NPDES discharge permit application.	Discharge of treated ground water to surface water shall be in accordance with a BMP program, although a permit is not required.
3. Guidelines Establishing Test Procedures for the Analysis of Pollutants	40 C.F.R. Part 136	Applicable	Establishes test procedures for analysis of effluent discharged under the NPDES program.	These guidelines shall be applicable to the discharge of treated ground water to surface water.
4. Regulation of Water Supply, Sewage Disposal and Solid Waste	COMAR 26.04.04	Applicable	Establishes requirements for well construction and abandonment.	All wells shall be installed and maintained in accordance with State requirements for construction and abandonment.
5. Stormwater Management	COMAR 26.09.02	Relevant and Appropriate	Requires development of a stormwater management plan and design and construction of systems necessary to control stormwater.	Stormwater shall be managed during and after constuction to minimize stream channel erosion, pollution, siltation, sedimentation and local flooding.
6. Erosion and Sediment Control	COMARs 26.09.01.01, .07 B and .08 A	Relevant and Appropriate	Requires preparation of an erosion and sediment control plan for activities involving land clearing, grading and other earth disturbances and establishes erosion and sediment control criteria.	These regulations shall apply to clearing, grading, excavation and capping activities at the Site.
7. EPA Policy for Ground Water Remediation at Superfund Sites	OSWER Directive 9355.4-03	To Be Considered	This policy recommends approaches to ground water remediation using a pump and treat system.	This policy shall be considered during the implementation of the remedial action.

ARAR or TBC	Legal Citation	Classification	Summary of Requirement	Applicability to Selected Remedy
C. Air				
1. Air Emission Standards for Process Vents	40 C.F.R. Part 264, Subpart AA	Relevant and Appropriate	Establishes requirements for process vents associated with operations that manage hazardous wastes with organic concentrations of at least 10 parts per million weight.	These regulations shall apply to operation of the air stripper.
2. Maryland Regulations Governing Toxic Air Pollutants	COMAR 26.11.15	Relevant and Appropriate	Requires emissions of Toxic Air Pollutants (TAPs) from new and existing sources to be quantified; establishes ambient air quality standards and emission limitations for TAP emissions from new sources; requires best available control technology for toxics (T-BACT) for new sources of TAPs.	These regulations shall apply to operation of the air stripper.
3. Maryland Regulations Governing Air Quality (Volatile Organic Compounds)	COMAR 26.11.06.06	Relevant and Appropriate	Provides air quality standards, general emission standards and restrictions for air emissions from vents and treatment devices.	Emissions from the air stripper and landfill gas vents shall meet emission limitations for VOCs.
4. Maryland Regulations Governing Air Quality (Visible Emissions, Particulates, Nuisance, Odors)	COMARs 26.11.06.02, .03, .08 and .09	Relevant and Appropriate	Provide air quality standards, general emission standards and restrictions for air emissions from vents and treatment devices.	These regulations shall apply to emissions from landfill gas vents.
5. State Implementation Plan	COMAR 26.11.19.02 G	Relevant and Appropriate	Requires reasonably available control technology (RACT) for control of emissions from existing sources that emit more than 25 tons of VOCs per year (in severe-15 ozone non-attainment areas, under the Clean Air Act).	An active gas collection system equipped with RACT shall be required if total VOC emissions from the landfill exceed 25 tons per year.
6. Control of Air Emissions from Air Strippers at Superfund Groundwater Sites, June 15, 1989	OSWER Directive 9355.0-28	To Be Considered	This policy guides the selection of controls for air strippers at ground water sites according to the air quality status of the area of the site (i.e., attainment or non-attainment area).	This policy shall be considered in determining if air emission controls are necessary for the air stripper. Sources most in need of controls are those with emissions rates in excess of 3 lbs./hour or 15 lbs./day or a potential rate of 10 tons/year of total VOCs.

ARAR or TBC	Legal Citation	Classification	Summary of Requirement	Applicability to Selected Remedy
D. Solid Waste				
1. Sanitary Landfill - Closure	COMARs 26.04.07.21 A, B, D and E	Relevant and Appropriate	Establish minimum requirements for closure of municipal landfills in the State, including minimum cap specifications.	The specifications of the landfill cap shall, at a minimum, comply with State closure requirements.
2. Sanitary Landfills - Post-Closure Monitoring and Maintenance	COMARs 26.04.07.22 A, B and C	Relevant and Appropriate	Establish minimum post-closure monitoring and maintenance requirements for sanitary landfills in the State.	Post-closure monitoring and maintenance of the landfill shall comply with these minimum requirements.
3. Conducting Remedial Investigations/Feasibility Studies for CERCLA Municipal Landfill Sites, February 1991	EPA/540-P-91/001	To Be Considered	Presents minimum specifications for single-barrier caps for CERCLA municipal landfill sites.	This guidance shall be considered in evaluating the adequacy of the cap design.
E. Hazardous Waste				
1. Characteristics of Hazardous Waste (Toxicity Characteristic)	40 C.F.R. § 261.24	Applicable	Establishes the criteria for determining if a solid waste exhibits the characteristic of toxicity.	These criteria shall be used in determining whether soils and treatment residuals are subject to RCRA hazardous waste regulations.
2. Characteristics of Hazardous Waste (Characteristics of Ignitability, Corrosivity, Reactivity)	COMARs 10.51.02.10, .11 and .12 (1985) and COMARs 26.13.02.11, .12 and .13	Applicable	Establishes the criteria for determining if a solid waste exhibis the characteristics of ignitability, corrosivity, or reactivity.	These criteria shall be used in determining whether soils and treatment residuals are subject to RCRA hazardous waste regulations.
3. Standards Applicable to Generators of Hazardous Waste	COMARs 10.51.03.01, .03, .04, .05 and .06 (1985) and COMARs 26.13.03.01, .03, .04, .05, .06 and .08	Applicable	Establishes requirements for a generator who treats, stores or disposes of hazardous waste on-site, including packaging, labeling, manifesting, and recordkeeping requirements.	On-site treatment and storage of any treatment residuals or soils that exhibit a characteristic of a hazardous waste shall comply with these regulations.
4. Standards Applicable to Transporters of Hazardous Waste	COMARs 10.51.04.01, .02, .03 and .04 (1985) and COMARs 26.13.04.01, .02, .03 and .04	Applicable	Establishes standards for persons transporting hazardous waste off-site, including manifesting, recordkeeping and spill-notification requirements.	These standards shall apply to any hazardous wastes transported off-site.
5. RCRA Land Disposal Restrictions	40 C.F.R Part 268	Applicable	Restrictions on land disposal of hazardous wastes.	These restrictions shall apply to land disposal of any treatment process wastes and contaminated soils that exhibit a characteristic of a hazardous waste.